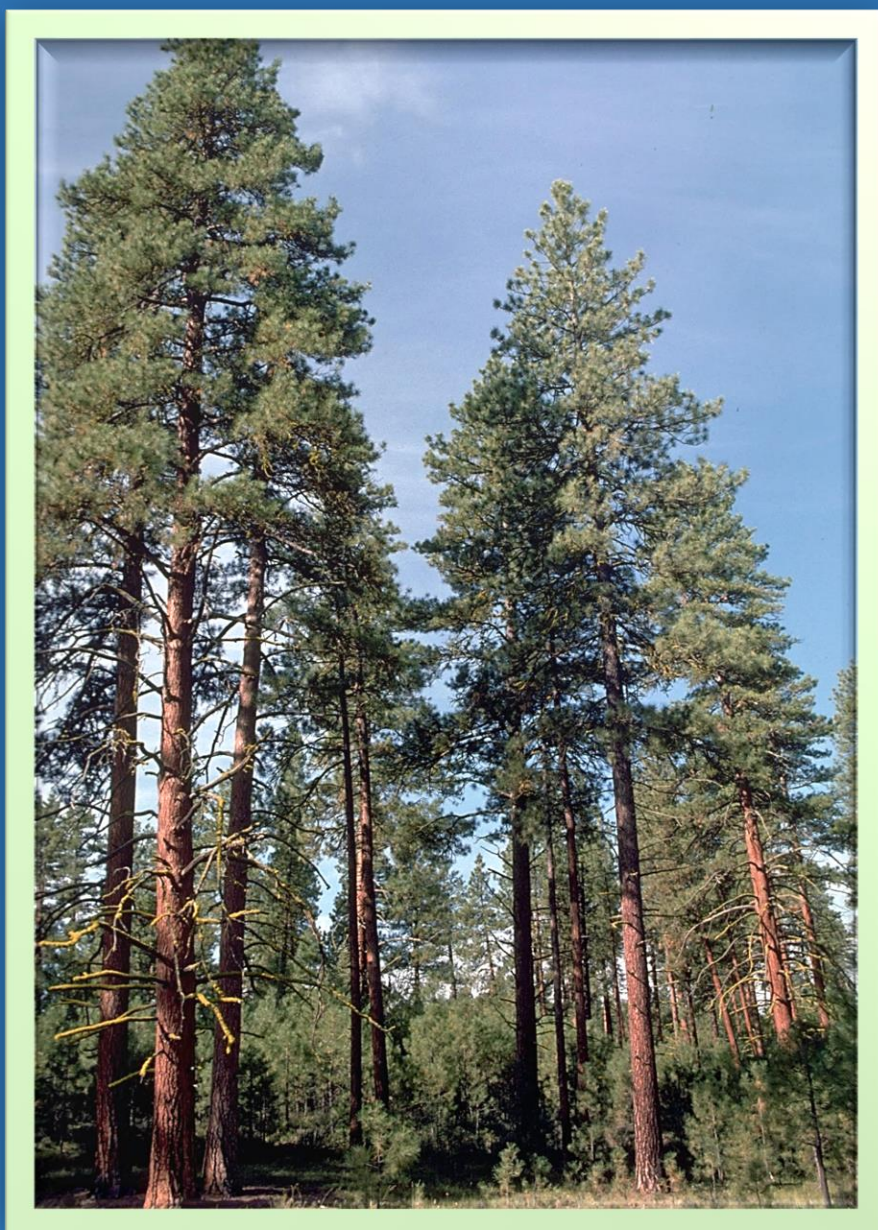




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## Suggested Stocking Levels for Upland Forests of Northeastern Oregon and Southeastern Washington



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## Dedication

This guide is dedicated to three plant ecologists (Charlie Johnson, Rod Clausnitzer, and Steve Simon) who had the foresight to collect stockability and productivity data when installing ecology plots during development of plant association classifications for the Blue Mountains. Without that information, it would not have been possible to produce the Cochran et al. (1994) research note. And without the Cochran research note, this Blue Mountains stocking guide would not exist.

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# **Suggested Stocking Levels for Upland Forests of Northeastern Oregon and Southeastern Washington**

David C. Powell



U.S. Department of Agriculture, Forest Service  
Umatilla National Forest  
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## Abstract

Beginning in the early 1970s, upland forests of the Blue, Ochoco, and Wallowa Mountains of northeastern Oregon and southeastern Washington have experienced substantial impact from mountain pine beetle and other bark beetles, defoliating insects such as spruce budworm and tussock moth, wildfires, and tree disease. Elevated disturbance levels are often viewed as an indicator of unhealthy forests.

As forest managers tried to address susceptibility to large-scale disturbance, they questioned the relevance of historical stocking recommendations. Recent concerns tend to focus on climate change and whether previous stocking levels are compatible with a warmer and dryer future. This guide responds to these concerns in two ways: (1) it establishes a Climate Resilience stocking level (which was not included in previous stocking guides from 1994 and 1999); and (2) two management stocking levels, the upper and lower limits of a management zone, are now calculated as slightly lower percentages of maximum density than were used in the past (to reflect warmer and dryer conditions).

This document, the third iteration of a Blue Mountains stocking guide, includes these items:

- It describes core concepts and principles relating to stand density and potential vegetation.
- The same process is used to calculate stocking levels for all seven tree species (but custom levels for lodgepole and ponderosa pines that reflect mountain pine susceptibility are also provided).
- It provides suggestions for how to use the maximum density stocking level with the FVS modeling system, especially for the SDIMAX keyword.
- It provides quantified stocking level and stand density information for upland forest potential vegetation types occurring in the Blue Mountains, and it synthesizes relevant literature influencing how local managers address density management concerns.
- It supplies examples for how to use the guide when preparing density management regimes and reforestation (tree planting) prescriptions.
- It describes how stand density information can be used to support wildlife and range management objectives.
- It provides insights for using the stocking levels with stands containing western white pine.
- It presents stand density metrics for 3 classes of crown fire susceptibility (low, moderate, high).
- It provides detailed stand density tables for 3 stocking levels (climate resilience, lower limit, and upper limit); tables are grouped by tree species (26 tables for ponderosa pine, 16 tables for Douglas-fir, 13 tables for western larch, 14 tables for lodgepole pine, 13 tables for Engelmann spruce, 12 tables for grand fir, and 13 tables for subalpine fir).

*Keywords:* Forest health, stand density index, Blue Mountains, Ochoco Mountains, Wallowa-Snake province, stand density, stocking levels, density management, climate resilience.



## Summary

Beginning in the early 1970s, a variety of vegetation changes started affecting the Blue Mountains region. Many of them were caused by disturbance processes, but anthropogenic factors also played a role – timber harvest, livestock grazing, forest densification involving fire exclusion, and climate change. Managers often view these changes as forest health issues.

Early in the 1990s, a Stressed Sites Cooperative was formed to help address forest health issues. One of its contributions was to develop a research note describing suggested stocking levels for Blue Mountain upland forests (Cochran et al. 1994). The note uses stand density index (SDI) to characterize full-stocking values for many potential vegetation types occurring in the Blue Mountains.

As managers implemented the research note, they requested additional information to help apply its stocking levels. Their requests led to the development of a stocking guide (Powell 1999).

This document is the third iteration of a Blue Mountains stocking guide. The 1999 guide and this version rely on base data provided by the first version – the 1994 research note. This guide provides four stocking levels (climate resilience, CR; lower limit, LL; upper limit, UL; maximum density, MD) for 81 potential vegetation types (PVTs, plant associations and plant community types) found in two Blue Mountain provinces – the Blue-Ochoco and Wallowa-Snake. Biologically meaningful stand development benchmarks are used to delineate the four stocking levels, shown in bold text below:

| STAND DEVELOPMENT BENCHMARKS<br>AND ASSOCIATED STOCKING LEVELS | PERCENT OF<br>MAXIMUM DENSITY |
|----------------------------------------------------------------|-------------------------------|
| Absolute-maximum level of competition                          | 100%                          |
| <b>Maximum density (MD)</b>                                    | <b>100%</b>                   |
| Lower limit of the self-thinning zone                          | 60%                           |
| <b>Upper limit of a management zone (UL)</b>                   | <b>55%</b>                    |
| Lower limit of full site occupancy                             | 35%                           |
| <b>Lower limit of a management zone (LL)</b>                   | <b>35%</b>                    |
| Onset of competition/crown closure                             | 25%                           |
| <b>Climate resilience (CR)</b>                                 | <b>25%</b>                    |

Color sections identify four stand development benchmarks and their corresponding stocking levels – benchmarks are shown in normal text; stocking levels are shown in bold text.

This guide utilizes five stand density metrics:

1. **Stand density index (SDI)** – number of trees per acre at a standard stand size: 10 inches quadratic mean diameter (QMD). *SDI is used to quantify the four stocking levels by PVT.*
2. **Trees per acre (TPA)** – number of tree stems per acre. TPA data is used for many purposes, especially with young stands containing mostly seedlings and saplings.
3. **Basal area per acre (BA)** – sum of the cross-sectional area of all stems in a stand, measured at a height of 4½ feet above the ground and expressed as square feet per acre. BA is often used with silvicultural prescriptions and marking guides, and for other operational purposes.
4. **Equilateral spacing (ES)** – intertree distance (spacing between trees, in feet) associated with

the TPA values. ES data is often used for reforestation and fuels management purposes.

5. **Canopy cover (CC)** – proportion of the ground surface (forest floor) covered by tree canopy. CC data is often used to characterize wildlife habitat, including elk and ungulate cover.

Stand density tables (chapter 6) include the CR, LL, and UL stocking levels; each table includes the five stand density metrics listed above. MD stocking levels are only found in tables 3-1 and 3-3, and they are quantified by using SDI. The per-acre data in chapter 6 tables – trees and basal area – is presented for three stand structures: even-aged (EA), irregular structure (IS), and uneven-aged (UA).

This guide emphasizes two stocking levels that support high tree and stand vigor – climate resilience and the lower limit. Two other stocking levels, the upper limit and maximum density, are best avoided whenever management objectives emphasize stand resistance to disturbance factors.

This guide describes concepts and principles related to stand density and potential vegetation (chapter 2). It also provides examples of how the stocking and density information can be applied (chapter 4), not just for silviculture but for other natural resource purposes as well.

Chapter 5 describes interactions between stand density and disturbance processes, including suggestions for how stand density treatments can address crown fire susceptibility, climate change, and forest health. For crown fire susceptibility, three canopy fuel loading classes (low, moderate, high) are expressed for each of the stand density metrics (SDI, TPA, BA, ES, and CC).

A climate change section is included in chapter 5; it describes projected climatic changes (temperature and precipitation) for the Blue Mountains and how they are expected to modify future vegetation conditions. A table provides climate change adaptation strategies for upland forests. The climate change section describes how a manager's choice of a stocking level, when preparing a density management regime, could affect future climate resistance and resilience.

### **Why Provide A Stocking Guide?**

Popular accounts report that total forest restoration need for the western United States is app. 80 million acres. Much of this area involves overstocked forest in need of thinning. A regional assessment (Rainville et al. 2008) found that app. 58% of the non-Reserved, non-Restricted forestland across about 6 million acres of federal land in the Blue Mountains was densely stocked.

For the Umatilla National Forest, a stand density assessment (2001) found that 46% of total forested acreage was overstocked. When another Forest-wide assessment was completed twelve years later (2013), the proportion of overstocked forests had increased to 57% (Powell 2013a).

These assessments suggest that the amount of overstocked forestland continues to grow. This stocking guide was designed to address this long-term densification trend by providing Blue Mountain practitioners with stocking level and stand density information for the lands they administer.

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# 1. INTRODUCTION

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In the early 1990s, the Blue Mountains were attempting to recover from more than a decade of intense spruce budworm defoliation. The 1980-92 budworm outbreak led to dialogue about whether the region was confronting a forest health crisis (Wickman 1992). As post-outbreak responses were being discussed, the need for fine-scale stocking levels to support site-specific prescriptions – by plant association and tree species – became apparent.

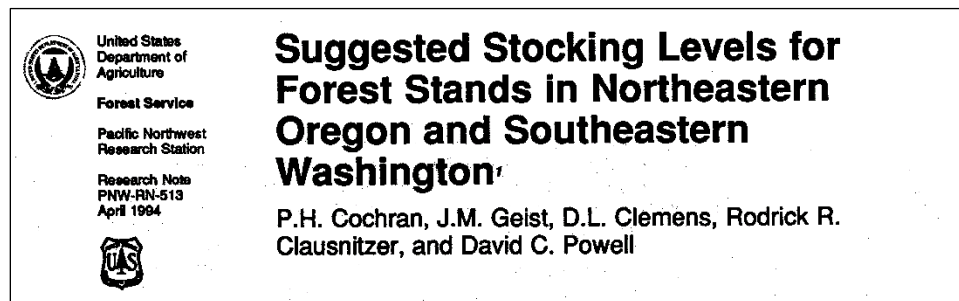


**Figure 1-1** – Research note published in April 1994. It provides stocking level information for 7 tree species and 66 plant associations – a total of 462 possible combinations.

In 1994, the Pacific Northwest Research Station published a research note (fig. 1-1) providing suggested stocking levels<sup>1</sup> for the Blue Mountains (Cochran et al. 1994). It provides quite a bit of detail:

- 1) Suggested stocking levels are presented for seven individual tree species.
- 2) Stocking values are presented separately for two Blue Mountain subregions – the Blue-Ochoco province (42 plant associations; Johnson and Clausnitzer 1992) and the Wallowa-Snake province (24 plant associations; Johnson and Simon 1987).

I am not aware of another North American effort that developed stocking-level information to a comparable level of detail as is presented by Cochran et al. (1994).

As managers began using the Cochran research note, two issues became apparent – the note quantifies only one stocking level, full stocking, and it does so for only one condition – even-aged stands with a quadratic mean diameter (QMD) of 10 inches.

The Cochran research note provides one stocking level, but it does not include detailed stand density information. Users requested additional information to help them implement the Cochran note. Here are their four primary requests:

1. *For each combination of tree species (7 in total) and potential vegetation type (PVT; 81 in total for the Blue-Ochoco and Wallowa-Snake provinces), SDI values need to be calculated for four stocking levels – climate resilience (CR), lower (LL) and upper (UL) limits of a management zone, and maximum density (MD).*

The Cochran research note provides none of these stocking levels – it provides one level called Full Stocking. This guide includes the four stocking levels requested by users.

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<sup>1</sup> Technical terms are defined in a glossary (chapter 7).



2. *Provide four stand density metrics – trees per acre (TPA), basal area per acre (BA), equilateral tree spacing (ES), and canopy cover (CC).*

These four metrics are not included in the Cochran research note – SDI is the only measure used to express stand density. This guide supplies TPA, BA, ES, and CC values. But these values are not provided for the MD level. Why not? Because for a management context, MD is a level to be avoided – it is only included in this guide because it serves as a reference level – other stocking levels (CR, LL, UL) are calculated as percentages of the MD level.

3. *Provide stand density information for three structures – even-aged (EA), irregular (IS), and uneven-aged (UA).*

This guide includes TPA and BA data for even-aged, irregular, and uneven-aged stand structures.

4. *Provide stand density information for quadratic mean diameters (QMDs) from 1 to 30 inches.*

This guide includes many QMDs (chapter 6), ranging from a low of 1 inch to a high of 30 inches, but it does so only for the CR, LL, and UL levels (not for the MD level).

Many of these items were addressed in an ‘implementation guide’ published in April 1999 (Powell 1999). But even so, users continued to provide feedback. This edition reflects input received over the past 25 years, along with updated science. *This version contains much material relating to climate change, including the CR level* – a previous version (Powell 1999) did not.

### **This Document Is A Stocking-Level Guide**

This guide provides stocking level and stand density data (chapter 6) for tree species and potential vegetation types of the Blue Mountains. Additional topics are also covered:

- 1) It describes core concepts, principles, and terminology relating to potential vegetation (plant associations; plant community types) and stand density (chapter 2).
- 2) It supplies insights about interactions between stand density and forest disturbances, including insects, diseases, crown fire susceptibility, and climate change (chapter 5).
- 3) It explains how stocking-level information can be used to support thinnings and silvicultural practices, and to assist with other aspects of natural resource management (chapter 4).
- 4) For users who wish to modify the stocking data, chapter 3 explains how it was derived.

### **Scope Of The Guide**

Scope of this guide is the Blue Mountains ecoregion (fig. 1-2), an area encompassing north-eastern Oregon, southeastern Washington, and west-central Idaho (Anderson et al. 1998, Bailey 1995, Clarke and Bryce 1997, Jackson and Kimerling 1993, McNab and Avers 1994).

Blue Mountain PVTs were aggregated into mid-scale hierarchies (fig. 1-3). Two primary mid-scale units are plant association group (PAG) and potential vegetation group (PVG) (Powell et al. 2007). Powell 2013b provides stocking level and stand density information by PAG and PVG.

### **Scale Considerations: Stand Versus Landscape Context**

Scale is fundamentally important, and scale considerations permeate all aspects of natural resource management (Haynes et al. 1996). Forest ecosystems have multiple organizational levels that vary over space and time. Levels are organized as hierarchies – each level has discrete ecological functions but also contributes to a larger whole – the landscape.

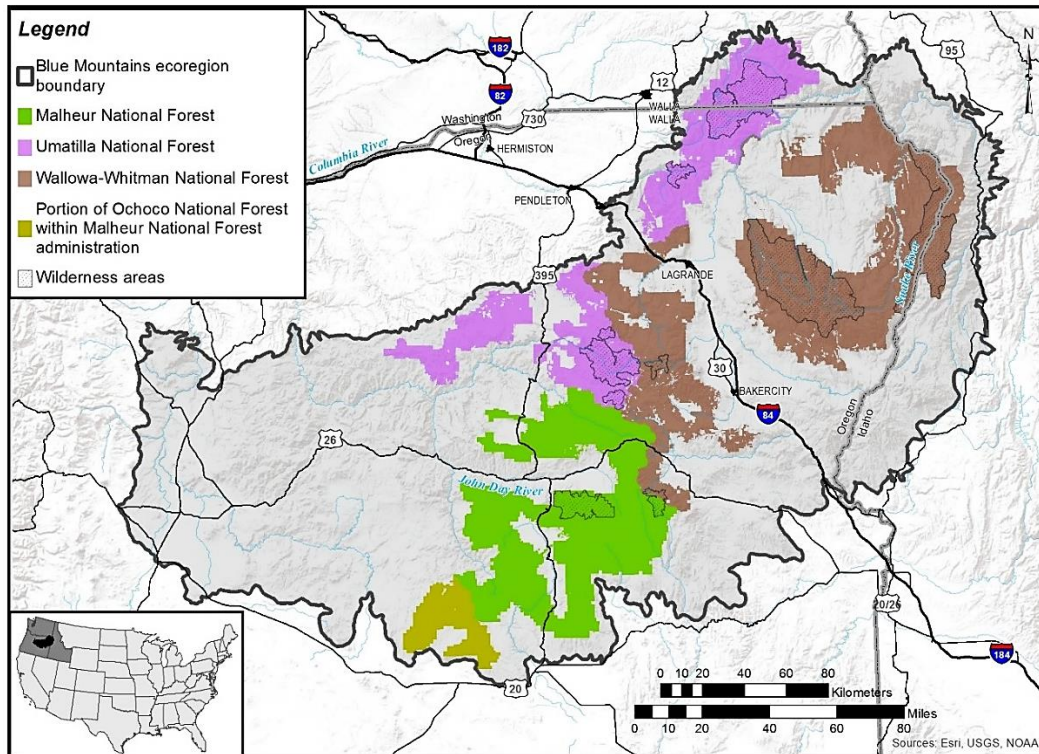


**Figure 1-2** – Blue Mountains ecoregion of northeastern Oregon, southeastern Washington, and west-central Idaho (Clarke and Bryce 1997, Thorson et al. 2003) (from Halofsky and Peterson 2017). The Blue Mountains consist of a series of mountain ranges occurring in a southwest to northeast orientation, extending from the Ochoco Mountains in central Oregon, its southwestern extent, to the western edge of the Seven Devils Mountains in west-central Idaho, its northeastern extent. Other mountain systems also occur in the ecoregion, including the Greenhorn, Elkhorn, Aldrich, Strawberry, and Wallowa Mountains. Colored shading depicts the geographical distribution of three national forests: Malheur, Umatilla, and Wallowa-Whitman. Most of the Ochoco National Forest, beyond a portion administered by the Malheur National Forest and shown in chartreuse, is not shown here. But this stocking guide is also useful for the Ochoco NF.

Moving upward through a vegetation hierarchy steps from a patch to a stand, a forest, a cover type, a formation, and finally to a biome – the highest level (Haynes et al. 1996).

**The fine-scale information in this guide is designed to be applied at a stand level.** Note that stand-scale stocking data has been generalized to the PAG and PVG levels (Powell 2013b), but the tables in this guide (chapter 6) are intended to be *used with individual tree species on particular PVTs* – this guide’s information pertains to individual stands only.

Stands are the building blocks of landscape mosaics. Project planning may evaluate various combinations of stands as alternatives for meeting landscape-level goals. Given our inability to treat all forests with high susceptibility to stand-replacing disturbance, it is important to understand where density management treatments can be most influential at a landscape scale. For a stand context, information provided by this guide may help with those decisions.

The relatively narrow focus of this stand-level stocking guide means that it likely has a limited role at the landscape scale. But once a planning process identifies stands to be treated to address overstocking issues, then this guide undoubtedly has a role to play.

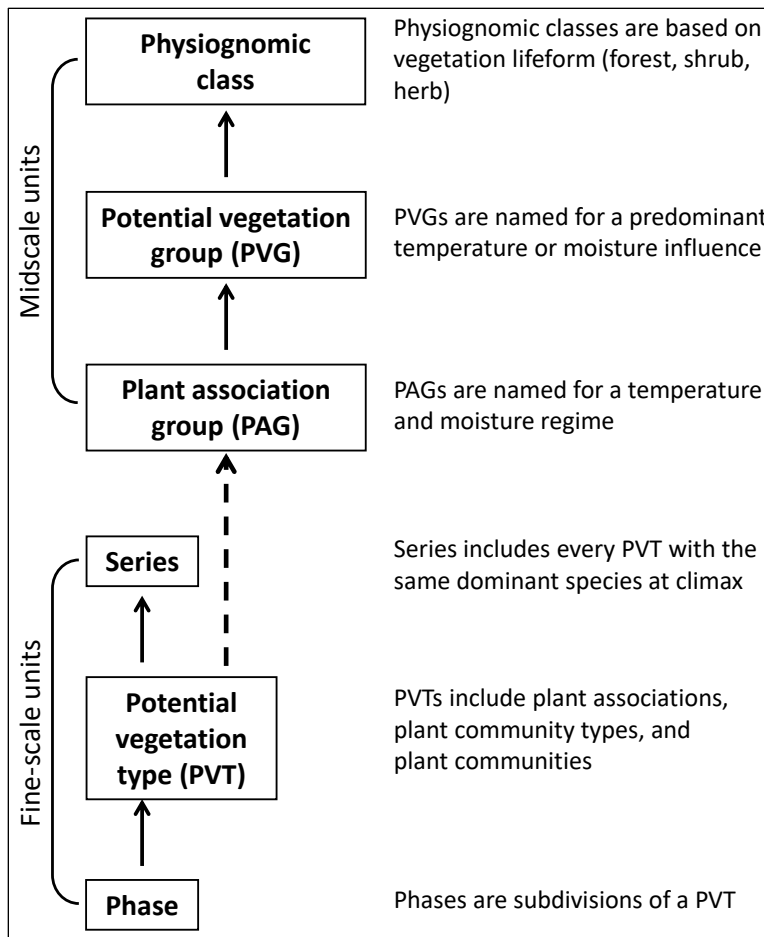


**Figure 1-3 – Potential vegetation (PV) hierarchy for the Blue Mountains (from Powell et al. 2007).** PV taxonomic units have been organized as two integrated portions of a hierarchy. Fine-scale hierarchical units are described in PV classification reports (Crowe and Clausnitzer 1997, Johnson 2004, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnson and Swanson 2005, Swanson et al. 2010, and Wells 2006); midscale units are primarily described in reports from an Interior Columbia Basin Ecosystem Management Project (such as Jensen et al. 1997). Potential vegetation types (PVTs) provide a link between the fine- and mid-scale portions of the hierarchy because PVTs are aggregated to form plant association groups. Stocking level and stand density information was developed for PAGs and PVGs by generalizing PVT-level data (Powell 2013b).

## What This Document Does Not Include

Upland-forest potential vegetation types (PVTs) described after the Cochran et al. (1994) research note was published are not included in this guide (e.g., Johnson 2004, Johnson and Swanson 2005, and Swanson et al. 2010). Cochran et al. (1994) does not include forested wetland types defined by Crowe and Clausnitzer (1997), Swanson et al. (2010), and Wells (2006) – forested wetland PVTs are not included in this guide.

## Changes Between The 1999 Guide And This Revised Edition

A stocking guide was published in April 1999 (Powell 1999). This guide is a revised edition; it includes many updates reflecting user feedback from 1999 to now. This list summarizes some differences between the two versions:

- The original edition is out of print and, rather than print additional copies, it was decided to revise the guide, incorporate suggested changes, and then publish an update edition.
- Edits were made to the text, tables, and figures; chapter topics are presented in a more logical sequence; stocking table layout was changed from a portrait to landscape format.
- An Executive Summary was added to provide more summary detail than could be included in an abstract.
- When stocking levels for multiple potential vegetation types (PVTs) are the same, or very close (within a few SDI points), for a tree species, then the relevant PVTs were included in a

single table. This results in less bulk for tables in chapter 6, and a shorter document.

- Feedback suggested that the full stocking value *for lodgepole pine* is too low. Therefore, ecoregion-wide values for full stocking and maximum density were increased to those provided by Dahms (1964). [An example: “An SDI of 277 is considered to depict normal stocking for lodgepole pine in south-central Oregon (Cochran et al. 1994). The normal stocking level for the plant community of this study area (Anthony burn, Blue Mountains) may be considerably higher than 277” (Cochran and Dahms 1998).]
- Additional information and figures were added to elaborate on concepts and principles, especially for stand density and potential vegetation (potential vegetation types).
- Powell 1999 includes potential vegetation types found only on the Umatilla National Forest; *this edition includes all potential vegetation types contained in Cochran et al. (1994).*
- The 1999 edition provided information for plant associations only; this updated edition includes stocking information for both plant associations and plant community types.
- Additional material describes how each stand density metric is calculated, so that users can make their own calculations in a spreadsheet application.
- This edition provides SDI values for the maximum density (MD) stocking level. MD is used as a reference level for this guide; the 1999 guide used full stocking as a reference level.
- Because maximum density was not discussed to any extent in the 1999 edition, additional background material was added to elaborate on the maximum density concept.
- Recent literature citations were added, especially references published after Powell 1999.
- A new section describes how users can fine-tune their FVS growth-and-yield modeling by incorporating stocking levels from this guide, especially when using the SDIMAX keyword.
- The upper limit of a management zone stocking level was calculated as 55% of maximum density, not as 60% as was done previously. The 55% value is a default used by FVS.
- The lower limit of a management zone stocking levels was calculated as 35% of maximum density, not as 40% as was done previously.
- A new stocking level was included – climate resilience (calculated as 25% of MD).
- Diameter-lift tables were added for three tree species, along with a stand growth table for four species, to assist users with preparation of thinning prescriptions.
- Guidance is offered for how to derive stocking levels for stands where western white pine will be a management focus.
- Stand density information was added to estimate crown fire susceptibility for three categories of canopy fuel loading (low, moderate, and high).
- When the 1999 guide was prepared, trees-per-acre (TPA) values were calculated by using procedures described in appendix 2 of Cochran et al. 1994. That appendix uses an equation involving species-specific intercept values (table 2-3). But except for western larch, the intercepts presented in table 2-3 deviate from Reineke’s 10" QMD reference diameter. I decided to use a 10" reference diameter when making the TPA calculations for this guide. This resulted in slightly different stand density results (in chapter 6 tables) than were presented in the 1999 document. Differences are most pronounced for Douglas-fir because its intercept (9.42) has the greatest deviation from Reineke’s 10" reference diameter. (*This equation is what I used to make the TPA calculations for chap. 6 tables:  $TPA = SDI / (QMD/10)^{slope}$ .*)

## 2. CONCEPTS AND PRINCIPLES

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A user must know two things about a forested stand to apply the stocking levels presented in this guide – potential vegetation type and tree species. If a manager is working with a ponderosa pine stand, for example, this guide is only useful if they know which potential vegetation type their ponderosa pine stand is growing on.

This chapter discusses foundational concepts and principles for two topics: (1) potential vegetation (e.g., potential vegetation type), and (2) stand density.

The potential vegetation material describes what potential vegetation is (what it refers to), how potential vegetation is classified, and why potential vegetation provides important insights about the ecological roles of Blue Mountains tree species (e.g., their successional status).

The stand density material describes many of the metrics used to characterize stand density (stand density index, trees per acre, basal area, etc.), along with descriptions of the stocking levels included in this guide (e.g., maximum density, full stocking, upper and lower limits of a management zone, climate resilience).

A glossary is included (chapter 7), and it includes definitions for plant association, plant community type, stockability, and other terms used in this chapter and elsewhere in the guide.

### POTENTIAL VEGETATION: CONCEPTS AND PRINCIPLES

**“A distant summer view of the Blue Mountains shows a dark band of coniferous forest occurring above a lighter-colored grassland zone. Each of the two contrasting areas seems to be homogeneous, and the border between them appears sharp. A closer view reveals great diversity within each zone and borders that are poorly defined: herbaceous communities and stands of deciduous trees are scattered throughout the coniferous forest, and the species of dominant conifer changes from one site to another.**

**At the foot of the Blue Mountains, fingers of forest and stands of tall deciduous shrubs invade the grassland zone for varying distances before becoming progressively less common and eventually disappearing altogether. These vegetation patterns demonstrate that the Blue Mountains are broken up into a myriad of small units, many of which repeat in an intricate, changing pattern. Making sense of this landscape mosaic is possible by using a concept called potential vegetation (PV)” (Powell et al. 2007).**

Potential vegetation is the community of plants that would be present if all successional sequences progressed to their ultimate endpoint, under existing environmental conditions and in the absence of disturbance, including no direct interference from humans (Hall et al. 1995).

Disturbance is pervasive in the inland Northwest, so it may seem unrealistic to use a classification system (potential vegetation) that interprets vegetation as though disturbance is absent. But since disturbance is inherently variable, and because it is difficult to include an inherently variable range of disturbance effects in a classification system, potential vegetation represents a good compromise – it characterizes ‘climax’ (endpoint) vegetation produced by existing environmental gradients and our recent climatic regime, while ignoring variable disturbance effects.

Potential vegetation can be thought of as the algebraic sum of all environmental factors influencing the flora of an area (Daubenmire 1976). Physical site factors interact to form a temperature and moisture regime influenced primarily by elevation, slope steepness and shape, aspect (slope direction), and geologic parent materials and their resulting soils (Meurisse et al. 1991).

Variation between seral and climax vegetation types involves an important difference in their dynamics: successional types are dynamic in terms of their total character – they change from one distinct community to another (e.g., from a lodgepole pine stand to a grand fir stand), whereas the total character of a climax community changes little from one century to the next (if left undisturbed, a climax spruce-fir stand will stay spruce and fir for a long period, although relative proportions of spruce and fir may fluctuate some across a long timeframe).

The range of variation (RV) concept is a valuable tool for describing how vegetation conditions typically change through time. Vegetation dynamics fluctuate within a range that remains relatively constant – the range remains constant, but any particular state (condition) within a range does not remain constant. RV for successional types differs from that for climax types, even though the trajectory of plant succession is trending, overall, in one direction (meadow community → lodgepole pine community → grand fir community, for example).

A successional stage often has an RV that differs by climax type – RV for a meadow community type will not necessarily have the same range for climax grand fir sites as it does for climax subalpine fir sites – in other words, differing proportions of an herbaceous successional stage (meadow) are expected for grand fir sites (e.g., 5-15%) than for subalpine fir sites (10-30%). [This example assumes transitional (temporary) meadow on sites that were previously forested.]

This RV example means that historically, between 5 and 15 percent of the land where the potential vegetation is grand fir forest would be expected to support meadow at any point in time. A common scenario is this: a lightning strike causes a wildfire, resulting in a patch of stand-replacing fire severity. An herbaceous community (meadow) initially occupies the fire-caused opening. Eventually, the meadow is replaced by early seral forest (lodgepole pine), which in turn is ultimately replaced by late seral forest (grand fir).

### **Tree Species Indicator Status**

Potential vegetation types with a similar temperature and moisture regime occupy a particular biophysical environment – ‘warm dry upland forest,’ for example. *This fact illustrates a strength and utility of the potential vegetation system – it allows us to stratify the vegetation into ecologically meaningful groups* (Powell et al. 2007).

An ecological setting provides useful context for a forest cover type – ponderosa pine forest growing on a warm dry setting functions much differently than ponderosa pine forest growing on a cool moist setting. And these differences emphasize that most tree species can fill multiple successional roles, depending on which biophysical environment they occur in and their life history traits (amplitude, etc.). Ponderosa pine is a good example for the Blue Mountains:

- On hot dry sites at low elevations, ponderosa pine is typically the late-seral (climax) species because most other trees (except woodland species such as western juniper) lack enough ecological amplitude to establish and survive in these environments.

- On warm dry sites where Douglas-fir or grand fir are climax species in dry mixed-conifer forests, ponderosa pine is a long-lived, early seral dominant. For the Blue Mountains, ponderosa pine is most common, and tends to make its best growth, on the warm dry sites.
- On cool moist sites where grand fir or subalpine fir is climax, ponderosa pine is a minor species (but it is still found on these settings, such as grand fir/twinflower sites).
- And on cold dry sites at high elevations, ponderosa pine is typically absent because it seldom gets established and survives in these harsh ecological environments.

These concepts can be extended with another example: the presence of ponderosa pine in stands trending toward domination by grand fir may indicate only that one or more mature ponderosa pines happened to be within seed dissemination distance when the last wildfire or other disturbance event occurred. How could a land manager come to this conclusion?

Shade-intolerant tree species, including ponderosa pine, can become established on sites that are moister than they can hold onto when facing competition from shade-tolerant species such as grand fir. Ponderosa pine and grand fir occurring together on the grand fir/twinflower plant association is an example of this situation (Johnson and Clausnitzer 1992).

This species pattern suggests that varying amounts of ponderosa pine and grand fir on an area may not indicate differences in temperature or moisture (e.g., ponderosa pine occupying warm dry microsites; grand fir occupying cool moist microsites); instead, it may reflect a species progression trend in a post-disturbance sere (fig. 2-1) where early- or mid-seral ponderosa pine is slowly being replaced by late-seral grand fir. [Common seral stages for many grand fir plant associations of the Blue Mountains are described in Clausnitzer 1993.]

This example illustrates that the proportion of ponderosa pine in a mixed-conifer stand may have limited value as an indicator of a site's temperature and moisture status, but it can be useful as a measure of how much time has passed since the last disturbance event with sufficient intensity to initiate a cohort of early-seral tree species.

Why are potential vegetation types (PVTs) used for this stocking guide? *PVTs are important because they delineate areas of similar productivity and ecological site potential.* When reduced to its essence, PVTs are the habitats for Blue Mountain tree species. (But an important question: Is the PV concept still relevant for a climate-changed future? Research suggests that PVT distributions will migrate dramatically (Hinze et al. 2023); other possible PV changes are unclear.)

## **Plant Community Types And Plant Communities**

In a potential vegetation context, plant communities (PCs) and plant community types (PCTs) are treated as classification units without any particular successional status. This differs from plant associations, the primary potential vegetation unit used in this guide, because plant associations are viewed as 'climax' types – the PNC stage shown in figure 2-1.

PCs and PCTs are viewed as examples of the mid or late stages shown in figure 2-1. Common PCTs are lodgepole pine communities where the ultimate PNC (climax) tree species is grand fir or subalpine fir. But seral stages dominated by lodgepole pine are persistent and may be managed to perpetuate lodgepole pine rather than allowing succession to reach the climax fir stage.



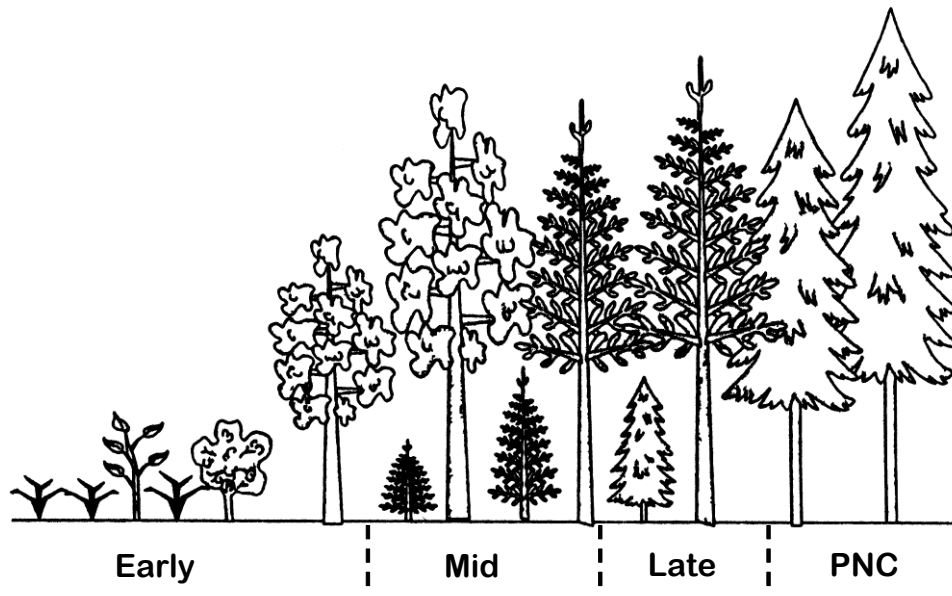


**Figure 2-1** – Seral stages for a grand fir plant association of the Blue Mountains (adapted from USDA Forest Service 1994). The series of stages shown here is called a sere (Hall et al. 1995). After a stand-initiating disturbance event, the resulting plant community transitions from simpler, somewhat disorganized states (early stage) to relatively complex, highly organized states (the PNC, potential natural community). An early-seral stage is initially dominated by grasses, forbs, and shrubs, but shade-intolerant tree species also get established. A mid-seral stage has a mix of species, with early species (ponderosa pine above) and mid species (Douglas-fir above) present in about equal amounts. Late-seral stands have both mid and late tree species present. Above, grand fir is a late species; note that a long-lived, early species, western larch, is also shown as persisting into mid- and late-seral stages. PNC or ‘climax’ stands tend to be infrequent in the Blue Mountains because ponderosa pine and western larch are long-lived, and it often requires centuries for them to completely drop out of a stand.

PCs and PCTs are common and can be perpetuated by using management activities, so it is important to have suggested stocking levels for them. A list of PCs and PCTs is provided in table 2-1. For each PC or PCT, it shows the ‘parent’ plant association – the climax type – that will ultimately occur if forest succession continues unimpeded.

### **Stockability As An Indicator Of Site Potential And Carrying Capacity**

Site potential can be characterized by using the stockability concept – stockability describes a site’s carrying capacity for stand density. Some plant associations have high inherent stockability for one or more tree species. Stockability differences are reflected in the maximum stocking levels (maximum SDI) expressed by tree species and potential vegetation type (see table 3-1).

Historical stocking guides vary their recommended levels by tree species. This guide does the same, but species-level stocking data also varies by PVT. For the Blue Mountains, ponderosa pine occurs in 48 PVTs (table 3-1), so this stocking guide includes 48 sets of suggested stocking levels for ponderosa pine. The same approach is used for the other six Blue Mountains species.

Because potential vegetation (PV) is an indicator of ‘carrying capacity’ for stand density, it reflects the rate at which forests and trees grow, and how quickly new trees get established.

**Table 2-1:** Upland-forest plant community types (PCTs) of the Blue Mountains, and an estimate of their parent (climax) plant association (PCTs are seral stages of associations).

| PLANT COMMUNITY TYPE (PCT) | PARENT PLANT ASSOCIATION                      |
|----------------------------|-----------------------------------------------|
| ABGR/ACGL-PHMA             | ABGR/ACGL                                     |
| ABGR/ARCO                  | ABGR/CARU                                     |
| ABLA2/ARCO                 | ABLA2/TRCA3                                   |
| ABLA2/CARU                 | No parent association identified for this PCT |
| ABLA2/POPU                 | ABLA2/VASC/POPU                               |
| ABLA2/STAM                 | No parent association identified for this PCT |
| ABLA2/STOC                 | ABLA2/CAGE                                    |
| ABLA2-PIAL/POPU            | No parent association identified for this PCT |
| PICO(ABGR)/ALSI            | ABGR/CLUN                                     |
| PICO(ABGR)/ARNE            | ABGR/VAME                                     |
| PICO(ABGR)/VAME            | ABGR/VAME                                     |
| PICO(ABGR)/VAME/CARU       | ABGR/VAME                                     |
| PICO(ABGR)/VAME-LIBO2      | ABGR/LIBO2                                    |
| PICO(ABGR)/VAME/PTAQ       | ABGR/VAME                                     |
| PICO(ABGR)/VASC/CARU       | ABGR/VASC                                     |
| PICO(ABLA2)/STOC           | ABLA2/CAGE                                    |
| PICO(ABLA2)/VAME           | ABLA2/VAME                                    |
| PICO(ABLA2)/VASC           | ABLA2/VASC                                    |
| PICO(ABLA2)/VASC/POPU      | ABLA2/VASC/POPU                               |
| PIPO/SPBE                  | No parent association identified for this PCT |
| PSME/CELE/CAGE             | No parent association identified for this PCT |

*Sources/Notes:* From Powell 1999. Parent associations are used to assign stocking levels for PCTs. When the phrase “No parent association identified for this PCT” is used, it means that the parent plant association for a PCT is unknown or uncertain.

Here are two examples of potential vegetation effects on stand density (representing both ends of a carrying capacity spectrum):

- For the ponderosa pine/bluebunch wheatgrass plant association, a fully stocked ponderosa pine stand supports 133 trees per acre at a quadratic mean diameter of 10 inches.
- For the grand fir/twinflower plant association, a fully stocked ponderosa pine stand supports 365 trees per acre at a quadratic mean diameter of 10 inches (Powell 1999).

These examples demonstrate that for the same stocking level (full stocking), same stand size (quadratic mean diameter of 10 inches), and same tree species (ponderosa pine), the carrying capacity (stockability) of grand fir/twinflower sites is almost three times greater ( $365/133 = 275\%$ ) than the carrying capacity of ponderosa pine/bluebunch wheatgrass sites.

*With such great differences in stockability from one biophysical environment to another, it is imperative that the suggested stocking levels presented in this guide appropriately reflect variations in ecological carrying capacity across the Blue Mountains.* Stocking levels that vary by PVT effectively reflect these variations.

## STAND DENSITY: CONCEPTS AND PRINCIPLES

Density is defined as the number of plants per unit area (Kimmins 2004). This is a simple definition, but it says nothing about distribution: are plants evenly distributed, or do they occur in a patchy pattern? And it conveys little information about tree size or crowding: Do 500 trees per acre occur as 1-foot seedlings or as 40-foot trees (Long 1996, Zeide 2005)? [The implications of 500 trees per acre certainly differ for 1-foot seedlings versus 40-foot trees.]

Stand density characterizes how many trees currently occupy an area. It is a quantitative measure of tree abundance expressed as number of trees, square feet of basal area, wood volume, canopy cover, or similar measures (Curtis 1970, Ernst and Knapp 1985).

The term stocking, however, relates existing stand density to the density of a reference stand or condition (Davis et al. 2001). Stand density tells us ‘what is,’ whereas stocking relates to an established standard of ‘what could be’ or perhaps ‘what should be’ (Smith et al. 1997). *Stocking is a relative concept that places existing stand density in a management or ecological context* (Gingrich 1967).

Terms such as understocked, fully stocked, or overstocked express how existing stand density relates to some measure of what is considered normal, desirable, or optimal. It is possible for a stand to be both understocked and overstocked, depending on objectives or what is considered desirable (Daniel et al. 1979a, Gingrich 1967). A moderately dense stand may be viewed as understocked for an elk hiding cover objective, and overstocked for an elk forage objective.

The relationship between an existing stand density and a reference level, for the same average tree size, is referred to as relative density (Helms 1998, Smith et al. 1997). Here’s another way to phrase it: Relative density is “the ratio of actual stand density (trees per acre) to the maximum stand density attainable in a stand with the same mean tree size” (Drew and Flewelling 1979, Comeau et al. 2010). [It is not a prerequisite to use ‘maximum stand density’ as a basis for comparison when using the relative density concept.]

Relative density typically relates existing density to one of three reference levels:

1. *Maximum density* for a species (Comeau et al. 2010, Curtis 1982, Drew and Flewelling 1979, Reineke 1933). In this guide, this level is termed maximum density.
2. *Normal density* (MacLean 1979), equivalent to an average-maximum level of competition (Curtis 1970, Ernst and Knapp 1985). In this guide, this level is termed full stocking. Figure 2-2 describes the difference between ‘average-maximum’ and ‘maximum’ density levels. The Cochran et al. (1994) stocking system uses full stocking as a reference level.
3. *Open-grown density* estimates the area used by all trees in a stand in relation to the maximum crown area they would use if they were open grown. This open-grown baseline reflects no intertree competition. An example is crown competition factor (Gingrich 1967, Krajicek et al. 1961) used in the Lake States. *This guide does not use this level.*

### Stand Density Index

Silviculturists often use relative density when developing thinning regimes. A common relative density tool in the western United States is stand density index (SDI) – it reflects a relationship between tree size and number of trees per acre (Daniel et al. 1979b, Reineke 1933).

Stand density index was developed by Lester Henry Reineke, a research silviculturist with USDA Forest Service's California Forest Experiment Station. Reineke (1933) examined size-density data for 14 forest types or tree species. He discovered that a fully stocked, even-aged stand of a given average stand diameter had approximately the same number of trees per acre as other fully stocked, even-aged stands *for the same species and average diameter*.

### **SDI Is An Index**

Reineke wanted to compare tree density for even-aged stands (Schnur 1934). To address this need, he developed a mathematical process to consistently compare stands with differing tree sizes and number of trees, because "stands of small average diameter have a large number of trees, while stands of large average diameter have relatively few" (Reineke 1933).

SDI indexes existing stand density to what it would have been in the past, or what we expect it to be in the future, at a reference size of 10 inches (quadratic mean diameter, QMD). Indexing to a specific reference diameter (10" QMD) allows SDI to 'scale' existing density to a common tree size. In other words, by holding reference diameter constant (10"), SDI allows users to compare density for multiple stands, and to do so without needing to account for varying tree size.

*Users can interpret an SDI value as representing the number of 10-inch trees that would experience about the same level of intertree competition as their stand's existing density.*

Some proponents have noted that "SDI 350 does not imply that the present stand will have or did have SDI 350 when it reaches or had an ASD [QMD] of 10 inches" (Daniel et al. 1979b, p. 4). But Reineke (1933) observed in his footnote 5 (page 636): "This stand-density index is determined very much as is site index, since it is the number of trees per acre with an average diameter of 10.0 inches *which the stand had or will have*, assuming that the change in number of trees and average diameter progresses parallel with the reference curve" (italics added by author).

If a stand has 200 trees per acre (TPA) at a quadratic mean diameter (QMD) of 9 inches, and another stand of the same species has 40 TPA at a QMD of 20 inches, are they equally stocked? To compare stands of differing QMD (9 and 20 inches) and differing density (200 TPA and 40 TPA), *Reineke's method translates a stand's existing density into its equivalent value at a standard reference diameter (QMD) of 10 inches*. [And the stands in this example do not have equivalent density – the 9-inch stand has a higher SDI (169) than the 20-inch stand (122) when SDI is calculated by using Reineke's non-specific slope factor of 1.605.]

A useful advantage of SDI (and similar relative density measures) is that they free users from needing to know site index or stand age when applying the measure. Therefore, stands of the same species – with the same quadratic mean diameter and number of trees per acre – are "more alike in every way than stands of the same site and age" (McArdle et al. 1961).

We often see this statement in forestry textbooks – SDI is independent of site index and stand age – but what does it really mean? A compelling answer to this question is provided by some actual forestry data. Independence of SDI from site index and stand age is demonstrated with information from normal yield tables for western hemlock (table 2-2).

**Table 2-2:** Variation in site index and stand age for equivalent values of quadratic mean diameter and trees per acre for western hemlock.

| SITE INDEX | STAND AGE | QUAD. MEAN DIAMETER | TREES PER ACRE |
|------------|-----------|---------------------|----------------|
| 70         | 160       | 10.0                | 510            |
| 90         | 100       | 10.0                | 510            |
| 130        | 60        | 9.9                 | 510            |
| 170        | 50        | 10.0                | 510            |

Source: Barnes 1962 (adapted from table 12.2, p. 262, in Daniel et al. 1979a).

Table 2-2 shows that SDI is independent of site index and stand age because *a stand with lower site index will reach a quadratic mean diameter (QMD) of 10" at a later age than a stand with higher site index, but when both stands eventually reach a 10" QMD, the older, low-index stand will have the same number of trees per acre as the younger, high-index stand.* Or to put it another way, table 2-2 shows that a fully stocked stand of 160-year-old trees (site index 70) can have the same density (510 trees per acre) as a fully stocked stand of 50-year-old trees (site index 170) when both stands reach the same average tree size (a 10" QMD).

When stocking data from Schumacher's red fir normal yield table (Schumacher 1928) is plotted as a percentage of normal yield table values, the resulting values also show independence from site index and stand age (Daniel et al. 1979a).

Some literature refers to a Suchatschew effect (Smith and Hann 1984), where stands of similar initial density travel along a similar pathway as development progresses, *but they travel along the pathway at differing rates* because they're growing on areas of differing site index. Hemlock data (table 2-2) provides an example of the Suchatschew effect because fully stocked, even-aged stands have similar stand densities when reaching a common point (10" QMD), although they required differing amounts of time to get there.

### Reineke's Development Of Stand Density Index

Reineke plotted tree densities for fully stocked, even-aged stands on log-log axes, and then drew a straight, freehand line skimming the outermost data values, such that all size-density points fell below the line (Zeide 2005). This process resulted in a maximum density line (fig. 2-2). Reineke observed that the maximum-density lines for redwood and red fir were identical, and both were higher than for other 14 species he examined, so he proposed that their maximum density SDI value (1,000) be adopted as a maximum-density reference line for all tree species (Reineke 1933).

Reineke's suggestion for how SDI could be used – calculate an SDI value for an existing stand, and then compare it against a reference level of 1,000 – is an example of why SDI is often assumed to be a relative density measure (see *relative density* in chapter 7, glossary).

SDI can also function as a stand density metric, in much the same way as 'trees per acre' or 'basal area per acre.' By plugging two attributes into Reineke's equation – trees per acre and quadratic mean diameter – SDI values are easily calculated for the stands in a project area.

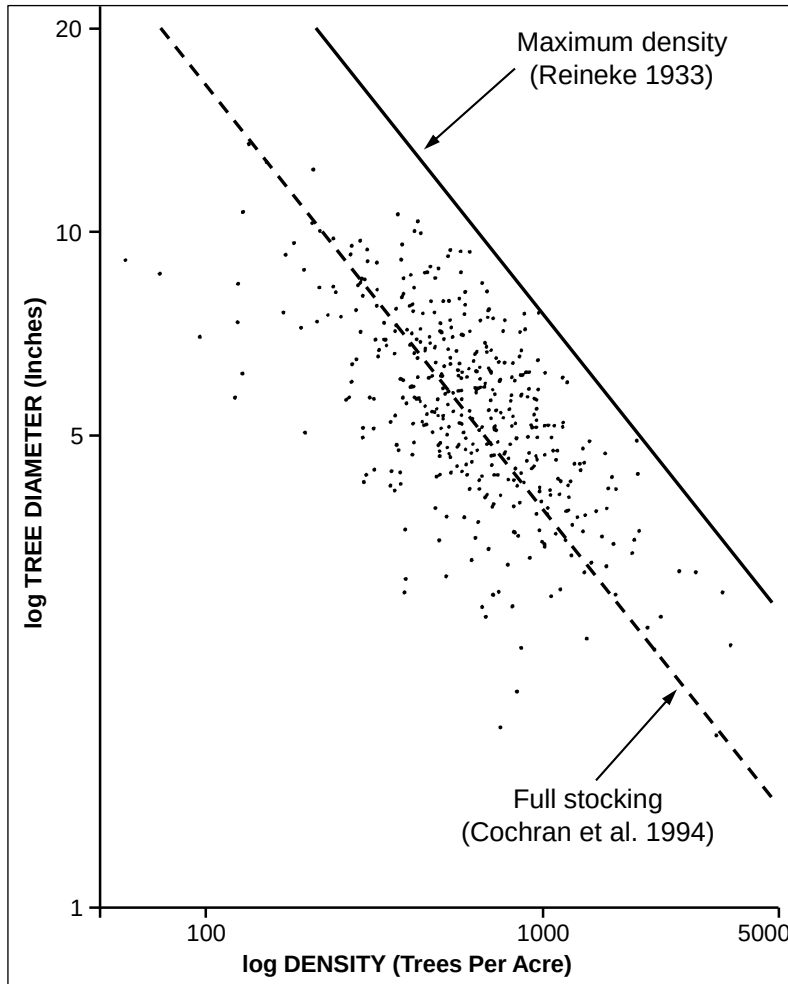


**Figure 2-2** – Relationship between maximum density and full stocking. L.H. Reineke plotted tree diameter and density on logarithmic scales for well-stocked, even-aged stands (Reineke 1933). The result was a scatter-plot where each dot represents a stand's data for mean diameter and trees per acre. Reineke drew a straight line skimming the cloud of points, representing an absolute-maximum level of competition (Daniel et al. 1979a). *This upper line represents maximum density.* When a least-squares regression is applied to the scatter-plot cloud, it results in an average density line for fully stocked stands, representing an average-maximum level of competition (in fact, this line is often referred to as 'average maximum density' (Long and Shaw 2005). This average line passes through the cloud of points and is referred to as normal density (Meyer 1961, McArdle et al. 1961) or full stocking (Cochran et al. 1994).

Cochran and others (1994) calculated their upper and lower limits of a management zone stocking levels as percentages of full stocking, whereas Reineke (1933) used maximum density as his reference level.

If a calculated SDI value is not being compared to a reference level, then it is being used to characterize existing stand density. Cochran et al. (1994, p. 2) used SDI in that way; the concept of using SDI to make stand density calculations was also discussed by Reineke (1933, p. 636).

Field guides for the Blue-Ochoco and Wallowa-Snake geographical areas provide stand density information by plant association, but it is expressed by using a metric called growth basal area (Hall 1983, 1987, 1989). Cochran et al. (1994) needed to convert growth basal area data from the plant association field guides into its corresponding SDI values. A *Converting GBA to SDI* section in Cochran et al. (1994: 5-7) describes how they accomplished the conversion task.

### Variation In Maximum Density

By plotting measured SDI values obtained from fully stocked, even-aged stands, for a variety of forest types, Reineke's work clearly demonstrates that maximum density reference levels vary by species: he determined maximum SDI values of 595 for Douglas-fir, 830 for white fir, 450 for loblolly pine, 400 for longleaf pine, and 830 for ponderosa pine (Reineke 1933).

Cochran et al. (1994) demonstrate the same result for the Blue Mountains – reference levels

vary by tree species (as shown by maximum density values presented in table 2-3), but they also vary within a tree species by potential vegetation type (see table 3-1).

To illustrate how stand density reference levels vary within an individual tree species, consider this brief step-down example for ponderosa pine (PP):

- Long and Shaw (2005) assume that 450 is a reasonable estimate of *maximum density* for ponderosa pine (based on analysis of 766 FIA plots spanning the western United States).
- Powell (1999) describes a *maximum density* of approximately 456 for PP in the Blue Mountains – calculated as 125% of Cochran et al.'s (1994) full-stocking value for PP.
- Cochran et al. (1994) describe a *full-stocking* reference level of 365 for ponderosa pine. This value pertains to the Blue Mountains ecoregion as a whole.
- PP maximum density for Douglas-fir and grand fir potential vegetation types (included in table 3-1 ranges from 215 to 456.
- For potential vegetation types where ponderosa pine is climax, the driest type – ponderosa pine/bluebunch wheatgrass – has a maximum density of only 166.

Variation in a tree species reference level by potential vegetation type (PVT) functions as an 'environment boundary line' (Sackville Hamilton et al. 1995) – each PVT represents a different biophysical environment. Figure 2-3 provides an example of this concept for ponderosa pine.

### Self-Thinning Process

A basic tenet of ecology is: the more closely that plants are crowded together, the smaller each plant must be. But what is remarkable about this relationship, termed the *self-thinning rule*, is that the density of surviving plants in crowded populations has a relatively precise relationship to their mean size (Hutchings 1983).

An exponential (power) relationship between average plant size and plant density is referred to as *self-thinning* – as plant size increases, some individuals in a population must relinquish their growing space (die) so it can be claimed by the survivors, allowing them to continue increasing in size (Hutchings 1983, Mohler et al. 1978, Pickard 1983). [And it appears that self-thinning may operate differently in understory versus overstory trees (Coomes et al. 2003).]

But rather than dying, some tree species, pines mostly, will slow their growth to imperceptible levels under high-density conditions – a phenomenon known as stagnation (see chapter 4).

The self-thinning process is a fundamental principle of Reineke's stand density index (Reineke 1933) because as carrying capacity for growing space becomes fully occupied, an increase in average stand diameter (tree size) can occur only if there is a corresponding reduction in the number of trees per unit area. "As individual trees grow in size their demands on site resources and growing space increase. When resources are no longer adequate to support additional growth of all the trees present, self-thinning will be initiated and the number of trees per unit area will decrease" (Burkhart 2013).

Reineke's (1933) analysis clearly shows that the growing space occupied by trees in fully stocked, even-aged stands increases at a constant exponential rate as quadratic mean diameter (QMD) increases. We can reach this conclusion because *tree density decreases as QMD increases* (fig. 2-2), indicating that trees require more growing space with increasing size.



**Table 2-3:** Intercept values, slope factors, and ecoregion-wide values of full stocking and maximum density, for tree species of the Blue Mountains.

| Tree Species         | Intercept Value <sup>1</sup> | Slope Factor <sup>1</sup> | Full Stocking <sup>1</sup> | Maximum Density <sup>2</sup> |
|----------------------|------------------------------|---------------------------|----------------------------|------------------------------|
| Ponderosa pine       | 9.97                         | 1.77                      | 365                        | 456                          |
| Interior Douglas-fir | 9.42                         | 1.51                      | 380                        | 475                          |
| Western larch        | 10.00                        | 1.73                      | 410                        | 512                          |
| Lodgepole pine       | 9.63                         | 1.74                      | 460 <sup>3</sup>           | 575 <sup>3</sup>             |
| Engelmann spruce     | 10.13                        | 1.73                      | 469                        | 586                          |
| Grand fir            | 10.31                        | 1.73                      | 560                        | 700                          |
| Subalpine fir        | 10.01                        | 1.73                      | 416                        | 520                          |

<sup>1</sup> Intercept value, slope factor, and full stocking are taken from table 1 in Cochran et al. (1994) (except for lodgepole pine). Full-stocking values in Cochran's table 1 pertain to the entire Blue Mountains ecoregion (fig. 1-2) – they are not specific to any particular Blue Mountain potential vegetation type.

<sup>2</sup> Maximum density was calculated as 125% of full stocking (table 3-2). They also relate to the whole Blue Mountains ecoregion. Full stocking and maximum density values are SDI.

<sup>3</sup> Some sources suggest that the lodgepole pine full stocking value in Cochran et al. (1994) is too low. Dahms (1964) reports a *normal density* value of 460 for lodgepole pine, equating to a maximum density value of 575. The Dahms (1964) full stocking value for lodgepole pine, and its equivalent maximum density value, are used for this stocking guide.

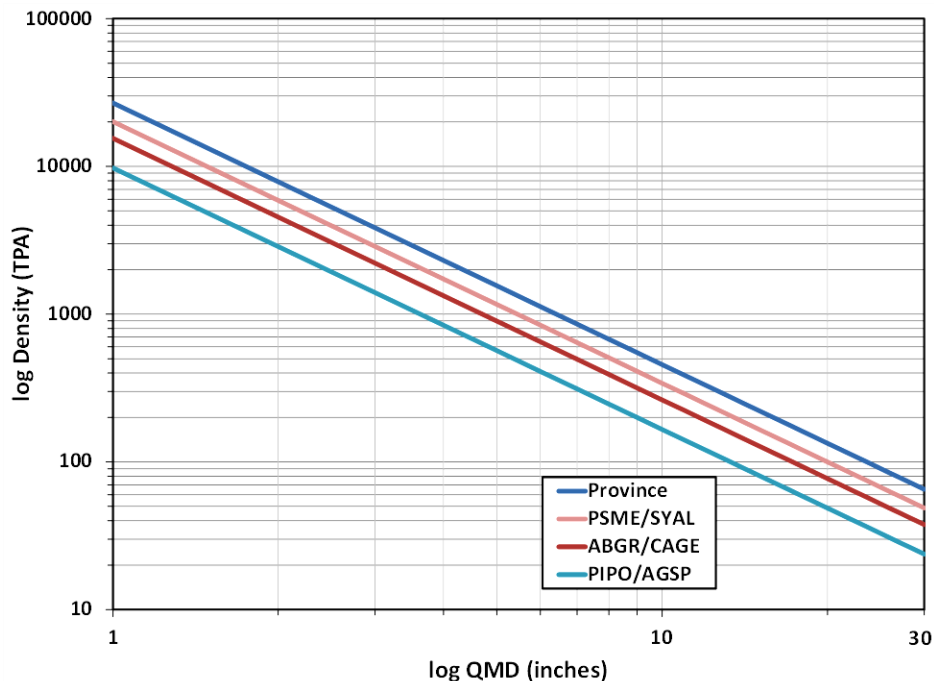


**Figure 2-3** – Environment boundary lines for ponderosa pine. Maximum density varies by tree species and potential vegetation type (PVT). Four environment boundary lines are shown – an ecoregion-wide maximum density level, and maximum densities for three PVTs supporting PP – Douglas-fir/common snowberry (PSME/SYAL), grand fir/elk sedge (ABGR/CAGE), and ponderosa pine/bluebunch wheatgrass (PIPO/AGSP). All four lines have different y-axis intercepts, reinforcing that they represent differing biophysical environments.

As time passes, tree stands move from the bottom right-hand corner of figure 2-2 (high stand density and low mean diameter) up the line toward the top left-hand corner (low stand density and high mean diameter). This growth pattern is illustrated in figure 2-4, which shows long-term stand development trajectories for a collection of forest inventory plots.

This discussion about growing space highlights another advantage of SDI: *“at any given SDI, the competition among trees is the same regardless of the number of trees present”* (Daniel et al. 1979a, p. 325). [This is an important principle, and a major advantage of the SDI metric.]

This principle means that in chapter 6, each table section pertaining to a **certain stocking level** (such as the Upper Limit) **represents an identical amount of growing-space occupancy and tree competition**, even though stand attributes (trees per acre, basal area per acre, etc.) vary across a range of tree size (1 to 30" QMD for the stocking tables).

A self-thinning rule was first proposed about 60 years ago (Yoda et al. 1963<sup>2</sup>). It maintains that for crowded populations, an increase in average plant size must be accompanied by a decrease in the number of plants present. Reineke noted a self-thinning relationship for trees when he observed that “for a given species, the maximum number of trees that it is possible for a stand to have is correlated negatively with the average diameter” (Reineke 1933, p. 637).

Theoretically, the rate of decline in the number of individuals with increasing size is the same for all organisms (e.g., a  $-3/2$  or  $-1.5$  relationship): it applies equally well to fish in a pond or trees in a stand (Enquist and Niklas 2001, Long and Smith 1984, Lonsdale and Watkinson 1982, Midgley 2001, Oliver and Uzoh 1997, Westoby 1984).

Self-thinning is also referred to as density-dependent mortality – intense, intertree competition occurring in dense stands allows big trees (those in a competitively superior canopy position) to take growing space away from small, overtopped trees. “Self-thinning starts before a stand reaches maximum density, and the self-thinning rate increases with stand density and reaches its maximum at maximum stand density” (Tang et al. 1995). [The lower limit of the self-thinning zone is used as a stocking level; see table 3-2.]

Reineke (1933) believed that the slope of a self-thinning line (more properly termed a maximum-density line), expressing the mathematical relationship between tree density and average diameter, was constant (1.605) for all tree stands experiencing maximum crowding. Recent evidence suggests otherwise, and it does so in at least four important respects:

1. Slope of a maximum-density line is more variable than previously thought (Reineke noted slope variation too, specifically for both slash and shortleaf pines; Reineke 1933: 633, 635).
2. Perfectly straight lines may be an exception rather than the rule.
3. Slope of a maximum-density line varies by tree species, and with the biology of a plant (especially when considering plants other than trees).

*[Note: minor calculation differences resulting from use of Reineke’s 1.605 slope value versus the species-specific slope values in table 2-3 are of little practical importance.]*

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<sup>2</sup> A Umatilla National Forest planner once feigned interest in this stocking-level work after hearing me mention Yoda. But his interest quickly evaporated after learning it was not Yoda from Star Wars!

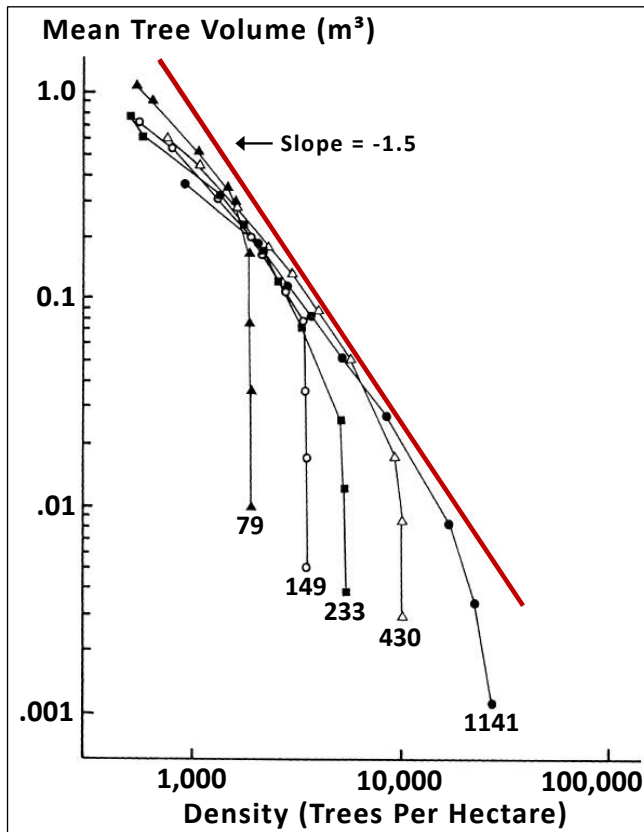


**Figure 2-4** – Stand development trajectories for a series of loblolly pine stands over a 50-year period (adapted from Peet and Christensen 1987). This diagram shows growth trajectory lines for five individual stands of loblolly pine; the number below each line shows initial tree density for a stand. Stands initially experience a period of little or no mortality during the establishment phase. As trees grow in size, they begin to compete with other trees and a stand enters what is referred to as a thinning phase. During this phase, surviving trees are growing fast enough to compensate for biomass lost due to tree death, and growing space liberated by tree mortality is reclaimed quickly. Eventually, surviving trees approach the maximum density or self-thinning line, and their trajectory bends to the left. The red self-thinning line is shown with a slope of -1.5 ( $-3/2$ ) in this figure. This diagram also illustrates the convergence concept – long-standing work tied to normal yield tables (McArdle et al. 1961, Meyer 1961, etc.) consistently shows that stand development tends to approach normality. Regardless of whether a stand starts out as understocked or overstocked, they all tend to converge on the same point (normal density) as development progresses (Daniel et al. 1979a).

4. Height of a line (its y-axis intercept) is not a constant value by tree species because it varies from one biophysical environment (plant association) to another, for the same species (this truth is clearly demonstrated by fig. 2-3 – *all 4 lines have a different y-axis intercept*). (List citations are: Bi 2001, Enquist and Niklas 2001, Hutchings 1983, Lonsdale 1990, Pretzsch and Biber 2005, Sackville Hamilton et al. 1995, Tang et al. 1995, Vanclay and Sands 2009, VanderSchaaf and Burkhart 2007, Weiskittel et al. 2009, Westoby 1984, Zhang et al. 2005).

As maximum size-density relationships were examined closely, it was found that maximum-density lines vary for conifers versus hardwoods, and for tolerant versus intolerant species (Daniel et al. 1979a, Hutchings 1983, Puettmann et al. 1993, Smith et al. 1997, Weiskittel et al. 2009).

### Variation In The Maximum Density Slope Factor

Cochran et al. 1994 used a slope factor of 1.77 for ponderosa pine (table 2-3), rather than Reineke's universal slope factor of 1.605, because it was found to provide a good statistical fit for data from northern California (Oliver 1995, Oliver and Powers 1978, Oliver and Uzoh 1997), Oregon, and Washington (DeMars and Barrett 1987). Slope factors for six other species in Cochran et al. (1994) also differ from Reineke's slope factor. Factors used for this stocking guide represent the slope of a least squares fit of  $\log_e \text{TPA}$ , as a function of  $\log_e \text{QMD}$ , for fully stocked stands (or plots) located east of the Cascade Range in the interior Northwest region (Cochran 1998).

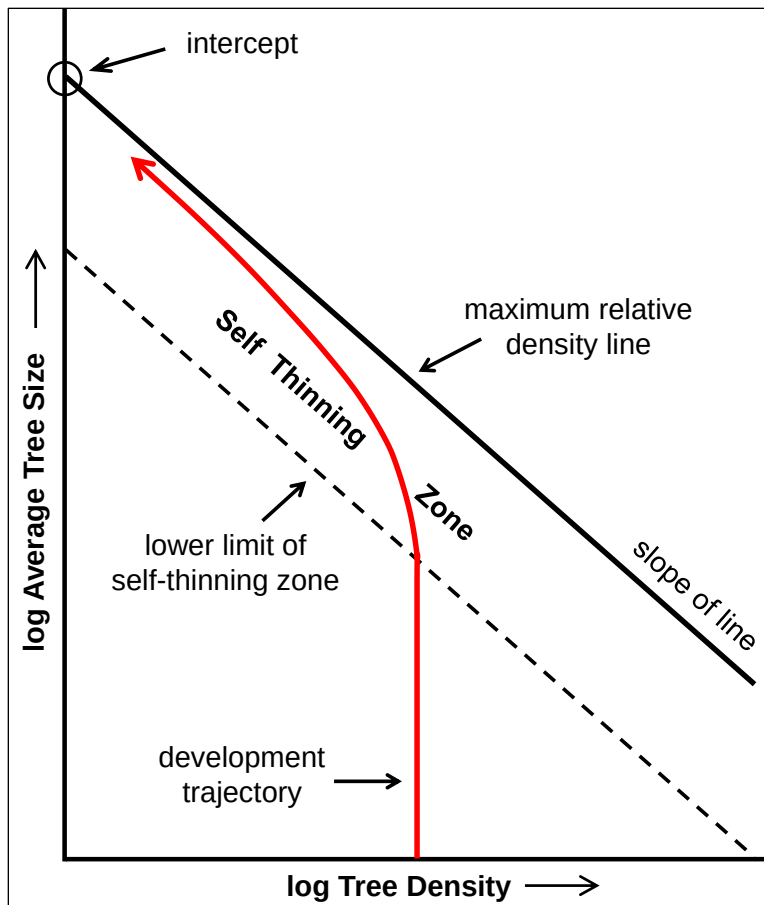


**Figure 2-5** – Diagram illustrating important concepts related to self-thinning (after Jack and Long 1996). This figure portrays an upper boundary or maximum size-density line which varies not only by tree species, but by potential vegetation type (PVT) within the same species. Variation by PVT can be thought of as ‘environment boundary lines’ (Sackville Hamilton et al. 1995) because each PVT represents a slightly different biophysical environment (fig. 2-3; Powell et al. 2007). The upper-boundary line is a logarithmic relationship with a negative slope (it’s sloping downward rather than upward), so higher density is associated with a small tree size and lower density with a large size. This negative relationship between mean size and density exists for all self-thinning plant populations, regardless of their life form (tree, shrub, or herb) (Westoby 1984). The red stand growth tra-

jectory line shows a typical development pattern for an individual even-aged tree stand that eventually experiences density-dependent mortality. After self-thinning begins, a stand is constrained by the upper boundary – its future trajectory will then bend to the left (fig. 2-4) and remain below, but track along, this line. A lower boundary line (dashed) shows the lower limit of a self-thinning zone; stands beyond this line experience density-related, competition-induced mortality. For many tree species, the lower boundary coincides with 75% of full stocking or 55-60% of maximum density (see table 3-2).

Other investigators have described slope factors that differ from Reineke’s universal value of 1.605 (Curtis 1982, DeMars and Barrett 1987, Oliver and Powers 1978, Oliver and Uzoh 1997, Puettmann et al. 1993, Seidel and Cochran 1981). Bob Curtis is probably correct when he observed that “Reineke’s 1.605 is a reasonable average over all species but is probably not quite right for any individual species” (Sterba and Monserud 1993).

Curtis’ observation reflects the fact that Reineke probably developed his universal slope factor by analyzing a dataset where multiple species were combined into one dataset for analysis (he used 14 species) and, if this supposition is correct, then we shouldn’t be surprised when his slope value differs slightly from those developed for individual species.

### **Stand Density As An Indicator Of Site Quality (Productivity)**

Site quality (synonymous with site productivity as used here) is defined as “productive capacity of a site, usually expressed as volume production of a given species” (Helms 1998).

Daniel et al. (1979a) defines site quality more specifically as the ‘maximum timber crop’ that

forest land can produce in a given time. They also note that “since site quality is measured by the maximum timber crop (volume) produced within a given period, it can vary with tree species.” This statement also means that “a particular area could have a different site quality depending on whether it supported Douglas-fir, western hemlock, or western redcedar” (Daniel et al. 1979a, p. 236).

The Daniel et al. (1979a) concepts raise important questions about site quality evaluation.

1. If site quality is best evaluated by determining a ‘maximum timber crop’ (a term typically used with stands, not individual trees), then might *stand-level measures be more appropriate for evaluating site quality than individual-tree measures* such as site index (fig. 2-6)?
2. If stand-level measures are considered superior to individual-tree measures, especially for sites with low stocking capacity (Lynch 1958, MacLean and Bolsinger 1973), wouldn’t some measure of site-potential stockability function as an effective indicator of productivity?
3. When considering the environment boundary-line approach (Sackville Hamilton et al. 1995; fig. 2-3), is there really any qualitative difference between maximum SDI (expressed by tree species and potential vegetation type) and traditional timber productivity measures?
4. And finally, wouldn’t we expect sites with high carrying capacity for density (high maximum SDI values) to also have high timber volume productivity, expressed as potential cubic-foot production at culmination of mean annual increment?

*I believe that maximum density is an effective indicator of site quality. And I believe it offers efficiency in comparison to traditional indicators such as site index. Although we may not be able to identify all the factors involved, we know that a separate suite of site factors controls potential tree height growth (e.g., site index) than controls stockability (DeBell et al. 1989). [This assertion relates to max SDI, not existing SDI, because max SDI reflects site potential, whereas existing SDI reflects stand history, which varies inconsistently from stand to stand.]*

Stand density information presented in this guide relates to the site quality concepts discussed in this section in at least two ways:

1. For a particular tree species, maximum density varies from one PVT to another (scan down an MD column in table 3-1 to verify this fact). Here, maximum density is used as a proxy for the ‘maximum timber crop’ from Daniel et al. (1979a), demonstrating that site quality varies by PVT *even when holding tree species constant*.

**This example shows how site quality varies within a single tree species, but across a range of PVTs.**

2. For a particular PVT, maximum density varies by tree species. Table 2-4 shows that *for the same PVT*, a stand of ponderosa pine stand has 456 trees per acre at a quadratic mean diameter (QMD) of 10 inches, whereas grand fir has 645 trees per acre at the same QMD.

This comparison indicates that grand fir is more efficient than ponderosa pine at converting site resources into vegetative biomass. The other five conifers have maximum density (MD) values falling between grand fir (highest) and ponderosa pine (lowest). Since MD reflects total site resources, it is analogous to ecological carrying capacity (Kimmins 2004).

**This example shows how site quality varies within a single PVT, but across a range of tree species.**

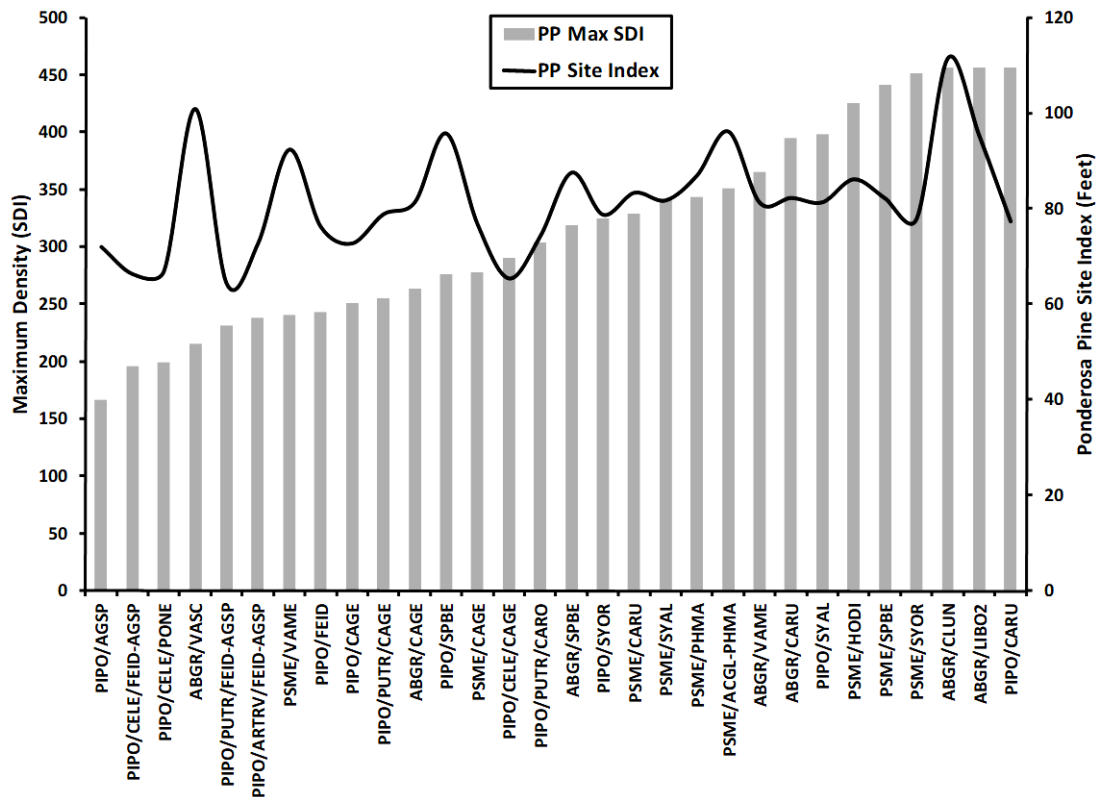


**Figure 2-6:** Maximum density (SDI) and site index (feet) for ponderosa pine (PP) on a range of Blue Mountain PVTs (from Powell 2018). PVTs are ordered from those with lowest (left) to highest (right) maximum density. This figure shows it is possible for PVTs with relatively low PP stockability (such as ABGR/VASC and PSME/VAME) to have relatively high site indexes, and for PVTs with relatively high PP stockability (such as PSME/SPBE and PSME/SYOR) to have relatively low site indexes.

**Table 2-4:** Maximum density, and equivalent trees per acre and basal area per acre values, for seven species when established on a grand fir/twinflower plant association.

| Tree Species     | Maximum Density (SDI) | Per Acre at 10" QMD |                            | Percentage |
|------------------|-----------------------|---------------------|----------------------------|------------|
|                  |                       | Trees               | BA (ft <sup>2</sup> /acre) |            |
| Ponderosa pine   | 456                   | 456                 | 249                        | 100%       |
| Douglas-fir      | 475                   | 475                 | 259                        | 104%       |
| Western larch    | 463                   | 463                 | 253                        | 102%       |
| Lodgepole pine   | 543                   | 543                 | 296                        | 119%       |
| Engelmann spruce | 499                   | 499                 | 272                        | 109%       |
| Grand fir        | 645                   | 645                 | 352                        | 141%       |
| Subalpine fir    | 466                   | 466                 | 254                        | 102%       |

*Notes:* Maximum density (MD) values are from table 3-1. Trees per acre values in this table (3<sup>rd</sup> column) relate to a quadratic mean diameter (QMD) of 10 inches; they are identical to maximum density only because the per-acre columns in this table use a QMD of 10 inches (if another QMD had been used, then the MD and Trees values would not be the same). BA is square feet of basal area per acre. For percentage calculations, the lowest productivity species (ponderosa pine) is used as a baseline (100%). Percentage values suggest that a grand fir/twinflower site is 41% more productive at maximum density when supporting a pure stand of grand fir than for a pure stand of ponderosa pine.

“In a conceptual sense, stockability can be regarded as the tolerance of a forest system to the presence of and/or competition from increasing numbers of trees. This tolerance may differ with environment and, in that regard, might be considered an aspect of site quality independent of that reflected in site index or potential height growth” (DeBell et al. 1989).

One strength of table 2-4 is it clearly demonstrates that each tree species functions within a potential vegetation type differently. This result may seem counterintuitive because the potential vegetation concept maintains that a potential vegetation type includes a relatively narrow range of biophysical (environmental) conditions. One reason species function differently on the same site type relates to light-water tradeoff theory (Smith and Huston 1989) – *plants cannot simultaneously have high tolerance for low levels of light and water*.

Tree species adapted to water-limited sites (dry forests) are governed by a specific suite of life history traits; the dominant conifers evolved to compete for water first and light second. Light-water tradeoff theory helps explain why species with low shade tolerance (fig. 2-7) and relatively high drought tolerance are generally the first trees to experience mortality in low-light environments, including sites with high stand density.

Intertree competition for water was minimized in Blue Mountains dry forests thinned by surface fire every 5 to 20 years. Ponderosa pine’s adaptations to a high-fire/low-water environment (high, sparse crowns; thick bark; etc.) are likely a productivity tradeoff in comparison to grand fir’s traits on these environments (low, dense crowns; thin bark; etc.).

High-fire environments promote species that compete for water. Frequent fire regimes are associated with dry, upland-forest environments with low inherent stockability and low water availability. These sites were dominated historically by ponderosa pine, a species with morphological adaptations for high fire resistance, high drought tolerance, and high light tolerance.

Moderate elevations of the upper-montane zone – moist, upland-forest environments with moderate to high stockability and moderate water availability, feature a mixed-severity fire regime. Moist-forest sites feature western larch and lodgepole pine as early seral species, both of which have high fire tolerance (when considering lodgepole’s serotiny), moderate drought tolerance, and high light tolerance.

High elevations of a subalpine zone – cold, upland-forest environments with moderate stockability and high moisture availability, feature a long-interval, stand-replacement fire regime. These cold-forest sites were dominated historically by Engelmann spruce and subalpine fir, two species with low fire resistance, low drought tolerance, and high shade tolerance.

### **Self-Thinning: Pure And Mixed Stands**

Because tolerances (life history traits) are often discussed for individual species, some readers may get the impression that species typically occur in pure stands. For the Blue Mountains, the opposite situation is true – most stands have species mixtures. But even for mixed stands, the life history traits of individual species can strongly influence stand dynamics – how a mixture develops (and functions) in the future.

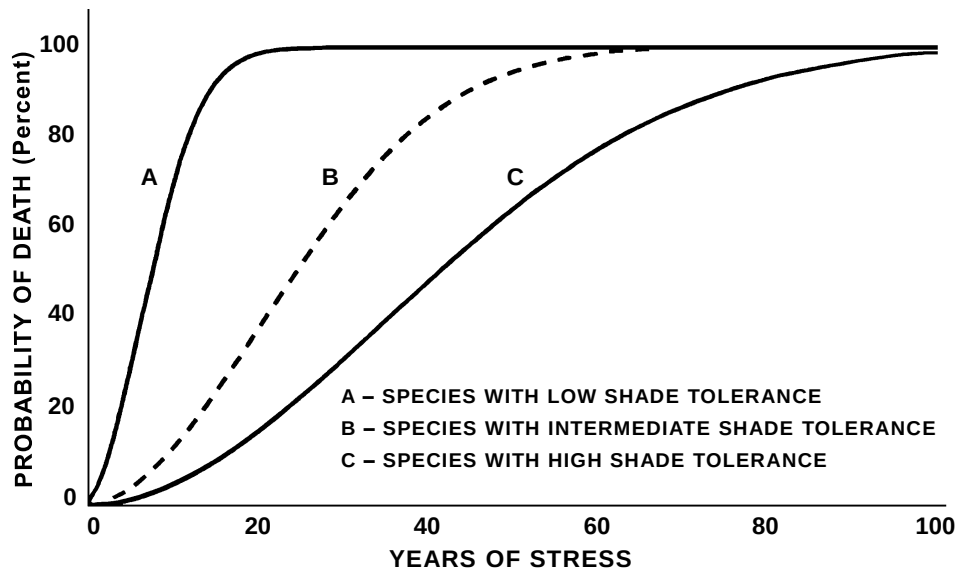


**Figure 2-7** – Tree resistance to stress varies with shade tolerance (adapted from Keane et al. 1996). Intolerant tree species (lodgepole pine, ponderosa pine, western larch) die relatively quickly when exposed to chronic stress such as high stand density. Trees with intermediate tolerance (Douglas-fir and western white pine) can withstand a longer period of stress without dying. Shade tolerant species (Engelmann spruce, grand fir, subalpine fir) can endure relatively long periods of stress before experiencing mortality.

Stress largely unrelated to stand density, including many tree diseases, may manifest differently than what is shown here because disease usually becomes acute more quickly than the multi-decadal time periods required to develop high levels of background stress. High stand density is frequently a source of high background stress.

Research examining tree competition and stand development found that when individual tree species *occur in a mixture*, they do not necessarily conform closely to the self-thinning rule. But when considering all the species in a mixed stand, *taken together as one unit*, they did show at least moderate conformity to the self-thinning rule (Peet and Christensen 1987).

This finding suggests that self-thinning may function as an ‘emergent property,’ where a mix of tree species interact collectively, as a forest community, and thus exhibit a markedly different self-thinning result than would be expected for any single species in the mixture. (But we should also consider that this Peet and Christensen (1987) study involved mixed-species, mixed-age eastern hardwood stands, not the western conifer species we work with.)



### 3. DERIVING STOCKING LEVEL AND DENSITY INFORMATION

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Tables in chapter 6 provide stand density information for three stocking levels: climate resilience, and the upper and lower limits of a management zone. That chapter includes a table for each combination of tree species and potential vegetation type (PVT) occurring on upland-forest sites in the Blue-Ochoco and Wallowa-Snake geographical areas.

This chapter describes how the detailed stand density information (chapter 6) was developed.

1. Stand density index (SDI) values for full stocking (FS) were obtained for each combination of tree species and PVT occurring in the Blue-Ochoco and Wallowa-Snake geographical areas (table 3-3). Full-stocking SDIs were taken from tables 1, 3, or 4 in Cochran et al. (1994).
2. Full-stocking SDI values were used to calculate maximum density (MD) SDI values:  
 $MD\ SDI = FS\ SDI \times 1.25$  (table 3-3); calculated values are provided in tables 2-3, 3-1, and 3-3.
3. SDI values for the upper limit (UL) of a management zone stocking level were calculated for each combination of tree species and PVT occurring in the Blue Mountains (table 3-1).  
*UL values are 55% of maximum density.*
4. SDI values for the lower limit (LL) of a management zone stocking level were calculated for each combination of tree species and PVT occurring in the Blue Mountains (table 3-1).  
*LL values are 35% of maximum density.*
5. SDI values for the climate resilience (CR) stocking level were calculated for each combination of tree species and PVT occurring in the Blue Mountains (table 3-1).  
*CR values are 25% of maximum density.*
6. SDIs for the CR, LL, and UL stocking levels were converted into two stand density metrics – trees per acre, and basal area per acre. Calculations were completed for a range of quadratic mean diameters (1 to 30 inches in variable increments), and for three stand structures – even-aged, irregular, and uneven-aged.
7. Trees per acre stand density values were used to calculate a measure of intertree distance – equilateral spacing (feet).
8. Basal area per acre stand density values were used to calculate a measure of forest crown closure – canopy cover (percentage).

Table 3-1 provides four stocking levels by tree species and PVT. For each species, stocking levels are presented from lowest to highest (left to right) – climate resilience (CR) first, lower (LL) and upper (UL) limits of a management zone, and maximum density (MD) last. For the CR, LL, and UL stocking levels, detailed stand density metrics (basal area and trees per acre, etc.) are provided in chapter 6 tables. *Detailed density metrics are not provided for the MD stocking level.*

#### THE MAXIMUM DENSITY STOCKING LEVEL

When Reineke (1933) developed stand density index, his outermost boundary line (fig. 2-2) represents maximum density for a species (this boundary line is often referred as an absolute-maximum level of competition for a species). If his sample of fully-stocked stands was reasonably comprehensive, then his line functions as an important threshold – in a ‘go/no-go’ context, areas above (to the right of) the maximum line function as a ‘no-go’ area for stand density.

**Table 3-1:** Suggested stocking levels (expressed as stand density index) for potential vegetation types (PVT; plant associations, plant community types) of the Blue-Ochoco and Wallowa-Snake geographical areas.\*

| POTENTIAL VEG TYPE              | PONDEROSA PINE |                 |                 |     | DOUGLAS-FIR |     |     |     | WESTERN LARCH |     |     |     | LODGEPOLE PINE |                 |                 |     | ENGELMANN SPRUCE |     |     |     | GRAND FIR      |     |     |     | SUBALPINE FIR |     |     |     |
|---------------------------------|----------------|-----------------|-----------------|-----|-------------|-----|-----|-----|---------------|-----|-----|-----|----------------|-----------------|-----------------|-----|------------------|-----|-----|-----|----------------|-----|-----|-----|---------------|-----|-----|-----|
|                                 | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR          | LL  | UL  | MD  | CR            | LL  | UL  | MD  | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR               | LL  | UL  | MD  | CR             | LL  | UL  | MD  | CR            | LL  | UL  | MD  |
| ABGR/ACGL                       |                |                 |                 |     | 75          | 105 | 166 | 301 | 110           | 154 | 241 | 439 |                |                 |                 |     | 101              | 142 | 223 | 405 | 144            | 202 | 317 | 576 |               |     |     |     |
| ABGR/ACGL <sup>2</sup>          | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 |               |     |     |     |                |                 |                 |     |                  |     |     |     | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/ACGL-PHMA <sup>2,4,5</sup> |                |                 |                 |     | 119         | 166 | 261 | 475 | 111           | 155 | 244 | 444 |                |                 |                 |     |                  |     |     |     | 157            | 220 | 345 | 628 |               |     |     |     |
| ABGR/ARCO <sup>7</sup>          | 99             | 138             | 217             | 395 | 112         | 156 | 245 | 446 | 96            | 134 | 211 | 384 | 96             | 134             | 211             | 384 |                  |     |     |     | 139            | 194 | 305 | 555 |               |     |     |     |
| ABGR/BRVU                       |                |                 |                 |     |             |     |     |     | 128           | 179 | 282 | 513 |                |                 |                 |     | 147              | 205 | 322 | 586 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/CAGE                       | 66             | 92              | 144             | 263 | 94          | 132 | 207 | 376 |               |     |     |     |                |                 |                 |     |                  |     |     |     | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/CARU                       | 99             | 138             | 217             | 395 | 112         | 156 | 245 | 446 | 96            | 134 | 211 | 384 | 96             | 134             | 211             | 384 |                  |     |     |     | 139            | 194 | 305 | 555 |               |     |     |     |
| ABGR/CARU <sup>2,5</sup>        | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 |               |     |     |     |                |                 |                 |     |                  |     |     |     | See Footnote 3 |     |     |     |               |     |     |     |
| ABGR/CLUN                       |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 |                |                 |                 |     | 147              | 205 | 322 | 586 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/CLUN <sup>2</sup>          | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 | 114           | 159 | 250 | 455 | 107            | 150             | 235             | 428 | 147              | 205 | 322 | 586 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/GYDR                       |                |                 |                 |     |             |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     | 173            | 242 | 380 | 691 |               |     |     |     |
| ABGR/LIBO2                      | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 | 116           | 162 | 254 | 463 | 136            | 190             | 298             | 543 | 125              | 175 | 274 | 499 | 161            | 226 | 355 | 645 | 117           | 163 | 256 | 466 |
| ABGR/LIBO2 <sup>2</sup>         |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 281 | 511 | 95             | 133             | 209             | 380 |                  |     |     |     | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/POMU-ASCA3                 |                |                 |                 |     |             |     |     |     | 109           | 153 | 241 | 438 |                |                 |                 |     | 147              | 205 | 322 | 586 | 152            | 213 | 334 | 608 |               |     |     |     |
| ABGR/SPBE                       | 80             | 112             | 175             | 319 | 62          | 87  | 136 | 248 |               |     |     |     |                |                 |                 |     |                  |     |     |     | 111            | 155 | 243 | 443 |               |     |     |     |
| ABGR/SPBE <sup>2,5</sup>        | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 |               |     |     |     |                |                 |                 |     |                  |     |     |     | See Footnote 3 |     |     |     |               |     |     |     |
| ABGR/TABR/CLUN                  |                |                 |                 |     |             |     |     |     |               |     |     |     |                |                 |                 |     | 133              | 186 | 293 | 533 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/TABR/LIBO2                 |                |                 |                 |     | 119         | 166 | 261 | 475 | 94            | 132 | 208 | 378 |                |                 |                 |     | 93               | 131 | 206 | 374 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/TRCA3                      |                |                 |                 |     |             |     |     |     | 124           | 174 | 274 | 498 |                |                 |                 |     | 121              | 170 | 267 | 485 | 173            | 242 | 381 | 693 |               |     |     |     |
| ABGR/VAME                       | 91             | 128             | 201             | 365 | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 74             | 104             | 164             | 298 | 107              | 149 | 234 | 426 | 142            | 199 | 313 | 569 | 129           | 180 | 283 | 515 |
| ABGR/VAME <sup>2</sup>          | 106            | 148             | 233             | 424 | 110         | 154 | 241 | 439 | 116           | 162 | 255 | 464 | 83             | 116             | 182             | 331 | 147              | 205 | 322 | 586 | 175            | 245 | 385 | 700 |               |     |     |     |
| ABGR/VASC                       | 54             | 75              | 118             | 215 | 86          | 120 | 188 | 343 | 95            | 133 | 209 | 380 | 93             | 130             | 204             | 370 |                  |     |     |     | 115            | 161 | 253 | 460 |               |     |     |     |
| ABGR/VASC-LIBO2                 |                |                 |                 |     | 108         | 152 | 239 | 434 | 79            | 111 | 174 | 316 | 103            | 144             | 227             | 413 | 109              | 153 | 240 | 436 | 154            | 216 | 340 | 618 | 58            | 81  | 127 | 230 |
| ABLA2/ARCO <sup>7</sup>         |                |                 |                 |     |             |     |     |     |               |     |     |     | 139            | 195             | 306             | 556 | 108              | 151 | 237 | 430 |                |     |     |     | 119           | 167 | 263 | 478 |
| ABLA2/CAGE                      |                |                 |                 |     |             |     |     |     |               |     |     |     | 123            | 172             | 270             | 490 |                  |     |     |     |                |     |     |     | 116           | 163 | 256 | 465 |
| ABLA2/CLUN                      |                |                 |                 |     |             |     |     |     | 128           | 179 | 282 | 513 |                |                 |                 |     | 147              | 205 | 322 | 586 |                |     |     |     | 130           | 182 | 286 | 520 |

| POTENTIAL VEG TYPE                 | PONDEROSA PINE |                 |                 |     | DOUGLAS-FIR |     |     |     | WESTERN LARCH |     |     |     | LODGEPOLE PINE |                 |                 |     | ENGELMANN SPRUCE |     |     |     | GRAND FIR |     |     |     | SUBALPINE FIR |     |     |     |
|------------------------------------|----------------|-----------------|-----------------|-----|-------------|-----|-----|-----|---------------|-----|-----|-----|----------------|-----------------|-----------------|-----|------------------|-----|-----|-----|-----------|-----|-----|-----|---------------|-----|-----|-----|
|                                    | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR          | LL  | UL  | MD  | CR            | LL  | UL  | MD  | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR               | LL  | UL  | MD  | CR        | LL  | UL  | MD  | CR            | LL  | UL  | MD  |
| ABLA2/CLUN <sup>2</sup>            | 95             | 133             | 208             | 379 |             |     |     |     | 103           | 145 | 228 | 414 |                |                 |                 |     | 147              | 205 | 322 | 586 | 170       | 238 | 375 | 681 | 107           | 150 | 236 | 429 |
| ABLA2/LIBO2                        |                |                 |                 |     |             |     |     |     | 128           | 179 | 282 | 513 |                |                 |                 |     | 118              | 166 | 261 | 474 |           |     |     |     | 105           | 147 | 230 | 419 |
| ABLA2/LIBO2 <sup>2</sup>           |                |                 |                 |     |             |     |     |     | 87            | 122 | 191 | 348 | 83             | 116             | 183             | 333 | 134              | 188 | 296 | 538 |           |     |     |     | 122           | 171 | 268 | 488 |
| ABLA2/MEFE                         |                |                 |                 |     |             |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |     |     |     | 130           | 182 | 286 | 520 |
| ABLA2/MEFE <sup>2</sup>            |                |                 |                 |     |             |     |     |     |               |     |     |     | 90             | 126             | 198             | 360 | 115              | 161 | 253 | 460 |           |     |     |     | 103           | 144 | 226 | 410 |
| ABLA2/POPU <sup>7</sup>            |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 101            | 142             | 223             | 405 | 142              | 199 | 312 | 568 |           |     |     |     | 121           | 169 | 265 | 483 |
| ABLA2/STAM <sup>2,5</sup>          |                |                 |                 |     |             |     |     |     |               |     |     |     | 90             | 126             | 197             | 359 | 147              | 205 | 322 | 586 |           |     |     |     | 111           | 155 | 243 | 443 |
| ABLA2/STOC <sup>7</sup>            |                |                 |                 |     |             |     |     |     |               |     |     |     | 123            | 172             | 270             | 490 |                  |     |     |     |           |     |     |     | 116           | 163 | 256 | 465 |
| ABLA2/TRCA3                        |                |                 |                 |     |             |     |     |     |               |     |     |     | 139            | 195             | 306             | 556 | 108              | 151 | 237 | 430 |           |     |     |     | 119           | 167 | 263 | 478 |
| ABLA2/VAME                         |                |                 |                 |     |             |     |     |     | 119           | 167 | 263 | 478 | 80             | 112             | 175             | 319 | 119              | 167 | 263 | 478 |           |     |     |     | 83            | 116 | 182 | 331 |
| ABLA2/VAME <sup>2</sup>            |                |                 |                 |     | 119         | 166 | 261 | 475 | 115           | 161 | 253 | 460 | 95             | 133             | 210             | 381 | 143              | 200 | 315 | 573 |           |     |     |     | 106           | 149 | 234 | 425 |
| ABLA2/VASC                         |                |                 |                 |     | 114         | 160 | 252 | 458 | 119           | 166 | 261 | 475 | 99             | 139             | 218             | 396 | 114              | 160 | 252 | 458 |           |     |     |     | 114           | 160 | 251 | 456 |
| ABLA2/VASC/POPU <sup>2,4</sup>     |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 101            | 142             | 223             | 405 | 142              | 199 | 312 | 568 |           |     |     |     | 121           | 169 | 265 | 483 |
| PICO/CARU                          |                |                 |                 |     |             |     |     |     |               |     |     |     | 70             | 98              | 153             | 279 |                  |     |     |     |           |     |     |     |               |     |     |     |
| PICO(ABGR)/ALSI <sup>7</sup>       |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 |                |                 |                 |     | 147              | 205 | 322 | 586 | 175       | 245 | 385 | 700 |               |     |     |     |
| PICO(ABGR)/ARNE <sup>7</sup>       | 91             | 128             | 201             | 365 | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 74             | 104             | 164             | 298 | 107              | 149 | 234 | 426 | 142       | 199 | 313 | 569 | 129           | 180 | 283 | 515 |
| PICO(ABGR)/VAME <sup>7</sup>       | 91             | 128             | 201             | 365 | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 74             | 104             | 164             | 298 | 107              | 149 | 234 | 426 | 142       | 199 | 313 | 569 | 129           | 180 | 283 | 515 |
| PICO(ABGR)/VAME/CARU <sup>7</sup>  | 91             | 128             | 201             | 365 | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 74             | 104             | 164             | 298 | 107              | 149 | 234 | 426 | 142       | 199 | 313 | 569 | 129           | 180 | 283 | 515 |
| PICO(ABGR)/VAME-LIBO2 <sup>7</sup> | 114            | 160             | 251             | 456 | 119         | 166 | 261 | 475 | 116           | 162 | 254 | 463 | 136            | 190             | 298             | 543 | 125              | 175 | 274 | 499 | 161       | 226 | 355 | 645 | 117           | 163 | 256 | 466 |
| PICO(ABGR)/VAME/PTAQ <sup>7</sup>  | 91             | 128             | 201             | 365 | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 74             | 104             | 164             | 298 | 107              | 149 | 234 | 426 | 142       | 199 | 313 | 569 | 129           | 180 | 283 | 515 |
| PICO(ABGR)/VASC/CARU <sup>7</sup>  | 54             | 75              | 118             | 215 | 86          | 120 | 188 | 343 | 95            | 133 | 209 | 380 | 93             | 130             | 204             | 370 |                  |     |     |     | 115       | 161 | 253 | 460 |               |     |     |     |
| PICO(ABLA2)/STOC <sup>7</sup>      |                |                 |                 |     |             |     |     |     |               |     |     |     | 123            | 172             | 270             | 490 |                  |     |     |     |           |     |     |     | 116           | 163 | 256 | 465 |
| PICO(ABLA2)/VAME <sup>7</sup>      |                |                 |                 |     |             |     |     |     | 119           | 167 | 263 | 478 | 80             | 112             | 175             | 319 | 119              | 167 | 263 | 478 |           |     |     |     | 83            | 116 | 182 | 331 |
| PICO(ABLA2)/VASC <sup>7</sup>      |                |                 |                 |     | 114         | 160 | 252 | 458 | 119           | 166 | 261 | 475 | 99             | 139             | 218             | 396 | 114              | 160 | 252 | 458 |           |     |     |     | 114           | 160 | 251 | 456 |
| PICO(ABLA2)/VASC/POPU <sup>7</sup> |                |                 |                 |     | 119         | 166 | 261 | 475 | 128           | 179 | 282 | 513 | 101            | 142             | 223             | 405 | 142              | 199 | 312 | 568 |           |     |     |     | 121           | 169 | 265 | 483 |
| PIPO/AGSP                          | 42             | 58              | 91              | 166 |             |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |     |     |     |               |     |     |     |
| PIPO/AGSP <sup>2</sup>             | 58             | 81              | 128             | 233 |             |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |     |     |     |               |     |     |     |
| PIPO/ARTRV/FEID-AGSP               | 59             | 83              | 131             | 238 |             |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |     |     |     |               |     |     |     |

| POTENTIAL VEG TYPE          | PONDEROSA PINE |                 |                 |     | DOUGLAS-FIR    |     |     |     | WESTERN LARCH |     |     |     | LODGEPOLE PINE |                 |                 |     | ENGELMANN SPRUCE |     |     |     | GRAND FIR |    |    |    | SUBALPINE FIR |     |     |     |
|-----------------------------|----------------|-----------------|-----------------|-----|----------------|-----|-----|-----|---------------|-----|-----|-----|----------------|-----------------|-----------------|-----|------------------|-----|-----|-----|-----------|----|----|----|---------------|-----|-----|-----|
|                             | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR             | LL  | UL  | MD  | CR            | LL  | UL  | MD  | CR             | LL <sup>1</sup> | UL <sup>1</sup> | MD  | CR               | LL  | UL  | MD  | CR        | LL | UL | MD | CR            | LL  | UL  | MD  |
| PIPO/CAGE                   | 63             | 88              | 138             | 251 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/CARU                   | 114            | 160             | 251             | 456 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/CELE/CAGE              | 73             | 102             | 160             | 290 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/CELE/FEID-AGSP         | 49             | 69              | 108             | 196 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/CELE/PONE              | 50             | 70              | 109             | 199 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/FEID                   | 61             | 85              | 133             | 243 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/FEID <sup>2</sup>      | 65             | 91              | 142             | 259 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/PUTR/CAGE              | 64             | 89              | 140             | 255 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/PUTR/CARO              | 76             | 106             | 167             | 304 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/PUTR/FEID-AGSP         | 58             | 81              | 127             | 231 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/SPBE <sup>2,5</sup>    | 69             | 97              | 152             | 276 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/SYAL                   | 99             | 139             | 219             | 398 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/SYAL <sup>2</sup>      | 75             | 105             | 166             | 301 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PIPO/SYOR                   | 81             | 114             | 179             | 325 |                |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/ACGL-PHMA <sup>2</sup> | 88             | 123             | 193             | 351 | 87             | 121 | 190 | 346 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/CAGE                   | 69             | 97              | 153             | 278 | 88             | 123 | 193 | 351 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/CARU                   | 82             | 115             | 181             | 329 | 83             | 116 | 182 | 330 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/CARU <sup>2</sup>      | 113            | 158             | 248             | 451 | 119            | 166 | 261 | 475 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/HODI                   | 106            | 149             | 234             | 425 | 80             | 112 | 175 | 319 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/PHMA                   | 86             | 120             | 188             | 343 | 70             | 98  | 155 | 281 | 80            | 112 | 176 | 320 |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/PHMA <sup>2</sup>      | 73             | 102             | 160             | 290 | 97             | 136 | 213 | 388 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/SPBE <sup>2</sup>      | 110            | 154             | 243             | 441 | 116            | 162 | 255 | 464 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/SYAL                   | 85             | 119             | 188             | 341 | 77             | 108 | 170 | 309 | 64            | 90  | 141 | 256 |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/SYAL <sup>2</sup>      | 104            | 146             | 229             | 416 | 119            | 166 | 261 | 475 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/SYOR <sup>2,5,6</sup>  | 113            | 158             | 248             | 451 | See Footnote 3 |     |     |     |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| PSME/VAME                   | 60             | 84              | 133             | 241 | 57             | 80  | 126 | 229 |               |     |     |     |                |                 |                 |     |                  |     |     |     |           |    |    |    |               |     |     |     |
| TSME/VASC+VAME <sup>2</sup> |                |                 |                 |     |                |     |     |     |               |     |     |     | 71             | 99              | 155             | 283 | 93               | 130 | 204 | 371 |           |    |    |    | 130           | 182 | 286 | 520 |

\* This table lists potential vegetation types in alphabetical order for ease of use. A few potential vegetation types are not listed here because stocking-level information was not

provided for them in productivity appendixes of the Blue-Ochoco and Wallowa-Snake field guides (Johnson and Clausnitzer 1992, Johnson and Simon 1987); field guides often do not include growth-basal-area stocking data for *plant community types* or *plant communities* – but see footnote 5. Tree species are ordered by temperature and moisture tolerance – warm dry (ponderosa pine) to cold moist (subalpine fir). This is the same ordering scheme used by Cochran et al. 1994.

<sup>1</sup> Cochran et al. (1994) recommends that for lodgepole and ponderosa pines, the lower (LL) and upper (UL) limits of a management zone be adjusted to reflect mountain pine beetle (MPB) susceptibility. The LL and UL values in this table were not adjusted to reflect MPB susceptibility. For ponderosa pine, SDI values reflecting MPB susceptibility are provided in tables 4-1 and table 5-4. Lodgepole pine stands with high MPB susceptibility have an SDI of 170 or more and a QMD of 9 inches or greater (see *Mountain Pine Beetle in Lodgepole Pine* section, chapter 5). **To account for MPB susceptibility in lodgepole pine, set an upper limit SDI of 170, and a lower limit SDI of 114 (see table 5-3).**

<sup>2</sup> These are PVTs from the Wallowa-Snake guide (Johnson and Simon 1987), and their stocking levels are derived from table 4 in Cochran et al. (1994). PVT listings without a footnote 2 refer to the Blue-Ochoco guide (Johnson and Clausnitzer 1992), and their stocking levels are derived from table 3 in Cochran et al. (1994).

<sup>3</sup> These stocking values are missing because a growth-basal-area value (Hall 1983, 1987) was not provided for them in the plant association field guide (Johnson and Simon 1987), so a corresponding SDI value could not be calculated. Note that certain other potential vegetation types included in the Blue-Ochoco or Wallowa-Snake guides are missing from this table, presumably because productivity data was not provided for them in one of the plant association field guides.

<sup>4</sup> ABLA2/VASC/POPU and ABGR/ACGL-PHMA exist in the Wallowa-Snake guide, but they are shown in Cochran et al. (1994) as ABLA2/VASC and ABGR/PHMA, respectively, because that is how they were named in appendix E of Johnson and Simon (1987). To be more consistent with nomenclature contained in the field guide (the guide itself, not its appendix E), these types are shown with their full names in this table.

<sup>5</sup> These are identified as plant community types in the Wallowa-Snake field guide (Johnson and Simon 1987). Although the scope of tables 3 and 4 in Cochran et al. (1994) is 'plant associations,' these plant community types are also included there because productivity information is provided for them in appendix E of Johnson and Simon (1987).

<sup>6</sup> PSME/SYOR is identified as a plant association in the Blue-Ochoco guide, but it is not included in table 3 of Cochran et al. (1994) because productivity information is not provided for it in appendix D of Johnson and Clausnitzer (1992).

<sup>7</sup> These potential vegetation types are plant community types or plant communities, and their suggested stocking levels are the same as for the parent plant association to which they are related (e.g., stocking levels for ABGR/ARCO are the same as those for ABGR/CARU, its parent association). See table 2-1 for more information.

#### Additional Notes:

1. All SDI values in this table pertain to an even-aged structure and a quadratic mean stand diameter (QMD) of 10 inches. Stocking-level data presented later in this guide (chapter 6) includes values for irregular and uneven-aged structures, and for QMDs other than 10 inches.
2. It is assumed that all calculations for SDI, basal area, trees per acre, QMD, and other stand-level metrics consider (include) all live trees 1" dbh and greater. Calculations that consider only trees 5" dbh and greater will have different results.
3. Tables in chapter 8 provide common and scientific plant names for the alphanumeric codes used to name the potential vegetation types in this table.
4. Column headings for table 3-1, as used for each of seven species sections:  
CR – Calculated SDI value for a climate resilience stocking level (25% of maximum density).  
LL – Calculated SDI value for the lower limit of a management zone (35% of maximum density).  
UL – Calculated SDI value for the upper limit of a management zone (55% of maximum density).  
MD – Calculated SDI value for maximum density (125% of full stocking; see tables 3-2 and 3-3).
5. Caution: the SDI values in this stocking guide were calculated by using measured values of growth basal area (GBA), as published in Appendix D of Johnson and Clausnitzer (1992) and Appendix E of Johnson and Simon (1987). Sampling intensity for some of the plant associations and plant community types was fairly low (less than 10 plots). This means that GBA values reported in the productivity appendixes (and their corresponding SDI values) may not adequately reflect the full spectrum of productivity associated with certain potential vegetation types, especially those characterized by using relatively few sample plots.

The concept of stocking requires use of a reference level, and much of the density management literature has adopted maximum density as a reference level (fig. 2-5). A reference level is a 'standard' – it helps users put existing stand density in a meaningful context, and it can be used when calculating other stocking levels (maximum density is used in that way for this guide).

As described later in this chapter (*Properly Functioning Density: The Management Zone*), Cochran et al. (1994) followed national direction, of that era, when they adopted average-maximum density as their reference level. But many portions of the western U.S. use maximum density as a reference level (and I do the same for this guide).

Table 3-2 shows that information from Cochran et al. (1994), along with information contained in this stocking guide, can be used to calculate maximum density.

1. Experience, and personal communication with Dr. James Long (Utah State University, retired) and Dr. Pat Cochran (Pacific Northwest Research Station, retired) suggests that full stocking (normal density) is about 80% of maximum density (and see Long and Shaw 2005); therefore, maximum density can be calculated as 125% of full stocking (table 3-2).

This assumption is supported by other evidence, including red fir data showing that near-maximum density occurred at about 130% of normal density (Daniel et al. 1979a: 319).

2. This guide provides ecoregion-wide values of full stocking for seven conifers in the Blue Mountains (table 2-3). They were used to make broad-scale maximum density calculations.
3. This guide provides full-stocking values for combinations of potential vegetation type (PVT) and tree species (table 3-3). They were used to calculate maximum density by PVT.

Tables 3-1 and 3-3 provide maximum-density SDI values by tree species and PVT. Diagrams of a density-management system that uses maximum density as its reference level are presented and described in figures 3-1 and 3-6.

## **FULL STOCKING (NORMAL DENSITY)**

Full stocking, as described in Cochran et al. (1994), is also referred to as normal density (figs. 2-2 and 3-1). Normal density is a reference level that relates to an important historical forestry tool – normal yield tables (e.g., Barnes 1962, McArdle et al. 1961, Meyer 1961). "The term fully stocked stand has traditionally meant a stand that has the same density as given in the natural stand normal yield table for that site and age" (Davis et al. 2001, p. 167).

"It is unfortunate that the word 'normal' has become attached as a standard of comparison to the concept of stands fully stocked at a given age; there is nothing normal about them in the sense of being 'usual' or 'regular'. When foresters wanted to determine the potential growth for natural stands on these sites, they did not use a random sample but rather selected only stands that appeared healthy, had an even distribution of trees on the ground, and were at the highest density levels observed; in short, they looked for nature's best" (Davis et al. 2001, p. 188, 190).

An example of how full stocking and normal density are related: a least-squares fit of data from fully stocked stands used to construct normal yield tables for ponderosa pine (Meyer 1961) results in an SDI of 365 (Oliver and Uzoh 1997). This least-squares result was adopted as the full-stocking value (table 2-3) for ponderosa pine in the Blue Mountains (Cochran et al. 1994).

**Table 3-2:** Characterization of selected stand development benchmarks and related stocking levels as percentages of maximum density and full stocking.

| STAND DEVELOPMENT BENCHMARKS<br>AND RELATED STOCKING LEVELS | PERCENT OF<br>MAXIMUM DENSITY <sup>1</sup> | PERCENT OF<br>FULL STOCKING <sup>2</sup> |
|-------------------------------------------------------------|--------------------------------------------|------------------------------------------|
| Absolute-maximum level of competition                       | 100%                                       | 125%                                     |
| <b>Maximum density<sup>3</sup></b>                          | <b>100%</b>                                | <b>125%</b>                              |
| Full stocking/normal density <sup>4</sup>                   | 80%                                        | 100%                                     |
| Lower limit of the self-thinning zone <sup>5</sup>          | 60%                                        | 75%                                      |
| <b>Upper limit of a management zone</b>                     | <b>55%</b>                                 | <b>~69%</b>                              |
| Crown ratio of 40 percent                                   | 50%                                        | ~63%                                     |
| Lower limit of full site occupancy                          | 35%                                        | ~45%                                     |
| <b>Lower limit of a management zone</b>                     | <b>35%</b>                                 | <b>~45%</b>                              |
| Onset of competition/crown closure                          | 25%                                        | ~30%                                     |
| <b>Climate resilience</b>                                   | <b>25%</b>                                 | <b>~30%</b>                              |

<sup>1</sup> Percent of maximum density values are based on Long (1985) or were calculated.

<sup>2</sup> Percent of full stocking values are based on Cochran et al. (1994) or were calculated.

<sup>3</sup> Maximum density is the absolute-maximum density observed for a tree species; although rare in nature, it represents a biologically meaningful upper limit (see fig. 2-2).

<sup>4</sup> Full stocking refers to normal stand density values published in sources such as Meyer (1961); full stocking has also been called average-maximum density (see fig. 2-2).

<sup>5</sup> Lower limit of the self-thinning zone stocking benchmark has also been referred to as the ‘zone of imminent competition mortality’ (Drew and Flewelling 1979).

Note: Color bands show benchmarks and stocking levels considered to be equivalent. The upper and lower limits, and climate resilience, are used for the chapter 6 stocking tables.

Occasionally in the literature, a *full-stocking* value of 365 for ponderosa pine is characterized as ‘maximum density’ (Oliver and Uzoh 1997, Sherlock 2007). An SDI of 365 for ponderosa pine was derived from data for normal (fully stocked) stands, and it is properly termed full stocking or normal density. ***The maximum density for ponderosa pine is not 365 – it is 456.***

Early in the twentieth century, normal yield tables were used to evaluate stand density (Osborne and Schumacher 1935). They provide average characteristics for fully stocked, even-aged, pure stands of the same age and site quality (Daniel et al. 1979a). Dry sites with inherent stocking limitations (shallow soils) were seldom sampled when preparing normal yield tables because they were viewed as representing understocked areas.

“Meyer (1961) excluded all sample plots having a stand density index of 250 or less during development of normal yield tables for ponderosa pine” (Cochran et al. 1994, p. 2). “In yield studies, however, biased sampling, as to stand density, is the rule. Plots are selected for maximum stocking and poorly stocked plots are not desired” (Reineke 1933, p. 631). This sampling approach – excluding plots with low stand density – failed to recognize that poorly stocked plots could actually occur on dry sites where full stocking has lower density than for moist sites. Note that at least half a dozen potential vegetation types (Hall 1973) have full-stocking SDI values for ponderosa pine that are less than Meyer’s (1961) cut-off value of 250 (table 3-3).

**Table 3-3:** Full stocking (FS) and maximum density (MD) stocking levels, expressed as stand density index, for potential vegetation types of the Blue-Ochoco and Wallowa-Snake geographical areas.

| Potential Vegetation Type | Ponderosa Pine |     | Douglas-fir |     | Western Larch |     | Lodgepole Pine |     | Engel. Spruce |     | Grand fir |     | Subalpine fir |     |
|---------------------------|----------------|-----|-------------|-----|---------------|-----|----------------|-----|---------------|-----|-----------|-----|---------------|-----|
|                           | FS             | MD  | FS          | MD  | FS            | MD  | FS             | MD  | FS            | MD  | FS        | MD  | FS            | MD  |
| ABGR/ACGL                 |                |     | 241         | 301 | 351           | 439 |                |     | 324           | 405 | 461       | 576 |               |     |
| ABGR/ACGL-WS              | 365            | 456 | 380         | 475 |               |     |                |     |               |     | 560       | 700 |               |     |
| ABGR/ACGL-PHMA-WS         |                |     | 380         | 475 | 355           | 444 |                |     |               |     | 502       | 628 |               |     |
| ABGR/ARCO                 | 316            | 395 | 357         | 446 | 307           | 384 | 307            | 384 |               |     | 444       | 555 |               |     |
| ABGR/BRVU                 |                |     |             |     | 410           | 512 |                |     | 469           | 586 | 560       | 700 |               |     |
| ABGR/CAGE                 | 210            | 263 | 301         | 376 |               |     |                |     |               |     | 560       | 700 |               |     |
| ABGR/CARU                 | 316            | 395 | 357         | 446 | 307           | 384 | 307            | 384 |               |     | 444       | 555 |               |     |
| ABGR/CARU-WS              | 365            | 456 | 380         | 475 |               |     |                |     |               |     |           |     |               |     |
| ABGR/CLUN                 |                |     | 380         | 475 | 410           | 512 |                |     | 469           | 586 | 560       | 700 |               |     |
| ABGR/CLUN-WS              | 365            | 456 | 380         | 475 | 364           | 455 | 342            | 428 | 469           | 586 | 560       | 700 |               |     |
| ABGR/GYDR                 |                |     |             |     |               |     |                |     |               |     | 553       | 691 |               |     |
| ABGR/LIBO2                | 365            | 456 | 380         | 475 | 370           | 463 | 434            | 543 | 399           | 499 | 516       | 645 | 373           | 466 |
| ABGR/LIBO2-WS             |                |     | 380         | 475 | 409           | 511 | 304            | 380 |               |     | 560       | 700 |               |     |
| ABGR/POMU-ASCA3           |                |     |             |     | 350           | 438 |                |     | 469           | 586 | 486       | 608 |               |     |
| ABGR/SPBE                 | 255            | 319 | 198         | 248 |               |     |                |     |               |     | 354       | 443 |               |     |
| ABGR/SPBE-WS              | 365            | 456 | 380         | 475 |               |     |                |     |               |     |           |     |               |     |
| ABGR/TABR/CLUN            |                |     |             |     |               |     |                |     | 426           | 533 | 560       | 700 |               |     |
| ABGR/TABR/LIBO2           |                |     | 380         | 475 | 302           | 378 |                |     | 299           | 374 | 560       | 700 |               |     |
| ABGR/TRCA3                |                |     |             |     | 398           | 498 |                |     | 388           | 485 | 554       | 693 |               |     |
| ABGR/VAME                 | 292            | 365 | 380         | 475 | 410           | 512 | 238            | 298 | 341           | 426 | 455       | 569 | 412           | 515 |
| ABGR/VAME-WS              | 339            | 424 | 351         | 439 | 371           | 464 | 265            | 331 | 469           | 586 | 560       | 700 |               |     |
| ABGR/VASC                 | 172            | 215 | 274         | 343 | 304           | 380 | 296            | 370 |               |     | 368       | 460 |               |     |
| ABGR/VASC-LIBO2           |                |     | 347         | 434 | 253           | 316 | 330            | 413 | 349           | 436 | 494       | 618 | 184           | 230 |
| ABLA2/ARCO                |                |     |             |     |               |     | 445            | 556 | 344           | 430 |           |     | 382           | 478 |
| ABLA2/CAGE                |                |     |             |     |               |     | 392            | 490 |               |     |           |     | 372           | 465 |
| ABLA2/CLUN                |                |     |             |     | 410           | 512 |                |     | 469           | 586 |           |     | 416           | 520 |
| ABLA2/CLUN-WS             | 303            | 379 |             |     | 331           | 414 |                |     | 469           | 586 | 545       | 681 | 343           | 429 |
| ABLA2/LIBO2               |                |     |             |     | 410           | 512 |                |     | 379           | 474 |           |     | 335           | 419 |
| ABLA2/LIBO2-WS            |                |     |             |     | 278           | 348 | 266            | 333 | 430           | 538 |           |     | 390           | 488 |
| ABLA2/MEFE                |                |     |             |     |               |     |                |     |               |     |           |     | 416           | 520 |
| ABLA2/MEFE-WS             |                |     |             |     |               |     | 288            | 360 | 368           | 460 |           |     | 328           | 410 |
| ABLA2/POPU                |                |     | 380         | 475 | 410           | 512 | 324            | 405 | 454           | 568 |           |     | 386           | 483 |
| ABLA2/STAM-WS             |                |     |             |     |               |     | 287            | 359 | 469           | 586 |           |     | 354           | 443 |
| ABLA2/STOC                |                |     |             |     |               |     | 392            | 490 |               |     |           |     | 372           | 465 |
| ABLA2/TRCA3               |                |     |             |     |               |     | 445            | 556 | 344           | 430 |           |     | 382           | 478 |
| ABLA2/VAME                |                |     |             |     | 382           | 478 | 255            | 319 | 382           | 478 |           |     | 265           | 331 |
| ABLA2/VAME-WS             |                |     | 380         | 475 | 368           | 460 | 305            | 381 | 458           | 573 |           |     | 340           | 425 |
| ABLA2/VASC                |                |     | 366         | 458 | 380           | 475 | 317            | 396 | 366           | 458 |           |     | 365           | 456 |
| ABLA2/VASC/POPU-WS        |                |     | 380         | 475 | 410           | 512 | 324            | 405 | 454           | 568 |           |     | 386           | 483 |
| PICO/CARU                 |                |     |             |     |               |     | 223            | 279 |               |     |           |     |               |     |
| PICO(ABGR)/ALSI           |                |     | 380         | 475 | 410           | 512 |                |     | 469           | 586 | 560       | 700 |               |     |
| PICO(ABGR)/ARNE           | 292            | 365 | 380         | 475 | 410           | 512 | 238            | 298 | 341           | 426 | 455       | 569 | 412           | 515 |
| PICO(ABGR)/VAME           | 292            | 365 | 380         | 475 | 410           | 512 | 238            | 298 | 341           | 426 | 455       | 569 | 412           | 515 |
| PICO(ABGR)/VAME/CARU      | 292            | 365 | 380         | 475 | 410           | 512 | 238            | 298 | 341           | 426 | 455       | 569 | 412           | 515 |



| Potential Vegetation Type | Ponderosa Pine |     | Douglas-fir |     | Western Larch |     | Lodgepole Pine |     | Engel. Spruce |     | Grand fir |     | Subalpine fir |     |
|---------------------------|----------------|-----|-------------|-----|---------------|-----|----------------|-----|---------------|-----|-----------|-----|---------------|-----|
|                           | FS             | MD  | FS          | MD  | FS            | MD  | FS             | MD  | FS            | MD  | FS        | MD  | FS            | MD  |
| PICO(ABGR)/VAME-LIBO2     | 365            | 456 | 380         | 475 | 370           | 463 | 434            | 543 | 399           | 499 | 516       | 645 | 373           | 466 |
| PICO(ABGR)/VAME/PTAQ      | 292            | 365 | 380         | 475 | 410           | 512 | 238            | 298 | 341           | 426 | 455       | 569 | 412           | 515 |
| PICO(ABGR)/VASC/CARU      | 172            | 215 | 274         | 343 | 304           | 380 | 296            | 370 |               |     | 368       | 460 |               |     |
| PICO(ABLA2)/STOC          |                |     |             |     |               |     | 392            | 490 |               |     |           |     | 372           | 465 |
| PICO(ABLA2)/VAME          |                |     |             |     | 382           | 478 | 255            | 319 | 382           | 478 |           |     | 265           | 331 |
| PICO(ABLA2)/VASC          |                |     | 366         | 458 | 380           | 475 | 317            | 396 | 366           | 458 |           |     | 365           | 456 |
| PICO(ABLA2)/VASC/POPU     |                |     | 380         | 475 | 410           | 512 | 324            | 405 | 454           | 568 |           |     | 386           | 483 |
| PIPO/AGSP                 | 133            | 166 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/AGSP-WS              | 186            | 233 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/ARTRV/FEID-AGSP      | 190            | 238 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/CAGE                 | 201            | 251 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/CARU                 | 365            | 456 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/CELE/CAGE            | 232            | 290 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/CELE/FEID-AGSP       | 157            | 196 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/CELE/PONE            | 159            | 199 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/FEID                 | 194            | 243 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/FEID-WS              | 207            | 259 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/PUTR/CAGE            | 204            | 255 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/PUTR/CARO            | 243            | 304 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/PUTR/FEID-AGSP       | 185            | 231 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/SPBE-WS              | 221            | 276 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/SYAL                 | 318            | 398 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/SYAL-WS              | 241            | 301 |             |     |               |     |                |     |               |     |           |     |               |     |
| PIPO/SYOR                 | 260            | 325 |             |     |               |     |                |     |               |     |           |     |               |     |
| PSME/ACGL-PHMA-WS         | 281            | 351 | 277         | 346 |               |     |                |     |               |     |           |     |               |     |
| PSME/CAGE                 | 222            | 278 | 281         | 351 |               |     |                |     |               |     |           |     |               |     |
| PSME/CARU                 | 263            | 329 | 264         | 330 |               |     |                |     |               |     |           |     |               |     |
| PSME/CARU-WS              | 361            | 451 | 380         | 475 |               |     |                |     |               |     |           |     |               |     |
| PSME/HODI                 | 340            | 425 | 255         | 319 |               |     |                |     |               |     |           |     |               |     |
| PSME/PHMA                 | 274            | 343 | 225         | 281 | 256           | 320 |                |     |               |     |           |     |               |     |
| PSME/PHMA-WS              | 232            | 290 | 310         | 388 |               |     |                |     |               |     |           |     |               |     |
| PSME/SPBE-WS              | 353            | 441 | 371         | 464 |               |     |                |     |               |     |           |     |               |     |
| PSME/SYAL                 | 273            | 341 | 247         | 309 | 205           | 256 |                |     |               |     |           |     |               |     |
| PSME/SYAL-WS              | 333            | 416 | 380         | 475 |               |     |                |     |               |     |           |     |               |     |
| PSME/SYOR-WS              | 361            | 451 |             |     |               |     |                |     |               |     |           |     |               |     |
| PSME/VAME                 | 193            | 241 | 183         | 229 |               |     |                |     |               |     |           |     |               |     |
| TSME/VASC+VAME-WS         |                |     |             |     |               |     | 226            | 283 | 297           | 371 |           |     | 416           | 520 |

**Table Notes:**

- Whenever a full-stocking cell (FS column) has gray shading, it means that the actual value, as provided in table 3 or 4 of Cochran et al. (1994), is higher than a species' full-stocking value for the Blue Mountains as a whole (table 2-3). When this situation occurs, the FS value for a potential vegetation type-species combination is reduced to the ecoregion value shown in table 2-3.
- All SDI values in this table pertain to an even-aged structure and a quadratic mean diameter (QMD) of 10 inches.
- Some footnotes for table 3-1 also provide additional information about this data.
- Main objective of this table is to express FS values by tree species and PVT. FS is crucially important because all 4 stocking levels are based on it, at least indirectly (e.g., FS is used to calculate MD; MD is used to calculate the CR, LL, and UL levels in table 3-1).
- Column headings:**  
 FS – SDI value for full stocking from table 3 or 4 in Cochran et al. (1994) or table 2-3 in this guide (see Note #1).  
 MD – Calculated SDI value for maximum density, calculated as 125% of full stocking (see table 3-2).

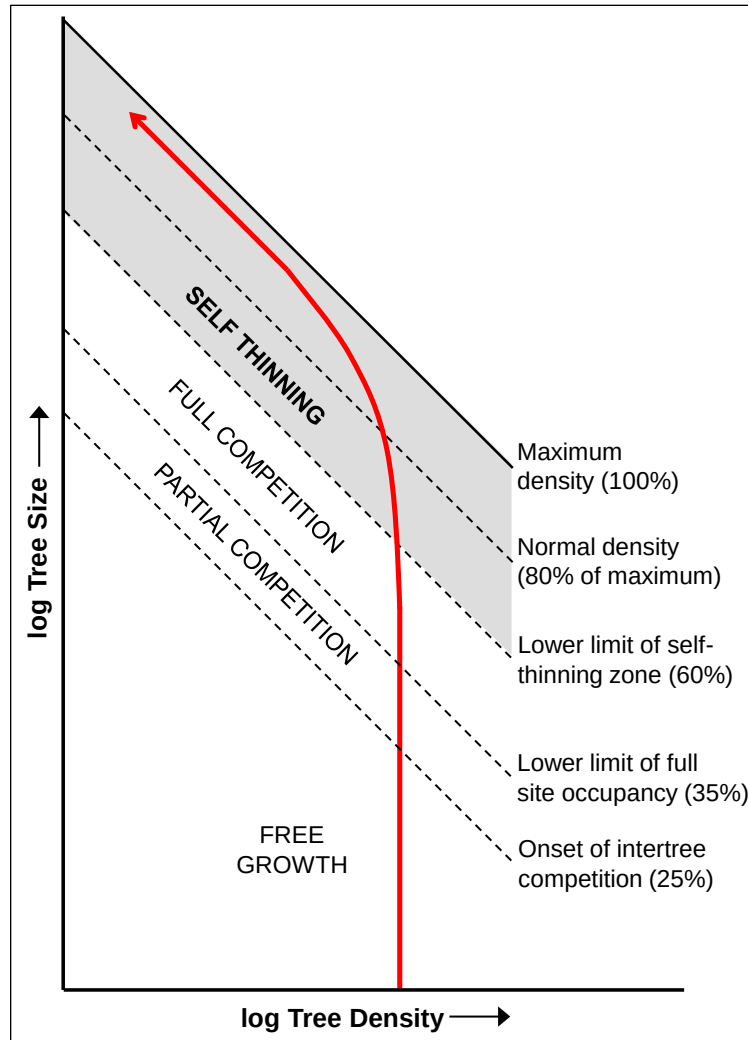


**Figure 3-1** – Stand development as related to maximum density (based on Long 1985). Initially, trees are too small to use all of a site’s resources: they experience what is termed free growth (no intertree competition occurs). Eventually, roots and crowns interact and an ‘onset of intertree competition’ benchmark is reached. As a stand moves through a partial competition zone, trees capture growing space and a ‘lower limit of full site occupancy’ benchmark is reached. Beyond this point, full competition occurs. As competition intensifies, stands enter a self-thinning zone by crossing the ‘lower limit of self-thinning zone’ benchmark. In the self-thinning zone (gray area), a tree can only increase in size after neighboring trees relinquish their growing space by dying (see *Self-Thinning Process* section, chap. 2). The pace of tree mortality quickens as a stand passes a ‘normal density’ benchmark and approaches maximum density. Maximum density, shown as a solid line, is the reference level (e.g., 100%) for the stand-development system shown here.

## Stand Differentiation

Full stocking implies a high-density condition (MacLean and Bolsinger 1973); trees in fully stocked stands compete vigorously for water, sunlight, and nutrients. Full stocking pertains to single-cohort (even-aged) stands where competition causes trees to differentiate into crown-classes – dominant, codominant, intermediate, and overtopped/suppressed trees are present (fig. 3-2).

If intense intertree competition persists, then density-dependent tree mortality eventually becomes evident. And density-dependent mortality is selective – it has the most influence on smaller, subordinate trees (the intermediate and suppressed crown classes in fig. 3-2) and on shade-intolerant species (fig. 2-7).

Historically, normal density (full stocking) was defined as the stocking level producing maximum possible yields of cubic timber volume for a given age and site (Barnes 1962, Behre 1928, McArdle et al. 1961, Meyer 1961, Schumacher 1928, and others).

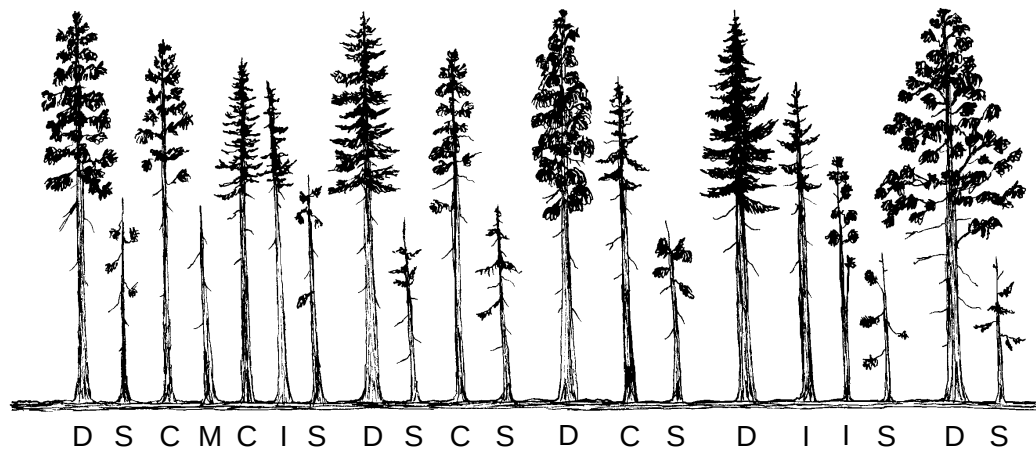


**Figure 3-2** – Crown classes resulting from differentiation in a mixed-species, single-cohort stand (from Powell 1994). Crown classes classify a tree’s position in a forest canopy. Dominant trees (D) have crowns rising above the general canopy, and they enjoy full sunlight from above and, to a certain extent, from the sides. Codominant trees (C) are not quite as tall as dominants, and their crowns may be hemmed in on their sides. Intermediate trees (I) occupy a subordinate position; they have competition from the sides but usually receive some overhead sunlight through canopy holes. Suppressed trees (S) are entirely overtopped; if they can tolerate shade, they may survive on filtered sunlight or sunflecks. Suppressed trees with low shade tolerance (fig. 2-7) quickly experience competition-induced mortality (M).

Long-term studies refute that high stocking is required for high timber volume production – it is now recognized that high yields of usable (board-foot) timber volume are often found at densities well below maximum or ‘normal’ (Zeide 2005). [This fact is demonstrated by Langsaeter’s ‘well-spaced’ Zone III – it coincides with maximum volume growth and merchantable timber production per acre. See figures 3-4 and 3-5 for more information.]

*Flewelling and Drew (1985) showed that 60 percent of maximum volume growth for a stand can be achieved with a density of about 25 percent of maximum.*

## PROPERLY FUNCTIONING DENSITY: THE MANAGEMENT ZONE

As shown in figure 3-3, the stocking levels described in Cochran et al. 1994 utilize a ‘management zone’ concept. Lower and upper limits of a management zone are set by using defined percentages of a reference level. Cochran et al. 1994 uses full stocking as a reference level.

This version of a Blue Mountains stocking guide continues to use a management zone, with lower and upper limits, *but it uses maximum density as a reference level, not full stocking*. So, the lower and upper limits of a management zone are now calculated as defined percentages of maximum density, not as percentages of full stocking.

This guide uses consistent percentages of maximum density to set management zone limits *for all 7 tree species*. This was not done for Cochran et al. 1994 or Powell 1999. However, modified zone limits for ponderosa and lodgepole pines, to reflect mountain pine beetle susceptibility, continue to be provided in this guide, in chapter 5 (tables 5-3 and 5-4).

## Historical Context For The Management Zone Concept

The National Forest Management Act (NFMA) of 1976 states in section 4(d)(1) that “it is the

policy of Congress that all forested lands in the National Forest System shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans” (P.L. 94-588; 16 USC 1600).

Because NFMA requires ‘degree of stocking’ to be addressed during land management planning, this led to a national policy to develop a standard set of stocking standards for each region of the country. That era’s policy specified that stocking standards should use either of two reference levels, as described by Ernst and Knapp 1985:

- 1) open-grown trees, a reference level representing no intertree competition, or
- 2) stands with high levels of intertree competition, termed ‘average-maximum’ density. (Normal density and full stocking qualify as this reference level.)

Up through the early 1990s, USDA Forest Service stocking-level policy was implemented by developing Gingrich-format stocking charts (Gingrich 1967) for major forest types (Ernst and Knapp 1985, Puuri et al. 1988). The charts were published as a supplement to a Region’s Silvicultural Practices Handbook. A common element of Gingrich-style stocking charts is a management zone bounded by lower and upper limits and highlighted with gray shading. Management zone was defined as “the area defined by the upper and lower bounds of acceptable relative densities in stands managed for a particular objective” (Ernst and Knapp 1985).

*Cochran et al. (1994) implemented the management zone concept in a similar way as the national policy because they adopted an average-maximum level of competition as a reference level (full stocking qualifies as average-maximum density), and they delineated a management zone by calculating upper and lower limits (bounds) as percentages of full stocking.*

The word ‘management’ implies that the management zone relates to management objectives. This implication is correct – a management zone could vary as objectives change and theoretically, a different zone could be established for any individual situation. This concept means that the same stand could be considered understocked, or overstocked, depending on an area’s objectives and management direction (Daniel et al. 1979a).

Stocking levels within a management zone are compatible with many resource values. A range of density exists across which stand growth is optimized – this range of appropriate density is a management zone. *Stocking levels above a management zone reflect unsustainable levels of stand density for most resource values* (Cochran et al. 1994, Daniel et al. 1979a, Lotan et al. 1988). [But I suppose if an area is snag deficient, then maintaining stand density between the upper limit and full stocking levels (fig. 3-3) can effectively create snags – see “The 3/4 power law in forest management: How to grow dead trees” (Ferguson and Archibald 2002).]

Research has characterized important stand development benchmarks as percentages of either maximum density or full stocking/normal density (Drew and Flewelling 1979, Long 1985). Many of these benchmarks are described in figures 3-1 and 3-3, and in table 3-2.

Density management represents a compromise between volume production and individual tree growth – both goals cannot be optimized simultaneously. Maximum stand volume production does not coincide with maximum individual tree growth (Daniel et al. 1979a, Long 1985).

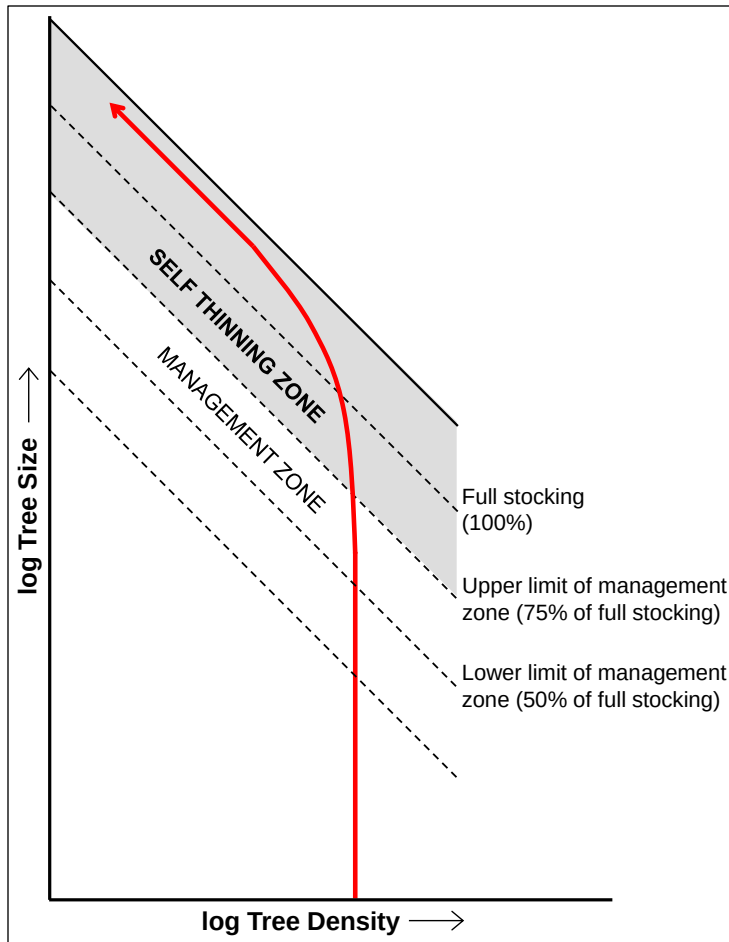


**Figure 3-3** – Stocking levels indexed to full stocking. When comparing this figure with figure 3-1, you will note that: (1) Cochran does not include a maximum density stocking level (the unlabeled solid line at the top); (2) full stocking is used as the reference level (it is shown as 100%) – maximum density is used as the reference level for figure 3-1; (3) normal density in fig. 3-1 is called full stocking by Cochran (they are the same stocking level); (4) the ‘lower limit of self-thinning zone’ in fig. 3-1 is the ‘upper limit of a management zone’ in Cochran; (5) the ‘lower limit of full site occupancy’ in fig. 3-1 is the ‘lower limit of a management zone’ in Cochran; (6) Cochran does not include a stocking level for the ‘onset of intertree competition’ shown in fig. 3-1 (the unlabeled dashed line at the bottom of this figure).

“As long as the site is fully occupied (trees making full use of available resources), the species will produce the same amount of wood per year over a relatively wide range of densities. Whether there are many small trees or fewer large trees, a similar wood volume is produced” (Barnes et al. 1998, p. 393). In other words, timber volume growth declines at both low and high extremes of density, but it remains consistent through a relatively wide middle zone.

Timber growth and yield were traditionally used to establish the limits of a management zone, but *other factors varying reliably with stand density could also be used for this purpose*. Let me provide a simple example based on ponderosa pine seed production and an important avian species of dry-forest ecosystems – white-headed woodpecker (Buchanan et al. 2003).

Ponderosa pine seed production was observed to vary with stand density in the southwestern U.S., with individual trees yielding an average of 0.7 bushels of cones in dense stands, 1.1 bushels of cones in moderately stocked stands, and 1.8 bushels in open stands (Pearson 1912).

An important avian species – white-headed woodpecker – forages on ponderosa pine seed during non-breeding seasons (Krannitz and Duralia 2004). Ponderosa pine stocking levels directly affect seed production and indirectly influence white-headed woodpecker habitat, because dense stands are likely above the upper limit of a management zone, moderately dense stands are within the management zone, and open stands are at or below the zone’s lower limit. This result demonstrates that maintaining stand density within the management zone enhances for-

age production – whether it be herbaceous plants for livestock, or pine seed for woodpeckers.

### **Langsaeter's Hypothesis**

Langsaeter hypothesized that “total production of cubic volume by a stand of given age and composition on a given site is, for all practical purposes, constant and optimum for a wide range of density of stocking. It can be decreased, but not increased, by altering the amount of growing stock to levels outside this range” (quoted in Gilmore et al. 2005; also see Smith et al. 1997).

How stand volume growth varies with stand density is exhibited graphically by using Langsaeter's hypothesis (fig. 3-4). Once a high density is reached, the rate of volume growth declines dramatically (zone IV/V in fig. 3-4) (Daniel et al. 1979a, p. 318-319).

The broad plateau of Langsaeter's curve (zone III in fig. 3-4) reinforces a maxim of thinning, as noted (previous page) by Barnes et al. 1998: *thinning can redistribute volume growth from smaller to larger stems, but it cannot increase the total amount of volume growth*. This reality provides managers with a choice: Produce many small stems for pulpwood, elk hiding cover, etc., or fewer large stems for lumber, cavity-nesting bird habitat, stable carbon stores, etc.

Stand growth is maximized when a stand is beyond the lower level of full site occupancy but below the lower limit of a self-thinning zone (fig. 3-1) – it then exists in the management zone shown in fig. 3-3. The management zone relates to Langsaeter's plateau in figure 3-4. Growing a stand at the lowest stocking level that makes reasonable use of growing space – at the climate resilience (preferably) or lower limit stocking levels – will emphasize both stand and individual-tree growth, as described for figure 3-5 (Daniel et al. 1979a, Lotan et al. 1988).

### **Crafting Your Own Stocking Levels And Management Zones**

Practitioners occasionally believe that the Lower Limit of a Management Zone values provided in table 3-1 (LL columns) may be too low for dry-forest sites. I hope this guide adequately describes the ecological rationale for these low stocking-level values. But as described previously (*Properly Functioning Density: The Management Zone*), users should feel free to establish their own site-specific stocking levels (including higher LL values than those in table 3-1).

This guide bases stocking levels (climate resilience; lower limit; upper limit) on percentages of maximum density (MD). *I suggest that any user who wishes to establish 'custom' stocking levels should also consider using maximum density as a reference level.*

To craft a new stocking level or modify an existing one (adjust the climate resilience level so it represents 20% of MD rather than 25%?), the MD information in table 3-1 supports your modification. *To make a new stocking level, just multiply the MD value for a tree species-potential vegetation type combination by the percentage you want to use, such as 20%.*

### **THE UPPER LIMIT OF A MANAGEMENT ZONE (ULMZ)**

Foresters prefer to manage stand density to avoid mortality of small trees in subordinate crown classes. This objective is met by establishing an upper management zone that discourages development of a suppressed crown class (fig. 3-2). Cochran et al. (1994) recommends this strategy because doing so avoids the competition-related tree mortality caused by self-thinning (chapter 2). The lower limit of a self-thinning zone (fig. 3-1) functions well as the upper limit of a management zone (fig. 3-3).

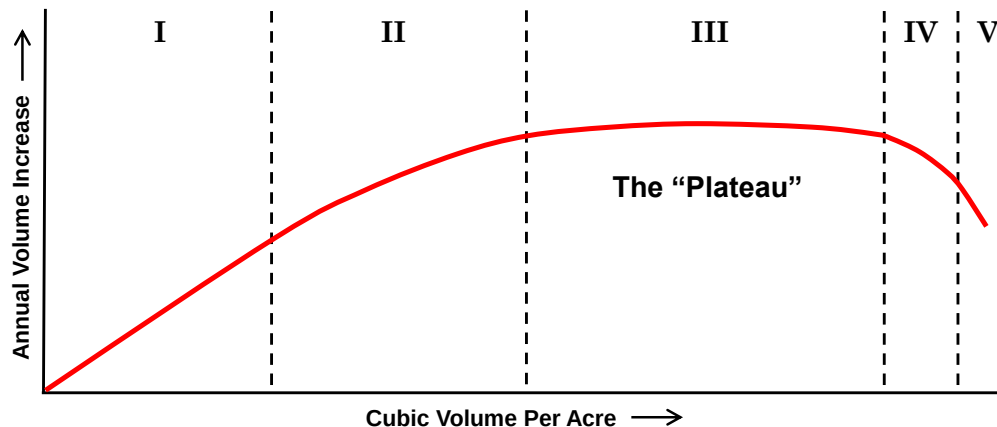


**Figure 3-4** – Langsaeter’s curve examining a relationship between cubic-foot volume growth and growing-stock, represented by five stages relating to stand development and levels of intertree competition (adapted from Daniel et al. 1979a, p. 318). In the context of growth-growing stock relationships, Langsaeter’s curve shows five stages of stand development:

- Stage I, *isolated*, is characterized by little or no competition between trees – individual tree growth is maximized, and trees are growing as fast as possible for prevailing conditions (environment or site, species, age, etc.).
- Stage II, *wide-spaced*, features the onset of competitive interactions between trees – individual tree growth begins to decline somewhat (it is slower than full potential for the site), stand growth is still increasing dramatically, but trees have not yet fully occupied the site.
- Stage III, *well-spaced*, is where stand growth is maximized across the ‘wide range of density’ described by Langsaeter (Lotan et al. 1988) – individual tree growth is even further below site potential, so a thinning at this point would restore a higher tree growth rate, but at some potential cost to stand growth, depending on thinning intensity.
- Stage IV, *crowded*, has increasingly severe competition, and crown-class differentiation occurs (see fig. 3-2). Self-thinning is occurring, but it is minor enough that liberated growing space (resources freed up as small trees die) is appropriated quickly by surviving trees.
- Stage V, *stagnated*, has intense intertree competition – self-thinning is causing tree mortality to an extent where surviving trees cannot capture all the liberated growing space, so new regeneration is getting established in this stage (analogous to the understory reinitiation structural stage). Overstory trees tend to be old and physiologically tired in this stage.

Note that the ‘plateau’ portion of Langsaeter’s curve demonstrates “that for many species, the absolute rate of annual growth in fiber or commercial wood volume is nearly constant over a wide range of cubic foot or basal area stocking” (Davis et al. 2001, p. 190).

The vast majority of commercial intermediate treatments (commercial thinnings, improvement cuttings, etc.) occur in the plateau stage where stands are generally immature but tree size is reasonably large (e.g., stands with a quadratic mean diameter of 7 to 21 inches).

Stage III (the plateau) is particularly important because it corresponds to a developmental zone where stand growth rates peak between a relative density range of 0.4 and 0.55 (40% to 55% of maximum density) for Douglas-fir (Drew and Flewelling 1979). *Stage III is equivalent to the management zone shown in figure 3-3.*

Other research suggests that even though different tree species have differing levels of maximum density (as is clearly demonstrated by the MD columns in tables 3-1 and 3-3), they all behave similarly with respect to the relationships shown here – stage III corresponds to a management zone with a lower limit of 35 to 40% of maximum density and an upper limit of 55 to 60% of maximum density (table 3-2) (Smith and Hann 1986).

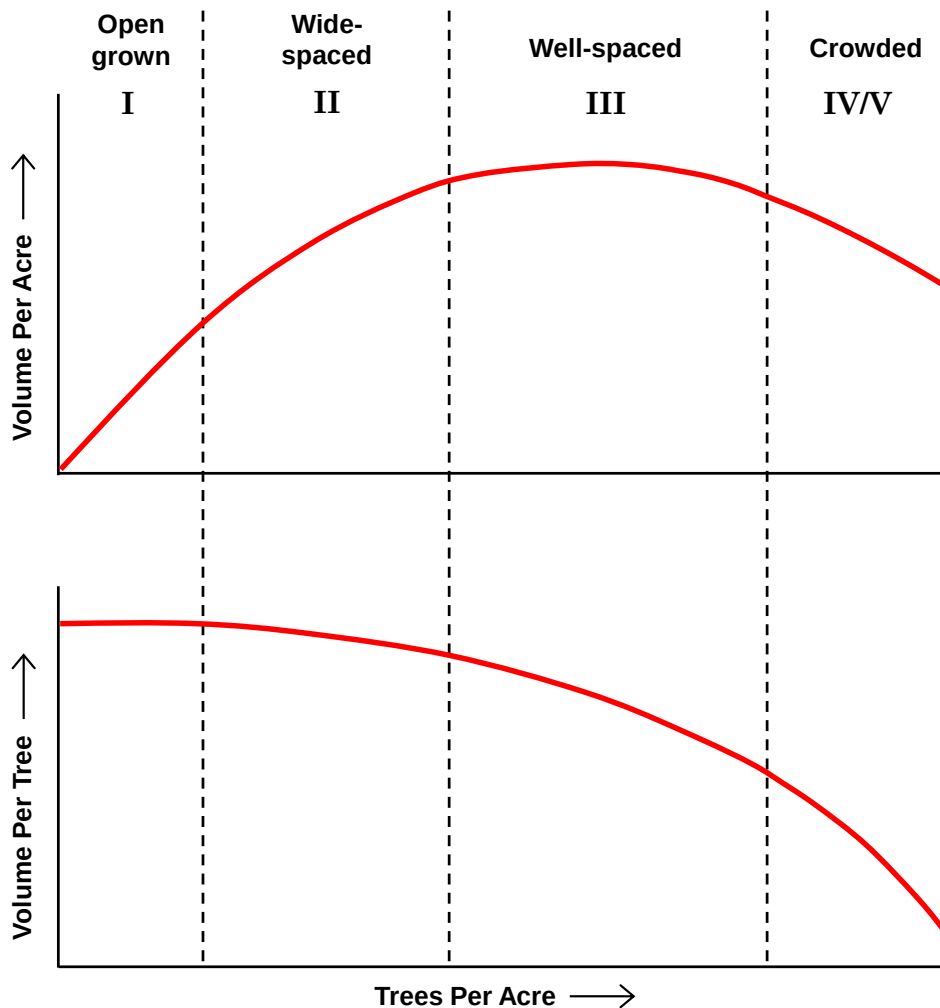


**Figure 3-5** – Changes in volume per acre (top) and volume per tree (bottom), as related to increasing numbers of trees (adapted from Daniel et al. 1979a, p. 319).

This diagram demonstrates that total stand volume increases up to a certain density (an optimal density for stand growth occurs at the zenith of zone III), after which a density increase causes a corresponding reduction in the rate of volume growth. It also illustrates that maximum tree growth does not coincide with maximum stand growth – *individual-tree growth is maximized at lower stand densities than is stand growth*.

The tension between stand and tree growth (they can't be optimized simultaneously) means that silvicultural prescriptions need to account for the compromise between these objectives, at least for situations where management goals emphasize volume growth or optimal tree vigor.

The lower limit of a self-thinning zone is 60% of maximum density (table 3-2), which agrees with Long's (1985) observation that self-thinning begins at a relative density of 0.6 for Douglas-fir, ponderosa pine, western hemlock, or lodgepole pine. This value agrees with Puettmann et al. (1993), who found that Douglas-fir mortality began at about 58% of maximum density. The lower limit of a self-thinning zone also varies among species or among guilds of species. Very shade-intolerant broadleaved species, such as red alder or quaking aspen, have less tolerance for crowding than do conifers – Puettmann et al. (1993) found that pure red alder stands began to self-thin at a relative density of only 44%.



Some users of the 1999 stocking guide (Powell 1999) asked that all seven tree species be handled similarly in terms of calculating stocking levels. For this guide, *upper management-zone limits are calculated as 55% of maximum density for all seven tree species (fig. 3-6)*. The 55% upper management zone percentage is slightly below the 60% value suggested by Long (1985) (60% is shown in table 3-2 as the lower limit of a self-thinning zone). However, 55% is compatible with the Lower Limit value used by the Forest Vegetation Simulator (FVS) (see fig. 4-1).

This stocking guide sets the upper limit of a management zone, for all seven species, as 55% of maximum density, including for lodgepole and ponderosa pines. In Powell 1999, upper limits for lodgepole and ponderosa pines varied due to mountain pine beetle susceptibility (MPB). Upper limits reflecting MPB susceptibility are also provided in this guide (tables 5-3 and 5-4).

## **THE LOWER LIMIT OF A MANAGEMENT ZONE (LLMZ)**

Cochran et al. (1994) recommends that a lower limit of a management zone (LLMZ) be established in such a way as to “capture a significant portion of the site resources in tree growth.” Since this objective is best met by using a stand development benchmark called the ‘lower limit of full site occupancy’ (fig. 3-1), the LLMZ level is based on this site occupancy benchmark.

As shown in table 3-2 and figures 3-1 and 3-6, the *lower limit of full site occupancy benchmark (e.g., the LLMZ stocking level) is equivalent to 35% of maximum density*.

Lower limits of a management zone are calculated as 35% of maximum density. This is done for all seven tree species and all combinations of species and potential vegetation type. For lodgepole and ponderosa pines, lower limits of a management zone that reflect mountain pine beetle susceptibility are provided in chapter 5 of this guide (tables 5-3 and 5-4).

## **THE CLIMATE RESILIENCE STOCKING LEVEL**

Figure 3-1 includes five stand development benchmarks, ranging from the Onset of Intertree Competition (lowest level) to Maximum Density (highest level). The Onset of Intertree Competition (25% of maximum density) is the first benchmark that foresters pay attention to as stand dynamics progress toward more impactful benchmarks – full site occupancy, self-thinning, etc.

What happens at the 25% level is that a tree begins to function as part of a stand, rather than experiencing the ‘world’ as all its own, as though it is the only tree present.

Below the 25% level, a tree is mostly competing with itself to see how quickly it can claim site resources – expand its roots to absorb maximum moisture and nutrients, expand its crown as widely as possible to harvest maximum sunlight and optimize photosynthesis, and so forth. Above this 25% threshold, a tree begins to compete with its neighbors to capture site resources. [This discussion adopts a tree-centric context – it disregards non-tree competition from herbs and shrubs, which can certainly be impactful, especially early in a tree’s life.]

Areas west of the Cascades have a maritime climatic regime – there, forest dynamics tend to be controlled more by sunlight than by soil moisture, and tree crowns are an effective indicator of stand development. When adjoining crowns in a young stand start to touch each other, it means that competition is beginning (e.g., the Onset of Intertree Competition benchmark has been reached) and tree growth will soon begin to slow due to lateral branch confinement.

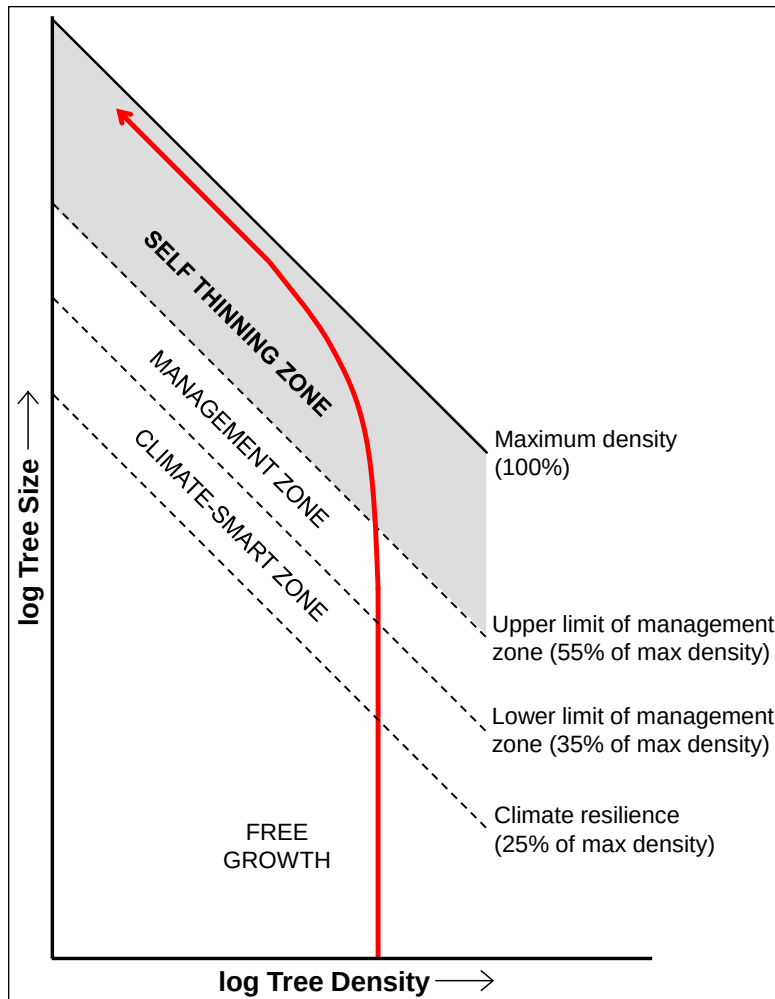


**Figure 3-6** – Stocking levels indexed to maximum density, just like figure 3-1, but showing the stocking-level names and zones used for this stocking guide. The climate resilience (CR) stocking level coincides with the ‘onset of intertree competition’ benchmark in fig. 3-1, but 25% of max density was selected for the CR level for a different reason – it coincides with historical, presettlement stand density for dry, mixed-conifer forests existing in a functional equilibrium with a frequent fire regime and historical climatic conditions (North et al. 2022). The Climate Resilience, Lower Limit of a Management Zone, Upper Limit of a Management Zone, and Maximum Density sections in this chapter provide more information about these stocking levels. The ‘self-thinning zone’ is an area to be avoided when managing stand density. The management zone includes stand density levels between the upper and lower bounds. The climate-smart zone includes

stand density levels between the climate resilience and lower limit stocking levels.

Foresters refer to this phase of stand development as ‘crown closure’ (Oliver and Larson 1996). [It is somewhat unfortunate that this ‘crown closure’ term was coined because the same term is often used to refer to a stand’s foliage amount (instead of canopy cover), leading to confusing terminology. See *Cover Versus Closure Terminology* at the end of this chapter.]

For areas east of the Cascades (the ‘Eastside’), forests tend to be moisture-limited instead of light-limited and young-tree crown closure is not a good indicator of intertree competition. Research shows that for drier Eastside environments, *stand development is influenced more by root competition than by crown competition* (McCune 1986). For dry pine sites, adjoining crowns may never touch. And for mesic sites, by the time that adjoining crowns touch, intertree competition has likely been underway for quite some time, even though much of it occurs underground. The following account provides a useful description of this root competition situation.

“When evaluating stand density as an indicator of the need for thinning or of space requirements for regeneration, the real indicator of competition is not visible. Degree of crown closure is not a useful guide under the dry conditions of the Montane Zone. Instead, the extent of site occupancy by tree roots determines tree vigor and ease of regeneration. Ponderosa pine stands

are adequately stocked when the crowns are still well separated. This is why some managers define proper stocking as 50 to 60 percent of the ‘room to grow and none to waste’ values of normal yield tables” (Myers 1974, p. 5).

## Climate Resilience

Climate change is a very important natural resource issue, especially in response to substantially increased levels of drought, wildfire, and extreme weather (Halofsky and Peterson 2017). As climate change intensifies, land managers have requested a new stocking level that could help our forests be resilient to warmer and dryer conditions (Kerns et al. 2017, 2018).

*This guide includes a climate resilience stocking level, and it was added in response to user requests for a stocking level promoting resilience and sustainability for a climate changed future. Managers now realize that in a warmer and drier future, the stocking levels we used in the past – based on assumptions tied to historical climatic conditions – should be adjusted downward to compensate for dramatically different circumstances in the future.*

The Onset of Intertree Competition benchmark (fig. 3-1) was used as a Climate Resilience (CR) stocking level. The CR level is 25% of maximum density. This percentage was selected not because it reflects the Onset of Intertree Competition benchmark, but because *it functions as a proxy for resilient conditions prior to Euro-American settlement of the West* (North et al. 2022).

## Does A Climate Resilience Stocking Level Support Forest Restoration?

Some managers have wondered: Might 25% of maximum density be appropriate as a climate resilience stocking level, and could it reasonably be used as a substitute for the lower limit stocking values (which are 35% of maximum density), particularly for dry forests?

This is a valid question because for a climate-change context, dry-forest conditions approximating those found in the presettlement era (mid-1800s) would certainly be more resilient, and sustainable, than existing dry-forest conditions reflecting a long history of fire exclusion (densification), livestock grazing, and selective timber harvest (Franklin et al. 2013, Powell 2020).

The primary goals of dry-forest treatments are to: (1) reduce tree density to manage surface, ladder, and canopy fuels; (2) increase average tree size, because stands comprised of large-diameter trees are more resilient to fire; and (3) shift forest (tree) composition toward more drought- and fire-tolerant species, especially ponderosa pine (Agee and Skinner 2005). Meeting these goals contribute to a fire regime featuring frequent, low-severity fire. I believe this outcome can best be supported by returning dry forests to presettlement (HRV) density levels.

Interest in using 25% of maximum density as a climate resilience<sup>3</sup> stocking level gained momentum following research conducted by North and others (North et al. 2022); it found that relative density for historical Sierran dry/mesic forests was 23-28% of maximum – falling in the low competition zone ( $\leq 25\%$ ). I believe the 25% value is also compatible with presettlement condi-

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<sup>3</sup> The term resilience is used here (and elsewhere in this guide). Like ‘forest health,’ resilience has different meanings depending on its context. For this guide, resilience refers to intrinsic properties allowing fundamental functions of a forest ecosystem to persist in the presence of disturbance (Falk et al. 2022) – in other words, it characterizes an ecosystem’s ‘bounce-back’ capacity to recover from disturbance. Resilience recognizes that systems have a capacity to absorb disturbance, but when limits are exceeded, the system may rapidly transition to a different state or trajectory (Gunderson et al. 2010). DeRose and Long (2014) provide a useful resilience framework for a silviculture context.

tions for the Blue Mountains (Churchill et al. 2017, Franklin et al. 2013, Johnston et al. 2018).

## **SDI ADJUSTMENTS FOR STRUCTURES OTHER THAN EVEN AGED**

SDI is directly proportional to site utilization and growing-space occupancy (Curtis 1970; Daniel et al. 1979a, 1979b; Stage 1968), so it can appropriately be used with stand structures that are not even-aged (fig. 3-7) (Cochran 1992; Ducey 2009; Long 1995, 1996; Long and Daniel 1990; O'Hara and Valappil 1995a; Shaw 2000; Zeide 1983).

Reineke's original method of calculating SDI is referred to as the Dq method (Diameter-quadratic) because it uses stand averages. For an even-aged stand, only density (number of trees per acre) and average tree size (quadratic mean diameter) are needed to calculate SDI (Reineke 1933). Even-aged stands have a bell-shaped diameter distribution (fig. 3-7) and are described reasonably well by using average number of trees and average diameter (Schnur 1934).

Because it is practical to calculate SDI for individual stand components such as cohorts or diameter classes and add them together to derive an approximate stand total (Stage 1968), an alternative calculation method – the Dsum method (Diameter-summation) – was developed for stands without a normal diameter distribution (fig. 3-7) (Daniel et al. 1979a, 1979b; Ducey and Larson 2003; Long and Daniel 1990; Shaw 2000).

As Ted Daniel et al. (1979b, p. 4) noted: "While SDI is designated as applicable only to even-aged stands, it could be used to describe the density of uneven-aged stands better than the present methods with their dependence on basal area." Although Reineke developed SDI by using even-aged stands, he hinted that it might also be useful for 'selection' (uneven-aged) stands (Reineke 1933, p. 637).

Long (1995) evaluated differences between the Dq and Dsum methods by calculating SDI for three stand structures – even-aged, a bi-modal or two-storied structure, and a balanced uneven-aged stand (fig. 3-8). His analysis suggests that an SDI value calculated for an even-aged structure (by using the Dq method) *could be reduced by a specific percentage* when attempting to approximate an SDI value for a two-storied or uneven-aged structure – SDIs for those stands are best calculated by using the Dsum method (Ducey 2009, Long 1995, 1996; Shaw 2000).

For the Blue Mountains, few wild stands fit Long's hypothetical structures perfectly, particularly for the two-storied structure, and yet the Blue Mountains have many wild stands with diameter distributions that are intermediate between even-aged and uneven-aged structures.

An SDI analysis was completed for three historical, large-area plots from the central and northern Blue Mountains (Bright 1912; Munger 1912, 1917) – results are presented in figure 3-9. Munger's plots typify the irregular structure historically associated with mature, unmanaged stands on dry-forest sites in the central and southern Blue Mountains (Churchill et al. 2017).<sup>4</sup>

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<sup>4</sup> Munger's data, collected in 1910-1911, quantifies historical stand conditions. Current conditions, however, differ dramatically following at least 90 years of fire suppression and 50 years of selective timber harvest. When two inventory plots located near Munger's Austin-Whitney sample area were measured in 1980 and then compared with his sample data, they showed dramatic increases in stand density (trees per acre) and stand density index, and substantial declines in quadratic mean diameter and the number of large-diameter trees per acre (Powell 1994).

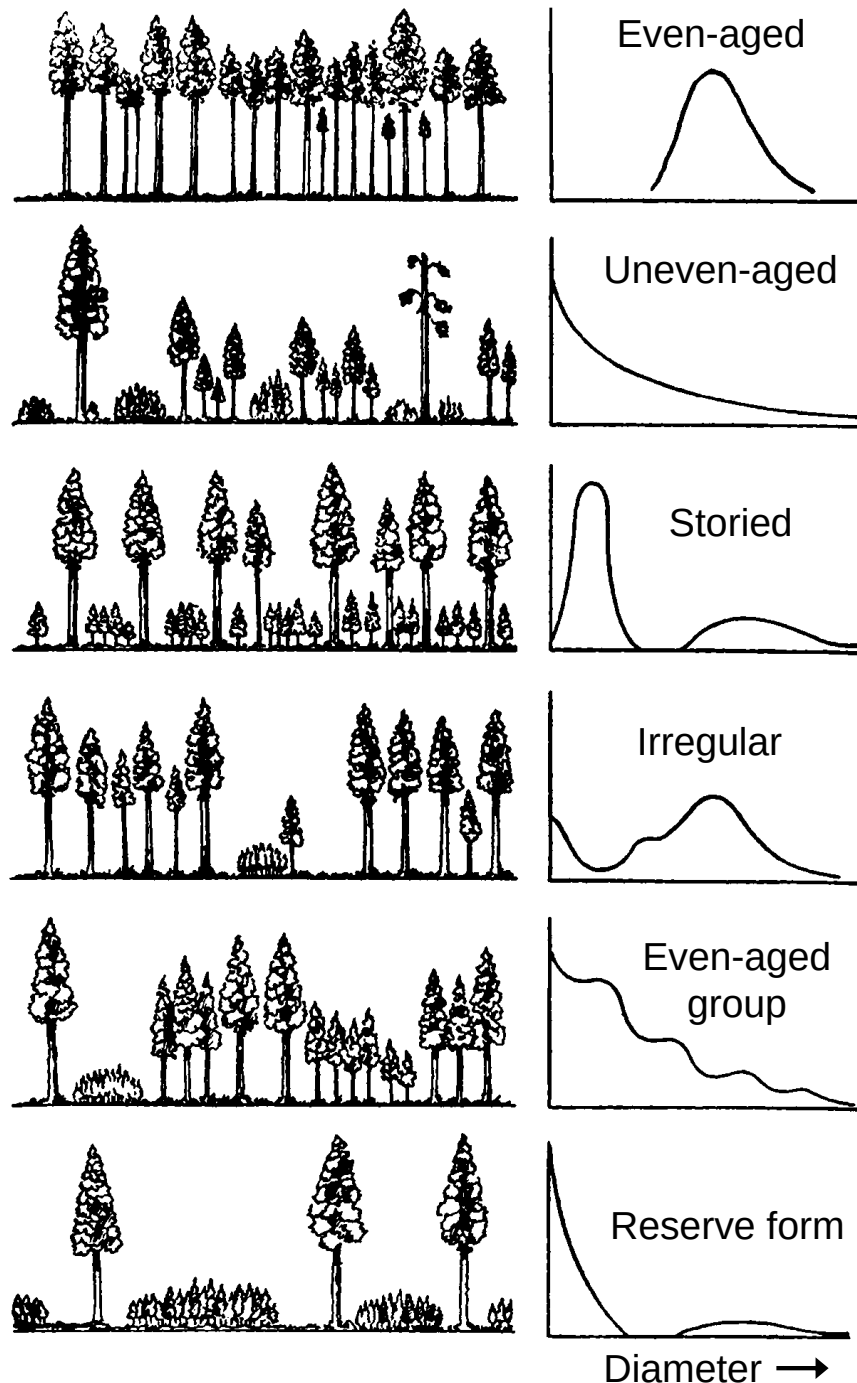


**Figure 3-7** – Forest stands have a variety of diameter distributions, and six of them are shown here (modified from Daniel et al. 1979a, p. 44). When Reineke developed SDI, he based it on even-aged stands (the unimodal or bell-shaped distribution shown at the top): “This stand-density index, based on the relationship between number of trees per acre and their average diameter, is premised on the characteristic distribution of tree sizes in even-aged stands” (Reineke 1933, p. 627). When calculating SDI for even-aged stands, use stand averages and the Dq method; for the other diameter distributions shown here, make SDI calculations by using the diameter-summation (Dsum) method (table 3-4 provides examples for both calculation methods).

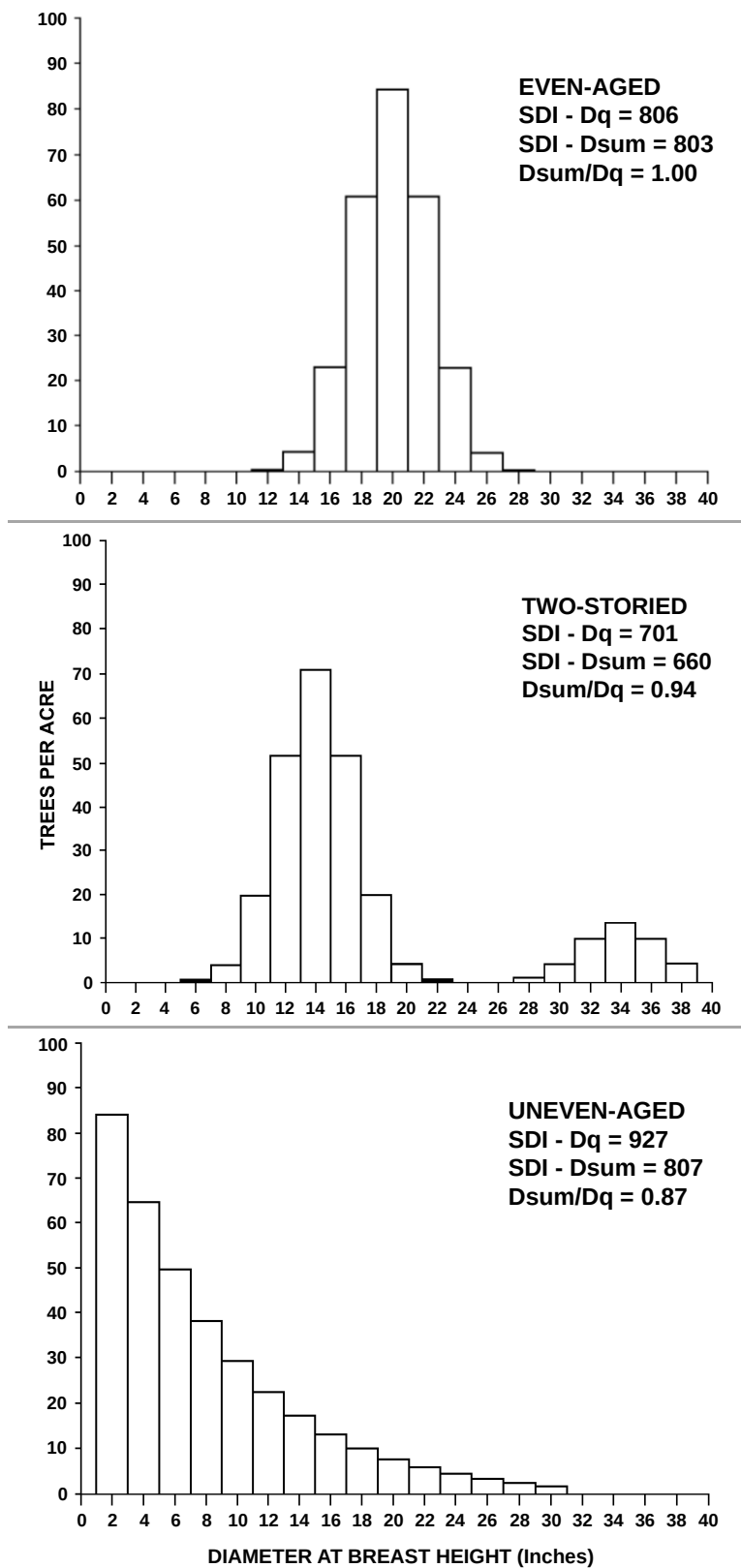


**Figure 3-8** – SDI calculations for three hypothetical stand structures (from Long 1995). This figure shows Dq and Dsum SDI results for three stand structures, and the Dsum/Dq fraction for each of them.

**Table 3-4:** SDI calculations by using the Dsum and Dq methods for the Lookingglass sample.

| 1<br>DBH<br>CLASS | 2<br>BA/<br>TREE | 3<br>PONDEROSA<br>TPA | 4<br>PINE<br>BA | 5<br>SDI     | 6<br>OTHER<br>TPA | 7<br>SPECIES<br>BA | 8<br>SDI    | 9<br>GRAND<br>TPA | 10<br>TOTAL<br>BA | 11<br>SDI    |
|-------------------|------------------|-----------------------|-----------------|--------------|-------------------|--------------------|-------------|-------------------|-------------------|--------------|
| 2                 | 0.02             | 4.0                   | 0.1             | 0.2          | 4.0               | 0.1                | 0.4         | 8.0               | 0.2               | 0.6          |
| 4                 | 0.09             | 3.0                   | 0.3             | 0.6          | 3.0               | 0.3                | 0.8         | 6.0               | 0.5               | 1.3          |
| 6                 | 0.20             | 3.1                   | 0.6             | 1.3          | 3.6               | 0.7                | 1.6         | 6.7               | 1.3               | 2.9          |
| 8                 | 0.35             | 5.0                   | 1.8             | 3.4          | 1.4               | 0.5                | 1.0         | 6.4               | 2.2               | 4.4          |
| 10                | 0.55             | 5.1                   | 2.8             | 5.1          | 1.4               | 0.8                | 1.4         | 6.5               | 3.5               | 6.5          |
| 12                | 0.79             | 5.3                   | 4.1             | 7.3          | 1.1               | 0.9                | 1.4         | 6.4               | 5.0               | 8.7          |
| 14                | 1.07             | 4.5                   | 4.8             | 8.2          | 1.1               | 1.1                | 1.8         | 5.6               | 6.0               | 10.0         |
| 16                | 1.40             | 3.4                   | 4.8             | 7.9          | 0.6               | 0.8                | 1.2         | 4.0               | 5.6               | 9.1          |
| 18                | 1.77             | 3.3                   | 5.9             | 9.5          | 0.5               | 0.8                | 1.1         | 3.8               | 6.7               | 10.5         |
| 20                | 2.18             | 2.5                   | 5.5             | 8.6          | 0.6               | 1.2                | 1.6         | 3.1               | 6.7               | 10.2         |
| 22                | 2.64             | 2.9                   | 7.5             | 11.5         | 0.5               | 1.3                | 1.6         | 3.3               | 8.8               | 13.1         |
| 24                | 3.14             | 2.8                   | 8.6             | 13.0         | 0.3               | 0.9                | 1.1         | 3.0               | 9.6               | 14.0         |
| 26                | 3.69             | 2.7                   | 9.9             | 14.5         | 0.3               | 1.2                | 1.4         | 3.0               | 11.1              | 15.9         |
| 28                | 4.28             | 2.1                   | 8.9             | 12.8         | 0.1               | 0.4                | 0.4         | 2.2               | 9.2               | 13.2         |
| 30                | 4.91             | 1.4                   | 6.9             | 9.9          | 0.1               | 0.4                | 0.5         | 1.5               | 7.4               | 10.3         |
| 32                | 5.59             | 1.2                   | 6.8             | 9.5          | 0.1               | 0.4                | 0.4         | 1.3               | 7.1               | 9.9          |
| 34                | 6.30             | 0.7                   | 4.3             | 5.9          | 0.1               | 0.6                | 0.6         | 0.8               | 4.9               | 6.5          |
| 36                | 7.07             | 0.8                   | 5.7             | 7.7          | 0.1               | 0.8                | 0.8         | 0.9               | 6.4               | 8.5          |
| 38                | 7.88             | 0.3                   | 2.0             | 2.7          | 0.1               | 0.7                | 0.7         | 0.3               | 2.7               | 3.3          |
| 40                | 8.73             | 0.4                   | 3.1             | 4.2          | 0.0               | 0.0                | 0.0         | 0.4               | 3.1               | 4.2          |
| 42                | 9.62             | 0.1                   | 1.3             | 1.8          | 0.0               | 0.0                | 0.0         | 0.1               | 1.3               | 1.8          |
| ≥43               | 10.56            | 0.3                   | 2.9             | 3.7          | 0.0               | 0.0                | 0.0         | 0.3               | 2.9               | 3.7          |
| <b>SDI (Dsum)</b> |                  | 54.8                  | 98.5            | <b>149.2</b> | 18.8              | 13.8               | <b>19.6</b> | 73.6              | 112.3             | <b>168.8</b> |
| <b>SDI (Dq)</b>   |                  | <b>157.5</b>          |                 |              | <b>23.5</b>       |                    |             | <b>181.0</b>      |                   |              |

**COLUMN DESCRIPTIONS**

- 1 Midpoint of the diameter class, in inches; used as a QMD for Dsum SDI calculations.
- 2 Basal area per tree, in square feet (column 1 squared × 0.00545415).
- 3 Trees per acre (TPA) for ponderosa pine; from Munger (1912, p. 17; 1917, p. 20).
- 4 Basal area per acre (BA) for ponderosa pine (column 2 × column 3).
- 5 Stand density index (SDI) for ponderosa pine (col. 3 × Power(10/QMD,-1.77)).
- 6 Trees per acre for other species; from Munger (1912, p. 17; 1917, p. 20).
- 7 Basal area per acre for other species (column 2 × column 6).
- 8 Stand density index for other species (col. 6 × Power(10/QMD,-1.51)).
- 9 Trees per acre for all species combined: column 3 + column 6.
- 10 Basal area per acre for all species combined: column 4 + column 7.
- 11 Stand density index for all species combined: column 5 + column 8.

**SDI (Dq) Calculation Methodology:** Total TPA (54.8) × Power(10/QMD,-1.77) for ponderosa pine; Total TPA (18.8) × Power(10/QMD,-1.51) for other species; and pine SDI + other species SDI for Grand Total. The Douglas-fir SDI coefficient from table 2-3 was used for other species. QMD calculations for both pine and other species: Power(Total BA/Total TPA,0.5) × 13.54.

*Sources/Notes:* Tree data from a plot measured in 1910 near Lookingglass Creek (Munger 1912, 1917). Top half has SDI calculated by using the Dsum method (columns 5, 8, and 11 are Dsum values); *middle gray band has SDI calculated by using the Dq method and is based on stand (plot) totals.*

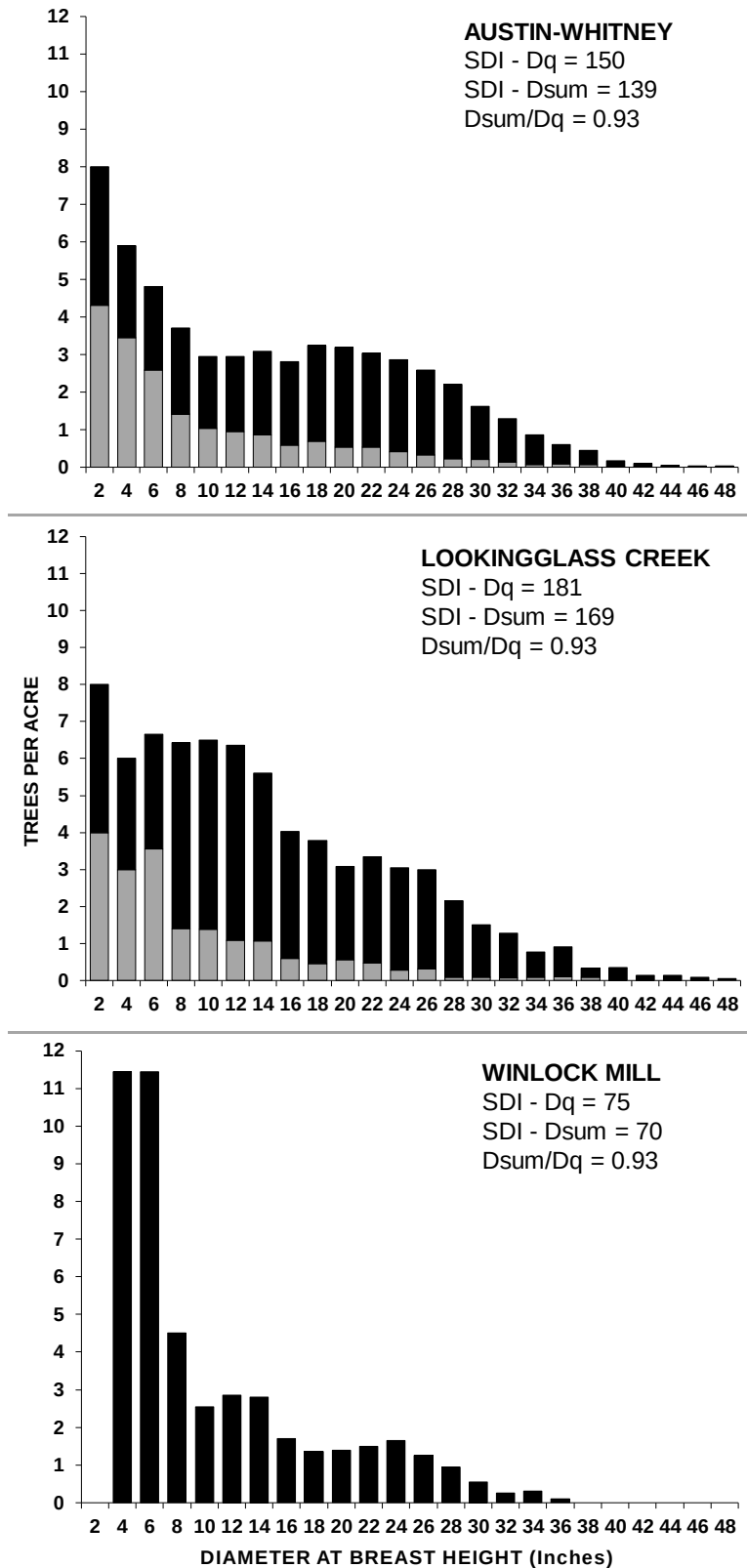


**Figure 3-9** – SDI values for mature, Blue Mountains stands measured in 1910-1911 (Bright 1912; Munger 1912, 1917). Black portion of columns is for ponderosa pine; gray portion is for other species.



Tables providing stocking levels by potential vegetation type and tree species (Chapter 6) include ‘trees per acre’ and ‘basal area per acre’ values for an even-aged structure. Those tables also provide ‘trees per acre’ and ‘basal area per acre’ values for irregular and uneven-aged stand structures, but they were derived by reducing the even-aged values by one of the percentages shown in figure 3-8 (6% for a two-storied (irregular) structure, and 13% for an uneven-aged structure) to account for differences between the Dq and Dsum calculation methods.

[Munger’s plots (fig. 3-9) suggest that 7% would be an accurate reduction percentage for irregular stands of the Blue Mountains. The difference between 6% (fig. 3-8 for two-storied) and 7% (fig. 3-9) is negligible, so *Long’s reduction value of 6% was used for an irregular structure.*]

*When making calculations described in this section, and elsewhere in this guide, I recommend that trees smaller than 1-inch diameter be excluded when calculating SDI (Curtis 2010).*

*When using SDI with an irregular or uneven-aged stand structure, practitioners should not make calculations by using an SDI equation from Cochran et al. (1994) (equation 2 on page 3 in that source) because it pertains to even-aged stands only (e.g., it is the Dq equation for SDI). The Cochran equation is suitable for an even-aged structure, and the result can then be reduced by a specific percentage to generate an approximate SDI value for irregular (6% reduction) or uneven-aged structures (13% reduction). This calculation process was used for this stocking guide.*

When forest inventory information includes a stand table format (tree density by DBH class), SDI is best approximated by using the Dsum method (table 3-4); this method is described by Cochran (1992), Long (1996), Long and Daniel (1990), and Shaw (2000).

Research from western Montana (Woodall et al. 2003b) suggests that SDI is somewhat biased in that it apportions greater relative density to smaller trees than to larger trees. Therefore, SDI may overpredict site occupancy for reverse-J diameter distributions with more small trees than large ones, and it may underpredict occupancy for other diameter distributions. These results may provide another clue for why ‘basal area creep’ occurs (see next section).

## **BASAL AREA CONSIDERATIONS**

SDI is more sensitive to tree size than basal area, a common stand density measure (Daniel et al. 1979a). As proof of this statement, consider two even-aged ponderosa pine stands, *each with an SDI of 200*: one has an 8-inch QMD, 298 trees per acre, and 104 square feet of basal area per acre; the other has a 22-inch QMD, 50 trees per acre, and 132 square feet per acre.

Both examples represent equivalent growing space occupancy (because both have the same SDI, namely 200), but one has 28 more square feet of basal area than the other. *Lack of a consistent relationship between basal area and SDI has caused many silviculturists to choose SDI as their preferred stocking index because it well represents how much growing space is being used by a forest stand (Zeide 2005).*

To compare changes in basal area for a constant SDI level, review any of the stocking level tables in chapter 6. Each table has three sections (climate resilience, lower limit, upper limit), and each section pertains to a constant SDI level. And yet, each section shows a steadily increasing amount of basal area, as QMD increases, even though SDI is held constant (a situation often referred to, informally, as ‘basal area creep’ because basal area is creeping upward by QMD).

Now, look at the situation in reverse – rather than examining how BA changes for the same SDI value, table 3-5 shows how SDI changes for the same level of basal area. It shows that for one square foot of basal area, the SDI associated with 4-inch Douglas-fir trees (2.87) is more than twice the SDI for one square foot of 24-inch Douglas-fir trees (1.19). Again, the *same amount of basal area* is used for this comparison – one square foot for both diameter classes.

Lack of a consistent relationship between basal area and SDI is confusing. It can be explained this way: not all square feet of basal area are created equal. Higher SDI, reflecting greater site utilization, is associated with a square foot of basal area in smaller trees than a square foot of basal area in larger trees (table 3-5). Reasons for this outcome are described in the next section.

### **Basal Area Creep**

Many reasons are postulated for an inconsistent relationship between basal area and SDI. Long and Smith (1984) believe that SDI relates to foliar biomass (leaf area), which relates to sapwood area (sapwood, the outermost portion of a tree stem, supplies tree foliage with water and soluble minerals) (Dean and Long 1986, Dewar 1993, Grier and Waring 1974, Ryan 1989). And logically, root occupancy may also affect basal area creep – roots of many small trees may be more effective at fully occupying a given soil volume than the roots of fewer large trees.

These physiological suppositions recognize that a functional balance exists between a tree's sapwood area and its leaf area (O'Hara 1996, Tappeiner et al. 2007). Water moved through sapwood tissue replaces water lost during transpiration. Due to its crucial role in water transport, cross-sectional area of sapwood relates closely to a tree's leaf area (Waring et al. 1982).

As trees grow and develop, their proportion of sapwood to total basal area changes (fig. 3-10); a higher ratio of sapwood to heartwood generally exists for smaller trees than for larger trees (table 3-6). This difference is understandable because:

- 1) Large trees require more mechanical support than small trees, much of which is provided by heartwood tissue with its high component of lignin. Large trees allocate much of their carbon production to woody trunks and branches for support, and to creating a taller stem to elevate their foliage (leaf area) above the prevailing canopy.
- 2) Smaller trees often have a higher proportion of their stem length supporting transpiring leaf area than for larger trees (e.g., small trees often have longer crown ratios than large trees). Young trees tend to allocate carbon (photosynthate) to foliage and roots, to support continued growth and capture of water and nutrients, and less to heartwood tissue.
- 3) Small trees, with high quantities of photosynthesizing foliage, require that a high proportion of their stemwood be sapwood to supply leaf area with water (fig. 3-10; table 3-6).
- 4) Items 1 to 3 demonstrate that carbon allocation evolves in response to tree growth. Small-tree allocation is focused on establishment and rapid initial growth; large-tree allocation emphasizes woody material (stem; branches) for mechanical support (Bonan 2010).
- 5) Items in this list also illustrate that a functional interdependence exists between foliage, which fixes carbon and transpires water, and the support tissues that supply water and nutrients to foliage (Bonan 2010).

**Table 3-5:** Stand density index, *per square foot of basal area*, by species and diameter class.

| DBH<br>CLASS | SDI FOR NUMBER OF TREES COMPRISING ONE SQUARE FOOT OF BASAL AREA |             |             |                |
|--------------|------------------------------------------------------------------|-------------|-------------|----------------|
|              | Ponderosa pine                                                   | Douglas-fir | WL/GF/SF/ES | Lodgepole pine |
| 2            | 2.65                                                             | 4.03        | 2.83        | 2.79           |
| 4            | 2.26                                                             | 2.87        | 2.35        | 2.33           |
| 6            | 2.06                                                             | 2.35        | 2.10        | 2.09           |
| 8            | 1.93                                                             | 2.05        | 1.95        | 1.94           |
| 10           | 1.83                                                             | 1.83        | 1.83        | 1.83           |
| 12           | 1.76                                                             | 1.68        | 1.75        | 1.75           |
| 14           | 1.70                                                             | 1.55        | 1.67        | 1.68           |
| 16           | 1.65                                                             | 1.46        | 1.61        | 1.62           |
| 18           | 1.60                                                             | 1.37        | 1.56        | 1.57           |
| 20           | 1.56                                                             | 1.31        | 1.52        | 1.53           |
| 22           | 1.53                                                             | 1.25        | 1.48        | 1.49           |
| 24           | 1.50                                                             | 1.19        | 1.45        | 1.46           |
| 26           | 1.47                                                             | 1.15        | 1.42        | 1.43           |
| 28           | 1.45                                                             | 1.11        | 1.39        | 1.40           |
| 30           | 1.42                                                             | 1.07        | 1.36        | 1.38           |

*Sources/Notes:* Adapted from Fiedler and Cully (1995). This table shows that a higher SDI is associated with a square foot of basal area when it occurs in smaller trees than in larger trees. DBH Class refers to 2-inch classes of tree diameter at breast height (4½ feet), in inches, with the numeric value being the mid-point of a class (the 2-inch class runs from 1-2.9 inches). WL/GF/SF/ES (western larch, grand fir, subalpine fir, and Engelmann spruce) are combined because they have the same SDI exponent, namely 1.73 (see Slope Factor values in table 2-3); other species have their own SDI exponent.

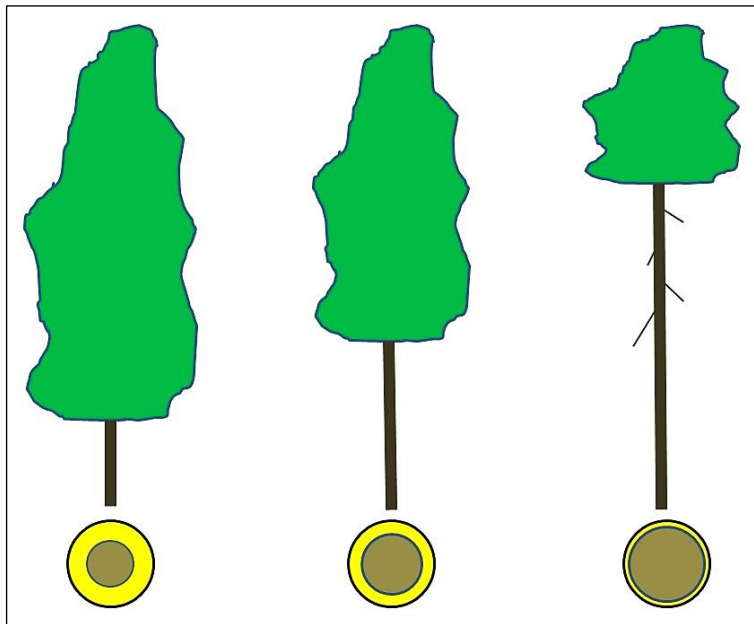


**Figure 3-10 –** Sapwood (yellow) to heartwood (brown) ratios by crown length (courtesy of Stephen Fitzgerald, OSU College of Forestry). Trees with long, full crowns (left) have a high proportion of sapwood. As crown length lifts (center and right), total sapwood area may increase because sapwood envelops a larger cylinder, but the ratio of sapwood to heartwood declines substantially. These examples relate to crown position – the further that live crown is elevated above the stem base, the more heartwood (and less sapwood) there will be (Dean and Long

1986, Oliver and Larson 1996). This relationship is often referred to as the pipe model – the amount of canopy foliage relates directly to the amount of stem conducting tissue (O'Hara and Valappil 1995b).

**Table 3-6:** Sapwood thickness by tree species.

| Tree Species     | Tree Diameter at Breast Height (Inches) | Sapwood Thickness (Inches) | Sapwood Percentage | Heartwood Percentage |
|------------------|-----------------------------------------|----------------------------|--------------------|----------------------|
| Douglas-fir      | 6.2" dbh (5.5" dib)                     | 0.80                       | 14.5%              | 85.5%                |
|                  | 10.6" dbh (9.5" dib)                    | 1.16                       | 12.2%              | 87.8%                |
|                  | 20.8" dbh (18.5" dib)                   | 1.53                       | 8.3%               | 91.7%                |
|                  | 29.8" dbh (26.5" dib)                   | 1.83                       | 6.9%               | 93.1%                |
| Engelmann spruce | 5.9" dbh (5.5" dib)                     | 0.91                       | 16.5%              | 83.5%                |
|                  | 10.1" dbh (9.5" dib)                    | 1.37                       | 14.4%              | 85.6%                |
|                  | 20.2" dbh (19.5" dib)                   | 1.93                       | 9.9%               | 90.1%                |
|                  | 30.6" dbh (29.5" dib)                   | 2.36                       | 8.0%               | 92.0%                |
| Lodgepole pine   | 5.7" dbh (5.5" dib)                     | 1.38                       | 25.1%              | 74.9%                |
|                  | 9.8" dbh (9.5" dib)                     | 1.86                       | 19.6%              | 80.4%                |
|                  | 20.0" dbh (19.5" dib)                   | 2.73                       | 14.0%              | 86.0%                |
|                  | 27.6" dbh (26.5" dib)                   | 3.93                       | 14.8%              | 85.2%                |
| Ponderosa pine   | 6.4" dbh (5.5" dib)                     | 2.06                       | 37.5%              | 62.5%                |
|                  | 9.9" dbh (8.5" dib)                     | 3.09                       | 36.4%              | 63.6%                |
|                  | 19.9" dbh (17.5" dib)                   | 4.99                       | 28.5%              | 71.5%                |
|                  | 29.5" dbh (26.5" dib)                   | 4.99                       | 18.8%              | 81.2%                |
| Western larch    | 6.4" dbh (5.5" dib)                     | 0.70                       | 12.7%              | 87.3%                |
|                  | 9.9" dbh (8.5" dib)                     | 0.88                       | 10.4%              | 89.6%                |
|                  | 20.4" dbh (17.5" dib)                   | 0.82                       | 4.7%               | 95.3%                |
|                  | 30.0" dbh (26.5" dib)                   | 0.97                       | 3.7%               | 96.3%                |

*Sources/Notes:* From Lassen and Okkonen (1969). Diameter at breast height was measured on the outside of the tree; 'dib' refers to diameter inside bark, where sapwood measurements were taken.

Sapwood relates to leaf area, so leaf area index is often viewed as a meaningful measure of resource use efficiency and site quality (O'Hara 1996). Work in the Black Hills and elsewhere in the western U.S. found that SDI is a suitable proxy for leaf area index, especially for uneven-aged ponderosa pine stands. A Black Hills study, for example, found that SDI explained almost 90% of the variation in leaf area index for 21 uneven-aged ponderosa pine stands, and SDI was unbiased by tree size (Ex and Smith 2013). [But consider that a western Montana study (Woodall et al. 2003b) suggests that SDI may be biased toward smaller trees.]

The Black Hills study concludes that SDI is a useful tool for working with complex stand structures (Ex and Smith 2013). I believe it also demonstrates that SDI may be better than basal area at regulating diameter distributions for uneven-aged stands (Ducey 2009; O'Hara 1996).

Because the ratio of heartwood to sapwood increases with tree size (table 3-6), and because sapwood is physiologically active whereas heartwood is not (but sapwood only contains 4-11% live cells by volume (Panshin and deZeeuw 1970)), stocking systems based on basal area generally pertain to relatively small diameter classes. Clifford Myers' growing-stock-level (GSL) system, which was commonly used in the central and southern Rocky Mountains, indexes basal area up to a diameter of 10 inches; beyond 10 inches, there is no difference between a GSL value and a basal-area limit (Edminster 1978; Myers 1967, 1974).

If SDI better represents site utilization and growing-space occupancy than basal area, why is basal area included in the stocking level tables in chapter 6? It was included because:

- It is a stand density metric familiar to foresters, and in long accepted usage.
- It is easily applied and estimated in the field.
- It might be the only stand density metric provided by some types of forest inventory.
- It is commonly used to monitor and evaluate stand treatment marking.
- “SDI measurements can always be converted back to basal area” (Daniel et al. 1979b: p. 4).

### Calculating Basal Area

SDI values were translated into ‘basal area per acre’ values by using a two-step process:

1. SDI is first used to calculate trees-per-acre:  $TPA = (MaxSDI \times Pct)/(QMD/10)^{slope}$  [Pct is .25, .35, or .55 by stocking level (CR, LL, UL); slope is from table 2-3.] This equation is for EA stands; values for IS and UA stands are reduced by using factors described in item #2 below.
2. Trees-per-acre (TPA) and quadratic mean diameter (QMD) values are used to calculate basal area per acre (BA), as follows:  $BA = TPA \times 0.005454154 \times QMD^2$  (for EA stands)

TPA and BA results for irregular (IS) and uneven-aged (UA) structures are percentages of the even-aged (EA) values, as follows:  $IS = 0.9415 \times EA$  value;  $UA = 0.8706 \times EA$  value (IS and UA percentages are based on fig. 3-8; IS uses the two-storied value in fig. 3-8).

### ACCOUNTING FOR BASAL AREA DIFFERENCES BY QMD

Users of an earlier stocking guide (Powell 1999) realized that ‘basal area creep’ was occurring – *for the same SDI level, basal area values crept upward (increased) as QMD increased*. Basal area (BA) creep first arose as an issue when developing thinning regimes for active management of dry mixed-conifer forests containing large-diameter ponderosa pines.

Here’s what happened: Some managers felt the BA for large pines should be ‘discounted’ because of their low sapwood-to-heartwood ratios (see discussion in previous section, figure 3-10, and table 3-6), likely reflecting a lower proportion of leaf area (respiring foliage) than would be present for the same amount of BA when it occurred as small trees.

When BA discounting questions arose, some experts advised practitioners to ignore the BA in large-diameter pines, as though they didn’t exist (i.e., treat large pines as invisible ‘ghost’ trees), and to focus solely on smaller, and presumably younger, trees that are perhaps more highly functional in a physiological context (and more worthy of management emphasis).

In my view, *ignoring the BA of large trees is an unwise strategy*. Big trees suppress the growth and vigor of smaller trees near them, and smaller trees also affect big-tree vitality in a two-way competition relationship (see *Competition: A Reciprocal Process* in Chapter 4). Also, litter removal (raking) research in long-unburned ponderosa pine forests (Hood 2010) suggests that big trees are more sensitive to stress than managers previously suspected.

This discussion suggests *there may be little rationale for using a single basal-area target when managing a forest type* (e.g., “reduce dry-forest density to 60 ft<sup>2</sup>/acre”). Instead, the density data in the chapter 6 tables provides a practical option for using variable basal area targets:

1. Select an SDI value as a stocking level. First, select a featured tree species for the PVT (see *Stocking Levels for Mixed Species Stands* in chap. 4), and then select its SDI value for the

- stocking level that best fits stand objectives (such as climate resilience or the lower limit).
2. As density management treatments are being planned, use the stocking tables (chapter 6) to translate an SDI stocking level into its corresponding basal area values, by QMD.
  3. Record the basal area values, from tables in chapter 6, in a chart, and use them when preparing a prescription or marking guide – an example is provided below as table 3-7.
  4. In table 3-7, basal area (BA) values creep upward, as QMD increases, for a stocking level and SDI value. *Table 3-8 shows this basal-area-creep phenomenon for ponderosa pine growing on a wide range of PVTs.* Table 3-7 shows that even though BA differences are large, a forester should feel comfortable that 148 ft<sup>2</sup>/acre of BA for a 30" QMD represents equivalent site utilization as 86 ft<sup>2</sup>/acre for a 10" QMD (Douglas-fir upper limit, SDI=182, table 3-7).
  5. This example provides a reason for ‘discounting’ basal area for stands with larger trees. If a silviculturist is visualizing a relatively small-diameter size class (10" QMD) and believes that 90 ft<sup>2</sup>/acre of basal area is an appropriate density target, then they may be perturbed if it is proposed to leave 120 ft<sup>2</sup>/acre of basal area instead. But *Table 3-7 demonstrates that retaining 120 ft<sup>2</sup>/acre of BA is entirely appropriate for a QMD of 20" instead of 10"*. (Table 3-7 shows that 90 and 120 ft<sup>2</sup>/acre of *Douglas-fir* BA represent an equivalent amount of site utilization (intertree competition) for an SDI of 182.)

**Table 3-7:** Basal area values for the Douglas-fir/pinegrass plant association.

| TREE SPECIES AND STOCKING LEVEL                 | BASAL AREA PER ACRE BY QMD |         |         |
|-------------------------------------------------|----------------------------|---------|---------|
|                                                 | 10" QMD                    | 20" QMD | 30" QMD |
| <i>Douglas-fir Values, By Stocking Level</i>    |                            |         |         |
| Climate resilience (SDI=83)                     | 39                         | 55      | 67      |
| Lower limit of management zone (SDI=116)        | 55                         | 77      | 94      |
| Upper limit of management zone (SDI=182)        | 86                         | 121     | 148     |
| <i>Ponderosa Pine Values, By Stocking Level</i> |                            |         |         |
| Climate resilience (SDI=81)                     | 39                         | 45      | 50      |
| Lower limit of management zone (SDI=114)        | 54                         | 63      | 70      |
| Upper limit of management zone (SDI=179)        | 85                         | 100     | 109     |

Sources/Notes: Data source is stocking tables in chapter 6 (basal areas pertain to an uneven-aged structure). Although the SDI values for Douglas-fir and ponderosa pine are quite close for all three stocking levels, basal area values diverge with increasing tree size (QMD) because of differing SDI slope factors (exponents) for Douglas-fir (1.51) and ponderosa pine (1.77) (table 2-3).

In summary, I recommend that density management regimes be developed by using SDI, and the resulting stocking levels then translated into BA when reaching the marking guide phase. BA works well when timber markers apply a marking guide, but ***SDI is the best tool for establishing stocking levels and designing a treatment regime for silvicultural prescriptions.***

### Calculating Intertree Distance

Suggested stocking levels are used when preparing silvicultural prescriptions and associated marking guides, especially for thinnings and intermediate stand treatments (Mahoney et al. 1980). Prescriptions or marking guides often include an estimate of intertree distance, an important attribute of the post-treatment (residual) stand (particularly for even-aged stands).

**Table 3-8:** Upper and lower limits of a management zone for ponderosa pine on selected PVTs of the Blue-Ochoco area, illustrating the ‘basal area creep’ phenomenon.

| POTENTIAL VEG TYPE                        | LOWER LIMIT MGMT ZONE |                   |     |     | UPPER LIMIT MGMT ZONE |                   |     |     |
|-------------------------------------------|-----------------------|-------------------|-----|-----|-----------------------|-------------------|-----|-----|
|                                           | SDI                   | BASAL AREA BY QMD |     |     | SDI                   | BASAL AREA BY QMD |     |     |
|                                           |                       | 10"               | 20" | 30" |                       | 10"               | 20" | 30" |
| ABGR/CAGE                                 | <b>92</b>             | 50                | 59  | 65  | <b>144</b>            | 79                | 93  | 102 |
| ABGR/CARU                                 | <b>138</b>            | 75                | 88  | 92  | <b>217</b>            | 118               | 139 | 153 |
| ABGR/LIBO2 and<br>PIPO/CARU               | <b>160</b>            | 87                | 102 | 112 | <b>251</b>            | 137               | 160 | 176 |
| ABGR/SPBE                                 | <b>112</b>            | 61                | 71  | 78  | <b>175</b>            | 96                | 112 | 123 |
| ABGR/VAME                                 | <b>128</b>            | 70                | 82  | 90  | <b>201</b>            | 109               | 128 | 141 |
| ABGR/VASC                                 | <b>75</b>             | 41                | 48  | 53  | <b>118</b>            | 64                | 76  | 83  |
| PIPO/AGSP                                 | <b>58</b>             | 32                | 37  | 41  | <b>91</b>             | 50                | 58  | 64  |
| PIPO/ARTRV/FEID-AGSP                      | <b>83</b>             | 45                | 53  | 58  | <b>131</b>            | 71                | 84  | 92  |
| PIPO/CAGE                                 | <b>88</b>             | 48                | 56  | 62  | <b>138</b>            | 75                | 88  | 97  |
| PIPO/CELE/CAGE                            | <b>102</b>            | 55                | 65  | 71  | <b>160</b>            | 87                | 102 | 112 |
| PIPO/CELE/FEID-AGSP and<br>PIPO/CELE/PONE | <b>69</b>             | 37                | 44  | 48  | <b>108</b>            | 59                | 69  | 76  |
| PIPO/FEID and<br>PSME/VAME                | <b>84</b>             | 46                | 54  | 59  | <b>133</b>            | 72                | 85  | 93  |
| PIPO/PUTR/CAGE                            | <b>89</b>             | 49                | 57  | 63  | <b>140</b>            | 76                | 90  | 98  |
| PIPO/PUTR/CARU                            | <b>105</b>            | 57                | 67  | 74  | <b>166</b>            | 90                | 106 | 116 |
| PIPO/PUTR/FEID-AGSP                       | <b>81</b>             | 44                | 52  | 57  | <b>127</b>            | 69                | 81  | 89  |
| PIPO/SYAL                                 | <b>139</b>            | 76                | 89  | 98  | <b>219</b>            | 119               | 140 | 154 |
| PIPO/SYOR and<br>PSME/CARU                | <b>114</b>            | 62                | 73  | 80  | <b>179</b>            | 97                | 114 | 126 |
| PSME/CAGE                                 | <b>97</b>             | 53                | 62  | 68  | <b>152</b>            | 83                | 97  | 107 |
| PSME/HODI                                 | <b>149</b>            | 81                | 95  | 104 | <b>234</b>            | 127               | 150 | 164 |
| PSME/PHMA and<br>PSME/SYAL                | <b>120</b>            | 65                | 77  | 84  | <b>188</b>            | 103               | 121 | 132 |

*Notes:* All basal area values, in square feet per acre, pertain to an even-aged stand structure. SDI and basal area values were taken from the stocking-level tables in chapter 6.

Intertree distance is used to characterize the competitive environment for individual trees. One example is the competitive zone density or CZD metric (Gulke et al. 2020, Shaw 2016). CZD provides a relatively simple tree vigor and resilience assessment for thinning and fuels treatments in south-central Oregon (Gulke et al. 2020, Shaw 2016).

To characterize neighborhood effects for individual trees, one measure of intertree distance (equilateral spacing) is provided in chapter 6; that data can help users visualize the average tree spacing associated with a suggested stocking level for any particular quadratic mean diameter.

It is not intended that intertree distance values could be followed sequentially, as a density management regime, because doing so would require physically moving the trees.

Square spacing assumes that tree crowns occupy the center of adjoining squares (fig. 3-11). This model of tree arrangement is most compatible with young stands comprised mainly of seedling- and sapling-sized trees. Therefore, recommended planting (reforestation) densities for the Pacific Northwest have often been expressed as square spacing (Cleary et al. 1978).

The regular geometric pattern created by a square-spacing approach may also provide operational advantages, including simpler administration and inspection of tree planting contracts.

Equilateral spacing assumes that trees occupy adjacent hexagons (fig. 3-11). This tree distribution pattern better reflects the crown shape of larger trees, and it is most representative of mature stands. As stands develop, even those originating on a square-spacing layout, crown spacing often evolves to an equilateral pattern (Oliver and Larson 1996). For hexagonal spacing, lines connecting the centers of three adjacent trees form an equilateral triangle (red dashed lines, fig. 3-11); therefore, equilateral spacing is sometimes referred to as triangular spacing.

Chapter 6 stocking tables provide an equilateral intertree distance (in feet) for the climate resilience, lower limit, and upper limit stocking levels. Intertree distance calculations are always based on an even-aged stand structure because it presumably has the most consistent tree spacing relationships; distance values in the chapter 6 tables are not considered usable with trees left in clumps or other variable spacing patterns.

For chapter 6, SDI stocking levels were translated into their corresponding intertree distance values (equilateral spacing) by using a two-step process:

1. SDI values for each stocking level were converted into their equivalent trees-per-acre (TPA) values by using a process described in the *SDI Adjustments for Stand Structures Other Than Even Aged* section (the *Calculating Basal Area* subsection describes this process); and
2. Intertree distance calculations are based on the TPA values for an even-aged structure:

$$\text{ES (equilateral spacing)} = \sqrt{50300.23/\text{TPA}}$$

## Canopy Cover Considerations

When a density management regime is designed, it may be helpful to express stand density as canopy cover. It refers to the proportion of ground or water surface covered by the natural spread of foliage or plants, including small openings within a canopy. Sometimes, canopy cover is allowed to exceed 100 percent because layering of different vegetative strata results in canopy covering the ground surface more than once. For this guide, *the ground surface can only be obscured by foliage once, and canopy cover can never exceed 100 percent.*

## Terminology: Cover Versus Closure

Different terms have been used to describe canopy cover and related concepts:

1. *Terms ending in cover* – canopy cover, crown cover, foliar cover, etc. These terms express how much of the ground surface, *as a percentage*, is ‘covered’ by foliage when viewed from above (similar to what is provided by aerial photography and remote imagery). FVS (Dixon 2022) uses cover this way: “stand percent canopy cover is the percentage of the ground area that is directly covered with tree crowns” (Crookston and Stage 1999, p. 1). [An FVS keyword, Structural Class (StrClass), can generate canopy cover estimates by stand & layer.]
2. *Terms ending in closure*, such as canopy closure, crown closure, and so forth. *Closure terms do not apply to how ‘canopy cover’ is used in this guide.*



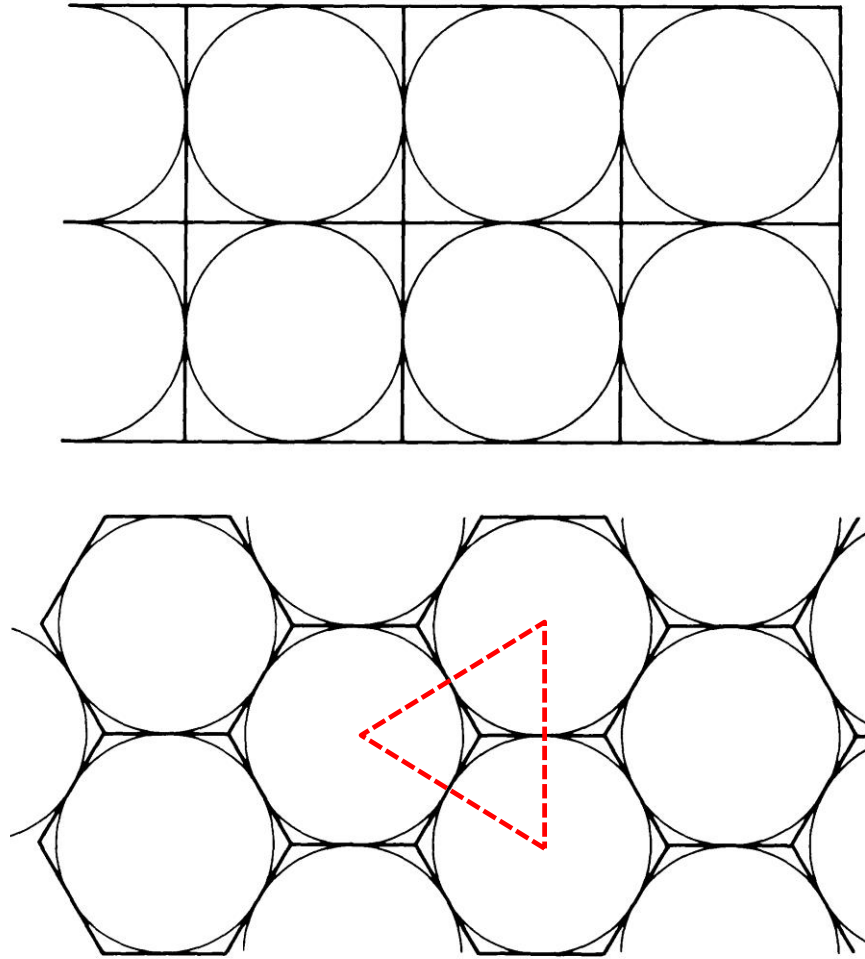


**Figure 3-11** – Two measures of tree spacing (from Smith et al. 1997: p. 124). Top portion shows square spacing where tree crowns (circles) occupy the center of adjacent squares. Bottom portion shows equilateral spacing where crowns occupy adjacent hexagons. Imaginary lines connecting the centers of three adjoining trees (shown with dashed lines) form an equilateral triangle. Therefore, equilateral spacing is sometimes referred to as triangular spacing.

### Canopy Cover As A Wildlife Habitat Attribute

Many wildlife objectives are expressed as canopy cover percentages – an example is satisfactory and marginal cover for Rocky Mountain elk (Thomas 1979). Elk cover guidelines for the Blue Mountains (Thomas 1979) utilize relatively high levels of canopy cover (Powell 2012). Note that recent work suggests that climate resilience and forest restoration goals are supported by low canopy cover levels, and they may also be more historically appropriate (Churchill et al. 2017, Hagmann et al. 2013, Johnston et al. 2018, North et al. 2022).

Field-sampled surveys often provide detailed information about stand density (trees and basal area per acre, etc.), whereas some remote-sensing sources may not. But remote sensing generally provides usable canopy cover information and it can serve as a proxy for stand density. Therefore, in the chapter 6 stocking tables, stand density is translated into canopy cover, allowing density to be assessed when utilizing remote-sensing data sources.

## Blue Mountains Canopy Cover Levels

Equations developed during an elk thermal cover study are used to calculate canopy cover percentages by stocking level. For the elk study, Ed Dealy (1985) sampled 609 unmanaged tree stands throughout the Blue and Ochoco Mountains. He used a 'type A' spherical densiometer (Dealy 1960, Lemmon 1956) to collect canopy cover measurements.

Dealy (1985) stratified his sample into five 'cover type' groups (ponderosa pine, Douglas-fir, grand fir, lodgepole pine, and spruce-fir) and then developed equations that relate 'basal area per acre' to a 'canopy cover' percentage. Other studies also identified a relationship between basal area and canopy cover (Mitchell and Popovich 1997).

Research in northeastern Oregon found that densiometers can be insensitive to substantial variations in overstory cover (Cook et al. 1995). Another report corroborates this finding by concluding that densiometers are unsuitable for many forestry uses (Bunnell and Vales 1990).

A third study, however, compared canopy cover estimates obtained from ground-based measurements (line-intercept, densiometer, moosehorn, and hemispherical photography) with calculated canopy cover estimates from the FVS model (Dixon 2022). *This study concluded that FVS canopy cover estimates were consistently lower and more variable than most ground-based measurements* (Fiala et al. 2006).

## Calculating Canopy Cover

Canopy cover calculations for this stocking guide involved three steps:

1. Stand density index values for each stocking level were converted into equivalent trees-per-acre values by using a process described in the *SDI Adjustments for Stand Structures Other Than Even Aged* section presented earlier in this chapter;
2. Trees-per-acre values (and associated quadratic mean diameter values) were used to calculate basal-area-per acre (BA) values; and
3. Basal-area-per-acre (BA) values were used to calculate canopy cover (CC) percentages by using Dealy's (1985) equations, as follows:

Lodgepole pine CC (also used for western larch) =  $-20.29 + 41.8(\text{LOG}_{10}(\text{BA}+1))$

Douglas-fir CC =  $-1.27 + 37.33(\text{LOG}_{10}(\text{BA}+1))$

Grand fir (white fir) CC =  $-5.55 + 41.59(\text{LOG}_{10}(\text{BA}+1))$

Ponderosa pine CC =  $-28.5 + 43.2(\text{LOG}_{10}(\text{BA}+1))$

Engelmann spruce and subalpine fir CC =  $-5.01 + 40.46(\text{LOG}_{10}(\text{BA}+1))$

[BA is basal area per acre; CC is canopy cover;  $\text{LOG}_{10}$  is the base-10 logarithm of a number.]

For six tree species (Douglas-fir, Engelmann spruce, grand fir, ponderosa pine, subalpine fir, and western larch), canopy cover values pertain to an irregular stand structure because it best reflects the unmanaged stands sampled by Dealy (1985). For lodgepole pine, values relate to an even-aged structure because unmanaged stands tend to be even-aged for this species.

*Managed-stand canopy cover* for lodgepole pine can be calculated by using an equation developed from young, thinned stands in the Anthony Lakes wildfire area (Cochran and Dahms 1998): LP (managed) CC =  $(0.630512 \times \text{TPA}) - (0.000994 \times \text{TPA}^2)$  [TPA is trees per acre.]

Due to insufficient space, I could not include managed-stand canopy cover (CC) values for lodgepole pine in the stocking tables (chapter 6). But table 3-9 provides managed CC values, by stocking level, for each of the lodgepole pine tables contained in chapter 6.

**Table 3-9:** Canopy cover percentages for managed stands of lodgepole pine.

| Table Number | Climate Resilience | Lower Limit | Upper Limit |
|--------------|--------------------|-------------|-------------|
| L1           | 51                 | 67          | 89          |
| L2           | 56                 | 72          | 93          |
| L3           | 67                 | 84          | 100         |
| L4           | 41                 | 55          | 77          |
| L5           | 45                 | 60          | 82          |
| L6           | 50                 | 65          | 87          |
| L7           | 54                 | 70          | 92          |
| L8           | 68                 | 85          | 100         |
| L9           | 62                 | 79          | 98          |
| L10          | 49                 | 64          | 86          |
| L11          | 54                 | 69          | 91          |
| L12          | 44                 | 58          | 80          |
| L13          | 53                 | 68          | 90          |
| L14          | 39                 | 52          | 73          |

*Sources/Notes:* Data pertains to three stocking levels (see chapter 6 tables), and to stands initially thinned before reaching a mean stand height of 9 feet (Cochran and Dahms 1998). Column 1 has lodgepole pine table numbers from chapter 6; each table typically includes multiple potential vegetation types. All PVTs included in the same table have basically the same SDI values. *Columns 2-4 provide managed canopy cover percentages associated with a stocking level's SDI value* (e.g., the managed-stand canopy cover percentage associated with the SDI's trees per acre density at a QMD of 10 inches).

## 4. APPLYING STOCKING LEVEL INFORMATION

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Stocking level and stand density information is useful for assessing susceptibility to disturbance (Steele et al. 1996), for supporting silvicultural decision-making processes (Cochran et al. 1994, Dixon 2022), for completing wildlife habitat evaluations (Liliehalm et al. 1994), and for many other purposes (Ducey and Larson 1999). It also supports silvicultural prescriptions and marking guides for density management treatments (Mahoney et al. 1980).

This chapter opens by explaining how the stocking level information can be used with the Forest Vegetation Simulator (FVS) (Dixon 2022). Perhaps no factor has more influence on FVS simulations than tree mortality, and this guide is useful when preparing an SDIMAX keyword to control tree mortality by tree species and potential vegetation type.

In my recent role as a silviculture mentor, it is clear that FVS users struggle with how to ensure that mortality occurs correctly. Hopefully, this initial section will help with that process.

### TREE MORTALITY IN THE FVS MODEL

The Blue Mountains variant of the Forest Vegetation Simulator (FVS) uses an SDI-based tree mortality model. This section describes the basics of FVS tree mortality prediction, and it explains how this guide's SDI information can be used to influence tree mortality rates in FVS.

The Blue Mountains variant of FVS uses two main types of tree mortality – background mortality and density-related (self-thinning) mortality. [FVS also has a third type of user-controlled mortality – Mortality in Over Mature Stands, which is designed to mimic mortality patterns associated with 'break-up' of overmature stands (see section 7.3.2.3 in Dixon 2022).]

*Silviculturists need to understand how FVS handles tree mortality because density-dependent mortality (see **Self-Thinning Process** in chapter 2) can dramatically affect simulation results.*

FVS's SDI mortality model has three main parameters, all of which can be modified:

- 1) Maximum SDI – a separate Max SDI value can be set for individual species, or a single Max SDI value can apply to all species in a stand.
- 2) Lower Limit – a percentage of max SDI at which density-related tree mortality begins.
- 3) Upper Limit – a percentage of max SDI at which density-related mortality tops out (e.g., an upper cap on mortality).

Each of these parameters can be changed by using an SDIMAX keyword (specifically, fields 2, 5, and 6 of the SDIMAX keyword relate to these parameters).

The main purpose of SDIMAX is to control *density-related* mortality – SDIMAX has no direct effect on background mortality, which is unrelated to high stand density levels.

### Background Tree Mortality

When stand density levels are below 55% of maximum SDI, background mortality operates. Background mortality occurs at low levels, and it is controlled by a species dependent equation. The lower limit percentage, 55%, where background mortality stops and density-related mortality begins, can be changed with an SDIMAX keyword.

If your stand's maximum SDI value is set incorrectly, *which is often related to a missing or*

***incorrect Ecoclass (potential vegetation type) code in your input data***, use an SDIMAX keyword to reset max SDI – and doing so may influence background mortality too. An example:

1. If a stand begins a simulation with an unrealistically high starting value for maximum SDI (e.g., 600 in the Blue Mountains), and if SDIMAX is not used to change this initial value to a more realistic value (400), then background mortality rates will be used for a longer period than they should be. Why does this occur? It's best explained with mathematics.
  - a. The default lower limit percentage for density-related mortality is 55%; therefore, 55% of 600 = 330, whereas 55% of 400 = 220. If a max SDI value is set correctly (400), background mortality quits when a stand reaches an SDI of 220, and higher rates of density-related mortality then take over. But if max SDI is set incorrectly (600), background mortality persists for longer than it should – up to an SDI of 330 instead of 220.
2. What difference does it make? Well, background mortality is substantially lower than density-related mortality – if max SDI is set too high and low background rates persist for longer than they should, the result is unrealistically low mortality levels (while also allowing unrealistically high tree and stand growth rates to continue for too long).
3. FVS users should check their input data to ensure that max SDI will be assigned correctly. ***If a stand has an incorrect Ecoclass (potential vegetation type) code, or if an Ecoclass code is missing, then FVS will likely assign a default max SDI value that is too high.***

### **Disturbance-Related Tree Mortality**

Tree mortality caused by insects, pathogens, wildfire, and other disturbance agents is typically simulated in FVS by using 'extensions' to a base model (for Blue Mountains foresters, the Blue Mountains variant of FVS is your base model). If you wish to account for tree mortality caused by root disease, the Western Root Disease Model, an extension linked to your FVS base model, should be invoked. You control how the Root Disease model functions by including root disease keywords in your simulation file.

One exception to this situation – a Dwarf Mistletoe Impact Model is embedded in the base model for all western FVS variants. This means that dwarf mistletoe will always be considered, without invoking a separate FVS extension, *whenever input tree records include dwarf-mistletoe damage codes* (e.g., Hawksworth 6-class dwarf-mistletoe ratings for mistletoe-affected species). Users can include keywords to adjust how the dwarf-mistletoe model functions (spread rates, diameter-growth rates for infected trees, etc.). Keywords are also used to alter how mistletoe-infected trees are handled during silvicultural treatments (Dixon 2022).

### **Density-Related Tree Mortality**

As a stand's existing density level approaches and then passes through a *lower limit* (55% of maximum SDI is FVS's default percentage for this threshold), tree mortality ramps up and functions as would be expected for self-thinning – shade-intolerant species with low crown ratios and in lower crown classes (including the suppressed and intermediate classes; fig. 3-2) are dying at higher rates than for overstory trees. Maximum amounts of density-related mortality occur at an *upper limit* (85% of max SDI is the default). These relationships are shown in figure 4-1.

Most mortality between the lower and upper limits is self-thinning mortality – intertree competition is the causal agent. Suppressed and intermediate trees are the first to die.

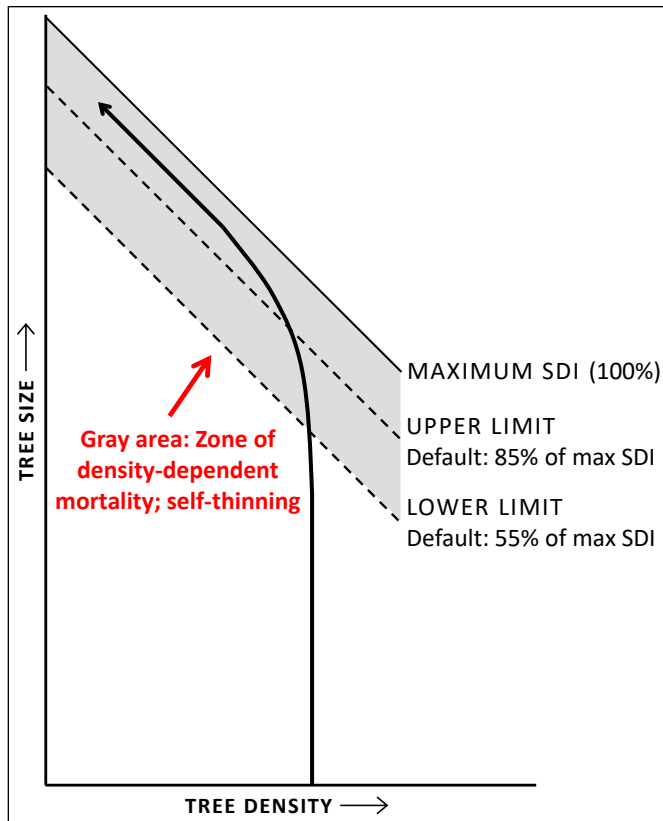


**Figure 4-1** – Forest Vegetation Simulator (FVS) stocking level system. This section of chapter 4 covers each parameter shown in this diagram: maximum SDI, upper limit, and lower limit, and it describes how users can modify them by using the SDIMAX keyword. Note: ‘Upper Limit’ and ‘Lower Limit’ in this diagram do NOT refer to the upper and lower limits of a management zone, which are described in chapter 3.

If thinning or another density-management treatment drops stand density below the lower density limit (the 55% default value, for example), FVS then reverts to background mortality.

*I recommend that Blue Mountains silviculturists review maximum SDI default values when making FVS simulations.* Modifications may be needed to ensure that density-related tree mortality is being handled properly (are lower and upper SDI percentage limits set correctly?), and that *max SDI values have been properly set by tree species.* Again, check your ECOCLASS code!

### **SDIMAX Lower Limit (Field 5)**

The SDI-based mortality model assumes that self-thinning mortality will be low (or nonexistent) when SDI is less than 55 percent of maximum. Whenever your stand’s SDI is below 55% of maximum SDI, then tree mortality will occur at a relatively small ‘background’ rate reflecting random tree death related to climatic events or non-specific insect and disease impact.

The default setting of 55 means that FVS assumes the lower limit of a self-thinning zone to occur at 55% of maximum SDI. As described earlier in this stocking guide (chapter 2), some forestry experts (Long 1985) believe the lower limit of a self-thinning zone occurs at 60% of max SDI (see table 3-2 and figure 3-1). Users can change the 55% lower limit percentage by using an SDIMAX keyword. *Some users may wish to set this parameter so it corresponds with the lower limit of a self-thinning zone value shown in table 3-2, in which case it **could be changed to 60%**.*

If during a simulation timestep, SDI occurs between the lower and upper limits of density-related mortality (55 and 85 percent of max SDI), mortality rates for subsequent growth periods are increased to reflect that competition-related tree mortality is occurring.

How about setting an SDIMAX lower limit for lodgepole or ponderosa pines? As stated earlier, the lower limit of a self-thinning zone (this is the same stocking level as the upper limit of a management zone; see table 3-2) can be calculated as 55% or 60% of max SDI for Douglas-fir, western larch, Engelmann spruce, grand fir, and subalpine fir. But for ponderosa and lodgepole pines, stocking levels can be calculated differently than for the other five species (Cochran et al. 1994) *if you wish to reflect mountain pine beetle (MPB) susceptibility*.

To account for MPB susceptibility, ***the lower limit of a self-thinning zone for ponderosa pine is not a standard percentage of maximum SDI***. The Lower Limit percentage could actually differ for every potential vegetation type in which ponderosa pine occurs (table 4-1). It could be changed to 54% for PIPO/SYAL or 31% for PSME/CAGE, for example (table 4-1, column 7)

Lower self-thinning zone limits that account for MPB susceptibility (these are the same as the upper limit of a management zone values) were calculated for lodgepole and ponderosa pines, and they are presented in chapter 5, in tables 5-3 and 5-4 (and for ponderosa pine, they are also provided in column 6 ('MPB ULMZ') of table 4-1).

### **SDIMAX Upper Limit (Field 6)**

FVS assumes that SDI will generally not exceed 85% of maximum SDI during a simulation. Note that 85% of maximum is slightly more than *full stocking*, as full stocking (normal density) is assumed to occur at 80% of maximum SDI (table 3-2 and figure 3-1). *The FVS 85% Upper Limit is meant to reflect what some experts refer to as 'average-maximum' density – this is the same stocking level as full stocking/normal density (fig. 2-2).*

If a stand's starting SDI value (calculated from the tree-data input file) exceeds the upper limit of 85%, then *FVS will increase initial mortality rates to place a stand at no more than the 85% level by the end of the first growth period*.

FVS will reset a stand's maximum SDI value if the calculated SDI exceeds its upper limit by 5% or more – in other words, *FVS resets the maximum SDI value if a stand's input data results in a calculated SDI value that is 90% or more of maximum SDI*. Recall that a maximum SDI value is established by using an SDIMAX keyword, input by the user, or is set automatically by using a stand's potential vegetation type (Ecoclass) code.

If starting conditions are at, or just slightly above the 85% limit (< 5% above), FVS does not reset maximum SDI to a different value, but it adjusts subsequent mortality rates to maintain a stand's SDI at no more than 85% of maximum for all future growth periods.

Users can change the 85% upper limit value by using an SDIMAX keyword. *Some users prefer to set this upper-limit parameter so it corresponds with full stocking (normal density), in which case it could be changed to 80% (but 5% is negligible, so I usually stay with the 85% default).*

### **SDIMAX Maximum SDI Value (Field 2)**

After understanding how FVS addresses tree mortality during a simulation, and how it uses lower and upper limits to account for density-related mortality (self-thinning) associated with high levels of relative stand density, a forester can then use SDIMAX keywords to establish specific values of maximum SDI for each tree species included in their simulation.

SDIMAX keywords are used to change max SDI values by species; *if different max SDI values*

are desired for each species, then an SDIMAX keyword must be included for each species.

One SDIMAX keyword can be used if all species will use the same maximum SDI value (as is often done when using a 'limiting-species' approach, described later in chapter 4), and if all species will use the same lower and upper limit percentages.

### Setting SDIMAX For Mixed Species Stands

One area of uncertainty involves how SDIMAX keywords should be used for mixed-species stands – should a separate SDIMAX keyword be used for each species, or should the same max SDI pertain to all species (maybe an average; see Example 1 below)? A few factors to consider:

1. The Blue Mountains variant assigns default values of maximum SDI by species and PVT. They are documented in appendix B, table 11.2.1, of the Blue Mountains documentation (Keyser and Dixon 2019), and in a white paper (Powell 2014).

*If users agree with the maximum SDI defaults, then **an SDIMAX keyword may not be necessary**.* (But check to see if the defaults were assigned correctly, as based on Ecoclass.)

2. When a simulation begins, *and if an SDIMAX keyword is not used to change the defaults*, FVS derives an average maximum SDI by calculating a weighted average for species included in your input data, and the weights are based on basal area by species.

*An example:* Default maximum SDI values for the Douglas-fir/common snowberry plant association (PSME/SYAL) in the Blue-Ochoco province are Douglas-fir – 309; ponderosa pine – 341; and western larch – 256 (table 3-1). Assume these initial basal area percentages by species: Douglas-fir – 60%, ponderosa pine – 30%, and western larch – 10%. A weighted average max SDI is calculated as:  $(309 \times 0.6) + (341 \times 0.3) + (256 \times 0.1) = 313.3$  [EXAMPLE 1]

If basal area proportions remain relatively constant (60%/30%/10%) as a simulation progresses, the maximum SDI value used for this mixed stand will continue to be close to 313. But as basal area changes by species, a new stand maximum SDI is calculated *for each cycle*. If basal area proportions change to 50%/35%/15% for cycle 2, for example, then the new max SDI value for cycle 2 is:  $(309 \times 0.5) + (341 \times 0.35) + (256 \times 0.15) = 312.3$  [EXAMPLE 2]

3. What about a situation where the user wants density-related tree mortality for a mixed stand to be based on one species in the mixture?

This is commonly referred to as a 'limiting species' approach – stocking levels for one species are also used for the other species in a mixture. Generally, a tree species with the most restrictive (lowest) density requirements, often ponderosa pine for the Blue Mountains, is selected as the limiting species. With this approach, density-related mortality for ponderosa pine, Douglas-fir and grand fir in a mixed, dry-forest stand would all be controlled by the maximum SDI for ponderosa pine.

Under a limiting-species scenario, an SDIMAX keyword is used to set a single maximum SDI value and it then applies to all species in the stand. For the PSME/SYAL example (#2 above), let's say we decide to use a maximum SDI of 309 for all species. [Larch is not well-adapted to dry sites, where it occurs at low percentages, so Douglas-fir's SDI value (309) was selected because it is lower than the PP value (341). This example also demonstrates that ponderosa pine often has the lowest max SDI value for dry sites, but not always.]

When SDIMAX sets a max SDI value of 309, a weighted average max SDI value is capped at 309 for all species, regardless of how the basal-area percentages change over time. The 309 SDI



value then functions as a ‘scalar’ – max SDI is always scaled (weighted) so it never exceeds 309.

For a scenario where a single SDI is used with a mixed-species stand, the equation in item #2 above is worked backward – the final SDI answer for the stand as a whole is known (309), proportions of basal area by species are calculated at the beginning of each cycle, and FVS then calculates proportional SDI values, by species, as a projection proceeds.

Instead of ‘locking in’ SDI values *by species* (they were 309/341/256 for example 1), and instead of total (weighted) SDI varying for the stand (it was 313.3 for example 1, based on the basal area percentages used for that example), a limiting-species approach locks in SDI *for the stand as a whole* (309), and FVS then varies individual-species SDI values based on their basal area proportions (SDI values calculated by FVS, by species, may be less than their max limits with this limiting-species approach).

But consider that for this PSME/SYAL example, ponderosa pine had the highest maximum SDI of the three species, not the lowest value as often occurs, so max SDI values for Douglas-fir and western larch might not be reduced as a simulation progresses.

When formulating density management regimes, Blue Mountains foresters often select ponderosa pine as a limiting species. For this reason, a table is included (table 4-1) that pulls together ponderosa pine stocking information and presents it in an FVS context.

As described earlier in this guide, upper and lower limit values for ponderosa pine may be adjusted for mountain pine beetle susceptibility. What if you want to prepare a density management regime for ponderosa pine and NOT adjust it for mountain pine beetle susceptibility?

I don’t endorse ignoring MPB susceptibility as a regular habit, but a manager might want to develop a ponderosa pine density regime by using the same process as for other species – set an upper limit as 55% of max SDI and a lower limit as 35% of max SDI. In table 3-1, upper and lower limits for ponderosa pine are calculated in this way – as 55% and 35% of max SDI, respectively.

Table 4-1 summarizes **ponderosa pine** stocking levels for the Blue Mountains. Column 2 provides maximum density, column 3 provides full stocking, and columns 4 and 5 provide upper and lower limits of a management zone, *calculated without accounting for MPB susceptibility*. Columns 6 through 9 provide upper and lower limits of a management zone calculated by using the Cochran et al. 1994 process – they account for MPB susceptibility. Columns 7 and 9 in table 4-1 provide ‘percentage of maximum’ values (Pct. of Max) compatible with FVS and SDIMAX.

*To reflect MPB susceptibility for ponderosa pine in FVS, column 7 of table 4-1 is useful when setting lower limit values with the SDIMAX keyword, and column 9 is helpful when using thinning keywords based on SDI.*

## DENSITY MANAGEMENT TREATMENTS

Thinnings were used in some parts of Germany as early as the sixteenth century. They became a common silvicultural practice throughout much of Europe by the latter half of the eighteenth century. Hartig and other early German foresters were ‘intensely conservative’ in their application of thinning (in terms of how many trees were being removed); this conservatism eventually migrated to early American forestry (Hubbard 1904a, b).

**Table 4-1:** Ponderosa pine stocking levels for use with Blue Mountains variant of FVS model.

| 1                         | 2               | 3             | 4           | 5          | 6                           | 7           | 8        | 9           |
|---------------------------|-----------------|---------------|-------------|------------|-----------------------------|-------------|----------|-------------|
| Potential Vegetation Type | Maximum Density | Full Stocking | WITHOUT MPB |            | COCHRAN ET AL. 1994 PROCESS |             |          |             |
|                           |                 |               | ULMZ (55%)  | LLMZ (35%) | MPB ULMZ                    | Pct. of Max | MPB LLMZ | Pct. of Max |
| ABGR/ACGL*                | 456             | 365           | 251         | 160        | 238                         | 0.52        | 159      | 0.35        |
| ABGR/CAGE                 | 263             | 210           | 144         | 92         | 109                         | 0.42        | 73       | 0.28        |
| ABGR/CARU                 | 395             | 316           | 217         | 138        | 154                         | 0.39        | 103      | 0.26        |
| ABGR/CARU*                | 456             | 365           | 251         | 160        | 270                         | 0.59        | 181      | 0.40        |
| ABGR/CLUN*                | 456             | 365           | 251         | 160        | 262                         | 0.57        | 176      | 0.38        |
| ABGR/LIBO2                | 456             | 365           | 251         | 160        | 162                         | 0.35        | 108      | 0.24        |
| ABGR/SPBE                 | 319             | 255           | 175         | 112        | 147                         | 0.46        | 98       | 0.31        |
| ABGR/SPBE*                | 456             | 365           | 251         | 160        | 270                         | 0.59        | 181      | 0.40        |
| ABGR/VAME                 | 365             | 292           | 201         | 128        | 139                         | 0.38        | 93       | 0.26        |
| ABGR/VAME*                | 424             | 339           | 233         | 148        | 221                         | 0.52        | 148      | 0.35        |
| ABGR/VASC                 | 215             | 172           | 118         | 75         | 101                         | 0.47        | 68       | 0.31        |
| ABLA2/CLUN*               | 379             | 303           | 208         | 133        | 224                         | 0.59        | 150      | 0.40        |
| PIPO/AGSP                 | 166             | 133           | 91          | 58         | 38                          | 0.23        | 26       | 0.15        |
| PIPO/AGSP*                | 233             | 186           | 128         | 81         | 86                          | 0.37        | 58       | 0.25        |
| PIPO/ARTRV/FEID-AGSP      | 238             | 190           | 131         | 83         | 101                         | 0.42        | 68       | 0.28        |
| PIPO/CAGE                 | 251             | 201           | 138         | 88         | 82                          | 0.33        | 55       | 0.22        |
| PIPO/CARU                 | 456             | 365           | 251         | 160        | 154                         | 0.34        | 103      | 0.23        |
| PIPO/CELE/CAGE            | 290             | 232           | 160         | 102        | 82                          | 0.28        | 55       | 0.19        |
| PIPO/CELE/FEID-AGSP       | 196             | 157           | 108         | 69         | 32                          | 0.16        | 21       | 0.11        |
| PIPO/CELE/PONE            | 199             | 159           | 109         | 70         | 49                          | 0.25        | 33       | 0.17        |
| PIPO/FEID                 | 243             | 194           | 133         | 85         | 62                          | 0.26        | 42       | 0.17        |
| PIPO/FEID*                | 259             | 207           | 142         | 91         | 101                         | 0.39        | 68       | 0.26        |
| PIPO/PUTR/CAGE            | 255             | 204           | 140         | 89         | 70                          | 0.28        | 47       | 0.18        |
| PIPO/PUTR/CARO            | 304             | 243           | 167         | 106        | 92                          | 0.30        | 61       | 0.20        |
| PIPO/PUTR/FEID-AGSP       | 231             | 185           | 127         | 81         | 66                          | 0.28        | 44       | 0.19        |
| PIPO/SPBE*                | 276             | 221           | 152         | 97         | 105                         | 0.38        | 70       | 0.26        |
| PIPO/SYAL                 | 398             | 318           | 219         | 139        | 218                         | 0.54        | 144      | 0.36        |
| PIPO/SYAL*                | 301             | 241           | 166         | 105        | 120                         | 0.40        | 80       | 0.27        |
| PIPO/SYOR                 | 325             | 260           | 179         | 114        | 135                         | 0.42        | 91       | 0.28        |
| PSME/ACGL-PHMA*           | 351             | 281           | 193         | 123        | 189                         | 0.54        | 127      | 0.36        |
| PSME/CAGE                 | 278             | 222           | 153         | 97         | 86                          | 0.31        | 58       | 0.21        |
| PSME/CARU                 | 329             | 263           | 181         | 115        | 122                         | 0.37        | 82       | 0.25        |
| PSME/CARU*                | 451             | 361           | 248         | 158        | 208                         | 0.46        | 139      | 0.31        |
| PSME/HODI                 | 425             | 340           | 234         | 149        | 252                         | 0.59        | 169      | 0.40        |
| PSME/PHMA                 | 343             | 274           | 188         | 120        | 167                         | 0.49        | 112      | 0.33        |
| PSME/PHMA*                | 290             | 232           | 160         | 102        | 139                         | 0.48        | 93       | 0.32        |
| PSME/SPBE*                | 441             | 353           | 243         | 154        | 226                         | 0.51        | 152      | 0.34        |
| PSME/SYAL                 | 341             | 273           | 188         | 119        | 151                         | 0.44        | 101      | 0.30        |
| PSME/SYAL*                | 416             | 333           | 229         | 146        | 224                         | 0.54        | 150      | 0.36        |
| PSME/SYOR*                | 451             | 361           | 248         | 158        | 180                         | 0.40        | 120      | 0.27        |
| PSME/VAME                 | 241             | 193           | 133         | 84         | 96                          | 0.40        | 64       | 0.27        |

#### **COLUMN DESCRIPTIONS FOR TABLE 4-1**

|                                     |                                                                                                                                                                                                                                                                                                             |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Potential Vegetation Type</b> | Abbreviation for potential vegetation type (PVT) name; taken from table 3-1 of this guide. <i>Names followed by an asterisk pertain to the Wallowa-Snake area; all other PVT listings are for the Blue-Ochoco area.</i>                                                                                     |
| <b>2. Maximum Density</b>           | Maximum density SDI value for ponderosa pine for a PVT, taken from table 3-1 in this guide.                                                                                                                                                                                                                 |
| <b>3. Full Stocking</b>             | Full stocking SDI value for ponderosa pine for a PVT, taken from table 3-3 in this guide.                                                                                                                                                                                                                   |
| <b>4. ULMZ<br/>(Without MPB)</b>    | Calculated upper limit of a management zone (ULMZ) SDI value without any adjustment for mountain pine beetle susceptibility. This value is 55% of the maximum density SDI in column 2.                                                                                                                      |
| <b>5. LLMZ<br/>(Without MPB)</b>    | Calculated lower limit of a management zone (LLMZ) SDI value without any adjustment for mountain pine beetle susceptibility. This value is 35% of the maximum density SDI in column 2.                                                                                                                      |
| <b>6. MPB ULMZ</b>                  | MPB ULMZ value calculated by using the Cochran et al. 1994 process. These values are the same as those presented in an <u>MPB ULMZ</u> column in table 5-4.                                                                                                                                                 |
| <b>7. MPB ULMZ:<br/>Pct. of Max</b> | Calculated percentage of Maximum Density represented by the MPB ULMZ value. <i>This percentage could be used as a Lower Limit (field 5) value with the SDIMAX keyword.</i> [If your pine stand is growing on the PSME/CAGE PVT, then SDIMAX could be used to set maxSDI to 278 and the lower limit to 31%.] |
| <b>8. MPB LLMZ</b>                  | MPB LLMZ value calculated by using the Cochran et al. 1994 process. These values are the same as those presented in the <u>MPB LLMZ</u> column in table 5-4.                                                                                                                                                |
| <b>9. MPB LLMZ:<br/>Pct. of Max</b> | Calculated percentage of Maximum Density represented by the MPB LLMZ value. This percentage could be used with FVS thinning keywords that schedule density-management treatments by using SDI instead of basal area.                                                                                        |

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Early on, it was widely recognized that “light thinning neither gives a very paying intermediate yield, nor greatly improves the growth and quality on the final stand” (Hubbard 1904a). It was also concluded that maintaining dense stands to force juvenile height growth, long a cherished forestry belief, was unneeded because “a reasonable amount of room not only increases the diameter, but also the height” (Hubbard 1904b). Both conclusions support the common adage to “thin early, thin heavy” (Bradley 1963).

Blue Mountains research found substantial increases in post-thinning tree growth for western larch (Seidel 1987), ponderosa pine (Cochran and Barrett 1993, 1995), and lodgepole pine (Cochran and Dahms 1998). Central Oregon work showed a similar post-thinning response for Douglas-fir, grand fir, western white pine, and Engelmann spruce (Seidel and Cochran 1981). Ponderosa pine thinning studies across the western United States have consistently shown post-thinning benefits related to biomass accumulation, carbon sequestration, plant diversity, and forest resiliency to a variety of stressors (Demarest et al. 2023, Zhang et al. 2020).

#### **Physiological Basis For Thinning**

To grow well, a tree needs a place in the sun and some soil to call its own. Once a stand occupies all its growing space, intertree competition causes some trees to die and survivors then compete for growing space relinquished by death of their neighbors (Long and Dean 1986). Thinnings mimic this natural trend for a few large trees to eventually occupy the space that once supported many small trees.

Thinnings that remove trees from beneath the main canopy are called low thinning or thinning from below (fig. 4-2; Smith et al. 1997). Table 4-2 provides two sets of indicators to help prioritize needs for low thinning.

**Table 4-2:** Recommended priorities for low thinning.

| <b>Priority</b> | <b>Stand Differentiation Indicators</b>                                                                                                                          | <b>Stand Density Indicators</b>                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High            | Stands exhibit little or no differentiation into crown classes; little height variation is present; height repression is occurring; very short live-crown ratios | Stands whose existing density generally occurs above the upper limit of a management zone – in the self-thinning zone (fig. 3-6)                           |
| Medium          | Stands exhibit limited amounts of differentiation; some height variation occurs; moderate amount of height repression; live-crown ratios are less than 40%       | Moderately dense stands whose density occurs at the mid-point of a management zone, or slightly above (at least midway between the lower and upper limits) |
| Low             | Stands are obviously differentiating into crown classes; no apparent height repression; live-crown ratios are consistently greater than 40 percent               | Stands whose density occurs below the mid-point of a management zone; no treatment needed now, but it might be warranted to adjust species composition     |

*Sources/Notes:* Stand differentiation indicators are based on O'Hara and Oliver (1999) and Oliver and Larson (1996); stand density indicators are based on figure 3-6 and table 3-2 in this document.

By reducing the number of trees and opening up a stand, thinning provides more sunlight, water, and mineral nutrients for residual trees (Donner and Running 1986). This improves physiological vigor of residual trees, increasing their seasonal energy activity and growth.

Trees respond to thinning by producing more foliage and developing a higher level of photosynthate reserves (Vernon et al. 2023), improving their capacity to resist and recover from insect or disease attacks (Franceschi et al. 2005, Kolb et al. 1998) (see table 5-1). When considering whether a density management treatment is warranted, a manager can evaluate vigor and stress indicators for a stand (table 4-3), many of which relate to insect and disease resistance.

Photosynthate refers to carbohydrates and other products created during photosynthesis. [A crucially important biological process called photosynthesis allows trees, and other green plants, to absorb carbon dioxide, fix the carbon obtained from carbon dioxide (e.g., use it to create tissues and other substances), and produce oxygen as a by-product. The dry weight of a tree, not including water, consists of 45-50% carbon.]

A tree allocates photosynthate in an order of precedence, but the hierarchy is not absolute (Loehle 1988; Oliver and Larson 1996; Waring and Pitman 1980, 1985). Here is the hierarchy of photosynthate allocation; it is also illustrated in figure 4-3:

1. Maintenance respiration (first).
2. Producing fine roots and foliage.
3. Flower and seed production.
4. Height, branch, and large root growth.
5. Diameter growth.
6. Insect and disease resistance (last).

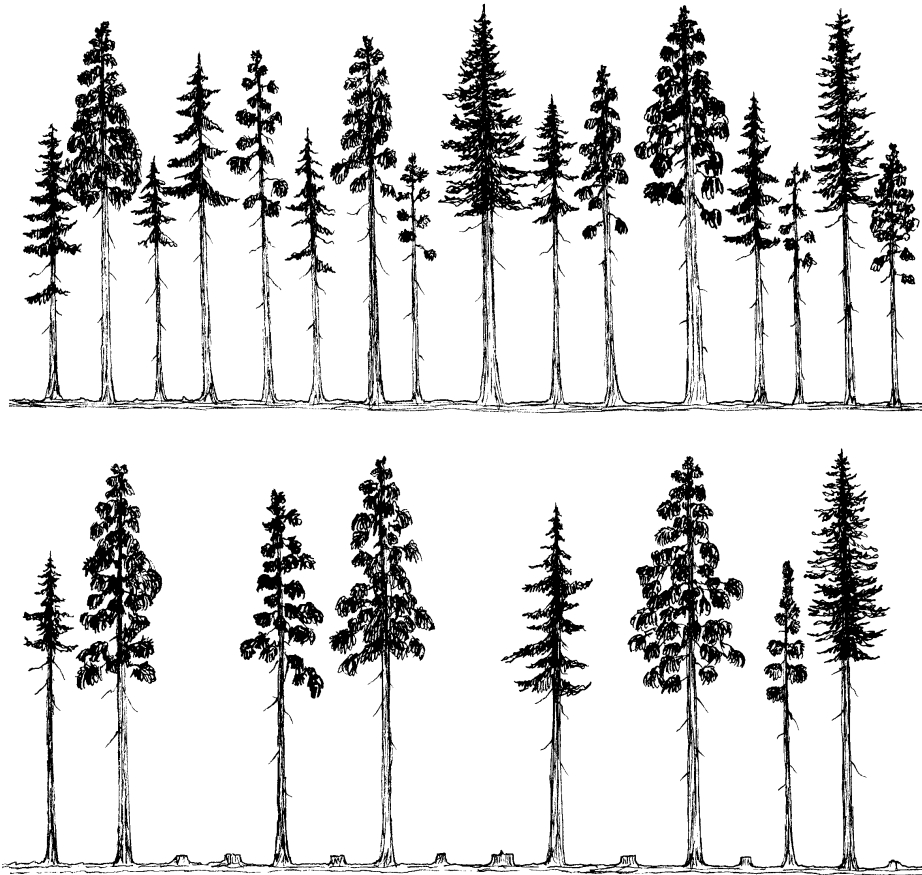


**Figure 4-2** – Low thinning removes trees from lower crown classes (see fig. 3-2) to favor trees in upper classes. Only subordinate trees were removed in this low thinning, with one exception: several western larches in the top panel were removed because dwarf mistletoe infection was severe enough to threaten their continued survival. This example demonstrates that treatments are seldom confined to a single method – a thinning may also be accompanied by minor amounts of sanitation cutting or cleaning.

**Table 4-3:** Indicators for evaluating tree vigor.

| INDICATORS OF LOW TREE VIGOR                | INDICATORS OF HIGH TREE VIGOR                        |
|---------------------------------------------|------------------------------------------------------|
| Thin, sparse tree crowns                    | Trees have high sap flow                             |
| Short, compressed tree crowns               | Trees have high foliar nitrogen content              |
| Dull, chlorotic tree foliage                | Increased tree foliage production                    |
| Low needle retention and few needle cohorts | High retention, many cohorts, usual needle longevity |
| Reduced tree seed production                | Increased tree radial growth                         |
| Treetop die-back (some dead tops)           | Good tree seedling height growth                     |
| Increased dwarf mistletoe severity          | Improved herbaceous undergrowth                      |

*Sources/Notes:* Vigor indicators are based on Fiedler and Harrington (2004) and Grulke et al. (2020). Overall, high-vigor trees have high seasonal energy activity, and relatively high capacity to resist drought and disturbance agents such as insects, pathogens, and parasites.

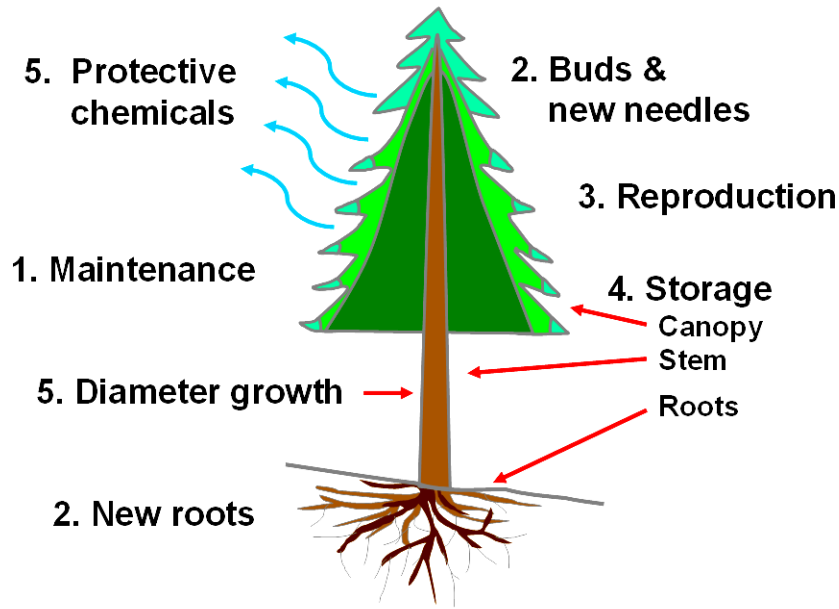


**Figure 4-3** – Hierarchy of photosynthate allocation (diagram from Stephen Fitzgerald, OSU College of Forestry). This figure illustrates that as tree vigor declines, a tree’s photosynthate production – carbohydrates created during photosynthesis – will be allocated to uses other than protective chemicals, affecting a tree’s capability to resist insect and disease attack.

This allocation hierarchy explains a basic dilemma of trees – they must grow fast enough to outpace their competitors, or at least keep up with them, but they can’t allocate all resources to growth because defense (resistance) is also important for survival in the presence of pathogens, insects, and herbivores (Herms and Mattson 1992, Vera 2004). The allocation pattern suggests that a tree can grow fast with few defenses, or grow slower with more defenses (Loehle 1988).

After a tree becomes crowded and loses vigor, its total photosynthate production declines, and a higher proportion of the photosynthate must be used for maintenance respiration. Due to insect and disease resistance being a low priority for photosynthate allocation, it may be one of the first needs that is reduced or abandoned by a stressed tree. I assumed that ‘protective chemicals’ (insect/disease resistance) would rank higher due to its influence on tree survival.

### Releasing Versus Maintaining Treatments

Low thinnings are referred to as ‘thinning from below’ because they remove the smallest trees first, working upward in the canopy until a stand density objective is met. Low thinning is not proportional – more stems are removed from smaller diameter classes than from larger ones. Low thinnings mimic stand maintaining disturbance processes (fig. 4-4). For the stand maintaining group, some processes are bottom-up and others are top-down (Smith et al. 1997), alluding to their function within a stand (low-severity surface fire is an example of a bottom-up process; bark-beetle outbreaks and windthrow are examples of top-down processes).

A low thinning can offer benefits for sustaining plant species richness (biodiversity) in young stands. A study found that stands regenerating after stand-replacing disturbance reach a biodiversity peak in the young stage – noncommercial thinning during that phase can prolong a period of maximum plant species diversity (Sullivan et al. 2009).

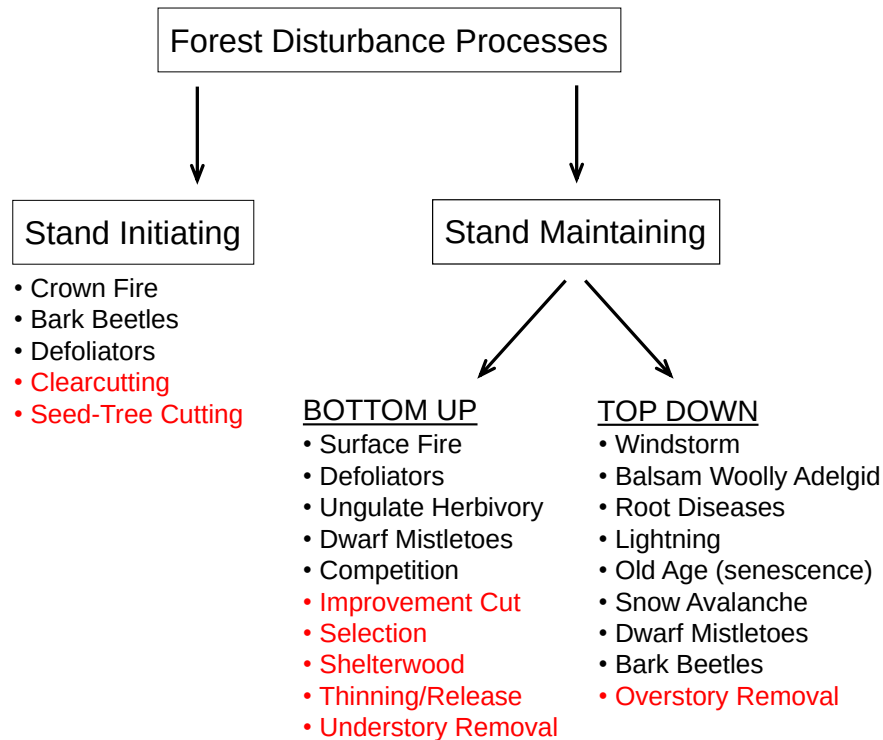


**Figure 4-4** – Classification of forest disturbance processes as stand initiating or stand maintaining (some are assigned to both groups). Stand maintaining processes are assigned to a bottom-up or top-down subgroup. Items in red text are silvicultural practices; thinnings and intermediate treatments are assigned to the bottom-up group because under most circumstances, they are implemented as a low thinning or a thinning-from-below.

Commercial thinning did not provide a similar biodiversity benefit because when it occurred, forest succession had already progressed to a point where species diversity was no longer at a maximum (Widenfalk and Weslien 2009), so thinning for species richness has an obvious time element (i.e., for biodiversity, thinning in young stands that still have a full complement of plant diversity is perhaps more important than thinning in mid-age or mature stands).

Figure 4-5 shows a low thinning in a spruce-fir forest. The treatment left a residual density slightly below the lower limit of a management zone for Engelmann spruce, offering future benefits in terms of reduced susceptibility to spruce beetle, improved plant species richness, and increased resilience to climate change.

### Thinnings Utilizing A Diameter Cap

Low thinning is especially relevant for contexts where diameter-limit caps will be used. Diameter caps set size limits (such as not removing any live tree over 21 inches in diameter); they can be an appropriate for situations where the historical disturbance regime featured bottom-up processes, including surface fire on dry-forest sites. An example – if a frequent fire regime promoted overstory ponderosa pines with an average mature age of 150 years, then a cap should be selected that aligns well with the mean tree diameter associated with an average age of 150 years (but caps should vary by productivity class). If site productivity results in 30-inch trees in 150 years, then a 21-inch diameter limit is not well suited *for that productivity class*.



**Figure 4-5** – Low thinning can be used to manage canopy fuels, reduce stand density, and reduce bark-beetle susceptibility.

This shows a low thinning in a high-elevation, mixed stand of Engelmann spruce and subalpine fir on the subalpine fir/grouse huckleberry plant association (ABLA2/VASC). The pre-treatment stand had a basal area of 101 square feet per acre, a quadratic mean diameter of 6.1 inches, and a stand density index of 224. Cut trees averaged exactly 200 per acre, resulting in a post-treatment stand with a basal area of 78 square feet per acre, a quadratic mean diameter of 7.1 inches, and a stand density index of 168.

Before thinning, the stand was midway between the upper and lower limits of a management zone for Engelmann spruce; after thinning, it was slightly below the lower limit of a management zone (LLMZ) stocking level.

For a spruce beetle context, prescribing a noncommercial thinning to retain slightly less density than is recommended for the lower limit (this reduced level is analogous to the climate resilience stocking level) will result in reduced spruce beetle susceptibility over a longer period (Hard 1985, Schmid and Frye 1976).

Diameter caps are seldom compatible with uneven-aged management or strategies where a wide range of tree diameters are desired (Abella et al. 2006). And it may be inappropriate to use caps that do not vary by setting – same cap for warm/dry (less productive) and cool/moist (more productive) biophysical environments, for example. After selecting an appropriate cap limit, low thinning may be ideal for adjusting stand density for diameter classes below the cap limit.

### **Competition: A Reciprocal Process**

Trees in a superior canopy position (dominant and codominant crown classes in fig. 3-2) have better access to sunlight, nutrients, and moisture than trees in subordinate canopy positions. Since dominant trees use a disproportionate share of site resources (Oliver and Larson 1996), it may seem that their growth is little influenced by the subordinate trees (Daniel et al. 1979a, Nyland 2007, Smith et al. 1997).



Research conducted in central Oregon (Barrett 1963, 1972; Grulke et al. 2020) and elsewhere in the West (Dolph et al. 1995, Stone et al. 1999) found that intertree competition functions as a two-way process, and that removing subordinate trees (particularly intermediate and suppressed trees; fig. 3-2) results in obvious vigor increases for dominant (overstory) ponderosa pine (Cochran 1992, Woodall et al. 2003), particularly for old-growth settings. “Individual ponderosa pine trees, even if long suppressed, can develop large diameters fairly rapidly if enough growing space becomes available” (Cochran 1992).

In a fuels-management context, removing understory trees is done to address ladder fuels. Ladder fuels consist of the lower stem branches and foliage of larger trees, along with understory seedlings, saplings, and small poles. Ladder fuel allows surface fire to transition to passive (torching) or active crown fire, which can threaten the survival of overstory trees (Powell 2010), including large-diameter, old-growth trees like those desired by society.

## SILVICULTURAL PLANNING

When reduced to its essence, silviculture is little more than application of ecological leverage – it provides opportunities to favor one species or genotype over another, produce a desirable configuration of vertical or horizontal stand structure, and influence a variety of stand development processes, all focused on achieving land management goals and objectives.

*A forester’s most powerful tool for applying ecological leverage may well be manipulation of stand density.* Dr. Ted Daniel and others (1979a, p. 259) describe the importance of density management: “Stand density is the second most important factor after site quality in determining the productivity of a site. This is important because stand density is the major factor that the forester can manipulate.”

Traditionally, thinning was used as an intermediate cutting in immature stands, primarily to stimulate growth of the residual trees and thereby increase future yield of usable wood products (Nyland 2007). The basic goal of this historical approach was to presumptively harvest trees that would otherwise die as a result of the self-thinning process (see chapter 2), and to enhance tree and stand growth (Hubbard 1904a, b).

By concentrating a site’s growth potential on fewer stems, larger trees grow faster and become more vigorous (assuming a low thinning was prescribed – it primarily removes the smaller, understory trees; see fig. 4-2). Thinning is now used in a broader context, including to culture multi-age (O’Hara 2014) or uneven-aged stands, and to address ladder fuels.

### Thinning Prescriptions

Stocking level information has always been central to the practice of forestry. Clear information about size-density interactions, indexes of stand density, growth-growing stock relationships, and density management responses can help silviculturists prepare prescriptions that best meet the vegetation management objectives for an area (Ducey and Larson 1997).

Unless management objectives indicate otherwise, I recommend that *a density-management method be prescribed when stand density approaches the upper limit stocking level (55% of maximum density), and treatment should reduce density to the lower limit (35% of maximum density) or climate resilience (25% of maximum density) stocking levels (fig. 3-6).*

This strategy recognizes that when stand density is maintained between the upper and lower limits, or between the upper limit and climate resilience levels, trees fully occupy a site, adequate growing space promotes good crown vigor, and self-thinning is not killing small trees.

One reason to consider managing stands below the lower limit stocking level is to adapt our forests to the existing and future effects of climate change. A climate resilience stocking level – 25% of maximum density – is provided in the stocking tables (chapter 6) for just this reason.

Because of a desire to maintain full site occupancy and maximize total (cubic-foot) volume production, or to force juvenile height growth and enhance self-pruning of residual stems, foresters were often unwilling to cut enough trees in a thinning to allow the remaining trees to grow vigorously (Cochran and Barrett 1993, Hubbard 1904a, Oliver and Larson 1996).

Results from a Flat Creek spacing study, located in the Middle Fork John Day River drainage northeast of John Day, Oregon, showed that for second-growth stands of ponderosa pine (growing on dry sites of relatively productivity), precommercial thinning to wide spacings (at least 18 to 22 feet between residual trees), followed by periodic commercial thinnings to sustain tree vigor, are important for promoting reasonable tree growth, producing large-diameter trees in the shortest possible time, maintaining stand health, and promoting low mountain pine beetle susceptibility (Cochran and Barrett 1993).

### Thinning Regime Options

Suggested stocking levels (chapter 6) are designed to ensure reasonable stand development if density is maintained below the upper limit of a management zone (ULMZ, fig. 4-6).

It is unusual for a stand to spend most of its time in the management zone – it is more likely that a stocking level will fluctuate inside and outside of the zone, with the timing and magnitude of fluctuations varying with a stand's growth rate and the thinning interval (or if active management is not being used, then the interval between disturbance events like bark-beetle attack).

In figure 4-6, initial stocking begins between the upper and lower stocking level curves, and quadratic mean diameter (QMD) then increases; the growth trajectory eventually approaches the ULMZ. This is trajectory A in figure 4-6. Note how trajectory A is shown with a slight downward slope to the right, suggesting that even though QMD is increasing (because the trajectory moves from left to right along the QMD axis), stand density is decreasing somewhat.

What might cause this small decrease? Although we don't know for sure, a small decrease like this usually reflects background mortality and is unrelated to self-thinning (often, it is associated with climatic events or insect and disease impact). A *Tree Mortality in the FVS Model* section, earlier in this chapter, provides more information about background mortality.

What are some alternatives for implementing the concepts illustrated in figure 4-6? After first deciding which tree species to favor for mixed-species stands (see *Stocking Levels for Mixed-Species Stands*, later in this chapter), there are at least three options available for designing a density management regime, and they are discussed next.

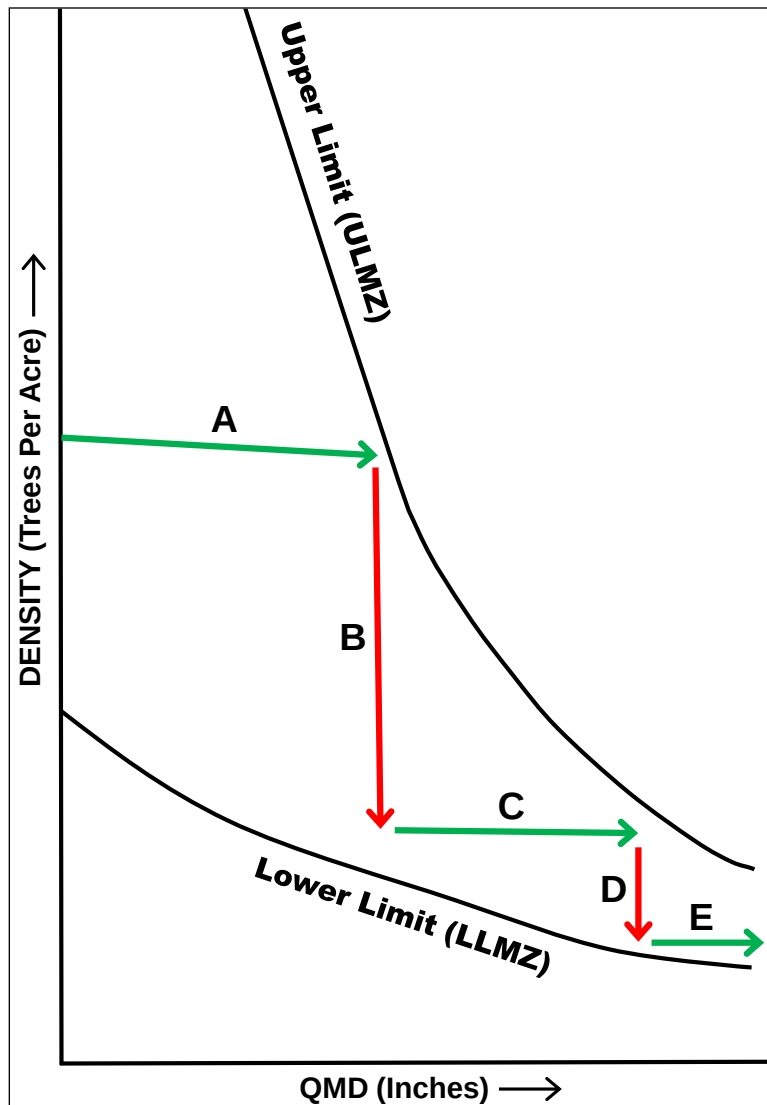


**Figure 4-6** – Thinning regime using the upper and lower limits of a management zone (black curving lines). This figure shows a stocking-level chart and how it can be used when preparing a thinning regime. Initial stocking begins in the management zone and stand growth then causes QMD to increase toward the upper limit (this is segment A, the green line). When the trajectory approaches the upper limit, thinning is scheduled (segment B, a red line) and density is reduced until it approaches the lower limit. Further growth (segment C, green) causes the stand to approach the upper limit again, at which point another thinning is scheduled (segment D, red). For this example, stand density stays within the management zone through the second thinning (segment E, red). Green arrows depict growth stages, and red arrows show thinnings.

1. The simplest and least sophisticated option is to consult a stocking-level table (chapter 6) and then choose the Lower Limit (LL) pertaining to a stand's existing QMD value. With this option, existing density would simply be reduced to the LL level. And it is assumed that the treatment would be a proportional thinning because QMD would not change.
2. A more sophisticated option is to estimate the *percentage of trees retained* after reducing existing density to the LL level, and then use a diameter-lift table (tables 4-4 to 4-6) to estimate how a stand's QMD would 'lift' (increase) by completing a low thinning or similar 'thin-from-below' treatment. With this option, your final LL density value would be based on the post-treatment QMD, *not on a stand's existing QMD as was done for option 1*.
3. The third and most sophisticated option is what I refer to as a 'sudden sawlog' approach. This alternative looks out into the future. It designs a noncommercial thinning treatment, *to be implemented now*, but the process incorporates a set of management assumptions about future conditions: what future timber merchantability standards will be, anticipated budget levels (are additional noncommercial thinnings economically viable?), and similar considerations. The Sudden Sawlog approach is described in more detail in the next section.

## Sudden Sawlog Thinning Regime Example

The 'sudden sawlog' approach provides a possible strategy for designing a noncommercial thinning (NCT) treatment that sets a stand on a trajectory to reach the commercial size class with maximum tree vigor and minimum bark-beetle risk. I will provide an example of the technique here, and it relies on a stocking table from chapter 6, along with diameter lift tables in this chapter (tables 4-4 to 4-6, below). [If using stand exam data, you can calculate your own diameter lift – if 10-year radial increment for growth sample trees averages 15/20ths of an inch (same as 1.5" of diameter growth per decade), then diameter lift for 30 years would be 4.5".]

When preparing a sudden-sawlog regime, first select a target tree species for the potential vegetation type (PVT) you are working with, a target diameter (QMD) near the lower end of the commercial size class you assumed for the future (9" QMD for this example), and a stocking level – this example uses the lower limit stocking level, although the climate resilience stocking level would also be a good option.

The premise of this example is: you're beginning with an overstocked, noncommercial-size stand, and you'd like to implement an NCT that stays in the management zone until the stand reaches a commercial size (9" QMD). Then, it's assumed that another treatment (such as a commercial thinning), or no treatment at all, would be evaluated.

This example uses data for a young stand (sapling-size) of ponderosa pine growing on the Douglas-fir/common snowberry (PSME/SYAL) PVT in the Blue-Ochoco area. So, the PVT (PSME/SYAL) and focus species (ponderosa pine, PP) has been identified, which leads to table P24 in chapter 6 (PP for PSME/SYAL PVT). Existing conditions include a relatively dense stand of small ponderosa pines (3" QMD) – the existing density is near the upper limit stocking level.

Because trees under 5" DBH have very little basal area, many managers use intertree spacing (e.g., equilateral spacing, ES, in table P24) when designing an NCT for small diameter stands. As described for option #1 on the previous page, you could choose the ES value associated with the lower limit (3" QMD) for this NCT – in which case you'd prescribe a residual tree density of 7 feet (ES value of 7.1 feet, for a 3" QMD, for the lower limit stocking level in table P24).

But this simplistic approach does not qualify as a sudden-sawlog approach – it does not reach out to the future (a 9" QMD), and it does not identify a thinning intensity that is likely to stay in the management zone until the stand reaches a commercial size class.

A better approach is to use data for a 9" QMD (future size objective) when designing the NCT treatment. The ES value associated with a 9" QMD, for the lower limit, is approximately 19 feet between leave trees. Some managers might interpret a 19-foot intertree spacing as uncomfortably wide (for a 3" QMD stand), but it is a reasonable option for a warm dry site (PSME/SYAL) (and, do you recall the Flat Creek thinning results described a few pages back?).

If we assume that minimal tree mortality occurs after the NCT, then the stand will still have intertree spacing of app. 19 feet when it reaches a target diameter of 9" QMD, and the basal area would then be app. 60 square feet per acre (irregular structure basal area, table P24, for lower limit). For a 9" QMD stand on a warm dry site, these are certainly reasonable attributes!

Obviously, if the stand reaches a 9" QMD *at the lower limit (LL) stocking level*, there will be

little need for commercial harvest at that time. But if markets are good, you could perhaps consider a light tune-up thinning where density is dropped down to the climate resilience stocking level (app. BA of 40). With this strategy, you're assuming that a stand reaches a commercial size in a vigorous, healthy condition and, when it gets there, an immediate entry will NOT be needed to drop stand density back within the management zone (because it will already be there).

In my view, the most useful advantage of this approach is that it uses an NCT to establish a stocking level that can be sustained for a decade or two beyond the commercial size (9" QMD).

For this example, we assume that minimal tree mortality occurs between the NCT (19-foot leave-tree spacing) and reaching a 9" QMD. So, when the stand is at 9", let's say the stand density is app. 130 trees per acre (TPA), which is halfway between the IS and UA densities for a 9" QMD at the LL – see table P24. (I assume that the stand would have an IS structure because many Blue Mountain stands do, but you could assume an EA or UA structure instead).

As described with fig. 4-6, most thinning regimes try to keep stand density between upper and lower limits of a management zone. When our example stand reaches a 9" QMD, we assume its density is near the lower limit. But it is growing briskly then – relatively soon, it will approach the upper limit and qualify for another thinning treatment. How much time do we have before it reaches the upper limit and another entry is needed?

If mortality remains negligible, then let's see where 130 TPA occurs. Scanning down the IS column for the *upper limit* (table P24), this happens at a QMD of 12" (128 TPA for IS structure). This suggests that between 9" and 12" QMD, the stand will be in the management zone.

This is 3" of diameter growth. If we examine Blue Mountains data relating stand diameter growth to residual basal area levels (table 4-7), we can assume that it will take app. 15 years for our stand to grow 3" in diameter and reach the upper limit. How can we determine this?

Table 4-7 shows a decadal growth rate of 2.6" for 60 sq. ft. per acre of basal area (BA) for ponderosa pine – 60 is the BA value for our 9" QMD (IS column for LL). Decadal growth is app. 1.8" for a BA of 100 sq. ft. per acre, the BA value for our 12" QMD (IS column for UL). So, average stand growth from 60 to 100 sq. ft. per acre (table 4-7) is app. 2.2" per decade. Therefore, 3" of growth, from 9" to 12" QMD, requires about 15 years. [You get the same result by taking the mid-point of our BA range, 80, and using its growth rate (2.2") from table 4-7.]

This sudden-sawlog example shows how the stocking-level tables in chapter 6 can be used to design a density management regime. It shows how a regime can start with an NCT entry, and then use lower and upper limit values to estimate when future treatments will be needed.

## **STOCKING LEVELS FOR MIXED SPECIES STANDS**

How should a density regime be developed for mixed-species stands? This is a fundamental question because for the Blue Mountains, many potential vegetation types (PVTs) have the ecological capability to support as many as five, six, or seven tree species (this is clearly shown in table 3-1). Chapter 6 provides as many as five, six, or seven sets of suggested stocking levels for your site – a table for each species occurring on your PVT.

For mixed-species stands, guidance about the mix of tree species to emphasize for any

particular PVT is often influenced by land management objectives, not by density management considerations. An example: “maintain 60% or more of the stand composition as non-host species in order to minimize future susceptibility to western spruce budworm” (Carlson and Wulf 1989).

Once a species composition goal has been identified, a silviculturist has several options for establishing stocking levels for mixed-species stands, depending on the circumstances.

1. For some situations, it might not matter much which focal tree species is selected because the stocking levels for species being considered are nearly the same (see table 3-7).
2. You may not need to evaluate the stocking levels for every species if one or more of them are likely to be removed during cultural operations such as cleanings or thinnings.
3. A weighted average could be calculated for two or more species, but this option should be used with caution when stocking levels vary widely between species. For additional background information about this approach, see Seidel and Cochran (1981).
4. The lowest suggested stocking-level could be selected. This strategy assumes that the species with the lowest stocking level has the most restrictive growing-space requirements, and that other species will develop acceptably (and likely be happier) under the lower densities established for the most limiting species. *This is the strategy recommended by Cochran et al. (1994), and for most circumstances, it is the strategy I recommend.*

## DIAMETER LIFT TABLES

Diameter lift tables (tables 4-4 to 4-6) can help silviculturists develop prescriptions and marking guides for intermediate cuttings, **especially low thinnings**. The tables are suitable for even-aged and irregular structures, but are not generally usable with uneven-aged stands.

An example of their use: If an even-aged ponderosa pine stand on the ABGR/CARU potential vegetation type has a QMD, before cutting, of 12" and a stand density of 140 trees/acre, and if the silvicultural objective is to reduce density down to the climate resilience (CR) stocking level (which is 72 trees/acre for a QMD of 12" and an EA structure, according to table P2 in chapter 6), then about 50% of the pretreatment density will be retained ( $72/140 = 51\%$ ).

The diameter-lift table for ponderosa pine (table 4-4) shows an approximate QMD increase from this treatment of 1.0" (QMD before cutting of 12", and 50% of trees retained = 13.0" residual QMD). The CR density for a QMD of 13" is about 62 trees per acre, so if a prescription specifies that existing density (140 trees/acre) be reduced to app. 60 trees/acre, it adequately reflects the CR stocking level and it also accounts for diameter lift.

Why is it important to incorporate diameter lift? If a thinning's marking guide is based on the stocking levels associated with a stand's existing QMD (option #1 in a *Thinning Regime Options* section earlier in this chapter), it results in slight overstocking when using low thinning (*as based on trees/acre rather than basal area/acre*; diameter lift from a lower to higher QMD results in more basal area being retained, not less). Why does this matter? If QMD increases in response to thinning, then stocking levels for a pretreatment QMD no longer apply – *a post-treatment stand with a larger QMD has different stocking levels*. As thinners leave a stand treated by using low thinning, they are walking away from a residual QMD that is slightly higher than it would have been if the stand was treated by using a proportional thinning.

**Table 4-4:** Diameter lift table for ponderosa pine stands: Average residual diameters (inches) after partial cutting from below and based on percentage of trees retained.

| QMD Before Cutting (Inches) | PERCENTAGE OF TREES RETAINED |      |      |      |      |      |      |      |      |
|-----------------------------|------------------------------|------|------|------|------|------|------|------|------|
|                             | 10                           | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   |
| 1                           | 1.9                          | 1.6  | 1.4  | 1.4  | 1.3  | 1.2  | 1.2  | 1.2  | 1.1  |
| 2                           | 3.3                          | 2.9  | 2.7  | 2.6  | 2.5  | 2.4  | 2.3  | 2.3  | 2.2  |
| 3                           | 4.7                          | 4.2  | 3.9  | 3.7  | 3.8  | 3.7  | 3.5  | 3.3  | 3.1  |
| 4                           | 6.0                          | 5.4  | 5.1  | 4.9  | 4.8  | 4.7  | 4.5  | 4.4  | 4.1  |
| 5                           | 7.2                          | 6.6  | 6.2  | 6.0  | 5.8  | 5.7  | 5.6  | 5.4  | 5.2  |
| 6                           | 8.4                          | 7.7  | 7.3  | 7.1  | 6.9  | 6.7  | 6.6  | 6.4  | 6.2  |
| 7                           | 9.6                          | 8.9  | 8.4  | 8.2  | 7.9  | 7.7  | 7.6  | 7.4  | 7.2  |
| 8                           | 10.8                         | 10.0 | 9.5  | 9.2  | 8.9  | 8.8  | 8.6  | 8.4  | 8.2  |
| 9                           | 11.9                         | 11.1 | 10.6 | 10.3 | 9.9  | 9.8  | 9.6  | 9.5  | 9.2  |
| 10                          | 13.0                         | 12.1 | 11.7 | 11.3 | 10.9 | 10.8 | 10.7 | 10.5 | 10.3 |
| 11                          | 14.1                         | 13.2 | 12.7 | 12.4 | 12.0 | 11.8 | 11.7 | 11.5 | 11.3 |
| 12                          | 15.2                         | 14.3 | 13.7 | 13.4 | 13.0 | 12.8 | 12.7 | 12.5 | 12.3 |
| 13                          | 16.2                         | 15.3 | 14.8 | 14.4 | 14.0 | 13.9 | 13.7 | 13.5 | 13.3 |
| 14                          | 17.3                         | 16.3 | 15.8 | 15.4 | 15.0 | 14.9 | 14.7 | 14.6 | 14.3 |
| 15                          | 18.3                         | 17.4 | 16.8 | 16.5 | 16.0 | 15.9 | 15.8 | 15.6 | 15.4 |
| 16                          | 19.3                         | 18.4 | 17.8 | 17.5 | 17.1 | 16.9 | 16.8 | 16.6 | 16.4 |
| 17                          | 20.3                         | 19.4 | 18.8 | 18.5 | 18.1 | 18.0 | 17.8 | 17.6 | 17.4 |
| 18                          | 21.4                         | 20.4 | 19.8 | 19.5 | 19.1 | 19.0 | 18.8 | 18.6 | 18.4 |
| 19                          | 22.4                         | 21.4 | 20.8 | 20.5 | 20.1 | 20.0 | 19.8 | 19.7 | 19.4 |
| 20                          | 23.3                         | 22.4 | 21.8 | 21.4 | 21.1 | 21.0 | 20.9 | 20.7 | 20.5 |
| 21                          | 24.3                         | 23.4 | 22.8 | 22.4 | 22.2 | 22.0 | 21.9 | 21.7 | 21.5 |
| 22                          | 25.3                         | 24.3 | 23.8 | 23.4 | 23.2 | 23.1 | 22.9 | 22.7 | 22.5 |
| 23                          | 26.3                         | 25.3 | 24.8 | 24.4 | 24.2 | 24.1 | 23.9 | 23.7 | 23.5 |
| 24                          | 27.2                         | 26.3 | 25.7 | 25.4 | 25.2 | 25.1 | 24.9 | 24.8 | 24.5 |
| 25                          | 28.2                         | 27.2 | 26.7 | 26.3 | 26.2 | 26.1 | 26.0 | 25.8 | 25.6 |

*Sources/Notes:* Taken from Edminster (1978). Table note from original source: “these values are for healthy stands. In dwarf mistletoe-infested stands, the increase in average d.b.h. due to thinning will be half the change indicated in the table.”

**Table 4-5:** Diameter lift table for lodgepole pine stands: Average residual diameters (inches) after partial cutting from below, and based on percentage of trees retained.

| QMD Before Cutting (Inches) | PERCENTAGE OF TREES RETAINED |     |     |     |     |     |     |     |     |
|-----------------------------|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
|                             | 10                           | 20  | 30  | 40  | 50  | 60  | 70  | 80  | 90  |
| 1                           | 1.6                          | 1.4 | 1.3 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 |
| 2                           | 2.9                          | 2.7 | 2.5 | 2.4 | 2.3 | 2.3 | 2.2 | 2.2 | 2.1 |
| 3                           | 4.2                          | 3.9 | 3.7 | 3.5 | 3.5 | 3.4 | 3.3 | 3.2 | 3.1 |
| 4                           | 5.5                          | 5.0 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 | 4.2 | 4.1 |
| 5                           | 6.7                          | 6.2 | 5.9 | 5.7 | 5.6 | 5.5 | 5.4 | 5.3 | 5.1 |
| 6                           | 7.8                          | 7.3 | 7.0 | 6.8 | 6.6 | 6.5 | 6.4 | 6.3 | 6.2 |

| QMD Before<br>Cutting (Inches) | PERCENTAGE OF TREES RETAINED |      |      |      |      |      |      |      |      |
|--------------------------------|------------------------------|------|------|------|------|------|------|------|------|
|                                | 10                           | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   |
| 7                              | 9.0                          | 8.4  | 8.1  | 7.9  | 7.7  | 7.6  | 7.5  | 7.3  | 7.2  |
| 8                              | 10.1                         | 9.5  | 9.2  | 9.0  | 8.7  | 8.6  | 8.5  | 8.4  | 8.2  |
| 9                              | 11.3                         | 10.6 | 10.3 | 10.0 | 9.7  | 9.6  | 9.5  | 9.4  | 9.3  |
| 10                             | 12.4                         | 11.7 | 11.3 | 11.1 | 10.8 | 10.7 | 10.6 | 10.4 | 10.3 |
| 11                             | 13.5                         | 12.8 | 12.4 | 12.1 | 11.8 | 11.7 | 11.6 | 11.5 | 11.3 |
| 12                             | 14.6                         | 13.9 | 13.5 | 13.2 | 12.8 | 12.7 | 12.6 | 12.5 | 12.4 |
| 13                             | 15.6                         | 14.9 | 14.5 | 14.2 | 13.9 | 13.8 | 13.7 | 13.5 | 13.4 |
| 14                             | 16.7                         | 16.0 | 15.6 | 15.3 | 14.9 | 14.8 | 14.7 | 14.6 | 14.4 |
| 15                             | 17.8                         | 17.0 | 16.6 | 16.3 | 15.9 | 15.8 | 15.7 | 15.6 | 15.4 |
| 16                             | 18.8                         | 18.1 | 17.6 | 17.3 | 16.9 | 16.9 | 16.8 | 16.6 | 16.5 |
| 17                             | 19.9                         | 19.1 | 18.7 | 18.3 | 18.0 | 17.9 | 17.8 | 17.7 | 17.5 |
| 18                             | 20.9                         | 20.1 | 19.7 | 19.4 | 19.0 | 18.9 | 18.8 | 18.7 | 18.5 |
| 19                             | 22.0                         | 21.2 | 20.7 | 20.4 | 20.0 | 20.0 | 19.8 | 19.7 | 19.6 |
| 20                             | 23.0                         | 22.2 | 21.7 | 21.4 | 21.1 | 21.0 | 20.9 | 20.8 | 20.6 |
| 21                             | 24.0                         | 23.2 | 22.7 | 22.4 | 22.1 | 22.0 | 21.9 | 21.8 | 21.6 |
| 22                             | 25.0                         | 24.2 | 23.7 | 23.4 | 23.1 | 23.0 | 22.9 | 22.8 | 22.7 |
| 23                             | 26.0                         | 25.2 | 24.8 | 24.4 | 24.2 | 24.1 | 24.0 | 23.8 | 23.7 |
| 24                             | 26.0                         | 26.0 | 25.8 | 25.4 | 25.2 | 25.1 | 25.0 | 24.9 | 24.7 |
| 25                             | 26.0                         | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 25.9 | 25.8 |

Sources/Notes: Same as for table 4-4.

**Table 4-6:** Diameter lift table for Engelmann spruce-subalpine fir stands: Average residual diameters (inches) after partial cutting from below, based on percentage of trees retained.

| QMD Before<br>Cutting (Inches) | PERCENTAGE OF TREES RETAINED |      |      |      |      |      |      |      |      |
|--------------------------------|------------------------------|------|------|------|------|------|------|------|------|
|                                | 10                           | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   |
| 1                              | 1.5                          | 1.4  | 1.3  | 1.2  | 1.2  | 1.1  | 1.1  | 1.1  | 1.1  |
| 2                              | 3.0                          | 2.7  | 2.6  | 2.5  | 2.3  | 2.3  | 2.2  | 2.2  | 2.1  |
| 3                              | 4.5                          | 4.1  | 3.8  | 3.7  | 3.5  | 3.4  | 3.3  | 3.2  | 3.1  |
| 4                              | 6.0                          | 5.4  | 5.1  | 4.9  | 4.6  | 4.5  | 4.4  | 4.3  | 4.2  |
| 5                              | 7.5                          | 6.7  | 6.3  | 6.1  | 5.8  | 5.6  | 5.5  | 5.3  | 5.2  |
| 6                              | 8.9                          | 8.1  | 7.6  | 7.3  | 6.9  | 6.8  | 6.6  | 6.4  | 6.2  |
| 7                              | 10.4                         | 9.4  | 8.8  | 8.5  | 8.1  | 7.9  | 7.7  | 7.5  | 7.2  |
| 8                              | 11.8                         | 10.7 | 10.1 | 9.7  | 9.3  | 9.0  | 8.8  | 8.5  | 8.3  |
| 9                              | 13.3                         | 12.0 | 11.3 | 10.8 | 10.4 | 10.1 | 9.9  | 9.6  | 9.3  |
| 10                             | 14.7                         | 13.3 | 12.5 | 12.0 | 11.6 | 11.3 | 11.0 | 10.6 | 10.3 |
| 11                             | 16.2                         | 14.6 | 13.8 | 13.2 | 12.7 | 12.4 | 12.0 | 11.7 | 11.4 |
| 12                             | 17.6                         | 15.9 | 15.0 | 14.4 | 13.9 | 13.5 | 13.1 | 12.8 | 12.4 |
| 13                             | 19.1                         | 17.2 | 16.2 | 15.6 | 15.0 | 14.6 | 14.2 | 13.8 | 13.4 |
| 14                             | 20.5                         | 18.5 | 17.5 | 16.7 | 16.2 | 15.7 | 15.3 | 14.9 | 14.5 |
| 15                             | 22.0                         | 19.8 | 18.7 | 17.9 | 17.3 | 16.9 | 16.4 | 16.0 | 15.5 |
| 16                             | 23.4                         | 21.1 | 19.9 | 19.1 | 18.5 | 18.0 | 17.5 | 17.0 | 16.5 |



| QMD Before<br>Cutting (Inches) | PERCENTAGE OF TREES RETAINED |      |      |      |      |      |      |      |      |
|--------------------------------|------------------------------|------|------|------|------|------|------|------|------|
|                                | 10                           | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   |
| 17                             | 24.8                         | 22.4 | 21.1 | 20.3 | 19.6 | 19.1 | 18.6 | 18.1 | 17.6 |
| 18                             | 26.3                         | 23.7 | 22.4 | 21.4 | 20.8 | 20.2 | 19.7 | 19.1 | 18.6 |
| 19                             | 27.7                         | 25.0 | 23.6 | 22.6 | 21.9 | 21.4 | 20.8 | 20.2 | 19.6 |
| 20                             | 29.1                         | 26.3 | 24.8 | 23.8 | 23.1 | 22.5 | 21.9 | 21.3 | 20.6 |
| 21                             | 30.6                         | 27.6 | 26.0 | 24.9 | 24.3 | 23.6 | 23.0 | 22.3 | 21.7 |
| 22                             | 32.0                         | 28.9 | 27.2 | 26.1 | 25.4 | 24.7 | 24.1 | 23.4 | 22.7 |
| 23                             | 33.4                         | 30.2 | 28.4 | 27.3 | 26.6 | 25.9 | 25.2 | 24.4 | 23.7 |
| 24                             | 34.9                         | 31.5 | 29.7 | 28.4 | 27.7 | 27.0 | 26.2 | 25.5 | 24.8 |
| 25                             | 36.3                         | 32.8 | 30.9 | 29.6 | 28.9 | 28.1 | 27.3 | 26.6 | 25.8 |

*Sources/Notes:* Taken from Edminster (1978). A *Diameter Lift Tables* section provides an example of how the information in these tables can be used to support development of silvicultural prescriptions and marking guides for intermediate treatments, and especially for low thinnings.

**Table 4-7:** Stand growth (inches of diameter growth per decade), in response to residual basal area levels (square feet per acre), for four Blue Mountain tree species.

| Residual Basal Area | Ponderosa Pine | Douglas-fir | Western larch | Lodgepole pine |
|---------------------|----------------|-------------|---------------|----------------|
| 20                  |                |             | 4.0           | 4.0            |
| 30                  | 4.0            |             | 3.0           | 2.5            |
| 40                  | 3.5            |             | 2.3           | 1.9            |
| 50                  | 3.0            | 4.0         | 2.0           | 1.6            |
| 60                  | 2.6            | 3.7         | 1.7           | 1.5            |
| 70                  | 2.4            | 3.2         | 1.5           | 1.3            |
| 80                  | 2.2            | 2.8         | 1.4           | 1.1            |
| 90                  | 2.0            | 2.5         | 1.2           | 1.0            |
| 100                 | 1.8            | 2.3         | 1.0           | 0.9            |
| 110                 | 1.7            | 2.0         | 0.9           | 0.8            |
| 120                 | 1.6            | 1.9         | 0.8           | 0.6            |
| 130                 | 1.5            | 1.7         | 0.7           | 0.5            |
| 140                 | 1.4            | 1.6         | 0.6           | 0.4            |
| 150                 | 1.3            | 1.5         | 0.6           | 0.4            |
| 160                 | 1.3            | 1.4         | 0.5           | 0.3            |
| 170                 | 1.2            | 1.3         |               | 0.3            |
| 180                 | 1.1            | 1.2         |               |                |
| 190                 | 1.0            | 1.1         |               |                |
| 200                 | 0.9            | 1.0         |               |                |

*Sources/Notes:* Taken from Hall (1987), specifically his figure 81 for ponderosa pine, figure 93 for Douglas-fir, figure 90 for western larch, and figure 86 for lodgepole pine.

## Treatment Longevity

After a thinning, why is being above the LLMZ of concern? After all, post-treatment density is still below the upper limit, so it's all good, right? To a certain extent, the answer to this question is yes – it's relatively good. But do you have circumstances (objectives; budgets) where you

can't count on being able to retreat the stand and adjust its stocking level within the next few decades? [This is a common scenario for large ownerships such as the national forests.]

If the answer to this question is “yes,” then leaving a higher stocking level than intended has shortened treatment longevity – the post-treatment stand may hit its upper limit stocking level sooner than otherwise. Instead of being maintained in a resilient density condition for 30 years, now it may hold for only 20 or 25 years, at which point another treatment would be needed to prevent it from entering the self-thinning zone.

How is treatment longevity estimated? Table 4-7 provides one option – it provides growth rates associated with residual basal area levels left after silvicultural treatments. Fast residual growth equals less treatment longevity; slow growth results in more treatment longevity.

Treatment longevity is of heightened concern in this climate change era (the Anthropocene) – climate change is an increasing stressor and stand vigor is more vulnerable now than earlier.

## **WESTERN WHITE PINE CONSIDERATIONS**

Western white pine, a mid-seral species, is occasionally found on cool moist, cool wet, and warm moist sites in the upper montane and lower subalpine vegetation zones. Table 4-8 shows the seral status of white pine (and other species) by potential vegetation type.

Western white pine is considered to have a limited geographical range in the Blue Mountains (Haig et al. 1941). It actually has a wide distribution, but it typically occurs as a minor species – it seldom comprises a plurality of basal area for any individual stand. Due to changes wrought by fire exclusion (encouraging invasion by grand fir and subalpine fir), bark-beetle outbreaks, and white pine blister rust, it is likely that white pine in the Blue Mountains was more abundant historically than at present.

Since the 1980s, western white pine has been included in reforestation plantings because it survives well and grows rapidly. Interest in planting white pine has existed for quite some time. When an extensive reconnaissance of the Wenaha National Forest (now the northern half of the Umatilla National Forest) was completed in 1913, it was thought that “white pine would be an excellent tree to plant on all the burns found on the higher altitudes.” The examiner, George Bright, believed that western white pine should be encouraged to the same extent that western yellow (ponderosa) pine was being encouraged at lower elevations (Bright and Powell 2008).

### **Western White Pine Stocking Levels**

Soon, plantations containing western white pine will need to be thinned. How should stocking objectives be determined for managed stands with a substantial component of white pine?

White pine was seldom present on sample plots used to develop potential vegetation classifications for the Blue Mountains ecoregion (Johnson and Clausnitzer 1992, Johnson and Simon 1987). Therefore, stocking levels for white pine could not be calculated by using productivity information provided in the field guides (as was done for the seven species included in this guide).

Seidel and Cochran (1981) used data from the northern Rocky Mountains to develop stocking level curves for western white pine. *Their white pine curves compare closely to those developed for Douglas-fir in eastern Oregon and eastern Washington*, and they suggested that Douglas-fir stocking levels could also be used for western white pine (Seidel and Cochran 1981).

**Table 4-8:** Tree species seral status for upland forest PVTs of the Blue Mountains.

| PVG                 | POTENTIAL VEG TYPE   | JUOC | PIPO | PSME | LAOC | PICO | PIMO | PIEN | ABGR | ABLA2 |
|---------------------|----------------------|------|------|------|------|------|------|------|------|-------|
| COLD UF             | ABGR/VASC            |      | ES   | MS   | ES   | ES   |      | LS   | PNC  |       |
|                     | ABLA2/CAGE           |      |      |      |      | ES   |      |      |      | PNC   |
|                     | ABLA2/MEFE           |      |      |      |      |      |      |      |      | PNC   |
|                     | ABLA2/VASC           |      |      | MS   | ES   | ES   |      | LS   |      | PNC   |
|                     | ABLA2/VASC/POPU      |      |      | MS   | ES   | ES   |      | LS   |      | PNC   |
|                     | PICO/CARU            |      |      |      |      | PNC  |      |      |      |       |
|                     | TSME/VAME+VASC       |      |      |      |      |      |      |      |      |       |
| MOIST UPLAND FOREST | ABGR/ACGL            |      | ES   | MS   | ES   |      | MS   | LS   | PNC  |       |
|                     | ABGR/BRVU            |      |      | MS   | ES   |      |      | LS   | PNC  |       |
|                     | ABGR/CLUN            |      | ES   | MS   | ES   | ES   | MS   | LS   | PNC  |       |
|                     | ABGR/GYDR            |      |      |      |      |      |      |      | PNC  |       |
|                     | ABGR/LIBO2           |      | ES   | MS   | ES   | ES   | MS   | LS   | PNC  |       |
|                     | ABGR/POMU-ASCA3      |      |      |      | ES   |      |      | LS   | PNC  |       |
|                     | ABGR/TABR/CLUN       |      | ES   | MS   | ES   |      |      | LS   | PNC  |       |
|                     | ABGR/TABR/LIBO2      |      |      | MS   | ES   |      | MS   | LS   | PNC  |       |
|                     | ABGR/TRCA3           |      |      |      | ES   |      |      | LS   | PNC  |       |
|                     | ABGR/VAME            |      | ES   | MS   | ES   | ES   |      | LS   | PNC  |       |
|                     | ABGR/VASC-LIBO2      |      |      | MS   | ES   | ES   |      | LS   | PNC  | LS    |
|                     | ABLA2/TRCA3          |      |      |      |      | ES   |      | LS   |      | PNC   |
|                     | ABLA2/CLUN           |      |      |      | ES   |      |      | LS   |      | PNC   |
|                     | ABLA2/LIBO2          |      |      |      | ES   |      |      | LS   |      | PNC   |
|                     | ABLA2/VAME           |      |      |      | ES   | ES   |      | LS   |      | PNC   |
|                     | PSME/ACGL-PHMA       |      | ES   | PNC  |      |      |      |      |      |       |
|                     | PSME/HODI            |      | ES   | PNC  |      |      |      |      |      |       |
| DRY UPLAND FOREST   | ABGR/CAGE            |      | ES   | MS   | ES   |      |      |      | PNC  |       |
|                     | ABGR/CARU            |      | ES   | MS   | ES   | ES   |      |      | PNC  |       |
|                     | ABGR/SPBE            |      | ES   | MS   | ES   | ES   |      |      | PNC  |       |
|                     | PIPO/AGSP            | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/ARTRV/FEID-AGSP | LS   | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/CAGE            | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/CARU            | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/CELE/CAGE       | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/CELE/FEID-AGSP  | LS   | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/CELE/PONE       | LS   | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/FEID            | LS   | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/PUTR/CAGE       |      | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/PUTR/CARO       | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/PUTR/FEID-AGSP  | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/SYAL            | A    | PNC  |      |      |      |      |      |      |       |
|                     | PIPO/SYOR            | A    | PNC  |      |      |      |      |      |      |       |
|                     | PSME/CAGE            |      | ES   | PNC  |      |      |      |      | A    |       |
|                     | PSME/CARU            |      | ES   | PNC  |      |      |      |      | A    |       |
|                     | PSME/PHMA            |      | ES   | PNC  | ES   |      |      |      |      |       |
|                     | PSME/SPBE            |      | ES   | PNC  |      |      |      |      |      |       |
|                     | PSME/SYAL            | A    | ES   | PNC  | ES   |      |      |      |      |       |
|                     | PSME/SYOR            |      | ES   | PNC  |      |      |      |      |      |       |
|                     | PSME/VAME            |      | ES   | PNC  |      |      |      |      |      |       |

*Sources/Notes:* Seral status is derived from Clausnitzer (1993), Hall (1973), Johnson and Clausnitzer (1992), and Steele et al. (1981). Seral status codes (Hall et al. 1995) are: PNC = dominates the potential natural community; LS = late seral; MS = mid seral; ES = early seral; A = accidental occurrence. PVG = potential vegetation group (Powell et al. 2007). A Species List (chapter 8) provides common and scientific names for plant symbols used in this table.

When white pine occurs in mixed stands, it is important to manage mountain pine beetle risk. White pines are particularly susceptible to mountain pine beetle attack, especially in mixed stands where lodgepole pine is present in sufficient numbers to serve as beetle attractant. If low-vigor lodgepole pines attract mountain pine beetle, any associated white pine will likely be killed – their thick phloem provides ideal beetle brood habitat (Mitchell 1989).

This insect behavior can accelerate compositional shifts because mountain pine beetle preferentially attacks certain species while ignoring others. This often results in non-host species such as true firs being released by mountain pine beetle activity (Eaton 1941, Fettig et al. 2007).

In mixed stands of ponderosa pine and white fir (at about a 50:50 ratio) originating on old burns and cutovers in northeastern California, attacks of mountain pine beetle were severe enough to change the species composition to nearly 100 percent white fir. Based on this work in the Warner Mountains of northeastern California (Eaton 1941), Eaton recognized the value of thinning for maintaining a reasonable proportion of vigorous ponderosa pine in the composition of mixed-species stands (Oliver and Uzoh 1997).

## **DEVISING A TREE PLANTING DENSITY**

Historically, forest managers have tended to be conservative, often planting more trees than is warranted by a site's carrying capacity. This approach is a 'hedge your bets' strategy for the future (Oliver and Larson 1996, Oliver et al. 1994).

But when ecologically based stocking level information is used to develop reforestation prescriptions, it is more closely aligned with a site's inherent stockability. This approach reduces the risk of planting more or fewer trees than are needed to fully utilize a site's growing space.

Research shows that at spacings of less than 10 feet (3 m), intertree competition reduces diameter growth of plantation trees. And the differences often persists (overcrowded plantations that fall behind early don't tend to catch up later) (Sjolte-Jorgensen 1967).

An example of how a stocking level (the lower limit of a management zone) could be used to formulate tree planting densities is provided by table 4-9 (and its extensive footnotes).

### **Managing Density to Avoid Stagnation**

When ideal site and environmental conditions coincide with abundant seed production, extremely dense tree stands can occur (Mowat 1953). In a dense stand on a uniform site, growth progresses normally, during a free-growth period, until the onset of intertree competition benchmark is reached (fig. 3-1). At that point, differentiation has not occurred, crown classes are not present (fig. 3-2), and most trees are about the same size – one tree is not able to take growing space away from another because neither has a competitive advantage.

Dense stands where height differentiation has occurred (table 4-2) may continue to develop normally because intertree competition can function properly – a self-thinning process (chapter 2) reduces density as tall trees suppress and eventually kill short trees. Effective stand development is indicated by differentiation into crown classes (fig. 3-2). Crown class differentiation is associated with a density benchmark known as the 'lower limit of full site occupancy' (fig. 3-1). This benchmark is also used as the lower limit of a management zone (fig. 3-3).

**Table 4-9:** Using the climate resilience stocking level to formulate tree planting density for ponderosa pine.

| POTENTIAL VEG TYPE  | CR (SDI) | TREES/ACRE (9" QMD) | SHORT-TERM MORTALITY | LONG-TERM MORTALITY | PLANTING DENSITY | SQUARE SPACING |
|---------------------|----------|---------------------|----------------------|---------------------|------------------|----------------|
| ABGR/CAGE           | 66       | 80                  | 28                   | 4                   | 112              | 20             |
| ABGR/CARU           | 99       | 119                 | 42                   | 6                   | 167              | 16             |
| ABGR/LIBO2          | 114      | 137                 | 48                   | 7                   | 193              | 15             |
| ABGR/SPBE           | 80       | 96                  | 34                   | 5                   | 135              | 18             |
| ABGR/VAME           | 91       | 110                 | 39                   | 6                   | 154              | 17             |
| ABGR/VASC           | 54       | 65                  | 23                   | 3                   | 91               | 22             |
| PIPO/AGSP           | 42       | 51                  | 18                   | 3                   | 71               | 25             |
| PIPO/CAGE           | 63       | 76                  | 27                   | 4                   | 107              | 20             |
| PIPO/CARU           | 114      | 137                 | 48                   | 7                   | 193              | 15             |
| PIPO/CELE/CAGE      | 73       | 88                  | 31                   | 5                   | 124              | 19             |
| PIPO/CELE/FEID-AGSP | 49       | 59                  | 21                   | 3                   | 83               | 23             |
| PIPO/FEID           | 61       | 74                  | 26                   | 4                   | 103              | 21             |
| PIPO/PUTR/CAGE      | 64       | 77                  | 27                   | 4                   | 108              | 20             |
| PIPO/PUTR/CARO      | 76       | 92                  | 32                   | 5                   | 129              | 18             |
| PIPO/PUTR/FEID-AGSP | 58       | 70                  | 25                   | 4                   | 98               | 21             |
| PIPO/SYAL           | 99       | 119                 | 42                   | 6                   | 167              | 16             |
| PIPO/SYOR           | 81       | 98                  | 34                   | 5                   | 137              | 18             |
| PSME/ACGL-PHMA      | 88       | 106                 | 37                   | 6                   | 149              | 17             |
| PSME/CAGE           | 69       | 83                  | 29                   | 4                   | 117              | 19             |
| PSME/CARU           | 82       | 99                  | 35                   | 5                   | 139              | 18             |
| PSME/HODI           | 106      | 128                 | 45                   | 7                   | 179              | 16             |
| PSME/PHMA           | 86       | 104                 | 36                   | 5                   | 145              | 17             |
| PSME/SPBE           | 110      | 133                 | 47                   | 7                   | 186              | 15             |
| PSME/SYAL           | 85       | 102                 | 36                   | 5                   | 144              | 17             |
| PSME/SYOR           | 113      | 136                 | 48                   | 7                   | 191              | 15             |
| PSME/VAME           | 60       | 72                  | 25                   | 4                   | 102              | 21             |

|                             |                                                                                                                                                                                                                                               |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential veg type</b>   | Selected potential vegetation types in which ponderosa pine occurs (mostly pertaining to the Blue and Ochoco Mountains); codes taken from table 3-1.                                                                                          |
| <b>CR (SDI)</b>             | SDI value, from table 3-1, for ponderosa pine for climate resilience (CR) stocking level. The CR level is selected as a target density because selecting a higher target presumes that noncommercial thinning will be necessary and feasible. |
| <b>Trees/Acre (9" QMD)</b>  | Trees per acre associated with the CR SDI value for an even-aged ponderosa pine stand with a quadratic mean diameter (QMD) of 9 inches; calculated by using this equation: $CR\ SDI / (9/10)^{1.77}$ (9 is the 9" QMD). CR SDI is column 2.   |
| <b>Short-term Mortality</b> | Estimated number of seedlings, per acre, that die during the first three years after planting. A survival percentage of 74% is assumed; it is based on long-term Umatilla National Forest data for plantation growth and survival.            |
| <b>Long-term Mortality</b>  | Estimated number of seedlings, per acre, that die between plantation certification (3 years) and when a stand reaches 9" QMD (a value of 5% is assumed).                                                                                      |
| <b>Planting Density</b>     | Total number of seedlings, per acre, that need to be planted to ensure that the tree density target (Trees/Acre at 9" QMD) is achieved. This Planting Density column is the mathematical sum of the previous three columns.                   |
| <b>Square Spacing</b>       | The intertree distance, rounded to the nearest foot, that needs to be used if the Planting Density objective is implemented by using a square spacing approach (fig. 3-11 provides information about intertree spacing).                      |



**Figure 4-7** – Dense lodgepole pine stand originating following the Tower Fire (burned in 1996; image from Powell 2019b). In many portions of this area, dense, ‘doghair’ stands of lodgepole pine became established, partly in response to cone serotiny storing huge amounts of seed in the canopy for long periods. Plots installed near postfire camera points often recorded 5,000 or more lodgepole pine trees per acre. Thousands of acres in the 51,000-acre Tower Fire have high potential for persistent stagnation.

In dense stands, most of a tree’s photosynthate is consumed for its own respiration, and growth may essentially cease. Stands where this occurs, and yet almost all the trees remain alive instead of some dying as a result of self-thinning, are considered to be stagnant (O’Hara and Oliver 1999, Oliver and Larson 1996, Smith et al. 1997). In the Blue Mountains, stagnation is most common for lodgepole pine and ponderosa pine (fig. 4-7, above). Stagnation potential is highest for poor (low productivity) sites, and in stands with extremely high tree density (O’Hara and Oliver 1999, Oliver and Larson 1996, Smith et al. 1997).

Lodgepole stands with high density should be thinned early (before age 10) to avoid stagnation (Cochran and Dahms 1998, Lotan and Critchfield 1990) (see fig. 4-10). Delaying or bypassing an early thinning can result in unreleasable stagnation and improper stand development.

Ponderosa pine, however, is more likely than lodgepole pine to remain physiologically young; stagnant ponderosa pine stands have responded to release at ages of 70 to 100 years with little apparent ill effect (Oliver and Ryker 1990). “Observations after partial cutting indicate that [ponderosa pine] trees with good crowns respond to increased growing space even when more than 250 years old. Dominant ponderosa pine also respond markedly to removal of adjacent subordinate trees (Barrett 1963)” (Cochran 1992).

Perhaps the most effective way to preclude stagnation, particularly for susceptible species growing on moisture-limited sites such as those prevalent in eastern Oregon and eastern Washington, is to prevent height repression by maintaining stand density below the upper limit of a management zone stocking level (O’Hara and Oliver 1999, Oliver et al. 1994).

## **MAINTAINING BALANCED TREE HEIGHT-TO-DIAMETER RATIOS**

A tree allocates photosynthate to differing needs in an order of precedence. Height growth has a higher priority than diameter growth (fig. 4-3), so high-density, low-vigor stands may eventually develop tall, spindly trees because height growth continues after diameter growth slows down or ceases (Oliver and Larson 1996, Wonn and O'Hara 2001).

Tall, spindly trees with an unbalanced height to diameter ratio, so-called 'wet noodles,' can't support themselves and tend to experience snow breakage (Oliver and Uzoh 1997), or they just bend over if adjacent support trees are removed or die. In the interior Pacific Northwest, trees with a high 'slenderness coefficient' (a height to diameter ratio of 80 or more) are most likely to become wet noodles (O'Hara and Oliver 1999, Wonn and O'Hara 2001).

An unbalanced height to diameter ratio can be avoided by maintaining stand density below the upper limit of a management zone, thereby ensuring that sufficient photosynthate is available for diameter growth (Oliver et al. 1994).

## **PRODUCING COMMERCIAL WOOD PRODUCTS**

The Langsaeter discussion (chapter 3) notes that density management strikes a balance between stand-level growth and tree-level growth (see fig. 3-5); maximum cubic-foot volume production is seldom compatible with maximum individual tree growth (Daniel et al. 1979a, Long 1985). Figure 4-8 shows board-foot and cubic-foot volume yields for ponderosa pine stands (site class IV; age 45) for a range of initial stand densities (Barrett 1971); it demonstrates that if dimension lumber is desired as a wood product, low-density stands can yield high volumes of merchantable timber (Sassaman et al. 1977).

Figure 4-8 shows that cubic-foot yield was remarkably consistent across a range of initial density; board-foot volume, however, was highest at low density, and lowest at high density. Since board-foot volume represents sawtimber products better than cubic-foot volume, figure 4-8 suggests that low stand density (such as the lower limit or climate resilience stocking levels) provides the greatest dividends in terms of usable wood volume.

### **Wood Quality**

Log quality may be influenced by density management treatments. Young stand thinning and wide tree spacing can affect log quality by producing larger branch diameters (bigger knots) and more juvenile wood (Bennett and Maguire 1995, Maguire et al. 1991). [Juvenile wood forms near a tree's center (pith); it tends to be structurally weak and prone to excessive shrinkage.]

Although thinning cannot eliminate knots, it can be used to control branch and knot size. An example: For lodgepole pine, branch size of two inches or less was associated with a density of at least 120 trees per acre; branch size of one inch or less resulted from an initial density of 500 trees per acre or more. This study means that silviculturists can exert control over branch size by how they prescribe noncommercial thinnings for lodgepole pine (Ballard and Long 1988). [But I don't suggest that noncommercial thinnings retain 500 or more trees per acre unless stands of low QMD, 2" or less, are being thinned.]

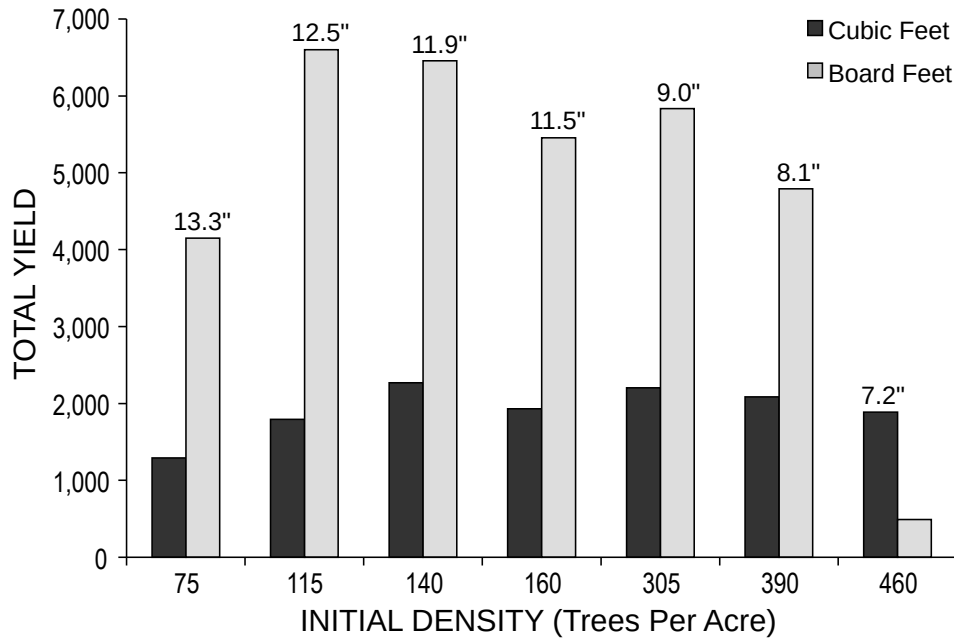


**Figure 4-8** – Total volume yield of site class IV ponderosa pine at age 45 for various initial tree densities (from Barrett 1971). Quadratic mean diameter, in inches, is shown directly above the highest yield bar – it illustrates the effect of initial tree density on diameter growth. This figure demonstrates that 115 trees per acre can produce more usable wood fiber (board feet) than a stocking level with more than three times as many trees (390).

## WILDLIFE AND RANGE MANAGEMENT

This stocking-level guide is useful for wildlife management because habitat for many wildlife species is closely tied to the forest structure they utilize (Thomas 1979). In the Blue Mountains, for example, roost trees used by big brown bats occur in an open forest structure, whereas those used by silver-haired bats are found in denser forest stands (Betts 1996).

Tree density is an important factor when identifying satisfactory elk cover, a wildlife habitat component defined as “a stand of coniferous trees at least 12 m (39 ft) tall and exceeding an average of 70 percent crown closure” (Thomas et al. 1979). Stocking tables in chapter 6 show that 70% canopy cover is at or above the upper limit of a management zone for many combinations of tree species and potential vegetation type occurring in the Blue Mountains (fig. 4-9).

The Thomas et al. (1979) elk cover guidelines have been used extensively in the Blue Mountains, including for national forest Forest Plans (USDA Forest Service 1990). One potential issue with the Thomas guidelines is they reflect conditions resulting from a long period of fire exclusion – recent wildfire trends suggest these crown closure conditions lack resilience to changing climatic and disturbance regimes (North et al. 2022, Powell 2012).

For some wildlife species, especially avian species, large-diameter trees provide an important habitat component. Density management treatments can be used to shift a site’s growth potential to fewer stems so the large-diameter trees needed for wildlife habitat are created more quickly (Cochran and Barrett 1993, 1995; Mowat 1953; Oliver et al. 1994).



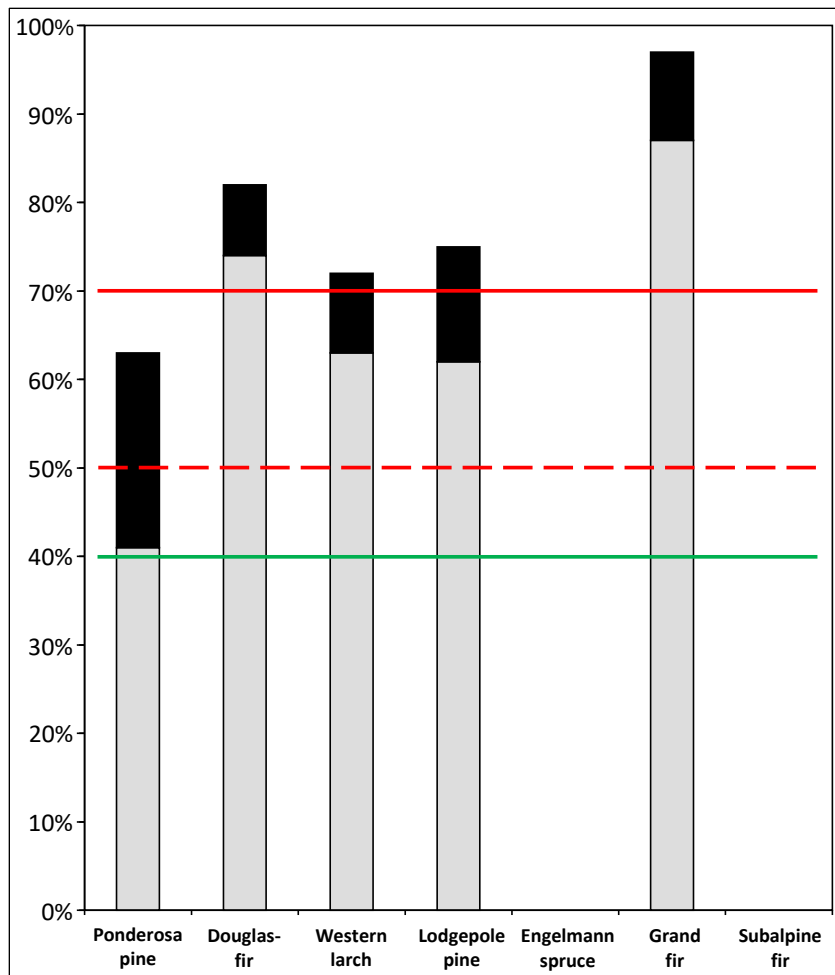


**Figure 4-9** – Canopy cover estimates for tree species of the Dry Upland Forest potential vegetation group (from Powell 2012). Blue Mountain elk cover standards (Thomas et al. 1979) use canopy cover limits: satisfactory cover is  $\geq 70\%$  cover (solid red line), and marginal cover is  $\geq 40\%$  canopy cover (solid green line). Bars are canopy cover estimates calculated by using Dealy's (1985) equations to convert basal area to canopy cover. The black portion of each bar shows canopy cover in the self-thinning zone (above the upper limit of a management zone, ULMZ); gray portion shows canopy cover below

the ULMZ (cover values taken from Powell 2013b). The Umatilla NF Forest Plan (USDA Forest Service 1990) has a separate satisfactory cover threshold for ponderosa pine (50% canopy cover), and it is shown here with a dashed red line. For the 70% satisfactory cover threshold, only dry-forest stands with a predominance of Douglas-fir or grand fir could provide that much canopy cover and still remain below the self-thinning zone.

Stand density information has been used for many wildlife and range purposes:

- SDI was used to characterize northern goshawk nesting habitat for Douglas-fir stands of the northern Rocky Mountains (Lilieholt et al. 1993, 1994).
- SDI was used to characterize elk thermal cover for ponderosa pine stands of the southwestern U.S., including a stocking chart and examples of its use (McTague and Patton 1989).
- Smith and Long (1987) used SDI to prepare elk hiding and thermal cover guidelines for lodgepole pine. They also developed a thinning prescription to delay self-pruning. *It is much easier to provide hiding cover with long-crowned lodgepole pine than with bare stem wood.*
- Cochran and Dahms (1998) found that if thinning is delayed past a mean stand height of 9 feet, it is difficult to delay crown recession, and once lodgepole pine crowns recede up the stem, they don't come back down again (fig. 4-10). They also concluded that early spacing was crucial to develop wide crowns and achieve satisfactory elk cover (fig. 4-9).
- SDI was used to develop a silvicultural prescription for Mexican spotted owl habitat in mixed-conifer and ponderosa pine forests of the southwestern U.S. (Fiedler and Cully 1995).



**Figure 4-10** – Low thinning in a lodgepole pine stand. This single-cohort lodgepole pine stand originated following a wildfire; it had app. 8,900 stems per acre before being thinned in the 1930s. The small-diameter surface fuel shown here resulted primarily from the 1930s thinning, but also from the self-thinning process.

When Cochran and Dahms (1998) studied lodgepole pine development after a wildfire in the Blue Mountains, they found: *“If thinning is delayed past a mean stand height of 9 feet, it is very difficult to delay or prevent crown recession, and once lodgepole pine crowns recede up a stem, they don’t come back down again.”* Stands with short crowns are ineffective at providing elk hiding cover because most cover must then be provided by bole wood instead of canopy foliage (Smith and Long 1987).

- Stand density has a strong relationship to undergrowth forage production (Dodd et al. 1972). SDI was useful for predicting understory forage production (graminoid, forb, and current-year shrub) on the Kaibab Plateau of northern Arizona (Moore and Deiter 1992). Basal area of 45 to 60 square feet provided an economically viable mix of beef and sawtimber (Clary et al. 1975) – this density range is similar to dry-forest values in this guide.
- Studies suggest that overstory cover significantly affects understory plant composition and production (Bedunah et al. 1988, McConnell and Smith 1965). For ponderosa pine stands of the southwestern U.S., herbage production under thinned stands was significantly greater for basal areas of less than 100 square feet per acre (fig. 4-11; Clary and Ffolliott 1966). In northeastern Oregon, shrub crown cover declined rapidly after overstory canopy cover exceeded 50 percent (fig. 4-12; Hedrick et al. 1968). Understory plant diversity for ponderosa pine forest was lowest where overstory density was high (Laughlin et al. 2007).

An ongoing policy of fire exclusion for the western U.S. suppresses an important thinning agent (frequent surface fire), and this inevitably leads to high stand density (Johnston et al. 2018). This forest densification trend contributes to reductions in nitrogen-fixing plants such as peavines, vetches, buffaloberry, and lupines (Newland and DeLuca 2000) – important contributors to soil nutrients and site productivity.

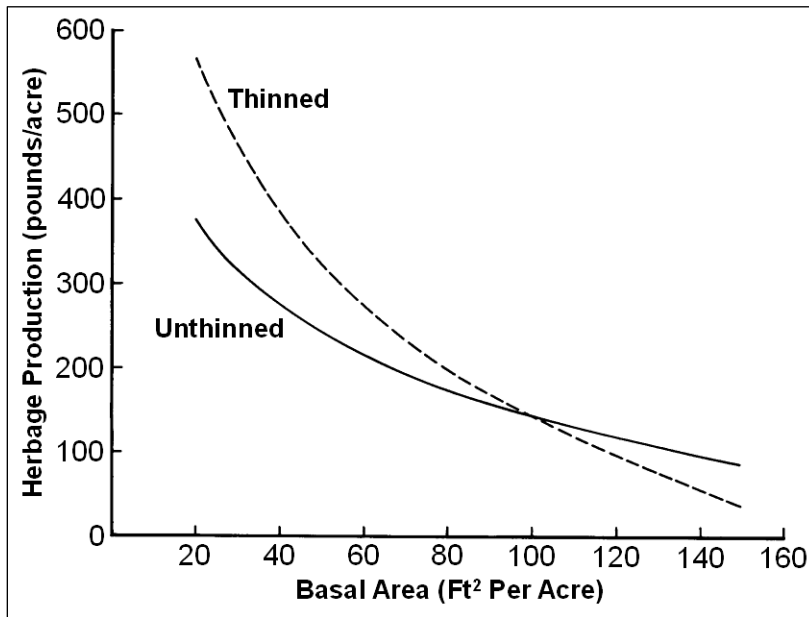


**Figure 4-11** – Differences in herbage production for thinned versus unthinned ponderosa pine stands in the Southwest (adapted from Clary and Ffolliott 1966). This figure shows that for basal areas of 100 square feet or less, herbage production for thinned stands is greater than for unthinned areas. A local study for eastern Oregon and Washington found understory herbage yield to be greater on thinned versus unthinned areas. And it was interesting that 45 percent canopy cover of ponderosa

pine seemed to function as a threshold – when pine cover exceeded 45%, forbs produced more herbage than grasses; below 45% cover, grasses were predominant (McConnell and Smith 1965).

Declining shrub abundance also has avian implications. When Blue Mountain sites were examined for neotropical migrant birds (Sallabanks et al. 2002), it was found they are influenced less by structural stage than by the presence or absence of understory shrubs, or down wood.

An important First Foods species for the Blue Mountains is big huckleberry. It often grows in the undergrowth of moist, mixed-conifer forests. Huckleberry is not particularly fire resistant and it may require several decades to return to pre-burn cover levels, so thinning (rather than prescribed fire) is often used to manage the overstory tree cover above huckleberry patches.

Thinning or fire (or both) are commonly used to manage the productivity and vigor of fruiting First Foods shrubs (serviceberry, huckleberry, chokecherry, thimbleberry, currants and gooseberries, elderberry, raspberry, buffaloberry, and others for the Blues). Figure 4-12 suggests that if it is desired to maintain the vigor of fruiting shrubs, then *managing overstory tree cover so it remains below 50 percent can effectively sustain acceptable berry production*.

## FUELS MANAGEMENT

Many studies (Churchill et al. 2017, Johnston et al. 2018, North et al. 2022) provide compelling evidence of forest densification across the West. Historical data reports relatively few trees per acre, but they were of large size and had fairly high basal areas. Contemporary stands typically contain many more trees but have lower basal areas and average stand diameters. This trend reflects that large trees are reduced, while smaller trees have increased substantially.

The trend has important implications because crown fire is becoming more prevalent due to higher levels of canopy fuel loading, and a proliferation of smaller trees leads to increased ladder fuels, an important fuels component allowing surface fire to easily transition to crown fire.

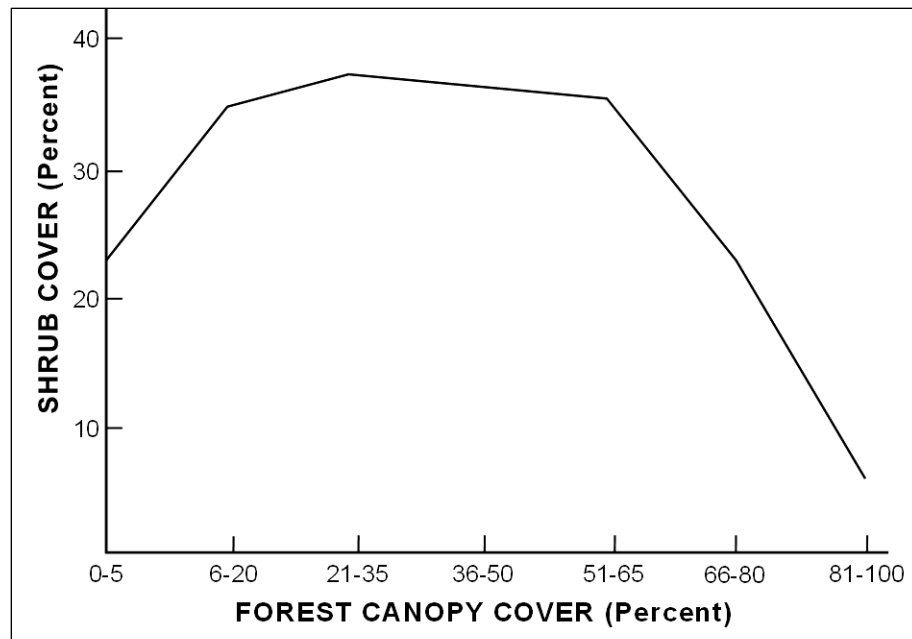


**Figure 4-12** – Relationship between shrub cover and forest cover for mixed-conifer forests of the Blue Mountains (adapted from Hedrick et al. 1968). Declining abundance of deciduous shrubs may relate to ungulate herbivory from deer and elk (Endress et al. 2012, Riggs et al. 2000), or from domestic live-stock grazing (Case and Kauffman 1997). But repeat photography studies (Skovlin and Thomas 1995) and research into overstory-understory relationships (Hedrick et al. 1968) have shown that shrub cover also tends to decline in response to increasing forest canopy cover.

Maintaining stand density near a lower stocking level, especially the Climate Resilience or Lower Limit level, provides advantages in terms of applying prescribed fire. Thinning is obviously an important first step, but for some ecosystem types, especially dry forests, the restoration job is not complete until an open, post-thinning environment has been treated with prescribed fire (Agee and Skinner 2005, North et al. 2022, Stephens et al. 2012b, and others). [There is much literature, only some of which is included in Chapter 9, supporting a combination of low thinning and prescribed fire as an ideal way to restore our currently lacking ‘open pine structure.’]

By modifying the format of figure 3-1 to include stand density characteristics for dry-forest stands containing a mix of ponderosa pine and Douglas-fir trees, and by making assumptions about how fire-caused tree mortality might vary in response to increasing stand density, figure 4-13 provides fuel loading estimates for four stocking levels described in this guide.

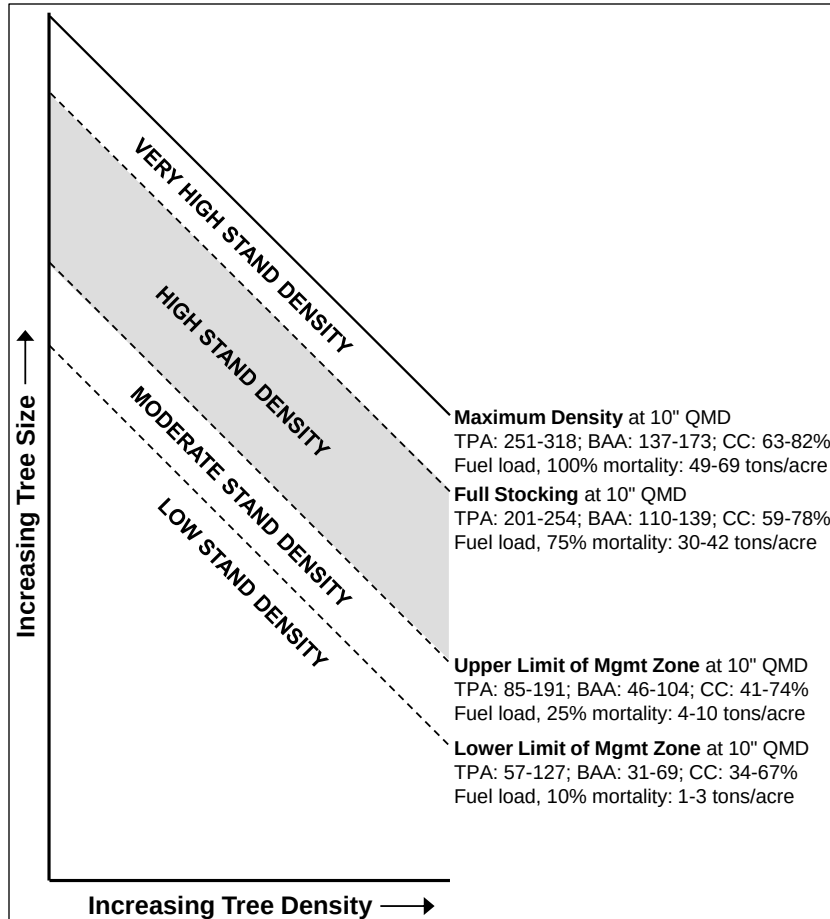


**Figure 4-13** – Relationship between stocking levels and fuel loading for dry upland forests (e.g., the Dry Upland Forest potential vegetation group).

Density ranges for trees per acre (TPA), basal area per acre (BA), and canopy cover (CC) relate to a mixed stand of ponderosa pine and Douglas-fir; the ponderosa pine value is shown first and the Douglas-fir value second (e.g., TPA: 251-318 for max density; 251 is max for pine; 318 is max for Douglas-fir). Density values are from Powell 2013b.

To derive the fuel loadings shown here, I first estimated what the fire-caused tree

mortality would be for each of the four stocking levels and then used bole weight conversion factors from table 2 in Brown et al. (2003) to convert the tree mortality (dead TPA) to its corresponding loading in tons per acre. [This figure is conceptual and not based on actual modeling, although fuel models could easily provide the data used for this chart.]

## 5. STAND DENSITY AND DISTURBANCE ECOLOGY

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Occasional old-growth pines killed by western pine beetle, pockets of mountain pine beetle mortality in younger, black-bark pine, and narrowing growth rings in nearly all live trees could cause a manager to conclude they are dealing with an 'over-the-hill' stand. But closer examination often reveals that the real cause of these changes is high stand density and little more.

In general, density-*dependent* mortality is more apparent in smaller trees due to the self-thinning process (see chapter 2), whereas density-*independent* mortality may be more evident in larger trees and it tends to be influenced by insects and diseases (Smith et al. 2005).

Density-dependent mortality may be a driving force of stand structure change when understory trees are dying at a higher rate than overstory trees. When high density causes an increase in tree mortality, it often occurs in the form of disturbance impact that clearly exceeds background levels. This chapter discusses how density affects insects, diseases, and other agents.

Susceptibility is the potential for a tree species to suffer damage or mortality in response to a disturbance (wildfire, insect outbreak, disease epidemic, etc.). It is evaluated by using stand characteristics such as species composition, forest structure, and tree density (Schmitt and Powell 2005, Steele et al. 1996). Since many disturbance processes are affected by stand density, susceptibility or hazard rating systems often include some type of stand density measure.

### HAZARD RATING

Stand hazard rating systems have been developed for central Idaho (Steele et al. 1996), the Blue Mountains (Schmitt and Powell 2005), and other portions of the interior Pacific Northwest (Garrison-Johnston et al. 2003). Stand density was a rating factor for a variety of disturbance agents, including Douglas-fir beetle, mountain pine beetle in lodgepole pine, spruce beetle, western pine beetle and mountain pine beetle in ponderosa pine, fir engraver, and western spruce budworm (Steele et al. 1996, Schmitt and Powell 2005).

To preclude serious tree mortality from mountain pine beetle, western dwarf mistletoe, and perhaps western pine beetle, stand density should be maintained below the upper limit of a management zone (figs. 3-3 and 3-6) (Barrett and Roth 1985, Cochran et al. 1994). To account for mountain pine beetle susceptibility, Cochran and others (1994) made adjustments to the upper limit stocking level for lodgepole and ponderosa pines.

Suggested stocking levels in this guide delineate a management zone in which stand densities are presumed to be relatively resistant to insect and disease problems (fig. 5-1) and to uncharacteristic fire severity (fig. 5-2). It also includes a climate resilience stocking level, which provides reasonable resistance to insect and disease agents and to climate change impacts.

### MOUNTAIN PINE BEETLE IN LODGEPOLE PINE

When examining mountain pine beetle (MPB) risk and hazard factors for lodgepole pine forests, Amman and Anhold (1989) found a negative correlation between SDI and tree mortality (e.g., less mortality occurred at high SDI levels than at low SDIs). This finding was assumed to reflect the fact that lower-density stands contain a higher proportion of large-diameter trees with thick phloem, providing ideal beetle-brood habitat (Anhold and Jenkins 1987).

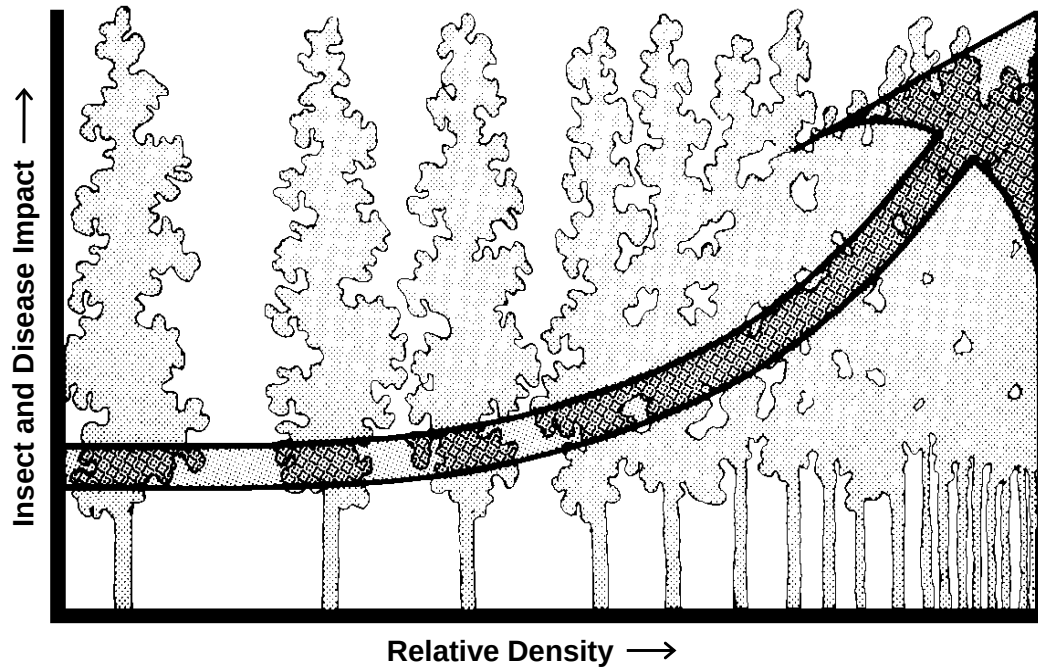


**Figure 5-1** – Insect and disease impact can vary with stand density (from Powell 1994). Because open stands generally have higher vigor levels than dense stands, they tend to be more resistant to insect and disease attack. Although not universally true, vigorous, widely spaced trees are generally able to better withstand attack from insects, pathogens, and parasites (see table 5-1).

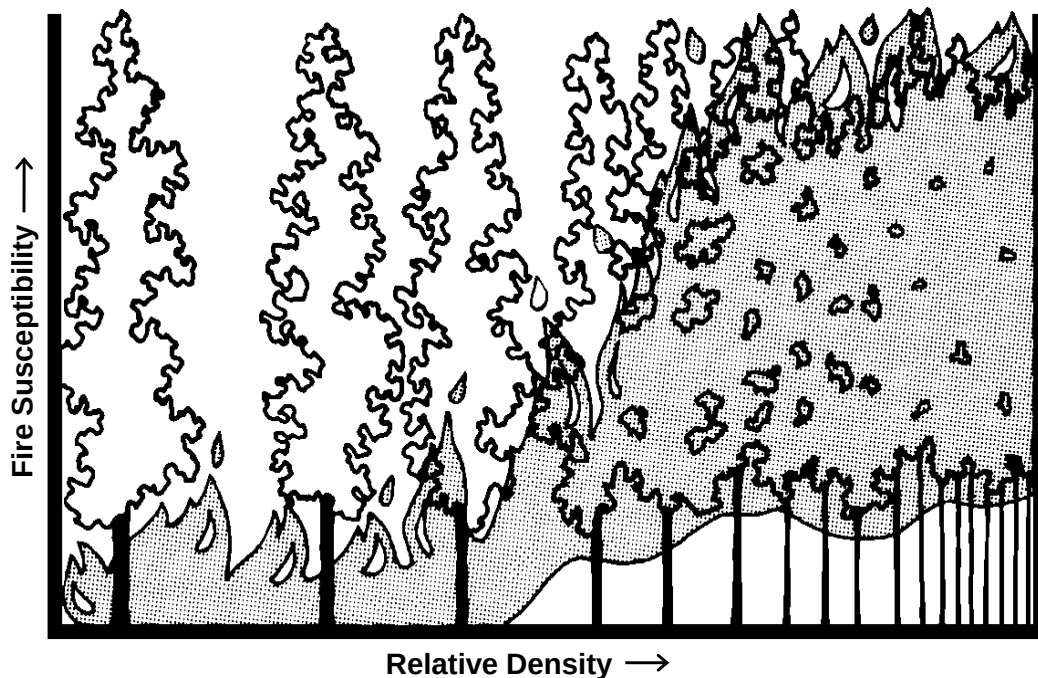


**Figure 5-2** – Fire severity varies with stand density (from Powell 1994). When moving across an open stand with widely spaced trees, fire tends to occur as a low-intensity surface burn. But when it encounters dense, closely spaced trees, fire is more likely to leave the surface and begin moving through the intermingled tree crowns as lethal, high-severity crown fire (Agee 1996, Powell 2010; see table 5-1). Ladder fuels contribute to a transition from surface to crown fire.

Anhold et al. (1996) identified a zone of high MPB susceptibility for lodgepole pine, consisting of relative densities between 20 and 35 percent of maximum SDI. This SDI zone results in rapid tree growth to a large size, including quadratic mean stand diameters greater than 8 inches, thereby creating a preponderance of trees with thick phloem.

Both studies (e.g., Amman and Anhold 1989, Anhold et al. 1996) suggest that dense lodgepole pine stands are unfavorable for MPB, presumably because they have a high proportion of smaller diameter trees with thin phloem, providing only marginal habitat for beetle broods.

For an MPB context, does thinning make a difference? Research found that thinning in lodgepole forest that had recently experienced a severe MPB outbreak had reduced surface fuel loadings, increased canopy fuels (e.g., more intact canopy), and similar carbon amounts when compared with unthinned stands, post-outbreak (Morris et al. 2023).

Some studies found that tree mortality due to MPB was insignificant until a threshold stand density level is reached, at which point mortality quickly escalated (Cochran 1992, Cochran and Barrett 1993, Mitchell et al. 1983, Oliver 1995, and others). Peterson and Hibbs (1989) analyzed published data from thinned and unthinned lodgepole pine stands for the Blue Mountains (Mitchell et al. 1983); they found that *an SDI of 160-170 was the threshold above which MPB-induced mortality became serious* for lodgepole pine (table 5-1).

Based partly on Peterson and Hibbs (1989), *an SDI threshold for high MPB susceptibility in lodgepole pine is 170 for stands with appreciable numbers of host trees greater than or equal to 9 inches in diameter* – Mitchell and Preisler (1991) showed that trees smaller than 9" in diameter are rarely attacked (due to their thin phloem) unless they are adjacent to a larger tree.

Table 5-2 summarizes trees per acre and basal area per acre values for lodgepole pine stands having a stand density index (SDI) of 170 (and for 2-inch increments of QMD).

**A Golden Rule:** To maintain low susceptibility to mountain pine beetle for lodgepole pine forests, keep stocking levels below a stand density index of 170, and keep average stand (tree) size below a quadratic mean diameter of 9 inches.

### Thinning For MPB Resistance In Lodgepole Pine

Thinning lodgepole pine increases tree vigor and resistance to mountain pine beetle attack (Mitchell et al. 1983). Fewer trees are killed in heavily thinned areas than in lightly thinned or unthinned stands (Preisler and Mitchell 1993, Schmitz et al. 1989, Whitehead and Russo 2005).

Waring and Pitman (1985) noted that the risk of a mountain pine beetle outbreak “can be greatly reduced by periodic thinning,” and that *improved bark-beetle resistance develops within three years of a thinning treatment*.

Relationships between stand density and mountain pine beetle susceptibility are complex, particularly for lodgepole pine ecosystems. Some thinning studies suggest that changes in stand microclimate (air movement, light intensity, etc.) influence mountain pine beetle attack, mostly because observed reductions in beetle activity occurred immediately after thinning; as described above for the Waring and Pitman (1985) study, an immediate response is too quick to be interpreted as a post-thinning tree vigor increase.



**Table 5-1:** Effects of stand density on important disturbance agents of the Blue Mountains.

| <b>DISTURBANCE</b>                    | <b>HOST TREES</b>                                                | <b>DAMAGE CAUSED</b>                                                                                                              | <b>EFFECTS OF STAND DENSITY OR THINNING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Annosus (Heterobasidion) root disease | True firs (S-type)<br>Ponderosa pine (P-type, on poor sites)     | Decay in lower tree stem<br>Tree mortality                                                                                        | Noncommercial thinning (or thinning and fertilization) increases grand fir vigor and growth, decreasing susceptibility to wound-associated stem decay from annosus root disease (Filip et al. 1992). High stand density allows easier disease transmission via root-to-root contact (Woodward et al. 1998). Repeated thinnings or partial-cutting entries involving removal of true fir may cause substantial root disease increases (Schmitt 2001).                                                                            |
| Armillaria root disease               | Douglas-fir<br>Grand fir<br>Pines (moderate)                     | Reduced tree vigor/growth<br>Decay in lower tree stem<br>Windthrow<br>Tree mortality                                              | A tendency toward greater tree mortality was observed for stands with high density (Filip et al. 1989c). Thinning increases host vigor and resistance to Armillaria (Schmitt 1999). Infected Douglas-fir stands should be thinned when trees are small rather than large (Entry et al. 1991).                                                                                                                                                                                                                                   |
| Atropellis canker                     | Lodgepole pine                                                   | Stem cankers<br>Tree mortality                                                                                                    | Atropellis severity, and tree mortality related to canker-caused girdling, are highest for dense, stagnated stands on cool sites (Hessburg et al. 1994, Schmitt 1999).                                                                                                                                                                                                                                                                                                                                                          |
| Douglas-fir beetle                    | Douglas-fir                                                      | Blue-staining of sapwood<br>Tree mortality                                                                                        | High stand density is positively correlated with high susceptibility (Weatherby and Thier 1993); in high-density stands, young trees are attacked and killed in addition to old ones (Furniss et al. 1979). Douglas-fir beetle tends to work from the 'top down' – largest trees in the stand are attacked first. If brood pressure is high and all the largest trees have already been attacked, then beetles make another pass and kill the next largest cohort (and so forth, down to a residual diameter of app. 7-9" dbh). |
| Douglas-fir tussock moth              | Douglas-fir<br>Grand fir                                         | Defoliation<br>Top-killing<br>Tree mortality                                                                                      | Outbreaks and damage levels are most severe on warm dry sites where host trees are stressed by competition for moisture and nutrients (Filip et al. 1996, Hessburg et al. 1994).                                                                                                                                                                                                                                                                                                                                                |
| Dwarf mistletoes                      | Douglas-fir<br>Lodgepole pine<br>Ponderosa pine<br>Western larch | Reduced tree vigor/growth<br>Top-killing<br>Stem deformities; brooms<br>Reduced seed production<br>Stem cankers<br>Tree mortality | Thinning increases intertree distance and can favor dwarf mistletoe seed dispersal and resulting spread rates. Stands thinned to a 12-foot spacing were almost optimal for mistletoe spread from tree to tree (Knutson and Tinnin 1980). Thinning can lessen impact in stands with a low dwarf mistletoe rating by removing infected trees, encouraging residual-tree height growth, and simplifying multi-layered structures (Baker 1988, Filip et al. 1989b, Hawksworth and Johnson 1989).                                    |
| Elytroderma blight                    | Ponderosa pine                                                   | Needle lesions; brooms<br>Reduced tree vigor/growth                                                                               | Thinning and other density management treatments can be used as preventive measures for high hazard sites (Schmitt 1999).                                                                                                                                                                                                                                                                                                                                                                                                       |

| <b>DISTURBANCE</b>                            | <b>HOST TREES</b>                | <b>DAMAGE CAUSED</b>                                   | <b>EFFECTS OF STAND DENSITY OR THINNING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------|----------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fir engraver                                  | Grand fir<br>Subalpine fir       | Brown-stained sapwood<br>Top-killing<br>Tree mortality | This bark beetle often attacks low-vigor trees weakened by overstocking (Hessburg et al. 1994). Resin production, a common defense of beetle-attacked firs, was significantly greater for high-vigor trees, including those in thinned areas (Filip et al. 1989a, Lewinsohn et al. 1993).                                                                                                                                                                                                                                                                                                                                                                                                     |
| Indian paint fungus<br>(rust red stringy rot) | Grand fir                        | Stem decay                                             | Noncommercial thinning (or thinning and fertilization) increases grand fir vigor and growth, decreasing susceptibility to wound-associated stem decay from Indian paint fungus (Filip et al. 1992).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Mountain pine beetle                          | Lodgepole pine<br>Ponderosa pine | Blue-staining of sapwood<br>Tree mortality             | For lodgepole pine, tree mortality is high once SDI exceeds 170 in stands containing trees over 9" dbh (Cochran et al. 1994). Thinning lodgepole pine increases tree vigor and beetle resistance (Mitchell et al. 1983). For ponderosa pine, maintain basal area below 75-100 square feet/acre to minimize susceptibility (Negrón and Popp 2004, Schmid and Mata 2005).                                                                                                                                                                                                                                                                                                                       |
| Pine butterfly                                | Ponderosa pine                   | Defoliation<br>Top-killing<br>Tree mortality           | Thinning and other density-management treatments have not been found to affect damage levels during an outbreak (DeMarco 2014, Kerns and Westlind 2013). Stands that are healthy and growing vigorously prior to an outbreak are best able to withstand and recover from defoliation impact. Thinning stands to maintain desirable stocking levels will enhance tree vigor and resistance to pine butterfly impact (Scott 2012).                                                                                                                                                                                                                                                              |
| Pine engraver (Ips beetles)                   | Lodgepole pine<br>Ponderosa pine | Top-killing<br>Tree mortality                          | May attack living trees after leaving green slash from thinnings. Preventing the build-up of Ips populations in slash is the best method to minimize damage from this beetle. Ips prefers fresh slash (moist phloem) that is 3-8" in diameter. Outside of an October to December timeframe, when 3-8" diameter slash can be lopped and scattered, avoid creating 3-8" diameter slash, or destroy it before beetles attack in April. Once slash has been fully colonized by beetles, they will emerge and attack stands of overstocked sapling and pole-sizes trees, especially during drought (when precipitation in the first half of the year is at least 25% below normal) (ODF 2021a, b). |
| Spruce beetle                                 | Engelmann spruce                 | Tree mortality                                         | Spruce beetle risk relates to stand density, one of four risk rating factors (Schmid and Frye 1976). Stand resistance can be enhanced by decreasing stocking levels to reduce competition and increase tree vigor (Hard 1985).                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Western pine beetle                           | Ponderosa pine                   | Blue-staining of sapwood<br>Tree mortality             | Western pine beetle damage is strongly associated with low stand vigor, regardless of source: root disease, drought, overstocking, fire wounding, and so forth (Keen 1950, Miller and Keen 1960, Whiteside 1951).                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| <b>DISTURBANCE</b>      | <b>HOST TREES</b>                                             | <b>DAMAGE CAUSED</b>                                                                                 | <b>EFFECTS OF STAND DENSITY OR THINNING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Western spruce budworm  | Douglas-fir<br>Engelmann spruce<br>Grand fir<br>Subalpine fir | Defoliation<br>Top-killing<br>Reduced tree vigor/growth<br>Reduced seed production<br>Tree mortality | Stress caused by factors such as drought, overstocking, and root disease influences susceptibility (Carlson and Wulf 1989, Filip et al. 1996). Fast-growing stands are less susceptible than dense, stagnant stands (Carlson 1989). Thinning increases tree and stand resistance, and it results in less defoliation damage (Carlson et al. 1985).                                                                                                                                                                                                                                                                                                                                                                             |
| White pine blister rust | Western white pine<br>Whitebark pine                          | Tree mortality                                                                                       | Infection rates have been shown to increase dramatically following thinning, particularly on sites with high rust hazard (Schmitt 1999).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Wildfire                | All species, though some are more resistant than others       | Tree wounding<br>Tree mortality                                                                      | Bark thickness, resin production, rooting depth, and crown base height affect surface fire resistance (Agee 1996). Stand density relates directly to crown fire susceptibility (Keyes and O'Hara 2002, Powell 2010).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Wind                    | All species, though some are more resistant than others       | Tree tops snapped out<br>Tree scraping/wounding<br>Tree mortality                                    | High stand density is considered to contribute to high windthrow hazard, primarily because trees in dense stands do not experience the wind-induced cambial stress that leads to formation of reaction wood (Alexander 1987). Windthrow often affects formerly dense stands that have been recently thinned – managing density regularly throughout a stand's development can help mitigate future windthrow potential. A metric referred to as slenderness coefficient (a ratio comparing tree height and diameter, in the same units) can serve as a good predictor of wind risk – trees with a slenderness coefficient of 80 or more are at high risk of wind or ice damage (O'Hara and Oliver 1999, Wonn and O'Hara 2001). |

*Sources/Notes:* Table format based on Safranyik et al. (1998). Forest insect information is derived primarily from Flanagan (1999). Forest disease information is based largely on Schmitt (1999). Host trees include native Blue Mountains species serving as a primary host of the insect or disease organism (Gast et al. 1991, Hayes et al. 2001). Scientific names for these organisms are provided in chapter 8, the Species List.

**Table 5-2:** Trees and basal area per acre values for lodgepole pine stands having an SDI of 170, for a range of quadratic mean diameter from 2 to 20 inches.

| QMD CLASS     | TREES PER ACRE | BASAL AREA PER ACRE |
|---------------|----------------|---------------------|
| 2 (1-2.9")    | <b>2797</b>    | <b>61</b>           |
| 4 (3-4.9")    | <b>837</b>     | <b>73</b>           |
| 6 (5-6.9")    | <b>413</b>     | <b>81</b>           |
| 8 (7-8.9")    | <b>251</b>     | <b>87</b>           |
| 10 (9-10.9")  | <b>170</b>     | <b>93</b>           |
| 12 (11-12.9") | <b>124</b>     | <b>97</b>           |
| 14 (13-14.9") | <b>95</b>      | <b>101</b>          |
| 16 (15-16.9") | <b>75</b>      | <b>105</b>          |
| 18 (17-18.9") | <b>61</b>      | <b>108</b>          |
| 20 (19-20.9") | <b>51</b>      | <b>111</b>          |

*Sources/Notes:* SDI threshold for high mountain pine beetle (MPB) susceptibility in lodgepole pine is 170 (Cochran et al. 1994, Cochran and Dahms 1998, Peterson and Hibbs 1989). *Lodgepole pine stands with stand densities greater than, or equal to, those shown in this table, and with a quadratic mean diameter (QMD) of 9" or greater (gray shading), have high susceptibility to MPB infestation.*

Table values for trees per acre, and basal area per acre, were calculated for the mid-point of a 2-inch QMD class (e.g., for the 18" class spanning diameter values of 17 to 18.9", calculated values relate to the mid-point diameter of 18 inches). Trees per acre, and basal area per acre, would obviously differ, slightly, for other diameter values within a 2-inch class.

Metrics in this table refer to individual lodgepole pine stands of differing quadratic mean stand diameter (QMD) – each row in the table refers to a stand with an SDI of 170. *Table values do not pertain to a range of diameter classes within a single stand.*

Here are some take-away messages from Table 5-2:

1. Table 5-2 is a 'go/no go' table for mountain pine beetle (MPB) and lodgepole pine (LP): *rows with gray shading have high susceptibility to mountain pine beetle attack.*
2. Gray (shaded) portion of table 5-2: this is a 'no-go' area for MPB, especially for stand density levels that meet, or exceed, the trees per acre (TPA) or basal area per acre (BA) values for a QMD class. *For lodgepole pine and management objectives emphasizing low levels of MPB susceptibility, it is important to prevent combinations of stand size (QMD) and stocking level in the gray portion of table 5-2.*
3. White (unshaded) portion of table 5-2: this is viewed as a 'go' area, based primarily on stand size (QMD). Although stocking level (SDI, TPA, BA) can almost be ignored for QMDs below 9 inches, *I believe the safest approach for small-diameter stands is to maintain stocking levels below an SDI of 170; then, when a stand crosses the important MPB size threshold of 9 inches QMD, stand density will already be in a zone of low susceptibility.*  
[This information pertains mostly to pure stands. For mixed-species stands, this MPB 'rule' (SDI <170; QMD <9") may be relaxed somewhat *unless lodgepole is the featured species.*]

## **MPB Process For Setting An Upper Limit: Lodgepole Pine**

For the Cochran et al. (1994) process, incorporating mountain pine beetle susceptibility results in a different procedure for establishing an upper limit of a management zone stocking level for lodgepole pine. An absolute threshold value is used as an upper limit – an SDI of 170.

This threshold reflects empirical evidence about tree mortality for thinned and unthinned lodgepole pine stands across a range of PVTs in the Blue Mountains, obtained during a widespread mountain pine outbreak in the 1970s (Mitchell et al. 1983, Peterson and Hibbs 1989).

For the Cochran et al. (1994) process, upper and lower management zone values are determined for lodgepole pine by using a 2-step process:

1. The Cochran et al. (1994) calculation method was completed first (calculate an upper limit (UL) value as 75% of the full stocking SDI) and compare the result with the absolute threshold value of SDI 170. If the calculated value is less than 170, it is used as the upper limit (this result happened only once, for the PICO/CARU PVT).
2. If the Cochran method results in an UL value exceeding SDI 170, then it is ignored and an absolute threshold (SDI 170) is used as the upper limit. *Table 5-3 provides ULMZ values for lodgepole pine that were adjusted to incorporate mountain pine beetle susceptibility.*

Upper and lower management zone limits for lodgepole pine that do not incorporate MPB susceptibility are calculated by using the same process as for the other 6 tree species – an upper limit (ULMZ) is calculated as 55% of maximum density, and a lower limit (LLMZ) is calculated as 35% of maximum density. Upper and lower limits that are not adjusted for MPB susceptibility are included in tables 3-1 and 5-3.

## **MOUNTAIN PINE BEETLE IN PONDEROSA PINE**

Mountain pine beetle (MPB) also attacks ponderosa pine (Olsen et al. 1996), especially younger, smaller-diameter, second-growth trees; western pine beetle is more common than MPB in older, larger-diameter, ponderosa pine trees (Miller and Keen 1960).

When Sartwell (1971) examined MPB effects on second-growth ponderosa pine in eastern Oregon and Washington, he found a direct relationship between stand density and beetle-induced tree mortality (fig. 5-3). Later studies found that when ponderosa pine stand density is reduced, then MPB-caused mortality declines as well (Egan et al. 2010, Fettig et al. 2007, Fiddler et al. 1989, Helvey 1975, Schmid and Mata 2005).

Sartwell's (1971) study suggests that better sites can carry higher basal area levels while continuing to sustain relatively low susceptibility to mountain pine beetle (fig. 5-3):

- Tree mortality from MPB is lowest on high-productivity areas (site class III in fig. 5-3), and tree killing acts like a low thinning in terms of its impact on stand structure.
- On moderate productivity areas (site class IV), tree mortality is greater than for the high sites, and it is insensitive to tree size because it affected a wide range of diameter classes.
- For low productivity areas (site class V), tree mortality is considerable, and it resembles a heavy thinning from above because larger trees are killed more often than smaller ones.

**Table 5-3:** Lodgepole pine stocking levels (SDI) that were not adjusted for mountain pine beetle susceptibility (*Without MPB* columns), along with values that do reflect MPB susceptibility (*With MPB* columns).\*

| POTENTIAL<br>VEGETATION TYPE       | Maximum<br>Density                                                       | Full<br>Stocking | Without MPB |      | With MPB          |                   |
|------------------------------------|--------------------------------------------------------------------------|------------------|-------------|------|-------------------|-------------------|
|                                    |                                                                          |                  | LLMZ        | ULMZ | LLMZ <sup>1</sup> | ULMZ <sup>1</sup> |
| ABGR/ARCO <sup>3</sup>             | 384                                                                      | 307              | 134         | 211  | 114               | 170               |
| ABGR/CARU                          | 384                                                                      | 307              | 134         | 211  | 114               | 170               |
| ABGR/CLUN <sup>2</sup>             | 428                                                                      | 342              | 150         | 235  | 114               | 170               |
| ABGR/LIBO2                         | 543                                                                      | 434              | 190         | 298  | 114               | 170               |
| ABGR/LIBO2 <sup>2</sup>            | 380                                                                      | 304              | 133         | 209  | 114               | 170               |
| ABGR/VAME                          | 298                                                                      | 238              | 104         | 164  | 114               | 170               |
| ABGR/VAME <sup>2</sup>             | 331                                                                      | 265              | 116         | 182  | 114               | 170               |
| ABGR/VASC                          | 370                                                                      | 296              | 130         | 204  | 114               | 170               |
| ABGR/VASC-LIBO2                    | 413                                                                      | 330              | 144         | 227  | 114               | 170               |
| ABLA2/ARCO <sup>3</sup>            | 556                                                                      | 445              | 195         | 306  | 114               | 170               |
| ABLA2/CAGE                         | 490                                                                      | 392              | 172         | 270  | 114               | 170               |
| ABLA2/LIBO2 <sup>2</sup>           | 333                                                                      | 266              | 116         | 183  | 114               | 170               |
| ABLA2/MEFE <sup>2</sup>            | 360                                                                      | 288              | 126         | 198  | 114               | 170               |
| ABLA2/POPU <sup>3</sup>            | 405                                                                      | 324              | 142         | 223  | 114               | 170               |
| ABLA2/STAM <sup>2,4</sup>          | 359                                                                      | 287              | 126         | 197  | 114               | 170               |
| ABLA2/STOC <sup>3</sup>            | 490                                                                      | 392              | 172         | 270  | 114               | 170               |
| ABLA2/TRCA3                        | 556                                                                      | 445              | 195         | 306  | 114               | 170               |
| ABLA2/VAME                         | 319                                                                      | 255              | 112         | 175  | 114               | 170               |
| ABLA2/VAME <sup>2</sup>            | 381                                                                      | 305              | 133         | 210  | 114               | 170               |
| ABLA2/VASC                         | 396                                                                      | 317              | 139         | 218  | 114               | 170               |
| ABLA2/VASC/POPU <sup>2</sup>       | 405                                                                      | 324              | 142         | 223  | 114               | 170               |
| PICO/CARU                          | 279                                                                      | 223              | 98          | 153  | 112               | 167               |
| PICO(ABGR)/ALSI <sup>3</sup>       | No parent plant association was identified for this plant community type |                  |             |      |                   |                   |
| PICO(ABGR)/ARNE <sup>3</sup>       | 298                                                                      | 238              | 104         | 164  | 114               | 170               |
| PICO(ABGR)/VAME <sup>3</sup>       | 298                                                                      | 238              | 104         | 164  | 114               | 170               |
| PICO(ABGR)/VAME/CARU <sup>3</sup>  | 298                                                                      | 238              | 104         | 164  | 114               | 170               |
| PICO(ABGR)/VAME-LIBO2 <sup>3</sup> | 543                                                                      | 434              | 190         | 298  | 114               | 170               |
| PICO(ABGR)/VAME/PTAQ <sup>3</sup>  | 298                                                                      | 238              | 104         | 164  | 114               | 170               |
| PICO(ABGR)/VASC/CARU <sup>3</sup>  | 370                                                                      | 296              | 130         | 204  | 114               | 170               |
| PICO(ABLA2)/STOC <sup>3</sup>      | 490                                                                      | 392              | 172         | 270  | 114               | 170               |
| PICO(ABLA2)/VAME <sup>3</sup>      | 319                                                                      | 255              | 112         | 175  | 114               | 170               |
| PICO(ABLA2)/VASC <sup>3</sup>      | 396                                                                      | 317              | 139         | 218  | 114               | 170               |
| PICO(ABLA2)/VASC/POPU <sup>3</sup> | 405                                                                      | 324              | 142         | 223  | 114               | 170               |
| TSME/VASC+VAME <sup>2</sup>        | 283                                                                      | 226              | 99          | 155  | 114               | 170               |

\* A few potential vegetation types of the Blue-Ochoco and Wallowa-Snake geographical areas are not included here because stocking-level information was not provided for them in the productivity appendices of the Blue-Ochoco and Wallowa-Snake field guides (Johnson and Clausnitzer 1992, Johnson and Simon 1987); the field guides often do not include growth-basal-area stocking data for plant community types or plant communities – but see footnote 4.

<sup>1</sup> The lower (LLMZ) and upper (ULMZ) limits of a management zone were adjusted to reflect mountain pine beetle (MPB) susceptibility for lodgepole pine (lodgepole pine stands with high susceptibility to mountain pine beetle have an SDI of 170 or more, and a QMD of 9 inches or greater; Cochran et al. 1994).

<sup>2</sup> These are potential vegetation types from the Wallowa-Snake guide (Johnson and Simon 1987), and their stocking levels are derived from table 4 in Cochran et al. (1994); all other PVT listings refer to the Blue-Ochoco guide (Johnson and Clausnitzer 1992), and their stocking levels are derived from table 3 in Cochran et al. (1994).

<sup>3</sup> These potential vegetation types are plant community types or plant communities, and their suggested stocking levels are the same as those for their parent plant association (table 2-1) (e.g., stocking levels for ABGR/ARCO are the same as those for ABGR/CARU, its parent association).

<sup>4</sup> These types are identified as plant community types in the Wallowa-Snake field guide (Johnson and Simon 1987), but productivity information was provided for them in appendix E of Johnson and Simon (1987), so their stocking levels are derived from table 4 of Cochran et al. 1994, rather than basing them on the stocking levels of their parent plant association (see footnote 3).

#### **ADDITIONAL NOTES**

- A. ***SDI values in this table pertain to an even-aged structure***, and to a quadratic mean stand diameter (QMD) of 10 inches (Reineke 1933). Stand density information presented later in this guide (chapter 6) provides values for irregular and uneven-aged structures, and for QMDs other than 10".
- B. Calculations for SDI, basal area, trees per acre, QMD, and other stand-level metrics should include all live trees 1" dbh and greater. Calculations that consider only trees 5" dbh and greater result in slightly different results than those included in this table.
- C. Chapter 8, the Species List, provides common and scientific plant names for the alphanumeric codes used to name the potential vegetation types in this table.

#### **COLUMN HEADINGS FOR TABLE 5-3**

|                                  |                                                                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential Vegetation Type</b> | Abbreviation for potential vegetation type name; taken from table 3-1.                                                                                                                         |
| <b>Maximum Density</b>           | Maximum density SDI value for lodgepole pine for the potential vegetation type, taken from table 3-1.                                                                                          |
| <b>Full Stocking</b>             | Full stocking SDI value for lodgepole pine for a potential vegetation type, taken from tables 3 and 4 in Cochran et al. 1994, and table 3-3 in this guide.                                     |
| <b>LLMZ (Without MPB)</b>        | Calculated lower limit of a management zone (LLMZ) SDI value without any adjustment for mountain pine beetle susceptibility. This value is 35% of the maximum density value shown in column 2. |
| <b>ULMZ (Without MPB)</b>        | Calculated upper limit of a management zone (ULMZ) SDI value without any adjustment for mountain pine beetle susceptibility. This value is 55% of the maximum density value shown in column 2. |
| <b>LLMZ (With MPB)</b>           | LLMZ SDI value calculated by using the Cochran et al. (1994) process for lodgepole pine, and it incorporates mountain pine susceptibility.                                                     |
| <b>ULMZ (With MPB)</b>           | ULMZ SDI value calculated by using the Cochran et al. (1994) process for lodgepole pine, and it incorporates mountain pine susceptibility.                                                     |

Sartwell concluded that mountain pine beetle functions opportunistically in second-growth ponderosa pine stands, and that beetle outbreaks are attributable to two main causes (Sartwell

1971, Sartwell and Dolph 1976, Sartwell and Stevens 1975):

- Second-growth stands are typically even-aged, and they have been ecologically simplified when compared with the uneven-aged, 'virgin' forest; and
- EuroAmerican fire exclusion removes an important thinning agent (Weaver 1947), causing an unnatural accumulation of stand density as compared to historical conditions.

I find it compelling that Meyer's normal yield table bulletin for ponderosa pine shows basal area growth leveling off dramatically at age 50 to 60 (see fig. 4 in Meyer 1961), *regardless of site index*, which happens to coincide with the stand age at which Sartwell (1971) noted that mountain pine beetle outbreaks tend to commence in second-growth ponderosa pine forest.

These relationships between mountain pine beetle and ponderosa pine reinforce a key finding from table 5-1: Armillaria root disease, defoliating insects, and other important Blue Mountains disturbance agents are not particularly impactful in ponderosa pine forests, but bark beetles are of prime importance (Keen 1936). And figure 5-3 clearly shows that high-productivity sites experience less tree killing by MPB, but *regardless of site class (productivity), MPB-caused tree mortality for ponderosa pine increases dramatically at high levels of basal area*.

Local experience (Andrew Addessi, personal communication) suggests that relationships portrayed in figure 5-3 may not be exclusive to just mountain pine beetle. Often, a bark-beetle cohort is involved, including MPB, western pine beetle, and pine engraver (Ips).

Studies examining ponderosa pine stand density and MPB-induced mortality identified basal-area thresholds below which mortality was minimal. These studies, completed over four decades and by different investigators, provide an interesting narrative about how science evolves through time.

For second growth stands of ponderosa pine, initial recommendations were that stand density be maintained *below 150 square feet of basal area per acre*, allowing vulnerable stands to withstand at least moderate attack from MPB (Larsson et al. 1983, Myers 1974, Oliver 1995, Oliver and Uzoh 1997, Sartwell 1971, Sartwell and Dolph 1976, Sartwell and Stevens 1975).

Subsequent studies found that a basal area threshold of 150 square feet per acre was too high and they suggested that ponderosa pine basal area be *maintained at 120 square feet per acre or less* to minimize bark beetle risk (Obedzinski et al. 1999, Schmid and Mata 1992). Then, further work suggested that even 120 square feet per acre may be too high, and it recommended an *upper threshold basal area of 75-100 square feet per acre* to minimize MPB risk in ponderosa pine forest (Negrón and Popp 2004, Schmid and Mata 2005).

*Many studies corroborate that 100 square feet of basal area is an effective upper threshold for minimizing MPB attack in second growth stands of ponderosa pine* (Fiddler et al. 1989, Helvey 1975, Mallams 2006, etc.).

### **MPB Process For Setting An Upper Limit: Ponderosa Pine**

Cochran et al. (1994) describes that susceptibility of ponderosa pine to MPB attack is related to stocking levels within broad ranges of site index (Barrett 1979, Cochran and Barrett 1983).



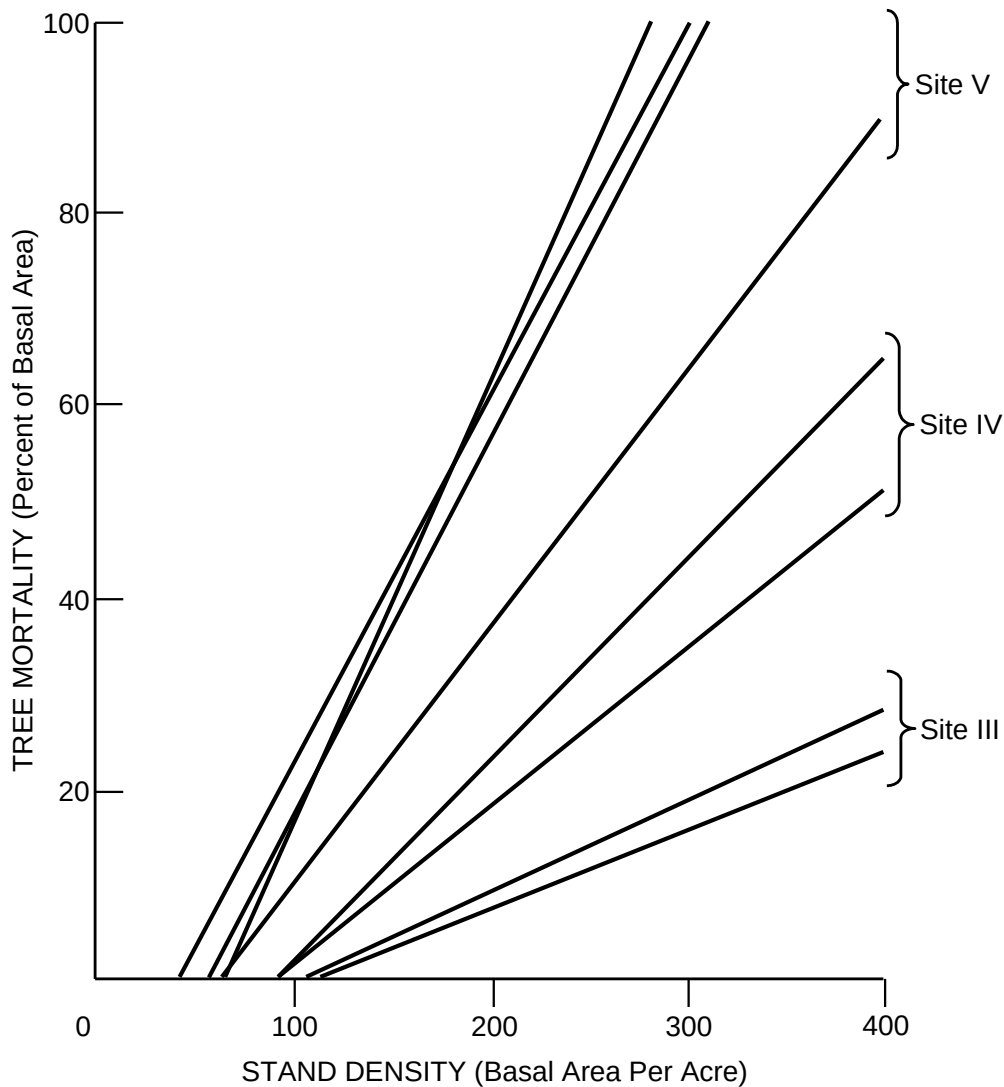


**Figure 5-3** – Tree killing by mountain pine beetle, as related to stand density and site productivity, for eight pole-sized, second-growth ponderosa pine stands in eastern Oregon and eastern Washington (from Sartwell 1971). Ponderosa pine can be assigned to site classes by using potential vegetation information from Johnson and Clausnitzer (1992) and Johnson and Simon (1987):

**Site Class III:** PSME/HODI.

**Site Class IV:** ABGR/LIBO2, ABGR/VAME, ABGR/SPBE, ABGR/CARU, ABGR/CAGE, PIPO/SYAL.

**Site Class V:** ABGR/VASC, PSME/ACGL-PHMA, PSME/PHMA, PSME/SYAL, PSME/VAME, PSME/CARU, PSME/CAGE, PSME/SPBE, PSME/SYOR, PIPO/SYOR, PIPO/CARU, PIPO/CAGE, PIPO/CELE/CAGE, PIPO/PUTR/CAGE, PIPO/PUTR/CARO.

For ponderosa pine, Cochran et al. (1994) did not provide an absolute ULMZ limit, although one was declared indirectly: “for higher values of site index, the ULMZ can be set at 74 percent of 365” (Cochran et al. 1994, page 4); this results in a ULMZ value of 270 (74% of 365). *It is interesting that an SDI of approximately 270 was recently identified as a threshold of high MPB susceptibility for ponderosa pine in Colorado* (Negrón and Popp 2004).

An SDI value of 270 is similar to, but slightly higher than, what was suggested by Oliver

(1995), Oliver and Uzoh (1997), and Cochran and Barrett (1993) – they indicated that an SDI of 200 to 230 might be appropriate as the upper limit of a management zone for ponderosa pine. Oliver and Uzoh (1997), however, propose that an SDI of 230 is the lower edge of a ‘zone of imminent bark beetle mortality’ for ponderosa pine, and that stand density should remain below this threshold to minimize mortality from MPB.

The Oliver and Uzoh (1997) threshold value is also supported by Blue Mountains data from Flat Creek on the Malheur National Forest (Cochran and Barrett 1993, 1995). [But note that other long-term plots on the Malheur National Forest (Crawford Creek) experienced high mortality from MPB once SDI exceeded 140 (Rabin et al. 2009).]

For the Cochran et al. (1994) process involving MPB susceptibility, the upper limit of a management zone (UL) was determined for ponderosa pine by using a 2-step method:

1. A procedure described in Cochran et al. (1994) was completed first; it calculates a UL value by using site index values and equation 3 from that source; these calculation results are presented in table 5-4.
2. If the Cochran procedure resulted in a UL value exceeding an SDI of 270, then the calculated value was ignored, and an absolute threshold (270) was used as the ULMZ. Table 5-4 includes ‘MPB ULMZ’ values that account for MPB susceptibility.

After calculating UL values reflecting MPB susceptibility, corresponding lower limit values were calculated as 67% of the UL values. These are the ‘MPB LLMZ’ values in table 5-4.

Ponderosa pine stocking levels that were not adjusted to account for MPB susceptibility were calculated by using the same process employed for the other six tree species – an upper limit is 55% of maximum density, a lower limit is 35% of maximum density, and a climate resilience level is 25% of maximum density. Upper and lower management zone limits for ponderosa pine – not adjusted for MPB – are provided in table 3-1.

## **PONDEROSA PINE FOCUS TREES**

Thinning ponderosa pine to manage bark beetle susceptibility could help prevent development of ‘focus trees’ – larger diameter trees that function as bark beetle attractant (Eckberg et al. 1994). The physiological factors promoting development of focus trees are not fully known, but they likely relate to a tree’s emission of volatile compounds (Eckberg et al. 1994, Person 1931), such as high levels of ethanol or other chemical indicators of tree stress (Kelsey 2001).

Focus tree development shows that tree density relationships may need to be placed in a broader context (Koontz et al. 2021). An individual tree’s vigor and susceptibility status is a function of its position within a local neighborhood (Sherlock 2007). Just as stands exist in a stand neighborhood at a landscape scale, trees exist in a tree neighborhood at a stand scale. An essential tenet of forest management is to look up one level to understand context, and to look down one level to understand process and function (Haynes et al. 1996). Therefore, the stand context should be examined and understood when evaluating the neighborhood context for focus trees.

Recent journal papers emphasize the importance of restoring historically appropriate intra-stand structure, especially for dry-forest ecosystems (Churchill et al. 2017, Johnston et al. 2018, Larson and Churchill 2012, Larson et al. 2012).

**Table 5-4:** Ponderosa pine stocking levels (SDI) for upper and lower limits of a management zone that reflect mountain pine beetle (MPB) susceptibility (Cochran et al. 1994).

| <b>Potential Vegetation Type</b> | <b>Full Stocking</b> | <b>Meyer SI</b> | <b>Barrett SI</b> | <b>Calculated ULMZ</b> | <b>Adjustment Fraction</b> | <b>MPB ULMZ</b> | <b>MPB LLMZ</b> |
|----------------------------------|----------------------|-----------------|-------------------|------------------------|----------------------------|-----------------|-----------------|
| ABGR/ACGL <sup>2</sup>           | 365                  | 92              | 101               | 238                    | 1.00                       | 238             | 159             |
| ABGR/CAGE                        | 210                  | 80              | 88                | 190                    | 0.58                       | 109             | 73              |
| ABGR/CARU                        | 316                  | 77              | 85                | 178                    | 0.87                       | 154             | 103             |
| ABGR/CARU <sup>2</sup>           | 365                  | 101             | 111               | 270*                   | 1.00                       | 270             | 181             |
| ABGR/CLUN <sup>2</sup>           | 365                  | 98              | 108               | 262                    | 1.00                       | 262             | 176             |
| ABGR/LIBO2                       | 365                  | 73              | 80                | 162                    | 1.00                       | 162             | 108             |
| ABGR/SPBE                        | 255                  | 85              | 94                | 210                    | 0.70                       | 147             | 98              |
| ABGR/SPBE <sup>2</sup>           | 365                  | 103             | 113               | 270*                   | 1.00                       | 270             | 181             |
| ABGR/VAME                        | 292                  | 76              | 84                | 174                    | 0.80                       | 139             | 93              |
| ABGR/VAME <sup>2</sup>           | 339                  | 92              | 101               | 238                    | 0.93                       | 221             | 148             |
| ABGR/VASC                        | 172                  | 86              | 95                | 214                    | 0.47                       | 101             | 68              |
| ABLA2/CLUN <sup>2</sup>          | 303                  | 118             | 130               | 270*                   | 0.83                       | 224             | 150             |
| PIPO/AGSP                        | 133                  | 59              | 65                | 106                    | 0.36                       | 38              | 26              |
| PIPO/AGSP <sup>2</sup>           | 186                  | 75              | 83                | 170                    | 0.51                       | 86              | 58              |
| PIPO/ARTRV/FEID-AGSP             | 190                  | 81              | 89                | 194                    | 0.52                       | 101             | 68              |
| PIPO/CAGE                        | 201                  | 70              | 77                | 150                    | 0.55                       | 82              | 55              |
| PIPO/CARU                        | 365                  | 71              | 78                | 154                    | 1.00                       | 154             | 103             |
| PIPO/CELE/CAGE                   | 232                  | 65              | 72                | 130                    | 0.64                       | 82              | 55              |
| PIPO/CELE/FEID-AGSP              | 157                  | 51              | 56                | 73                     | 0.43                       | 32              | 21              |
| PIPO/CELE/PONE                   | 159                  | 61              | 67                | 114                    | 0.44                       | 49              | 33              |
| PIPO/FEID                        | 194                  | 62              | 68                | 118                    | 0.53                       | 62              | 42              |
| PIPO/FEID <sup>2</sup>           | 207                  | 77              | 85                | 178                    | 0.57                       | 101             | 68              |
| PIPO/PUTR/CAGE                   | 204                  | 64              | 70                | 126                    | 0.56                       | 70              | 47              |
| PIPO/PUTR/CARO                   | 243                  | 67              | 74                | 138                    | 0.67                       | 92              | 61              |
| PIPO/PUTR/FEID-AGSP              | 185                  | 65              | 72                | 130                    | 0.51                       | 66              | 44              |
| PIPO/SPBE <sup>2</sup>           | 221                  | 76              | 84                | 174                    | 0.61                       | 105             | 70              |
| PIPO/SYAL                        | 318                  | 95              | 105               | 250                    | 0.87                       | 218             | 146             |
| PIPO/SYAL <sup>2</sup>           | 241                  | 78              | 86                | 182                    | 0.66                       | 120             | 80              |
| PIPO/SYOR                        | 260                  | 80              | 88                | 190                    | 0.71                       | 135             | 91              |
| PSME/ACGL-PHMA <sup>2</sup>      | 281                  | 94              | 103               | 246                    | 0.77                       | 189             | 127             |
| PSME/CAGE                        | 222                  | 68              | 75                | 142                    | 0.61                       | 86              | 58              |
| PSME/CARU                        | 263                  | 75              | 83                | 170                    | 0.72                       | 122             | 82              |
| PSME/CARU <sup>2</sup>           | 361                  | 85              | 94                | 210                    | 0.99                       | 208             | 139             |
| PSME/HODI                        | 340                  | 107             | 118               | 270*                   | 0.93                       | 252             | 169             |
| PSME/PHMA                        | 274                  | 88              | 97                | 222                    | 0.75                       | 167             | 112             |
| PSME/PHMA <sup>2</sup>           | 232                  | 87              | 96                | 218                    | 0.64                       | 139             | 93              |
| PSME/SPBE <sup>2</sup>           | 353                  | 91              | 100               | 234                    | 0.97                       | 226             | 152             |
| PSME/SYAL                        | 273                  | 83              | 91                | 202                    | 0.75                       | 151             | 101             |
| PSME/SYAL <sup>2</sup>           | 333                  | 94              | 103               | 246                    | 0.91                       | 224             | 150             |
| PSME/SYOR <sup>2</sup>           | 361                  | 78              | 86                | 182                    | 0.99                       | 180             | 120             |
| PSME/VAME                        | 193                  | 78              | 86                | 182                    | 0.53                       | 96              | 64              |

#### **COLUMN DESCRIPTIONS FOR TABLE 5-4**

|                                  |                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential Vegetation Type</b> | Abbreviation for PVT name; taken from tables 3 and 4 of Cochran et al. 1994, and from table 3-1 of this guide. <i>Names with footnote 2 pertain to the Wal-lowa-Snake area; all others are for the Blue-Ochoco area.</i>                                                                                                              |
| <b>Full Stocking</b>             | Full stocking SDI value, taken from tables 3 and 4 in Cochran et al. 1994.                                                                                                                                                                                                                                                            |
| <b>Meyer SI</b>                  | Site index (SI), in feet of tree height, as derived from Meyer 1961; actual SI values were taken directly from tables 3 and 4 in Cochran et al. 1994.                                                                                                                                                                                 |
| <b>Barrett SI</b>                | Conversion of Meyer SI to Barrett SI (Barrett 1978): $\text{Meyer SI} \times 1.1 = \text{Barrett SI}$ (see page 7 in Cochran et al. 1994). Barrett SI is required when using equation 3 from Cochran et al. 1994 to calculate an ULMZ value.                                                                                          |
| <b>Calculated ULMZ</b>           | Calculated SDI for ULMZ by using equation 3 from Cochran et al. 1994 (page 4): $\text{ULMZ} = 365[-0.36 + 0.01(\text{SI})]$ , where SI is Barrett SI. Values with an * are 74% of the ecoregion-wide, full-stocking SDI for ponderosa pine; they pertain to instances where Barrett SI exceeds 110 (see Cochran et al. 1994, page 7). |
| <b>Adjustment Fraction</b>       | This item was calculated by dividing the 'Full Stocking' value (column 2) by the ecoregion-wide, full-stocking SDI value (365; see table 2-3).                                                                                                                                                                                        |
| <b>MPB ULMZ</b>                  | 'Calculated ULMZ' value, column 5, multiplied by the adjustment fraction.                                                                                                                                                                                                                                                             |
| <b>MPB LLMZ</b>                  | Although Cochran et al. 1994 did not specify how to calculate the LLMZ stocking level, it is assumed to be 67% of the MPB ULMZ value because LLMZ is 67% of ULMZ for the five species other than lodgepole or ponderosa pines.                                                                                                        |

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An important feature of historical structure for dry forests is clumps of closely spaced, mature trees (fig. 5-4, Harrod et al. 1999, Munger 1917). But this clumpy structure can allow mature trees to eventually experience enough competitive stress to function as focus trees for western pine beetle, particularly during droughts (Keen 1936, 1950; Koontz et al. 2021; Person 1928, 1931).

When using historical information (Bright 1912; Munger 1912, 1917) to provide context, we should consider that tree clumps occurred within a broader mosaic where herbaceous openings were common (occupying as much as 70% of a stand's area). A mature tree clump embedded in a grass matrix (a savanna condition) experienced a much different competitive environment than a clump now surrounded by young trees. And as ongoing tree invasion continues and non-forest components (herblands and shrublands) are displaced by forest, heterogeneity declines and a natural resilience mechanism is ultimately compromised (Hessburg et al. 2016, 2020).

Substantial ingrowth resulting from a century of fire exclusion often exposes ponderosa pine clumps to high stress levels (Everett et al. 2007). This trend suggests that a clump should be thinned, or that trees surrounding a clump should be removed for a distance of at least twice the clump's dripline, to prevent mature pines from functioning as focus trees (Sohn et al. 2016).

Because white fir or grand fir are often plentiful around relict pine clumps, and because they are generally viewed as unsustainable species for dry-forest sites (Filip and Schmitt 1990, Wickman 1992), "managed stands on these sites should have a strong ponderosa pine component and should be managed by using ponderosa pine stocking curves" (Cochran 1998). [This section describes some of the benefits of restoring a 'clumpy/gappy' structure (Franklin et al. 2013), especially for a bark-beetle context. Other benefits also exist, including wildfire resistance.]





**Figure 5-4** – Clumpy growth habit for old ponderosa pine trees. According to Churchill et al. (2017), Cooper (1961), Munger (1917), and others, a clumpy tree pattern used to be the norm for dry forests. Clumped trees grow close together, but they were historically contained in a grassy matrix – trees could extend their roots into areas without tree competition. Intertree competition was high inside a clump, but relatively low outside of it. Due to factors such as fire exclusion, ungulate herbivory, and selective timber harvest (Powell 2020), small trees invaded the grassy areas and stressed the old pines, often causing them to become focus trees for western pine beetle attack.

## PHYSIOLOGICAL DROUGHT

Drought is often a source of tree stress and associated mortality. As trees die, managers assume that insects or diseases are causal agents. And perhaps from a ‘direct mortality’ perspective – what killed the tree now? – this assumption is correct. But it fails to recognize that a lack of soil moisture was a predisposing factor (Edmonds et al. 2005). Drought set these trees up for a future problem – all insects or diseases did was apply a coup de grâce.

Predisposing factors generally reflect prevailing conditions for a year or more before a tree dies. Biologically, insects and diseases react to predisposing factors as expected – they find a highly-stressed tree and ‘put it out of its misery.’ Concepts embodied in a ‘predisposing, inciting, and contributing’ factors trilogy (Edmonds et al. 2005, Sinclair and Hudler 1988) are also reflected in a death spiral analogy (fig. 5-5; Franklin et al. 1987).

### Does High Stand Density Function As Physiological Drought?

Perhaps an alternative term for high stand density is ‘physiological drought’ because trees in dense stands experience chronic soil moisture stress. When experiencing climatic drought, trees in stands with low or moderate density levels respond quickly when precipitation improves. A similar response does not occur for high-density stands because they are locked into the chronic stress associated with high levels of intertree competition.

Often when conducting forest inventory, foresters collect increment cores and notice long periods of reduced growth in the annual rings. Periods with tight rings may be traceable to a climatic drought episode. But generally, long periods of reduced growth result from suppression caused by high stand density. And a period of suppressed radial growth can be an important indicator of imminent tree mortality (Cailleret et al. 2017).

For climatic drought, suppressed tree growth reflects below-normal precipitation. But for dense stands, there is not enough soil moisture to meet the needs of all trees, even if precipitation amounts remain normal. Not every tree cohort in a stand is suppressed to the same degree, but high stand density inevitably results in long periods of chronic physiological stress.

According to research conducted in the Southwest, ponderosa pines in high-density stands are unable to take advantage of favorable rainfall years due to chronically high background levels of stress related to intertree competition (McDowell et al. 2006).

Some bark beetle species preferentially seek out stands experiencing physiological drought (Filip et al. 1996), likely in response to chemical cues emitted by stressed trees (Kelsey 2001). An example is Douglas-fir beetle – it caused the highest levels of tree mortality in stands with stocking levels at 80 percent or more of normal density (Furniss et al. 1979), equivalent to the upper limit of a management zone stocking level (aka, lower limit of self-thinning zone) (fig. 3-3).

Thinnings can alleviate a physiological drought condition. They also address vulnerability to bark-beetle attack by modifying a stand’s microclimatic conditions, positively affecting tree and stand vigor (Grulke et al. 2020) and chemical-cue patterns relating to pheromone dispersion. For both physiological and climatic drought, bark beetles initially target chronically stressed trees with weakened defenses (Bentz et al. 2010, Raffa et al. 2008) – mostly because their capacity to produce protective chemicals is substantially reduced (fig. 4-3).

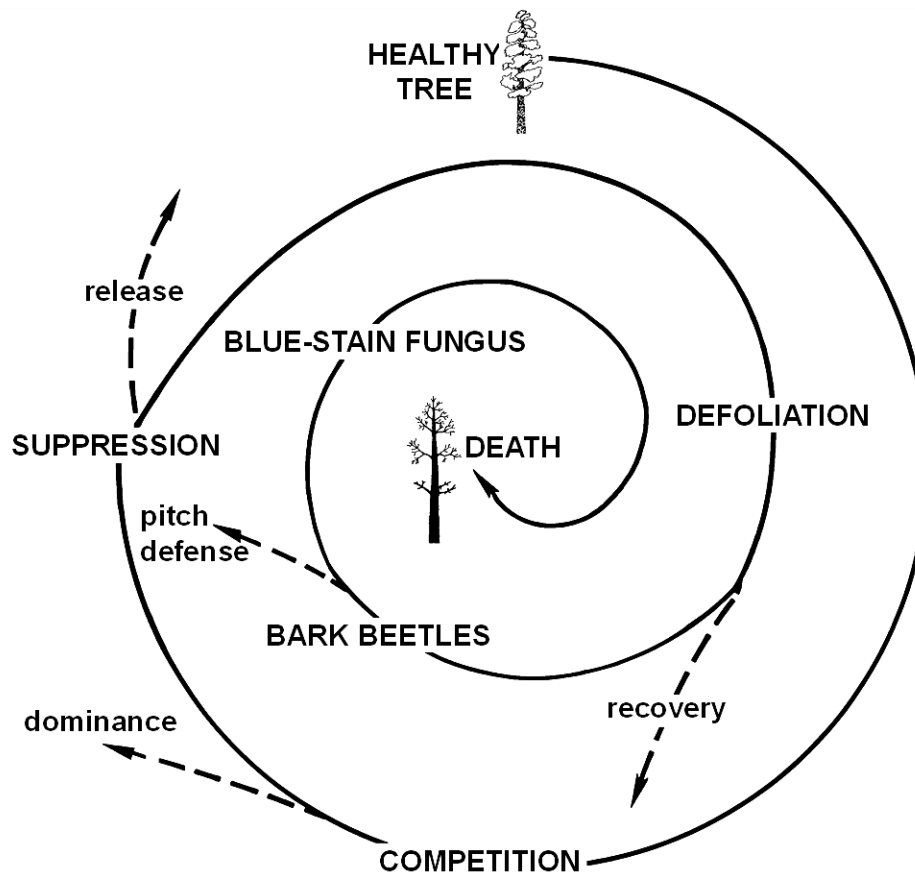


**Figure 5-5** – Death spiral for a Blue Mountains Douglas-fir tree (adapted from Franklin et al. 1987). A healthy tree (top) eventually experiences competition. If not released from the competition, it becomes suppressed and is predisposed to attack by defoliators. Once partially defoliated, it becomes attractive to Douglas-fir beetle (Wickman 1978), which carries blue-stain fungus. The fungus blocks a tree’s water and sap movement, causing foliage desiccation. As a tree moves along this death spiral, opportunities to use silvicultural treatments to help it avoid mortality become more limited.

### Tree Production Of Protective (Defensive) Chemicals

Once conifers respond physiologically to thinning, often by 3 years after a treatment (Vernon et al. 2023), their improved vigor promotes increased production of protective chemicals (fig. 4-3), providing enhanced bark-beetle resistance (Bradley 1963, Christiansen et al. 1987; Franceschi et al. 2005; Kolb et al. 1998, 2007; McDowell et al. 2007; Perrakis and Agee 2006; Shrimpton 1978; Wallin et al. 2008).

Most conifers have well-defined resin duct systems that mobilize large amounts of oleoresin in response to wounding (Hood and Sala 2015); this is a primary defense against bark-beetle attack. Beetles that initially colonize host trees may be killed by immobilization in resin, particularly when trees have adequate moisture, resin flow, and oleoresin exudation pressure. Resin chemistry also plays an important role by affecting the amount and composition of inhibitory chemicals in resin (Reid et al. 1967, Smith 1975, Vité 1961).

“A considerable body of evidence indicates that environmental stress (primarily water



stress) renders pines, spruces, and firs more susceptible to bark beetle invasion by a general reduction in oleoresin flow, and, at least in some conifer species, the induced response to bark beetle attack is diminished under stress conditions” (Lewinsohn et al. 1993).

Thinning typically improves physiological performance during and after drought: “This meta-analysis showed that thinning of forest stands has the potential to improve physiological and growth performance of trees during and after drought events. However, the response of trees to drought varied with thinning intensities, taxonomic class (conifer vs. broadleaved), time since the last thinning and stand age, and site quality” (Sohn et al. 2016).

This study (Sohn et al. 2016) identified that thinning benefits following drought (improved tree recovery and resilience) decrease with time since the last treatment. Further, growth resistance during active drought became less with stand age, while the rate of growth recovery following drought increased over time regardless of thinning intensity. Another study (Hood et al. 2015) concluded that prescribed fire is also helpful – low-severity fire induces increased resin-duct production by ponderosa pine, improving its induced defense to bark beetle attack.

## DEFOLIATING INSECTS

Two defoliating insects are especially important in the Blue Mountains – Douglas-fir tussock moth and western spruce budworm (Gast et al. 1991, Torgersen 2001, Wickman 1992) (table 5-1). Outbreaks of these defoliators are cyclic and tend to be favored by a high proportion of climax tree species and by dense, multi-layered stand structures. For the interior Pacific Northwest, note that the areal extent of western spruce budworm outbreaks have exceeded that for mountain pine beetle outbreaks (fig. 5-6; Meigs et al. 2015).

Powell (1994) analyzed budworm-caused impacts for mixed-conifer forests of the south-central Blue Mountains. Defoliation and top-killing exhibited little variation with changes in stand density, although budworm-induced tree mortality was clearly greater for plots with an SDI of 151 or more (but the difference was not statistically significant).

Research from Montana (Carlson and Wulf 1989) found that reducing stand density improved budworm resistance by increasing stand vigor, increasing budworm larval mortality during their dispersal period, and by reducing the budworm host species component in mixed species stands (table 5-1). This Montana work suggests that thinning could be more effective than waiting until defoliation becomes acute and then applying a chemical or biological insecticide.

Carlson and Wulf (1989) concluded that *for treated stands, thinning provides short-term protection against spruce budworm and it presumably contributes to long-term budworm resistance if large areas are treated* (Carlson et al. 1985).

Thinning studies from northeastern Oregon had varying results – when budworm populations were very high, density management provided little benefit because budworm easily overwhelmed any thinning effect (Wickman et al. 1992). And Wickman’s studies suggest that thinning could actually favor budworm development by allowing more sunlight into the forest canopy, creating warmer microclimates and allowing larvae to develop more quickly, eat more, and possibly escape more natural predation (Boyd Wickman, personal communication, 1994).



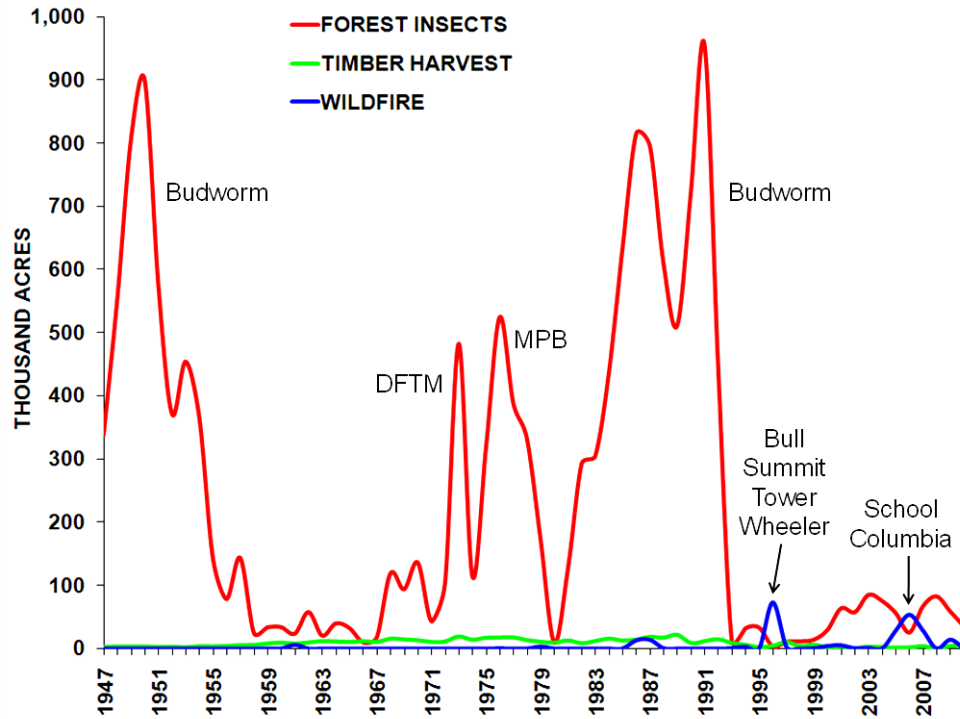


**Figure 5-6** – Disturbance trends from 1947 to 2010 for the Umatilla National Forest. This history suggests that forest insects have affected more area than wildfire or timber harvest. Two major outbreaks of western spruce budworm are shown (1944-1958 and 1980-1992), along with outbreaks of mountain pine beetle (MPB) and Douglas-fir tussock moth (DFTM) in the 1970s. Six large wildfires are shown (Bull, Summit, Tower, Wheeler Point, School, and Columbia Complex). For the U.S. as a whole, forest area affected by insects and pathogens was approximately 45 times greater than the area affected by wildfire, with an economic impact almost five times as great (Dale et al. 2001).

## FOREST DISEASES

Bark beetles prefer high-density stands (Filip et al. 1996) – their populations vary predictably with stand density and they can be managed by using silvicultural practices such as thinning. The same cannot be said for diseases because susceptibility seems to vary with stand density for some circumstances, but not for others (table 5-1; Parker et al. 2006, Schmitt 1999).

This difference between insects and diseases illustrates an important relationship: early seral lodgepole and ponderosa pines tend to be regulated by bark beetles, especially mountain pine beetle, whereas late-seral species (grand fir, subalpine fir, Engelmann spruce) are often regulated by diseases that function as site factors due to their long persistence (root disease).

Three groups of diseases play important roles in Blue Mountain forests: dwarf mistletoes, stem decays, and root diseases (Gast et al. 1991, Hayes et al. 2001). Disease impact may be overlooked (an ‘invisible present’) because it causes insidious changes occurring across decades.

Perhaps no disease has a greater impact on Blue Mountain forests than parasitic plants called dwarf mistletoes (table 5-1; Filip et al. 1996, Gast et al. 1991, Parks and Flanagan 2001). Dwarf mistletoe exhibits varying responses to stand density and density management treatments.

A study from the south-central Blue Mountains found that *noncommercial thinning increased the radial and height growth of Douglas-firs with light or moderate mistletoe infections*, but thinning did not produce a growth response for heavily infected trees (Knutson and Tinnin 1986). For ponderosa pine, Barrett and Roth (1985) found that wide thinning spacing allowed the released trees to produce full crowns and acceptable rates of growth, despite heavy mistletoe infection levels. But *dwarf mistletoe spread rates are greater for open stands* (Reich et al. 1991), particularly for areas with low species diversity and little intermixing of nonhost species.

Stand density has subtle effects on disease severity for late-seral species. An example is provided by rust-red stringy rot caused by Indian paint fungus (fig. 5-7). This disease commonly infects grand fir, particularly suppressed fir growing in an understory – they grow slowly and have low vigor, causing twig stubs to heal slowly. *Open, unhealed stubs are infection points, and for suppressed trees, they are exposed for a long time.*

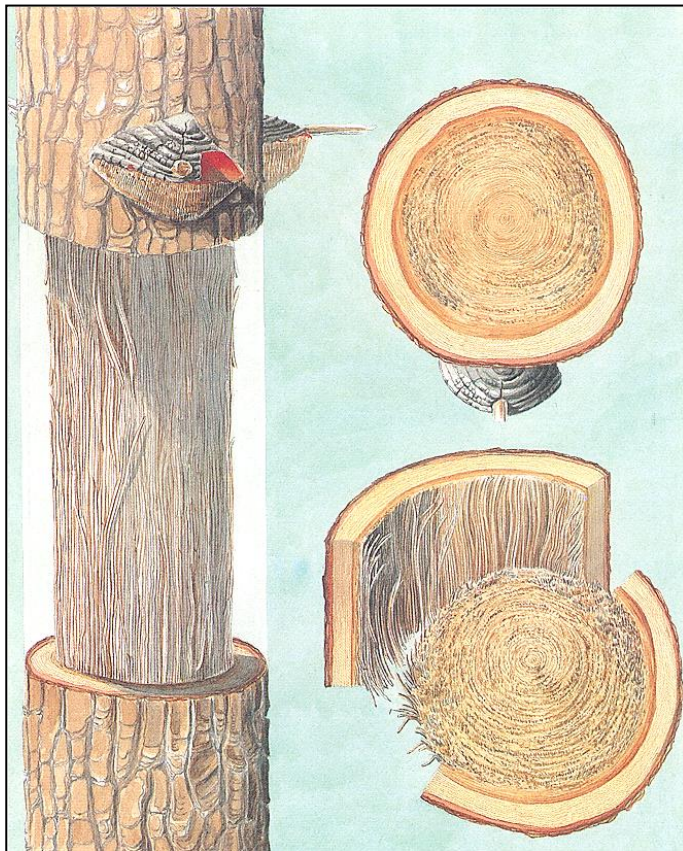


**Figure 5-7** – Rust-red stringy rot in a grand fir tree caused by the Indian paint fungus (from Shigo 1979). This is a common pathogen and wood-decay organism affecting older grand fir trees in the Blue Mountains. The fungus enters the main stem after a long period in a dying branch. When many branches die at about the same time, the fungus may convert a stem's central column into a stringy, fibrous mass of decayed material. Indian paint fungus is a decay organism that creates a valuable type of wildlife tree: a hard outer 'rind' surrounding decayed inner wood. The fruiting body of this fungus is a brick-red color, and Native Americans of the Columbia River basin (including the Canadian portion) used it to produce a red pigment utilized as a dye or stain (Turner et al. 1990).

Rapidly growing grand firs have unhealed branch stubs for short periods (because vigorous trees heal wounds quickly), and this greatly reduces their exposure to Indian paint fungus infection (Filip and Schmitt 1990). *Firs that start off as suppressed trees tend to have many latent paint fungus infections*, and they are readily activated by wounding from tree harvest, bombardment by dwarf mistletoe brooms (from nearby larches, for example), and similar sources.

This Indian paint fungus example demonstrates that maintaining low stand density and high tree vigor, even for late-seral grand fir, can help reduce future disease incidence and severity.

Often, this sentiment is expressed: “late seral species with high shade tolerance are used to being suppressed and growing in crowded conditions – it’s not a big deal for them.” Some aspects of this sentiment ring true, but it fails to acknowledge that true fir stands are healthier when they occur in a vigorous, low-density condition. Suppressed grand firs can survive a shady, high-density condition longer than early seral pines or larch (fig. 2-7) but perpetuating a high-density condition may contribute to an undesirable disease outcome. [We should remember that grand fir benefits from shade *during establishment* but doesn’t require it after then.]

## GENERAL FOREST HEALTH

From the 1970s to the mid-1990s, Blue Mountain forests experienced increasing levels of damage from wildfire, insects, and diseases. Assessments conducted during that era documented high damage levels and speculated about their underlying causes (Caraher et al. 1992, Gast et al. 1991, Lehmkuhl et al. 1994, Mutch et al. 1993, Wickman 1992). As a result of these assessments, the Blue Mountains became known for its forest health problem (Sampson et al. 1994).

Schmitt and Scott (1993) provide guidelines to help Blue Mountain managers determine whether stand damage levels qualify as catastrophic. Their system describes uncharacteristic stand conditions from an insect and disease perspective, and it provides guidelines for estimating the imminence of catastrophic damage. *One of six rating factors in the Schmitt and Scott (1993) system involves stand density, and it is based on the same stocking level recommendations published the next year by Cochran et al. (1994).*

Historically, scientists and the public raised concerns about poor forest health in the Blue Mountains (Wickman 1992). Now, the benefits of minimizing insect and disease damage by maintaining high stand vigor, and the value of restoring an appropriate species composition for dry mixed-conifer sites (less fir, more pine), are widely recognized (Filip and Schmitt 1990). (A holistic perspective views forest health as more than just an absence of insect and disease damage – it also includes factors focused on properly functioning composition and density.)

Perhaps no silvicultural approach can contribute as much to forest health as stand density management. To a great degree, density management is vigor management. Trees with high vigor grow faster than trees with low vigor; slow growth is often an indicator of high vulnerability to insect and disease damage, including possible tree mortality (Bleiker and Uzunovic 2004).

A study involving timber inventory plots for the southern and central Sierra Nevada (installed in 1911; remeasured in 2011) found that historical densities maintained by an active fire regime were quite low, ensuring vigorous tree growth from a lack of intertree competition. It was found that low density may have been essential for maintaining high forest resilience. And high growth rates translate into resilience for a range of stressors – not just fire – including drought, pathogens, and insects (North et al. 2022). Therefore, high levels of tree and stand vigor contribute to improved forest health, however it is defined (O’Laughlin et al. 1994).

### Forest Health Case Study: White Fir Stand Density Study Collapses

For late-seral species, especially grand fir or white fir, insect and disease impact is derived from a variety of organisms and it may be additive – impact from one agent can be compounded by impact from other agents. An example of additive insect and disease impact is provided by a

stand density study installed in central Oregon (Cochran 1998).

Four levels of growing stock were installed in white fir stands – plots represented 20, 30, 40, and 50 percent of normal density (also known as full stocking). This study was designed to investigate growth, yield, and mortality at relatively low stand densities.

Even after having been noncommercially thinned in 1982 and 1985, the stands collapsed in the early 1990s and the study had to be abandoned. High mortality levels were due to four factors – drought, *Armillaria* root disease, western spruce budworm, and fir engraver beetles.

High tree mortality was unexpected because: (1) mortality agents, other than suppression, had not been shown to be closely related to stand density for even-aged white fir stands; and (2) the range of stand densities used for this study were intended to prevent future development of a suppressed tree class (Cochran 1998).

The Cochran (1998) study concluded that it is questionable whether white or grand fir can successfully be sustained on drier sites in central and eastern Oregon (Filip and Schmitt 1990, Wickman 1992), although many such stands exist following a century or more of fire exclusion (Powell 2020). It also suggests that grand or white fir can perk along fine on drier sites *at younger stand ages*. But when stand development reaches a point where the site struggles to satisfy increasing tree needs for moisture and nutrients, then stand collapse soon occurs, with root disease and other biotic agents functioning as precipitating factors.

Experience on the eastside of Oregon and Washington (Gast et al. 1991, Filip and Schmitt 1990, Wickman 1992) has shown that ‘pine sites’ (e.g., dry mixed conifer) with the ecological capacity to support grand fir/white fir (based on their plant association) can sustain a late-seral, shade-tolerant species composition to a certain point, but seldom will that point be far enough along on the developmental spectrum to qualify as a mature stand.

Shade-intolerant, early seral species (pine, larch) are capable of relieving competitive stress by self-thinning, but self-thinning seldom functions well for dry sites with a high proportion of late seral species (grand fir or white fir). *Late seral stands with a high fir component, and growing on dry sites, can easily reach a tipping point and then collapse* (Cochran 1998).

How should managers deal with this situation? To a large extent, I believe the best course of action is to ignore the existing species composition and manage warm dry sites by using the more conservative ponderosa pine stocking levels, even if succession has advanced to a point where these sites currently support more grand fir or white fir than ponderosa pine.

**FOREST HEALTH SUMMARY.** Since the early 1970s, millions of forested acres in the Blue Mountains have been affected by disturbance agents, including bark beetles, insect defoliators, root diseases, and wildfire (fig. 5-6). Anthropogenic factors play a role too – timber harvest (especially historically) and climate change contribute to ongoing change. Biotic change agents (insects; diseases) have always been present, but man has clearly influenced how they function.

Forest health integrates biotic, abiotic, and anthropogenic factors causing tree damage and mortality. When we suppress low-severity wildfire on dry sites, we curtail a natural thinning agent (Weaver 1947), tree numbers increase, and intertree competition worsens. When bark beetles find stressed trees and stands, an outbreak occurs, and dead trees and fine fuels are

produced in abundance, contributing to increased wildfire susceptibility.

## **CROWN FIRE SUSCEPTIBILITY**

Fire managers traditionally recognize three types of fire:

- Ground fires burning in organic materials such as peat;
- Surface fires burning in herbs and other fuels lying on or near the ground surface; and
- Crown fires burning in elevated canopy fuels (fig. 5-8).

When considering fire effects, crown fire is acknowledged as the most severe of the three fire types. Crown fire is normal and expected for moist and cold forests, but a large amount of crown fire is neither normal nor expected for dry forests (Cassell et al. 2019). An important goal of dry-forest management (Agee and Skinner 2005) is to retain a post-thinning tree density that allows dry forest to resist stand-replacing crown fire (preferred strategy), or a density that will offer some resilience to the aftereffects of stand-replacing crown fire.

Because dry forests are being affected by crown fire with increasing regularity (Mutch et al. 1993), and as treatments are planned for the wildland-urban interface where crown fire can seldom be tolerated, managers need tools to evaluate crown fire susceptibility for forested lands.

If land managers can identify areas with high potential for crown fire, then those areas can be targeted for application of prescribed fire and thinning, two treatments with demonstrated effectiveness for reducing crown fire behavior (Bilgili 2003, Graham et al. 2004).

This *Crown Fire Susceptibility* section quantifies three categories of crown fire susceptibility (high, moderate, low), and it relates them to five common measures of stand density (stand density index, trees per acre, basal area per acre, canopy cover, and equilateral tree spacing).

## **CANOPY BULK DENSITY (CBD)**

CBD is “the primary controlling factor of crown fire behavior” (Graham et al. 1999). CBD is strongly influenced by species composition and stand density (Agee 1996, Keyes and O’Hara 2002), and it is usually expressed in kilograms per cubic meter ( $\text{kg}/\text{m}^3$ ). CBD is the dry weight of available canopy fuel (including foliage and small branches) per unit of canopy volume. CBD ranges from zero, where there is no canopy, to about  $0.40 \text{ kg}/\text{m}^3$  (Scott and Reinhardt 2002).

Agee (1996) analyzed seven stands that had been thinned and subsequently exposed to crown fire during the 1994 Tyee Fire in north-central Washington; he found that crown fire was not sustained in stands where recent thinning had reduced CBD below about  $0.10 \text{ kg}/\text{m}^3$ . Anecdotal evidence from the southwestern United States corroborates that stands with CBD exceeding  $0.10 \text{ kg}/\text{m}^3$  are susceptible to crown fires (Cram et al. 2003).

Van Wagner (1977) and Alexander (1988) showed that crown fire is nearly impossible below a CBD of  $0.05 \text{ kg}/\text{m}^3$ , although other research suggests that a CBD as low as  $0.037 \text{ kg}/\text{m}^3$  might be marginally capable of sustaining crown fire (Sando and Wick 1972). Analysis of two stands from western Montana concluded that the Sando and Wick (1972) threshold value ( $0.037 \text{ kg}/\text{m}^3$ ) might be relevant to the interior Pacific Northwest (Scott and Reinhardt 2001). Nonetheless, a CBD value of  $0.05 \text{ kg}/\text{m}^3$  was selected as the lower threshold value.



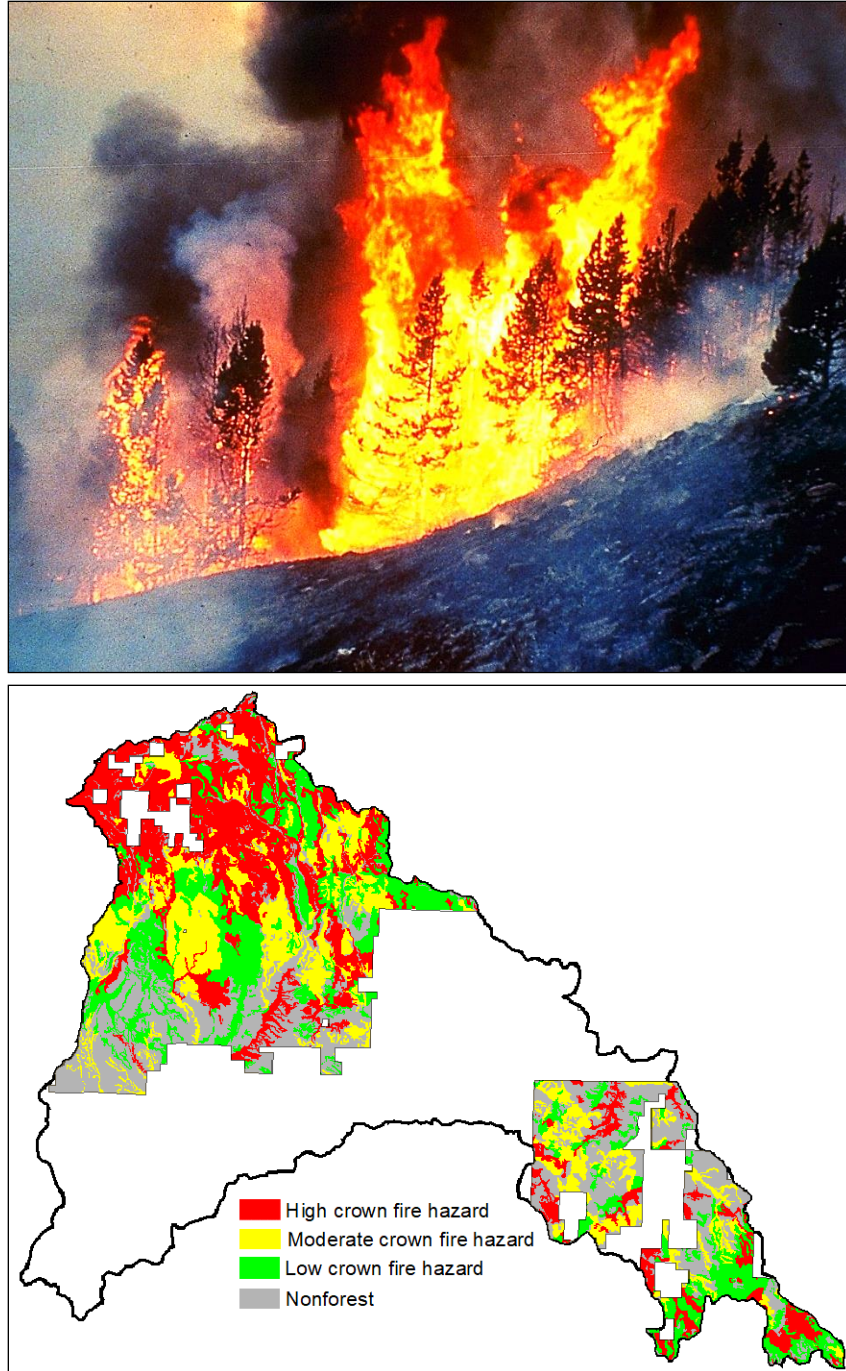


**Figure 5-8** – Upper half shows the long flame lengths and high fireline intensity typically produced by crown fire; lower half shows historical (1939) crown fire susceptibility ratings for the Potamus watershed in northeastern Oregon (Powell 2010).

After quantifying these two thresholds – CBD above which crown fire is easily sustained ( $0.10 \text{ kg/m}^3$ ), and CBD below which crown fire is unlikely ( $0.05 \text{ kg/m}^3$ ) – the boundaries of high and low crown fire susceptibility categories have been established. The moderate category then includes all CBD values occurring between these upper and lower bounds.

## Relating CBD To Stand Density

After CBD was used to establish three categories of crown fire susceptibility (high/moderate/low), the CBD category boundaries were translated into stand density metrics. For the Blue Mountains, Keyes and O'Hara (2002) started this task by relating Agee's (1996) upper threshold value (CBD of 0.10 kg/m<sup>3</sup>) to relative density (relative density was defined as a percentage of the species-wide full-stocking SDI value; see table 2-3), and they did so for the three tree species included in Agee's (1996) paper: grand fir, Douglas-fir, and ponderosa pine.

The following relative density percentages pertain to the upper CBD threshold of 0.10 kg/m<sup>3</sup> (e.g., the lower limit of the high crown fire susceptibility category; see table 5-5):

- Grand fir is about 35% of its Blue Mountains full-stocking SDI value of 560 (table 2-3), resulting in an SDI value of 200 for the upper CBD threshold.
- Douglas-fir is about 66% of its Blue Mountains full-stocking SDI value of 380 (table 2-3), resulting in an SDI value of 250 for the upper CBD threshold, and
- Ponderosa pine remains below the upper CBD threshold even at its Blue Mountains full-stocking SDI value of 365 (table 2-3).

The following relative density percentages pertain to the lower CBD threshold of 0.05 kg/m<sup>3</sup> (e.g., the lower limit of the low crown fire susceptibility category; see table 5-5):

- Grand fir is about 12% of its Blue Mountains full-stocking SDI value, resulting in an SDI value of 70 for the lower CBD threshold;
- Douglas-fir is about 26% of its Blue Mountains full-stocking SDI value, resulting in an SDI value of 100 for the lower CBD threshold; and
- Ponderosa pine is about 38% of its Blue Mountains full-stocking SDI value, resulting in an SDI value of 140 for the lower CBD threshold.

**Table 5-5:** Rating crown fire susceptibility by using stand density index.

| COVER TYPE<br>GROUPS <sup>1</sup> | CROWN FIRE SUSCEPTIBILITY: STAND DENSITY INDEX <sup>2</sup> |                                             |                                      |
|-----------------------------------|-------------------------------------------------------------|---------------------------------------------|--------------------------------------|
|                                   | LOW<br>(≤.05 kg/m <sup>3</sup> CBD)                         | MODERATE<br>(.06–.09 kg/m <sup>3</sup> CBD) | HIGH<br>(≥.10 kg/m <sup>3</sup> CBD) |
| Ponderosa pine                    | ≤ 140                                                       | 141-364                                     | ≥ 365                                |
| Douglas-fir                       | ≤ 100                                                       | 101-249                                     | ≥ 250                                |
| Grand fir                         | ≤ 70                                                        | 71-199                                      | ≥ 200                                |

<sup>1</sup> Cover type composition is: ponderosa pine – western larch, whitebark pine, lodgepole pine, and ponderosa pine; Douglas-fir – Douglas-fir and species not in pine or fir; and grand fir – grand fir, subalpine fir, and Engelmann spruce. CBD is canopy bulk density.

<sup>2</sup> Stand density index ranges are based on Agee (1996), and Keyes and O'Hara (2002).

To express crown fire susceptibility by using the trees per acre (TPA) metric, SDI values from table 5-5 were converted into their equivalent TPA values (table 5-6). Since SDI is indexed to a QMD of 10 inches, TPA and SDI values are only the same when a stand's QMD is 10 inches. Therefore, TPA values provided in table 5-6 vary by tree size (QMD), and they are presented for three common size classes. Because tables 5-7 to 5-9 also relate to TPA, they include the three size classes as well.

To express crown fire susceptibility by using the basal area per acre (BA) metric, it was necessary to convert the TPA values from table 5-6 into their equivalent BA values (table 5-7). To express susceptibility by using the canopy cover (CC) metric, Dealy's (1985) equations were used to convert the BA values from table 5-7 into their equivalent CC values (table 5-8). And to express susceptibility by using the equilateral spacing (ES) metric, the TPA values from table 5-6 were converted into their equivalent ES values (table 5-9).

**Table 5-6:** Rating crown fire susceptibility by using trees per acre.

| Cover Type Groups <sup>1</sup> | Size Class Categories <sup>2</sup> | CROWN FIRE SUSCEPTIBILITY: TREES PER ACRE  |                                             |                                             |
|--------------------------------|------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------------|
|                                |                                    | LOW<br>( $\leq .05$ kg/m <sup>3</sup> CBD) | MODERATE<br>(.06-.09 kg/m <sup>3</sup> CBD) | HIGH<br>( $\geq .10$ kg/m <sup>3</sup> CBD) |
| Ponderosa pine                 | Seed-Sap (3" QMD)                  | < 1,180                                    | 1,180-3,075                                 | > 3,075                                     |
|                                | Poles (7" QMD)                     | < 265                                      | 265-685                                     | > 685                                       |
|                                | Small+ (12" QMD)                   | < 100                                      | 100-265                                     | > 265                                       |
| Douglas-fir                    | Seed-Sap (3" QMD)                  | < 615                                      | 615-1,540                                   | > 1,540                                     |
|                                | Poles (7" QMD)                     | < 170                                      | 170-430                                     | > 430                                       |
|                                | Small+ (12" QMD)                   | < 75                                       | 75-190                                      | > 190                                       |
| Grand fir                      | Seed-Sap (3" QMD)                  | < 560                                      | 560-1,605                                   | > 1,605                                     |
|                                | Poles (7" QMD)                     | < 130                                      | 130-370                                     | > 370                                       |
|                                | Small+ (12" QMD)                   | < 50                                       | 50-145                                      | > 145                                       |

<sup>1</sup> Cover type groups are described in footnote 1 to table 5-5.

<sup>2</sup> Average size class pertaining to a forested polygon; QMD refers to quadratic mean diameter.

**Table 5-7:** Rating crown fire susceptibility by using basal area (square feet per acre).

| Cover Type Groups <sup>1</sup> | Diameter Class Categories <sup>2</sup> | CROWN FIRE SUSCEPTIBILITY: BASAL AREA PER ACRE |                                             |                                             |
|--------------------------------|----------------------------------------|------------------------------------------------|---------------------------------------------|---------------------------------------------|
|                                |                                        | LOW<br>( $\leq .05$ kg/m <sup>3</sup> CBD)     | MODERATE<br>(.06-.09 kg/m <sup>3</sup> CBD) | HIGH<br>( $\geq .10$ kg/m <sup>3</sup> CBD) |
| Ponderosa pine                 | Seed-Sap (3" QMD)                      | < 60                                           | 60-150                                      | > 150                                       |
|                                | Poles (7" QMD)                         | < 70                                           | 70-185                                      | > 185                                       |
|                                | Small+ (12" QMD)                       | < 80                                           | 80-210                                      | > 210                                       |
| Douglas-fir                    | Seed-Sap (3" QMD)                      | < 30                                           | 30-75                                       | > 75                                        |
|                                | Poles (7" QMD)                         | < 45                                           | 45-115                                      | > 115                                       |
|                                | Small+ (12" QMD)                       | < 60                                           | 60-150                                      | > 150                                       |
| Grand fir                      | Seed-Sap (3" QMD)                      | < 30                                           | 30-80                                       | > 80                                        |
|                                | Poles (7" QMD)                         | < 35                                           | 35-100                                      | > 100                                       |
|                                | Small+ (12" QMD)                       | < 40                                           | 40-115                                      | > 115                                       |

Footnotes 1-2 are the same as for table 5-6.



**Table 5-8: Rating crown fire susceptibility by using canopy cover (percentage, for trees only).**

| Cover Type Groups <sup>1</sup> | Diameter Class Categories <sup>2</sup> | CROWN FIRE SUSCEPTIBILITY: CANOPY COVER |                                             |                                      |
|--------------------------------|----------------------------------------|-----------------------------------------|---------------------------------------------|--------------------------------------|
|                                |                                        | LOW<br>(≤.05 kg/m <sup>3</sup> CBD)     | MODERATE<br>(.06-.09 kg/m <sup>3</sup> CBD) | HIGH<br>(≥.10 kg/m <sup>3</sup> CBD) |
| Ponderosa pine                 | Seed-Sap (3" QMD)                      | < 50%                                   | 50-65                                       | > 65%                                |
|                                | Poles (7" QMD)                         | < 50%                                   | 50-70                                       | > 70%                                |
|                                | Small+ (12" QMD)                       | < 55%                                   | 55-70                                       | > 70%                                |
| Douglas-fir                    | Seed-Sap (3" QMD)                      | < 55%                                   | 55-70                                       | > 70%                                |
|                                | Poles (7" QMD)                         | < 60%                                   | 60-75                                       | > 75%                                |
|                                | Small+ (12" QMD)                       | < 65%                                   | 65-80                                       | > 80%                                |
| Grand fir                      | Seed-Sap (3" QMD)                      | < 55%                                   | 55-75                                       | > 75%                                |
|                                | Poles (7" QMD)                         | < 60%                                   | 60-80                                       | > 80%                                |
|                                | Small+ (12" QMD)                       | < 60%                                   | 60-80                                       | > 80%                                |

Footnotes 1-2 are the same as for table 5-6.

**Table 5-9: Rating crown fire susceptibility by using equilateral intertree spacing (feet).**

| Cover Type Groups <sup>1</sup> | Diameter Class Categories <sup>2</sup> | CROWN FIRE SUSCEPTIBILITY: EQUILATERAL SPACING |                                             |                                      |
|--------------------------------|----------------------------------------|------------------------------------------------|---------------------------------------------|--------------------------------------|
|                                |                                        | LOW<br>(≤.05 kg/m <sup>3</sup> CBD)            | MODERATE<br>(.06-.09 kg/m <sup>3</sup> CBD) | HIGH<br>(≥.10 kg/m <sup>3</sup> CBD) |
| Ponderosa pine                 | Seed-Sap (3" QMD)                      | > 7                                            | 7-4                                         | < 4                                  |
|                                | Poles (7" QMD)                         | > 14                                           | 14-9                                        | < 9                                  |
|                                | Small+ (12" QMD)                       | > 22                                           | 22-14                                       | < 14                                 |
| Douglas-fir                    | Seed-Sap (3" QMD)                      | > 9                                            | 9-6                                         | < 6                                  |
|                                | Poles (7" QMD)                         | > 17                                           | 17-11                                       | < 11                                 |
|                                | Small+ (12" QMD)                       | > 26                                           | 26-16                                       | < 16                                 |
| Grand fir                      | Seed-Sap (3" QMD)                      | > 10                                           | 10-6                                        | < 6                                  |
|                                | Poles (7" QMD)                         | > 20                                           | 20-12                                       | < 12                                 |
|                                | Small+ (12" QMD)                       | > 31                                           | 31-19                                       | < 19                                 |

Footnotes 1-2 are the same as for table 5-6.

### Notes Relating To Tables 5-5 To 5-9

Tables provided in this section estimate crown fire susceptibility; they do not predict potential crown fire behavior because there is no consideration of weather, topography, canopy base height, or foliar moisture content (Reinhardt and Crookston 2003).

Vegetation databases often include more cover types than the three included in Agee's (1996) study, so the additional species were assigned to one of Agee's cover type groups. Assignments are based primarily on crown characteristics: Engelmann spruce crowns have a similar size and density to those of grand fir, so spruce was assigned to the grand fir type.

Density values for the ponderosa pine cover type are higher than those for grand fir and Douglas-fir. This result reflects crown differences (particularly density and length) – it takes more stems per acre with the open, sparse canopy of ponderosa pine to reach the same level of CBD as for the thicker-crowned grand fir or Douglas-fir.

## CLIMATE CHANGE

Fossil fuel combustion began during the Industrial Revolution era (about 1750), resulting in increased levels of carbon dioxide (CO<sub>2</sub>) in the atmosphere. As CO<sub>2</sub>, methane, and other greenhouse gases accumulate, they contribute to a phenomenon known as climate change.

Warming accelerated over the past 30 years and a recent period, 2015 to 2021, had the warmest seven years recorded globally (as of 2023, it is now the warmest nine years). The Intergovernmental Panel on Climate Change (IPCC 2022), a National Climate Assessment (USGCRP 2018), and a Blue Mountains assessment (Halofsky and Peterson 2017) conclude that the magnitude of climate change affecting forest ecosystems will be unprecedented.

For Blue Mountains national forests, average monthly temperatures during the 21<sup>st</sup> century are projected to increase by ~3.3 °C in winter (December-February) and 5.0 °C in summer (June-August). Projected changes in precipitation vary substantially among models, but a central tendency is for increased precipitation (~15%) in winter (November-February) and decreased precipitation (~17%) in summer (June-September) (Mauger and Mantua 2011).

Findings from a Blue Mountains Climate Change Vulnerability and Adaptation assessment agree with those from Mauger and Mantua (2011): “Global climate models project that the current warming trend will continue throughout the 21st century in the Blue Mountains. Compared to observed historical temperature, average warming is projected to be 2.4 to 3.1 °C by 2050 and 3.2 to 6.3 °C by 2100, depending on greenhouse gas emissions. Precipitation may increase slightly in the winter, although the magnitude is uncertain” (Halofsky and Peterson 2017).

Temperature and precipitation changes have implications for soil moisture, water availability, and streamflow timing for the Blue Mountains. Projections for the end of this century show a 69-72% decrease for April 1<sup>st</sup> snowpack, with snowmelt occurring at least 3 weeks earlier than now. Projected changes in soil moisture, with important implications for tree and stand vigor (Grant et al. 2013), show increases in average winter amounts (12-13% for January-April), and decreases in average summer storage (4-7% for June to September) (Mauger and Mantua 2011).

Since 1990, it has been obvious that changing climatic conditions are affecting disturbance regimes. As local fires become larger (fig. 5-9) and wildfire season lengthens (fig. 5-10), climate change impact is now apparent at the smaller geographical scales commensurate with our management activities.

Local forests are experiencing marked changes in tree establishment (Boag et al. 2020), stand growth, and species distribution patterns (Kerns et al. 2017, 2018). Steadily increasing levels of tree mortality are predicted due to increasing wildfire and insect and disease outbreaks (van Mantgem et al. 2009). These changes will affect the distribution and productivity of many local tree species, including Douglas-fir, ponderosa pine, lodgepole pine, and whitebark pine.

### Carbon Management Considerations

Forests are a natural climate solution (Fargione et al. 2018) because they provide effective options for offsetting CO<sub>2</sub> emissions (Bonan 2008, Canadell and Raupach 2008). Carbon (C) sequestration is also a natural solution, but recent questions have arisen about whether active forest management should continue or be curtailed to sequester maximum amounts of C.

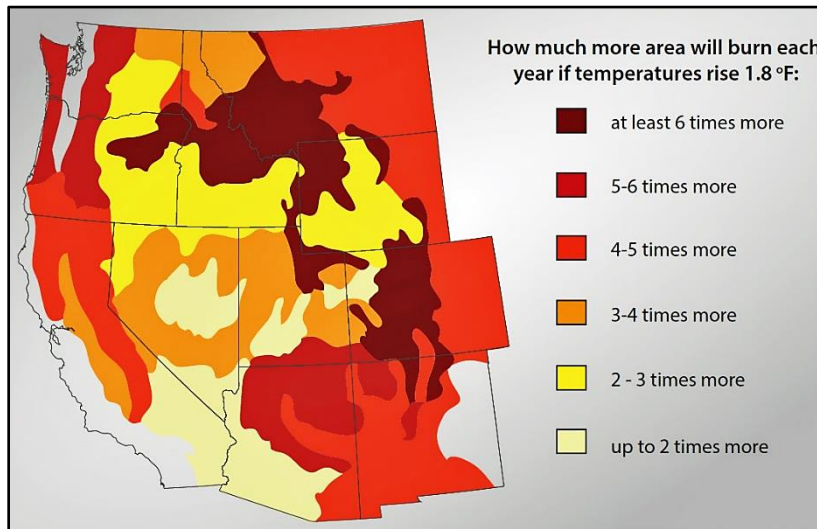


**Figure 5-9** – Predicted increase in wildfire burn area associated with a mean annual temperature increase of 1 °C (1.8 °F); percentage change relative to median annual area burned during 1950-2003 (Climate Central 2012). Results are aggregated to ecoprovinces (Bailey 1995), and are similar to findings from the National Research Council showing at least a quadrupling of area burned with each 1 °C of temperature increase (National Research Council

2011). Recent increases in wildfire activity in the West are attributable to anthropogenic warming, not to normal variability (Zhuang et al. 2021).

Terrestrial C sequestration involves processes through which CO<sub>2</sub> from the atmosphere is absorbed by trees, plants, and crops through a biological process called photosynthesis, and then stored as C in biomass (tree trunks, branches, foliage, and roots) and soils. Forests have an important role in the global C cycle because they are estimated to sequester about 80% of the aboveground terrestrial C pool (Waring and Running 1998).

Wildfire also releases stored C as emissions. Traditionally, it was believed that the main loss of C during a wildfire occurred in a gaseous form (when elements are carried away by the smoke plume). But research found that much of the C loss is particulate matter carried in smoke. A substantial loss of elements not only contributes to greenhouse gas and air quality concerns, but it can lower site productivity and C sequestration rates (Bormann et al. 2008) because many of the elements removed in smoke are nutrients important for plant health and growth.

Wildfire is a significant source of future CO<sub>2</sub> emissions, so emphasis is now directed at reducing wildfire susceptibility (Sohngen and Haynes 1997). Thinning and prescribed fire treatments designed to address wildfire susceptibility cause small C releases now but help to minimize large CO<sub>2</sub> wildfire emissions in the future (Canadell and Raupach 2008, Davis et al. 2023, Hurteau et al. 2019).

Research suggests that wildfire burn area could increase by at least 78% by 2100 (fig. 5-9), with some of the increase related to a 44% increase in lightning ignitions (Price and Rind 1994). [But consider that contemporary fire extents are *substantially reduced* from the historical extents prior to EuroAmerican settlement of the western United States (Donato et al. 2023).]

Significant increases in fire resistance can be achieved by removing small ladder fuels, along with fire-sensitive intermediate trees, and doing so is expected to cause little or no reduction in the live-tree C pool for dry mixed-conifer sites – most of the C pool for these areas consists of intermediate pines and large trees of all species (Hurteau and North 2009, North et al. 2009).

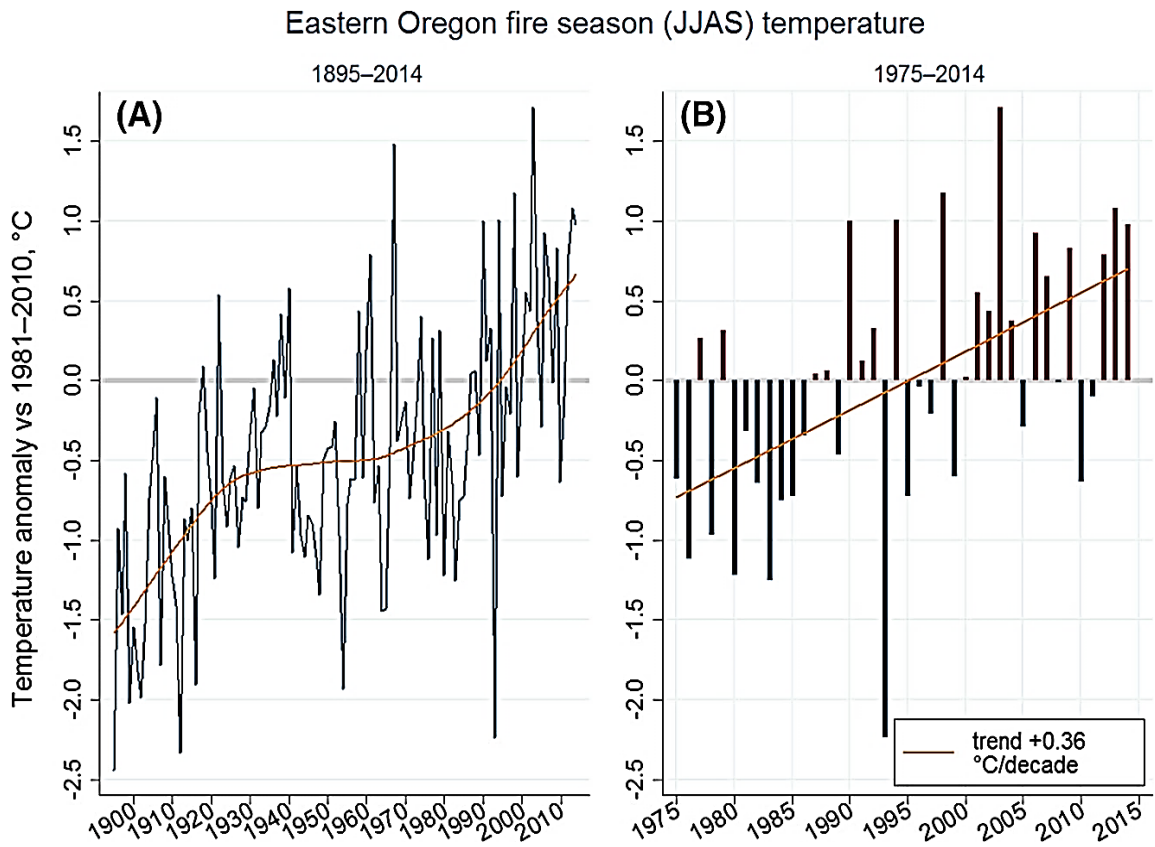


**Figure 5-10** – Empirical trends in fire season temperatures for eastern Oregon, expressed as temperature anomalies (source: Hamilton et al. 2016, p. 1824). Part A (left) shows June through September temperature anomaly for eastern Oregon, 1895–2014, with a lowess regression curve; Part B (right) shows June through September temperature anomaly for eastern Oregon, 1974–2014, as a linear trend. The baseline for this analysis (0.0 point on each vertical axis, shown as a heavy gray line) represents 1981–2010 climatic normals (means); anomalies were calculated by subtracting annual values from their 1981–2010 means. Negative values, located below the 0.0 baseline, represent years with temperatures cooler than the 1981–2010 baseline; positive values, located above the 0.0 line, represent years with temperatures warmer than the 1981–2010 means. This figure demonstrates that: (A) Eastern Oregon has experienced a significant trend of increasing temperatures during the summer months that qualify as fire season (and this trend has been accompanied by decreasing soil moisture and more fire activity); (B) “Average monthly June–September temperatures in eastern Oregon have risen over the past century, from a median around 60.1 °F during 1895–1914 to 63.4 °F during 1995–2014, the coolest and warmest 20-year periods on record;” (C) “Recent warming, since 1970, has been accompanied by more frequent wildfires: a statistically significant upward trend averaging 2.3 additional fires per decade;” (D) “The past 20 years include 6 of the 10 warmest in this 120-year record;” and (E) “The June through September warming in eastern Oregon over these 120 years has been steeper than global trends” (Hamilton et al. 2016).

Research found that historic stands with a relatively low density of large trees supported more biomass (and C) than contemporary, fully stocked, fire-suppressed forest (DeLuca and Aplet 2008). How can this be? An explanation: on a proportional basis, one large tree has a higher C content than many small trees – according to Fellows and Goulden (2008), *a single large tree (> 90 cm; 35 in) contains the same amount of C as 60 small (10–30 cm; 4–12 in) trees.*

### Mitigation And Adaptation As Climate Change Responses

Societies can use two primary strategies in response to climate change: (1) climate change

mitigation, involving efforts to reduce greenhouse gas emissions and increase carbon storage and sequestration; and (2) climate change adaptation, involving efforts to prepare for and respond to the effects of climate change.

For land managers, mitigation is most relevant when considering the potential effects of management activities on biological carbon cycled by forests and other ecosystems. The USDA Forest Service is increasingly emphasizing a carbon stewardship approach, highlighting carbon storage and sequestration as ecosystem services, managing carbon in line with goals of ensuring resilient ecosystems, and balancing mitigation and adaptation measures in response to climate change (USDA Forest Service 2022, USDA 2021).

Land managers can implement adaptation by increasing the resistance and resilience of ecosystems to disturbance processes. Many ongoing forest restoration activities help achieve these goals. As an example, managers can reduce future C emissions by modifying dry-forest treatments to focus on surface fuels, along with removal of small understory trees and intermediate, fire-sensitive species (North et al. 2009).

For dry forests historically shaped by a high frequency, low severity fire regime, sequestering more C by allowing tree density to continue increasing will exacerbate a recent trend toward increased amounts of uncharacteristic, high-severity fire. These severe fires are attributed mainly to fire exclusion (creating more fuel) and climate change (creating a longer fire season; fig. 5-10) (Bernal et al. 2022, Miller et al. 2009, Westerling et al. 2006).

For a C management context, dry forest thinning relies on a fundamental premise – by accepting repeated, but small, reductions in C stocks (by thinning from below) – a substantial future C sink is maintained by sequestering C in the form of relatively stable, long-lived, large-diameter trees (Hurteau et al. 2008, 2019; Hurteau and North 2010; North et al. 2021, 2022). C sink recovery after low thinning can be rapid, perhaps in just a few years (Dore et al. 2012).

Blue Mountains national forests have no explicit goal to manage forests for C sequestration (USDA Forest Service 1990), so an important reason to conduct fuel treatments is restoration of late-old structure and ecosystem function (USDA Forest Service 1995), especially for dry forests (Hagmann et al. 2021, Hessburg et al. 2021, Mutch et al. 1993, Prichard et al. 2021).

If active management is used to reduce stand density to historic levels, it may result in reducing C storage to amounts below where they are today. But managing to prioritize C storage at the expense of other goals (climate change adaptation, providing ecosystem services and ecosystem integrity, etc.) is ill advised due to high risk for severe disturbance (Hurteau et al. 2019).

Furthermore, reducing existing stand density down to the climate resilience stocking levels presented in this guide is a key adaptation strategy – it better prepares stands for more frequent and widespread wildfire (fig. 5-9), it increases resilience to steadily worsening drought, and it helps forests resist future insect outbreaks.

## **Adaptation Strategies**

This climate change section describes how disturbance processes will have greater impact on upland forests than the direct effects of warm dry conditions (Kerns et al. 2018). Therefore, strategies and tactics presented in table 5-10 focus mainly on forest disturbance and its impact.

**Table 5-10.** Climate change adaptation strategies for a forest management context.

| Climate Change Adaptation Strategy                                                                                                                                                          | Tactics for Strategy Application                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Improve the capability of ecosystems to withstand uncharacteristically severe drought, wildfire, and insect outbreak at landscape scales.                                                   | Low thinning and prescribed fire could be used on dry-forest units up to 1,000 acres to mimic the historical extent of surface fire (Heyerdahl 1997).                                                                                                                                                           |
| Facilitate natural (evolutionary) adaptation through silvicultural treatments that shorten regeneration times and promote interspecific competition.                                        | Older trees may date back to the Little Ice Age – they are ill-adapted to future climates. Wide thinnings can establish a new tree cohort and create forests better adapted to future climates.                                                                                                                 |
| Where ecosystems will very likely become more water limited, manage for drought- and heat-tolerant species.                                                                                 | Treatments should retain species with heat and drought tolerance. Also consider direct heat effects: a June 2021 heat dome caused direct damage from heat, not drought (Still et al. 2023).                                                                                                                     |
| Reduce homogeneity of stand structure and synchrony of disturbance patterns across landscapes by promoting diverse age classes and species mixes, stand diversities, and genetic diversity. | When thinning or burning, use a unit pattern to break up contiguous areas of high-vulnerability condition. Landscapes form a memory of high vulnerability – don’t allow this inertia to persist.                                                                                                                |
| Reset ecological trajectories to take advantage of early successional stages that are adaptive to present rather than past climates.                                                        | There is little to be gained by perpetuating forests adapted to past climatic conditions. New stands and trees will adapt to present climates and be more vigorous, sustainable, and resilient.                                                                                                                 |
| Use historical ecological information to identify environments buffered against climate change and that would be good candidates for conservation.                                          | For dry forests, historical characteristics are better adapted to a changing future than current conditions. Restoring open, park-like stands of ponderosa pine is viewed as a climate-smart strategy.                                                                                                          |
| Encourage local industries that can adapt to or cope with variable types of forest products because of uncertainty about which tree species will prosper in the future.                     | Future species or sizes to harvest may be dictated less by economic value and more by adaptation potential. To remove low-value trees, it is important to have biochar or bioenergy markets.                                                                                                                    |
| Reforestation after disturbance may require different species than were present before the disturbance to better match site-level changes associated with climate change.                   | Assisted migration, where species and genotypes are moved long distances, can align future stands with conditions expected by the end of this century. Conifers are not moving fast enough to keep up with their migrating habitats, causing <i>stranded forests</i> (Hill et al. 2023, Rosenblad et al. 2023). |
| After a disturbance event, use intensive site preparation activities to remove competing vegetation, and then replant with high-quality, genetically appropriate, and diverse stock.        | During drought, a tree’s resources are used for survival – it has less capacity to compete with non-tree competitors. Use site preparation practices to create low-stress regeneration conditions.                                                                                                              |
| To promote climate resilience for existing stands, use widely spaced thinnings or shelterwood cuttings, along with rapid response to forest mortality from fire or insects.                 | Future climates will have high-stress conditions; we should favor stand structures and densities that promote tree vigor. Background levels of tree mortality are increasing, so we need to proactively address mortality, especially when managing insect and disease risk.                                    |

| Climate Change Adaptation Strategy                                                              | Tactics for Strategy Application                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Plan for higher-elevation insect outbreaks, species mortality events, and altered fire regimes. | Disturbance regimes are changing. Without modifying our management practices in anticipation of change, we will be in a reactive mode instead of proactively planning for resistance and resilience. |

*Sources/Notes:* Adaptation strategies were derived from Joyce et al. (2008, 2009) and West et al. (2009). Unless noted otherwise (with citations), tactics were provided by the author of this document. Recent assessments concluded that dry forests are most ‘out of whack,’ so dry-forest tactics are emphasized here.

## Climate Change Summary

Until recently, climate change was viewed as an issue that would affect our children and grandchildren. Today, we can’t ignore it as we deal with our hottest, windiest, coldest, wettest, and driest days. Forests are being hit hard by its impact. Insect outbreaks, a clear signal of a warmer world, cause die-offs across millions of acres in the western US (Robbins et al. 2022). But in what appear to be otherwise healthy forests, background rates of tree mortality are also increasing (Quirion et al. 2021). And recent wildfires are more severe than early settlement-era fires, setting new records for fire size with each passing year (Parks et al. 2023).

Over the past 15 years, the world’s lands and oceans have warmed 40% faster than in the 1970s – and the past 9 years have been the warmest since instrumented readings began around 1850. Much of what we expect from here on out is informed by modeling. Already, field data suggests that climate change models are correct (Hausfather et al. 2020) – except in one important respect: *changes are occurring faster than predicted.*

Monitoring indicates that changes are just beginning. Higher temperatures are certain in the future. Declines in precipitation, both rain and snow, are likely. Less water will be available for trees, wildlife, and people. It’s quite clear that our ecosystems need enhanced resilience to deal with these changes – and it is needed sooner rather than later.

Hotter and drier are not the only climate change themes. We must pay attention to variability too. For regions where total rainfall amounts are predicted to remain stable, the timing and form of rainfall will be more variable – heavy downpours will be followed by longer dry periods, and more precipitation will occur as rain and less as snow. And these changes are confidently linked to human-caused climate change (Lynas et al. 2021).

**Blue Mountains climate change implications** (Halofsky and Peterson 2017, and Kerns et al. 2017, 2018):

- Changes in temperature will dominate. Frequency of hot days ( $\geq 90^\circ\text{F}$ ) is projected to increase by almost 30 days per year by the 2050s (Dalton 2020).
- Water availability (timing; amount) is changing due to increased evaporation and wide variation in snowpack and precipitation amounts. River flooding risk, due mainly to rain-on-snow events at mid to low elevations, is projected to increase substantially (Dalton 2020).
- The risk of summer drought will increase – drought becomes more severe and often extends into the shoulder seasons of spring and autumn. Forests won’t just waste away; drought will push them past a tipping point, culminating in stand-replacing disturbance (wildfire, etc.).
- Direction of climate change for the Blue Mountains is more certain than its magnitude.

- Dominance of ponderosa pine and sagebrush will increase for many locations.
- The forest-steppe (shrubland) ecotone will move upward in latitude and elevation.
- Ponderosa pine will be distributed at higher elevations than at present.
- Subalpine and alpine ecosystems may be replaced by grass species, pine, and Douglas-fir.
- Moist forest types could possibly increase under wetter scenarios.
- Subalpine fir, Engelmann spruce, and whitebark pine will likely decline, and some lower-elevation species will likely increase (ponderosa pine, grand fir) (Cassell et al. 2019).
- Regarding adaptation measures, “it would be appropriate to focus treatments at the upper ecotone of where certain species might be expected to move in the future, rather than at the lower ecotone where it would be difficult to maintain those species” (Kerns et al. 2018).
- Juniper woodlands have been increasing in recent decades; they may decrease if warmer and dryer summer conditions lead to more wildfire (a likely outcome – see fig. 5-9).
- Grasslands and shrublands at lower elevations will increase, but their composition will shift toward higher representation of drought-tolerant species (e.g., C4 grasses).
- Non-native species, notably annual grasses like cheat and Ventenata, are likely to increase in abundance and extent – which will contribute to fire spread across historically effective fire-breaks such as scabland (Tortorelli et al. 2020, 2023).
- Climate-driven increases in fire activity and severity will not only affect subalpine tree species but are also likely to create more landscape homogeneity (Cassell et al. 2019).

## Land Management Considerations

- Depending on how it is implemented, establishing C sequestration as an explicit goal could contribute to increased wildfire susceptibility (Kalies and Yocom Kent 2016), more high-severity wildfire, and reduced dry-forest resilience (North et al. 2021, Stephens et al. 2020).
- Silvicultural and fuel-management practices can be used to restore forests that are currently below their carbon carrying capacity (Hurteau et al. 2016, Parks et al. 2016). Research examining a 60-year horizon showed that when forests are managed sustainably, carbon stocks can increase substantially, even as timber harvests increased (Kauppi et al. 2022).
- Adult trees have extensive and deep root systems, allowing them to persist under drier conditions, at least temporarily. Seedlings and saplings don’t have deep root systems. In the warmer and drier conditions expected by mid-century, young forests are likely to experience higher mortality rates than for mature forests (Luo and Chen 2013).
- A recent survey involving 179 Blue Mountain sites affected by wildfire, with assessments occurring 15 to 21 years after burning, found that *one-third of the areas had no tree regeneration at all (zero seedlings and saplings)* (Boag et al 2020). This unfortunate postfire outcome is expected to become more common as warming and drying intensify.
- We should consider that early noncommercial thinning (NCT) is not a carbon hit – it results in little or no change to long-term carbon storage (Schaedel et al. 2017). If young, regenerated stands are to have a reasonable survival opportunity, then *NCT offers crucial benefits*.
- Dry forests with a frequent fire regime add more carbon when fire is excluded, but this additional biomass can destabilize forest carbon stocks by increasing disturbance susceptibility (Earles et al. 2014; Hurteau et al. 2019; McCauley et al. 2019, North et al. 2021, 2022).
- Thin dry forests to promote both resistance and resilience: retain a residual density allowing



them to resist stand-replacing crown fire (preferred strategy) or prescribe postfire seedling densities that offer resilience to future climate change impact (Franklin et al. 2013).

- Analysis suggests that secure carbon stores – an historically appropriate carbon carrying capacity – is below the unstable carbon levels we have now, particularly for dry forests (North et al. 2021, 2022). This outcome reflects a long period of disturbance regime modification (Keith et al. 2009), especially as related to fire exclusion (Stephens et al. 2016).
- For ongoing carbon benefits, forests should be kept in forest use, and their loss to uncharacteristically severe wildfire should be prevented when possible (Boag et al. 2020, Coop et al. 2020; Davis et al. 2019, Lydersen et al. 2014; Stephens et al. 2018, 2020; Stevens et al. 2017).
- Future composition, structure, and density should accommodate ‘good fire’ (Kaufmann et al. 2005), especially so low-severity prescribed fire can be used to help stabilize dry-forest carbon stocks (Agee and Skinner 2005, Hurteau et al. 2016; Stephens et al. 2012a, 2016).
- We should adjust composition, structure, and stand density to be resilient to climate change and its resulting modification of disturbance regimes (Falk et al. 2022, Koontz et al. 2020, Zhang et al. 2019). This guide includes a climate resilience stocking level; one reason for including it is to support future resiliency to climate change (North et al. 2022).
- Western juniper, a woodland species with high rates of water use (Miller et al. 2005), has expanded onto dry forest stands historically dominated by ponderosa pine (Gedney et al. 1999). Recent work suggests that juniper expansion has a strong climate change signal – it cannot be attributed solely to fire exclusion (Miller et al. 2005).
- Water, and its availability for a myriad of uses, will undoubtedly be a defining issue of the 21<sup>st</sup> century (Clifton et al. 2018). River and stream summer low flows, for example, are projected to decrease substantially by the end of the 21<sup>st</sup> century (Dalton 2020), affecting both ecosystem and municipal uses.

Forestry practices can help manage snowpack (Schneider et al. 2019) – thinning allows snow to pass through the canopy and be stored on a semi-shaded ground surface, to be slowly released during spring and early summer. (Typically, snow hung up in a dense canopy is returned directly to the atmosphere via sublimation and evaporation.) By encouraging slowly melting snowpack (Broxton et al. 2020, Woods et al. 2006), thinning promotes aquifer recharge – groundwater supplies are reaching a crisis point in many rural areas.

In addition to downstream and human uses, melting snow provides water for trees and alleviates forest water stress (Grant et al. 2013). Trees and forests, frontline victims of climate change, provide many ecosystem services and ask for little in return. If we value forests and the services they provide, we should provide them with enough water to sustain their vigor and health (Grant et al. 2013).

As water scarcity increases, we should orient our forest management practices toward water yield augmentation. For the interior Pacific Northwest, past policy has focused on providing water for base flows, anadromous fish, and downstream fish habitat (all are important uses); future policy should emphasize manipulating forests to augment water yields and support groundwater recharge efforts.

- Managers should consider assisted migration as an option for introducing new species or genotypes to better match future conditions. An example: A study involving Douglas-fir in

western Oregon and Washington found that continued use of local seed sources could result in maladapted stands by the end of this century (St. Clair and Howe 2007). It concluded that Douglas-fir populations that will be adapted to climatic conditions at the end of this century are now located 500-1,000 meters lower in elevation (1,640-3,281 feet) and 2-5 degrees farther south in latitude (app. 140-350 miles) than existing populations.

How might these results be used? Let's say you own a private forest tract outside Oakridge, OR (southeast of Eugene). You harvest an area and decide that the climate changes you've been observing are significant enough to warrant a different reforestation approach. Instead of replanting with Douglas-fir seedlings grown entirely from local sources, you purchase Douglas-fir seed from a source outside Mt. Shasta, CA, about 300 miles south and 2,000 feet lower than your planting site. You grow seedlings from this seed and plant them. Will this strategy work? It all depends on frost damage and other near-term consequences. As a prudent landowner, it might be good to hedge your bets by mixing a few local sources into your planting mix too.

[To some, this may seem like an extreme example of assisted migration (AM). But in my view, it really isn't – it involves migrating a southern seed source (genotype) north for a considerable distance. But it doesn't include introducing an entirely new species, like incense cedar, to a local planting area (and often, AM utilizes the 'new species' tactic).]

- To summarize, here are some strategies for responding to climate change issues.
  1. Know your forest and be alert to unusual changes; use a forest management plan.
  2. Accept uncertainty and expect to be surprised occasionally.
  3. Monitor changes and use monitoring results to adapt your management approaches.
  4. Assess your risks and opportunities (both exist), and then plan ahead.
  5. Be especially careful about assuming that the past is a useful guide for the future.
  6. Use active management to promote adaptation; consider using disturbance as an opportunity for adaptation (e.g., consider assisted migration for postfire reforestation).
  7. Always consider the twin pillars of resistance and resilience – what can be done, now, to help existing resources prepare for near-term change (resistance)? And when planning treatments with longer-term effects, or when responding to wildfire and stand-replacing events by assisting ecosystem recovery, how can we provide for future resilience?
  8. Ensure that forests have the right tools to cope with future change, including proper composition, structure, and stand density in an historical range of variability (HRV) context. And consider that what is considered to be 'proper' HRV differs for the dry, moist, and cold upland forest biophysical environments (Powell 2019a). And evaluate whether traditional HRV ranges should be adjusted to account for climate change.
  9. Thinning is not a solution for every climate change problem (although I suspect it should be 😊). But when evaluating options for climate change adaptation, it's generally appropriate to include density management in the mix (Bradford and Bell 2017) – thinning provides more water for your trees, it redistributes snowpack and allows it to be released more slowly, and it improves tree vigor and overall forest health.

## 6. SUGGESTED STOCKING LEVELS

This chapter provides suggested stocking levels as a series of tables; they are grouped initially by tree species and secondarily by potential vegetation type.

### STOCKING LEVEL TABLES

Stocking-level tables follow a similar order as is used for table 3-1, both for tree species (columns in table 3-1) and potential vegetation type (rows in table 3-1).

These tables do not provide stand density information for the full-stocking or maximum density levels (those levels are provided in table 3-3); *only the climate resilience stocking level, and the upper and lower limits of a management zone levels, are included in these tables.*

Each table consists of 25 columns arranged in four sections. Boundaries between each section are delineated with a heavy black line (shown below in fig. 6-1).

The three main sections are divided into subsections, as illustrated in figure 6-1 (*only 2 of the 3 sections are shown below, in fig. 6-1*). Each section or subsection is described below.

| QMD  | CLIMATE CHANGE; SDI 99; 25% OF MAX |      |      |      |                 |    |    |    | LOWER LIMIT; SDI 138; 35% OF MAX |      |      |      |                 |    |    |    |
|------|------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                     |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                 | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 5815                               | 5475 | 5062 | 2.9  | 32              | 30 | 28 | 36 | 8141                             | 7665 | 7087 | 2.5  | 44              | 42 | 39 | 42 |
| 1.5  | 2837                               | 2671 | 2470 | 4.2  | 35              | 33 | 30 | 38 | 3972                             | 3739 | 3458 | 3.6  | 49              | 46 | 42 | 44 |
| 2.0  | 1705                               | 1605 | 1484 | 5.4  | 37              | 35 | 32 | 39 | 2387                             | 2247 | 2078 | 4.6  | 52              | 49 | 45 | 45 |
| 2.5  | 1149                               | 1081 | 1000 | 6.6  | 39              | 37 | 34 | 40 | 1608                             | 1514 | 1400 | 5.6  | 55              | 52 | 48 | 46 |
| 3.0  | 832                                | 783  | 724  | 7.8  | 41              | 38 | 36 | 40 | 1165                             | 1096 | 1014 | 6.6  | 57              | 54 | 50 | 47 |
| 3.5  | 633                                | 596  | 551  | 8.9  | 42              | 40 | 37 | 41 | 886                              | 835  | 772  | 7.5  | 59              | 56 | 52 | 47 |
| 4.0  | 500                                | 471  | 435  | 10.0 | 44              | 41 | 38 | 42 | 700                              | 659  | 609  | 8.5  | 61              | 58 | 53 | 48 |
| 4.5  | 406                                | 382  | 353  | 11.1 | 45              | 42 | 39 | 42 | 568                              | 535  | 495  | 9.4  | 63              | 59 | 55 | 48 |
| 5.0  | 337                                | 317  | 293  | 12.2 | 46              | 43 | 40 | 43 | 472                              | 444  | 410  | 10.3 | 64              | 61 | 56 | 49 |
| 5.5  | 285                                | 268  | 248  | 13.3 | 47              | 44 | 41 | 43 | 398                              | 375  | 347  | 11.2 | 66              | 62 | 57 | 49 |
| 6.0  | 244                                | 230  | 212  | 14.4 | 48              | 45 | 42 | 43 | 341                              | 321  | 297  | 12.1 | 67              | 63 | 58 | 50 |
| 6.5  | 212                                | 199  | 184  | 15.4 | 49              | 46 | 42 | 44 | 296                              | 279  | 258  | 13.0 | 68              | 64 | 59 | 50 |
| 7.0  | 186                                | 175  | 162  | 16.5 | 50              | 47 | 43 | 44 | 260                              | 245  | 226  | 13.9 | 69              | 65 | 60 | 50 |
| 7.5  | 164                                | 155  | 143  | 17.5 | 50              | 47 | 44 | 44 | 230                              | 217  | 200  | 14.8 | 71              | 66 | 61 | 51 |
| 8.0  | 147                                | 138  | 128  | 18.5 | 51              | 48 | 45 | 45 | 205                              | 193  | 179  | 15.7 | 72              | 67 | 62 | 51 |
| 8.5  | 132                                | 124  | 115  | 19.5 | 52              | 49 | 45 | 45 | 184                              | 174  | 160  | 16.5 | 73              | 68 | 63 | 51 |
| 9.0  | 119                                | 112  | 104  | 20.6 | 53              | 49 | 46 | 45 | 167                              | 157  | 145  | 17.4 | 74              | 69 | 64 | 51 |
| 9.5  | 108                                | 102  | 94   | 21.6 | 53              | 50 | 46 | 45 | 151                              | 143  | 132  | 18.2 | 75              | 70 | 65 | 52 |
| 10.0 | 99                                 | 93   | 86   | 22.6 | 54              | 51 | 47 | 46 | 138                              | 130  | 120  | 19.1 | 75              | 71 | 66 | 52 |

| Section One | Subsection One |  |  |  | Subsection Two |  |  |  | Subsection One |  |  |  | Subsection Two |  |  |  |
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|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |
|             |                |  |  |  |                |  |  |  |                |  |  |  |                |  |  |  |

## Section One: QMD

Section one is a single column providing quadratic mean diameters (QMDs) ranging from 1 to 10 inches in 0.5-inch increments, from 10 to 20 inches in 1-inch increments, and from 20 to 30 inches in 2-inch increments.

Smaller increments are used for QMDs below 10 inches because the additional detail is useful when preparing silvicultural prescriptions for young-stand treatments. If more detail is needed than the tables provide, intermediate values can be interpolated.

## Section Two: Climate Resilience

Section two consists of eight columns divided into two subsections. It provides information about the climate resilience (CR) stocking level.

The CR stocking level represents a constant level of stand density index (SDI); a constant SDI indicates that the same relative level of site occupancy and intertree competition occurs across the range of stand diameters/QMDs (Daniel et al. 1979a). The actual SDI value selected as a CR stocking level is shown in the section heading: **Climate Resilience; SDI 99; 25% of Max.**

Refer to *The Climate Resilience Stocking Level* section, chapter 3, for further information about the CR stocking level.

The first part of section two, subsection one, provides **trees per acre** (TPA) values; they are calculated by using the SDI value established as a CR stocking level and the QMDs presented in section 1. TPA data is useful because small trees contain little basal area, and stand density is often expressed as TPA for stands where most of the trees are smaller than 5-inches dbh.

The first column in subsection one provides TPA values associated with an even-aged (EA) stand structure, the next column provides TPA for an irregular structure (IS), and the third column shows TPA for an uneven-aged (UA) structure. Chapter 3 provides information about how the trees-per-acre calculations are made for these three stand structures.

The fourth column in subsection one shows the equilateral spacing (ES) associated with the TPA value for an even-aged stand structure. Equilateral spacings are always based on the even-aged structure because it presumably has the most consistent intertree distances. ES values shown in this column would not apply to trees left in clumps or in other irregular arrangements.

Subsection two of section two provides **basal area per acre** (BA) values; they are based on the TPA values from subsection one and the QMDs from section 1. BA is commonly used to express stand density for stands where most trees are greater than 5-inches dbh.

Subsection two provides BA values associated with even-aged (EA), irregular (IS), and uneven-aged (UA) structures. BA values for the IS and UA structures were calculated by multiplying the EA value by an adjustment factor described in chapter 3 (see *Calculating Basal Area*).

The fourth column in subsection two provides a **canopy cover** (CC) percentage calculated by using BA values; the calculation equations are based on Blue Mountain unmanaged stands. Users who want a *managed-stand* CC value for lodgepole pine should consult table 3-9.

For Douglas-fir, Engelmann spruce, grand fir, ponderosa pine, subalpine fir, and western

larch, CC values pertain to an irregular structure because it best reflects the unmanaged stands used to derive mathematical formulas for calculating canopy cover (Dealy 1985).

For lodgepole pine, canopy cover values pertain to even-aged (often fire-origin) stands because unmanaged stands tend to be even-aged for this species.

### **Sections Three & Four: Lower And Upper Limits Of A Management Zone**

Sections three and four of each table, each of which consists of eight columns divided into two subsections, provide information about the lower and upper limits of a management zone (Lower Limit, LL; and Upper Limit, UL).

The LL represents a constant level of stand density index (SDI), and a constant SDI indicates that the same level of site occupancy occurs across the range of stand diameters (Daniel et al. 1979a). The actual SDI value selected as an LL stocking level is shown in the section heading: **LOWER LIMIT; SDI 138; 35% OF MAX** (same format is used for the Upper Limit section).

Two sections of chapter 3 provide more information about how SDI values are determined for the LL and UL stocking levels – *The Lower Limit of a Management Zone (LLMZ)*, and *The Upper Limit of a Management Zone (ULMZ)*.

Detailed information presented in sections three and four (Lower Limit; Upper Limit) has exactly the same specifications as described above for the Climate Resilience section.

### **Calculation Methodology**

All calculations used to produce the stand density tables in chapter 6 were made in a computerized spreadsheet program.

Calculation methodology follows procedures described in chapter 3 – the *Calculating Basal Area* section in chapter 3 provides an example of how the calculations were made.

### **Summary Of Abbreviations And Acronyms**

Each table in chapter 6 provides 25 columns of information – this is a lot of detail. To provide the information in a compact format, tables are presented in a landscape orientation (to fit more detail on each page), and abbreviations or acronyms are used as column headings.

Each table includes three stocking levels (Climate Resilience, Lower Limit, and Upper Limit), and the 24 columns (8 per stocking level) provide stand density data for the stocking levels. Stocking levels are expressed as SDI, and the SDI value for a stocking level is provided in a section's header. To optimize space, the table and column headings are abbreviated as follows:

|     |                         |
|-----|-------------------------|
| SDI | Stand Density Index     |
| Max | Maximum Density         |
| QMD | Quadratic Mean Diameter |
| EA  | Even Aged               |
| IS  | Irregular Structure     |
| UA  | Uneven Aged             |
| ES  | Equilateral Spacing     |
| CC  | Canopy Cover            |

## INDEX TO STOCKING LEVEL TABLES

Stocking-level tables are organized in the same manner as stocking-level information is presented in table 3-1 – first by tree species (e.g., all the ponderosa pine tables are grouped together), and second by potential vegetation type within a species.

Just like for table 3-1, the seven tree species are ordered by using a temperature-moisture gradient, from warm and dry (ponderosa pine, PP) to cold and moist (subalpine fir, SF). Unlike the tree species, the potential vegetation types (PVTs) are organized alphabetically, and the order is based on name acronyms (e.g., ABGR/ACGL). With this alphabetical ordering scheme, grand fir PVTs (ABGR) appear first, and mountain hemlock (TSME) PVTs appear last.

To help decipher table and page numbering, table 6-1 (next page), provides an index showing potential vegetation type (rows on the index page), and tree species (columns on the index page); each entry provides a table number and page number, in this format: W4/p182.

This example entry, appearing in the WL (western larch) column for the ABLA2/CLUN PVT (B-O area), shows that suggested stocking levels for western larch on the subalpine fir/queencup beadlily (ABLA2/CLUN) PVT are provided in table W4, and table W4 can be found on page 182.

Tables are numbered by first using a single letter to denote the species section. The letter notation is the first letter of a species column in table 6-1, as follows:

|                       |                         |
|-----------------------|-------------------------|
| Ponderosa pine, PP: P | Engelmann spruce, ES: E |
| Douglas-fir, DF: D    | Grand fir, GF: G        |
| Western larch, WL: W  | Subalpine fir, SF: S    |
| Lodgepole pine, LP: L |                         |

Sometimes, stocking levels for a species on a particular PVT are the same as, or very close to, stocking levels for the same species on another PVT (for example: PP on ABGR/CARU and ABGR/ACGL, both for the W-S area). When this happens, all the PVTs involved are included in one table and their names are listed in the table title. (This approach is used when SDI values for multiple PVTs are either the same, or only differ from each other by a few points).

The combination approach described here is *only used within a tree species* (NOT within a PVT for multiple tree species). Multiple tree species with the same stocking levels for a particular PVT are NOT combined in one table. *The combination approach resulted in this stocking guide having less bulk than if every tree species-PVT combination had its own individual table.*

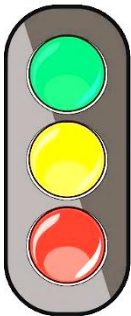


**Figure 6-2** – Stoplight analogy for table heading rows. Each stocking-level table in chapter 6 has three main sections, and each section has a different header-row color: *Green means GO: Climate Resilience.* The climate resilience stocking level promotes long-term resilience and ecological integrity better than the other stocking levels. *Yellow means CAUTION: Lower Limit.* The lower limit stocking level is sustainable, but this benefit will not be maintained for as long as it will for the climate resilience level. *Red means STOP: Upper Limit.* The upper limit stocking level coincides with the *lower limit of the self-thinning zone* (table 3-2). **When possible, stand density should be managed so it stays below the self-thinning zone and the Upper Limit.**

**TABLE 6-1: STOCKING TABLE INDEX (index format: chapter 6 table #/page #)**

| POTENTIAL VEG. TYPE | AREA | PP      | DF      | WL       | LP       | ES       | GF    | SF       |
|---------------------|------|---------|---------|----------|----------|----------|-------|----------|
| ABGR/ACGL           | B-O  |         | D1/p163 | W1/p179  |          | E1/p206  | G1/p  |          |
| ABGR/ACGL           | W-S  | P1/p137 | D2/p164 |          |          |          | G2/p  |          |
| ABGR/ACGL-PHMA      | W-S  |         | D2/p164 | W2/p180  |          |          | G3/p  |          |
| ABGR/ARCO           | PCT  | P2/p138 | D3/p165 | W3/p181  | L1/p192  |          | G4/p  |          |
| ABGR/BRVU           | B-O  |         |         | W4/p182  |          | E2/p207  | G2/p  |          |
| ABGR/CAGE           | B-O  | P3/p139 | D4/p166 |          |          |          | G2/p  |          |
| ABGR/CARU           | B-O  | P2/p138 | D3/p165 | W3/p181  | L1/p192  |          | G4/p  |          |
| ABGR/CARU           | W-S  | P1/p137 | D2/p164 |          |          |          |       |          |
| ABGR/CLUN           | B-O  |         | D2/p164 | W4/p182  |          | E2/p207  | G2/p  |          |
| ABGR/CLUN           | W-S  | P1/p137 | D2/p164 | W5/p183  | L2/p193  | E2/p207  | G2/p  |          |
| ABGR/GYDR           | B-O  |         |         |          |          |          | G5/p  |          |
| ABGR/LIBO2          | B-O  | P1/p137 | D2/p164 | W6/p184  | L3/p194  | E3/p208  | G6/p  | S1/p231  |
| ABGR/LIBO2          | W-S  |         | D2/p164 | W4/p182  | L1/p192  |          | G2/p  |          |
| ABGR/POMU-ASCA3     | B-O  |         |         | W1/p179  |          | E2/p207  | G7/p  |          |
| ABGR/SPBE           | B-O  | P4/p140 | D5/p167 |          |          |          | G8/p  |          |
| ABGR/SPBE           | W-S  | P1/p137 | D2/p164 |          |          |          |       |          |
| ABGR/TABR/CLUN      | B-O  |         |         |          |          | E4/p209  | G2/p  |          |
| ABGR/TABR/LIBO2     | B-O  |         | D2/p164 | W7/p185  |          | E5/p210  | G2/p  |          |
| ABGR/TRCA3          | B-O  |         |         | W8/p186  |          | E6/p211  | G5/p  |          |
| ABGR/VAME           | B-O  | P5/p141 | D2/p164 | W4/p182  | L4/p195  | E7/p212  | G9/p  | S2/p232  |
| ABGR/VAME           | W-S  | P6/p142 | D6/p168 | W6/p184  | L5/p196  | E2/p207  | G2/p  |          |
| ABGR/VASC           | B-O  | P7/p143 | D7/p169 | W7/p185  | L6/p197  |          | G10/p |          |
| ABGR/VASC-LIBO2     | B-O  |         | D6/p168 | W9/p187  | L7/p198  | E8/p213  | G11/p | S3/p233  |
| ABLA2/ARCO          | PCT  |         |         |          | L8/p199  | E7/p212  |       | S4/p234  |
| ABLA2/CAGE          | B-O  |         |         |          | L9/p200  |          |       | S1/p231  |
| ABLA2/CLUN          | B-O  |         |         | W4/p182  |          | E2/p207  |       | S5/p235  |
| ABLA2/CLUN          | W-S  | P8/p144 |         | W10/p188 |          | E2/p207  | G12/p | S6/p236  |
| ABLA2/LIBO2         | B-O  |         |         | W4/p182  |          | E9/p214  |       | S7/p237  |
| ABLA2/LIBO2         | W-S  |         |         | W11/p189 | L5/p196  | E10/p215 |       | S8/p238  |
| ABLA2/MEFE          | B-O  |         |         |          |          |          |       | S5/p235  |
| ABLA2/MEFE          | W-S  |         |         |          | L10/p201 | E11/p216 |       | S9/p239  |
| ABLA2/POPU          | PCT  |         | D2/p164 | W4/p182  | L11/p202 | E12/p217 |       | S10/p240 |
| ABLA2/STAM          | W-S  |         |         |          | L10/p201 | E2/p207  |       | S11/p241 |
| ABLA2/STOC          | PCT  |         |         |          | L9/p200  |          |       | S1/p231  |
| ABLA2/TRCA3         | B-O  |         |         |          | L8/p199  | E7/p212  |       | S4/p234  |
| ABLA2/VAME          | B-O  |         |         | W12/p190 | L12/p203 | E9/p214  |       | S12/p242 |
| ABLA2/VAME          | W-S  |         | D2/p164 | W6/p184  | L1/p192  | E13/p218 |       | S7/p237  |
| ABLA2/VASC          | B-O  |         | D8/p170 | W12/p190 | L13/p204 | E11/p216 |       | S13/p243 |
| ABLA2/VASC/POPU     | W-S  |         | D2/p164 | W4/p182  | L11/p202 | E12/p217 |       | S10/p240 |
| PICO/CARU           | B-O  |         |         |          | L14/p205 |          |       |          |
| PICO(ABGR)/ALSI     | PCT  |         | D2/p164 | W4/p182  |          | E2/p207  | G2/p  |          |

| POTENTIAL VEG. TYPE   | AREA | PP       | DF       | WL       | LP       | ES       | GF    | SF       |
|-----------------------|------|----------|----------|----------|----------|----------|-------|----------|
| PICO(ABGR)/ARNE       | PCT  | P5/p141  | D2/p164  | W4/p182  | L4/p195  | E7/p212  | G9/p  | S2/p232  |
| PICO(ABGR)/VAME       | PCT  | P5/p141  | D2/p164  | W4/p182  | L4/p195  | E7/p212  | G9/p  | S2/p232  |
| PICO(ABGR)/VAME/CARU  | PCT  | P5/p141  | D2/p164  | W4/p182  | L4/p195  | E7/p212  | G9/p  | S2/p232  |
| PICO(ABGR)/VAME-LIBO2 | PCT  | P1/p137  | D2/p164  | W6/p184  | L3/p194  | E3/p208  | G6/p  | S1/p231  |
| PICO(ABGR)/VAME/PTAQ  | PCT  | P5/p141  | D2/p164  | W4/p182  | L4/p195  | E7/p212  | G9/p  | S2/p232  |
| PICO(ABGR)/VASC/CARU  | PCT  | P7/p143  | D7/p169  | W7/p185  | L6/p197  |          | G10/p |          |
| PICO(ABLA2)/STOC      | PCT  |          |          |          | L9/p200  |          |       | S1/p231  |
| PICO(ABLA2)/VAME      | PCT  |          |          | W12/p190 | L12/p203 | E9/p214  |       | S12/p242 |
| PICO(ABLA2)/VASC      | PCT  |          | D8/p170  | W12/p190 | L13/p204 | E11/p216 |       | S13/p243 |
| PICO(ABLA2)/VASC/POPU | PCT  |          | D2/p164  | W4/p182  | L11/p202 | E12/p217 |       | S10/p240 |
| PIPO/AGSP             | B-O  | P9/p145  |          |          |          |          |       |          |
| PIPO/AGSP             | W-S  | P10/p146 |          |          |          |          |       |          |
| PIPO/ARTRV/FEID-AGSP  | B-O  | P11/p147 |          |          |          |          |       |          |
| PIPO/CAGE             | B-O  | P12/p148 |          |          |          |          |       |          |
| PIPO/CARU             | B-O  | P1/p137  |          |          |          |          |       |          |
| PIPO/CELE/CAGE        | B-O  | P13/p149 |          |          |          |          |       |          |
| PIPO/CELE/FEID-AGSP   | B-O  | P14/p150 |          |          |          |          |       |          |
| PIPO/CELE/PONE        | B-O  | P14/p150 |          |          |          |          |       |          |
| PIPO/FEID             | B-O  | P15/p151 |          |          |          |          |       |          |
| PIPO/FEID             | W-S  | P16/p152 |          |          |          |          |       |          |
| PIPO/PUTR/CAGE        | B-O  | P16/p152 |          |          |          |          |       |          |
| PIPO/PUTR/CARO        | B-O  | P17/p153 |          |          |          |          |       |          |
| PIPO/PUTR/FEID-AGSP   | B-O  | P10/p146 |          |          |          |          |       |          |
| PIPO/SPBE             | W-S  | P18/p154 |          |          |          |          |       |          |
| PIPO/SYAL             | B-O  | P19/p155 |          |          |          |          |       |          |
| PIPO/SYAL             | W-S  | P17/p153 |          |          |          |          |       |          |
| PIPO/SYOR             | B-O  | P20/p156 |          |          |          |          |       |          |
| PSME/ACGL-PHMA        | W-S  | P21/p157 | D7/p169  |          |          |          |       |          |
| PSME/CAGE             | B-O  | P18/p154 | D9/p171  |          |          |          |       |          |
| PSME/CARU             | B-O  | P20/p156 | D10/p172 |          |          |          |       |          |
| PSME/CARU             | W-S  | P22/p158 | D2/p164  |          |          |          |       |          |
| PSME/HODI             | B-O  | P23/p159 | D11/p173 |          |          |          |       |          |
| PSME/PHMA             | B-O  | P24/p160 | D12/p174 | W9/p187  |          |          |       |          |
| PSME/PHMA             | W-S  | P13/p149 | D13/p175 |          |          |          |       |          |
| PSME/SPBE             | W-S  | P25/p161 | D14/p176 |          |          |          |       |          |
| PSME/SYAL             | B-O  | P24/p160 | D15/p177 | W13/p191 |          |          |       |          |
| PSME/SYAL             | W-S  | P26/p162 | D2/p164  |          |          |          |       |          |
| PSME/SYOR             | W-S  | P22/p158 |          |          |          |          |       |          |
| PSME/VAME             | B-O  | P15/p151 | D16/p178 |          |          |          |       |          |
| TSME/VASC+VAME        | W-S  |          |          |          | L14/p205 | E5/p210  |       | S5/p235  |

Note: Index entries (such as E12/p160) are formatted in this way: chapter 6 table number/page number.



Column headings in table 6-1 include potential vegetation type (col. 1), geographical area (col. 2), and 2-digit alpha codes for seven tree species (columns 3 through 9).

Area refers to the Blue-Ochoco (B-O) and Wallowa-Snake (W-S) portions of the Blue Mountains ecoregion. PCT in this Area column refers to plant community type; PCTs are not assigned to a sub-area (B-O or W-S) within the Blue Mountains.

Tree species codes are: PP, ponderosa pine; DF, Douglas-fir; WL, western larch; LP, lodgepole pine; ES, Engelmann spruce; GF, grand fir; and SF, subalpine fir.

Dashed horizontal lines in table 6-1 delineate potential vegetation series (ABGR, ABLA2, etc.), and potential vegetation types are organized, within a series, in the same **alphabetical** order used for table 3-1.

Sometimes, stocking levels for a tree species are the same for multiple potential vegetation types (or the SDI values only differ by a few points). When this happens, all the PVTs are included in one species table and their names listed in the table title. *This combination approach is only used within a tree species* – different tree species are not combined within a single PVT.

Detailed stocking tables follow this page. They are grouped by species – and just like for table 3-1, the seven tree species are organized by using a temperature-moisture gradient, from warm and dry (ponderosa pine, PP) to cold and moist (subalpine fir, SF).

|                                    |     |
|------------------------------------|-----|
| Ponderosa pine (26 tables).....    | 137 |
| Douglas-fir (16 tables) .....      | 163 |
| Western larch (13 tables) .....    | 179 |
| Lodgepole pine (14 tables) .....   | 192 |
| Engelmann spruce (13 tables) ..... | 206 |
| Grand fir (12 tables) .....        | 219 |
| Subalpine fir (13 tables).....     | 231 |

**Table P1:** Ponderosa pine stocking levels for the ABGR/ACGL, ABGR/CARU, ABGR/CLUN, and ABGR/SPBE plant associations (W-S province), the ABGR/LIBO2 and PIPO/CARU plant associations (B-O province), and the PICO(ABGR)/VAME-LIBO2 plant community type.

| QMD  | Climate Resilience; SDI 114; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 160; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 251; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6713                                    | 6320 | 5844 | 2.7  | 37              | 34 | 32 | 38 | 9398                             | 8848 | 8182 | 2.3  | 51              | 48  | 45 | 45 | 14768                            | 13904 | 12857 | 1.8  | 81              | 76  | 70  | 53 |
| 1.5  | 3275                                    | 3083 | 2851 | 3.9  | 40              | 38 | 35 | 40 | 4585                             | 4317 | 3992 | 3.3  | 56              | 53  | 49 | 46 | 7205                             | 6784  | 6273  | 2.6  | 88              | 83  | 77  | 55 |
| 2.0  | 1968                                    | 1853 | 1714 | 5.1  | 43              | 40 | 37 | 41 | 2756                             | 2594 | 2399 | 4.3  | 60              | 57  | 52 | 48 | 4330                             | 4077  | 3770  | 3.4  | 94              | 89  | 82  | 56 |
| 2.5  | 1326                                    | 1248 | 1154 | 6.2  | 45              | 43 | 39 | 42 | 1856                             | 1748 | 1616 | 5.2  | 63              | 60  | 55 | 48 | 2917                             | 2747  | 2540  | 4.2  | 99              | 94  | 87  | 57 |
| 3.0  | 960                                     | 904  | 836  | 7.2  | 47              | 44 | 41 | 43 | 1344                             | 1266 | 1170 | 6.1  | 66              | 62  | 57 | 49 | 2113                             | 1989  | 1839  | 4.9  | 104             | 98  | 90  | 58 |
| 3.5  | 731                                     | 688  | 636  | 8.3  | 49              | 46 | 43 | 44 | 1023                             | 964  | 891  | 7.0  | 68              | 64  | 60 | 50 | 1608                             | 1514  | 1400  | 5.6  | 107             | 101 | 94  | 58 |
| 4.0  | 577                                     | 543  | 502  | 9.3  | 50              | 47 | 44 | 44 | 808                              | 761  | 703  | 7.9  | 71              | 66  | 61 | 50 | 1270                             | 1195  | 1105  | 6.3  | 111             | 104 | 96  | 59 |
| 4.5  | 469                                     | 441  | 408  | 10.4 | 52              | 49 | 45 | 45 | 656                              | 618  | 571  | 8.8  | 72              | 68  | 63 | 51 | 1031                             | 970   | 897   | 7.0  | 114             | 107 | 99  | 59 |
| 5.0  | 389                                     | 366  | 338  | 11.4 | 53              | 50 | 46 | 45 | 544                              | 512  | 474  | 9.6  | 74              | 70  | 65 | 51 | 855                              | 805   | 745   | 7.7  | 117             | 110 | 102 | 60 |
| 5.5  | 328                                     | 309  | 286  | 12.4 | 54              | 51 | 47 | 46 | 460                              | 433  | 400  | 10.5 | 76              | 71  | 66 | 52 | 723                              | 680   | 629   | 8.3  | 119             | 112 | 104 | 60 |
| 6.0  | 282                                     | 265  | 245  | 13.4 | 55              | 52 | 48 | 46 | 394                              | 371  | 343  | 11.3 | 77              | 73  | 67 | 52 | 619                              | 583   | 539   | 9.0  | 122             | 115 | 106 | 61 |
| 6.5  | 244                                     | 230  | 213  | 14.3 | 56              | 53 | 49 | 46 | 342                              | 322  | 298  | 12.1 | 79              | 74  | 69 | 53 | 538                              | 506   | 468   | 9.7  | 124             | 117 | 108 | 61 |
| 7.0  | 214                                     | 202  | 187  | 15.3 | 57              | 54 | 50 | 47 | 300                              | 283  | 261  | 12.9 | 80              | 76  | 70 | 53 | 472                              | 444   | 411   | 10.3 | 126             | 119 | 110 | 61 |
| 7.5  | 190                                     | 179  | 165  | 16.3 | 58              | 55 | 51 | 47 | 266                              | 250  | 231  | 13.8 | 81              | 77  | 71 | 53 | 417                              | 393   | 363   | 11.0 | 128             | 121 | 111 | 62 |
| 8.0  | 169                                     | 159  | 147  | 17.2 | 59              | 56 | 51 | 47 | 237                              | 223  | 206  | 14.6 | 83              | 78  | 72 | 53 | 372                              | 350   | 324   | 11.6 | 130             | 122 | 113 | 62 |
| 8.5  | 152                                     | 143  | 132  | 18.2 | 60              | 56 | 52 | 47 | 213                              | 200  | 185  | 15.4 | 84              | 79  | 73 | 54 | 334                              | 315   | 291   | 12.3 | 132             | 124 | 115 | 62 |
| 9.0  | 137                                     | 129  | 120  | 19.1 | 61              | 57 | 53 | 48 | 192                              | 181  | 167  | 16.2 | 85              | 80  | 74 | 54 | 302                              | 285   | 263   | 12.9 | 134             | 126 | 116 | 62 |
| 9.5  | 125                                     | 118  | 109  | 20.1 | 61              | 58 | 53 | 48 | 175                              | 165  | 152  | 17.0 | 86              | 81  | 75 | 54 | 275                              | 259   | 239   | 13.5 | 135             | 127 | 118 | 63 |
| 10.0 | 114                                     | 107  | 99   | 21.0 | 62              | 59 | 54 | 48 | 160                              | 150  | 139  | 17.8 | 87              | 82  | 76 | 54 | 251                              | 236   | 218   | 14.2 | 137             | 129 | 119 | 63 |
| 11.0 | 96                                      | 91   | 84   | 22.9 | 64              | 60 | 55 | 49 | 135                              | 127  | 117  | 19.3 | 89              | 84  | 77 | 55 | 212                              | 199   | 184   | 15.4 | 140             | 132 | 122 | 63 |
| 12.0 | 83                                      | 78   | 72   | 24.7 | 65              | 61 | 56 | 49 | 116                              | 109  | 101  | 20.9 | 91              | 85  | 79 | 55 | 182                              | 171   | 158   | 16.6 | 143             | 134 | 124 | 64 |
| 13.0 | 72                                      | 67   | 62   | 26.5 | 66              | 62 | 57 | 49 | 100                              | 94   | 87   | 22.4 | 92              | 87  | 80 | 56 | 158                              | 148   | 137   | 17.9 | 145             | 137 | 126 | 64 |
| 14.0 | 63                                      | 59   | 55   | 28.3 | 67              | 63 | 58 | 50 | 88                               | 83   | 77   | 23.9 | 94              | 89  | 82 | 56 | 138                              | 130   | 120   | 19.1 | 148             | 139 | 129 | 64 |
| 15.0 | 56                                      | 52   | 48   | 30.1 | 68              | 64 | 59 | 50 | 78                               | 73   | 68   | 25.4 | 96              | 90  | 83 | 56 | 122                              | 115   | 107   | 20.3 | 150             | 141 | 131 | 65 |
| 16.0 | 50                                      | 47   | 43   | 31.8 | 69              | 65 | 60 | 50 | 69                               | 65   | 60   | 26.9 | 97              | 91  | 84 | 56 | 109                              | 103   | 95    | 21.5 | 152             | 143 | 133 | 65 |
| 17.0 | 45                                      | 42   | 39   | 33.6 | 70              | 66 | 61 | 50 | 62                               | 59   | 54   | 28.4 | 98              | 93  | 86 | 57 | 98                               | 92    | 85    | 22.7 | 155             | 146 | 135 | 65 |
| 18.0 | 40                                      | 38   | 35   | 35.3 | 71              | 67 | 62 | 51 | 56                               | 53   | 49   | 29.9 | 100             | 94  | 87 | 57 | 89                               | 83    | 77    | 23.8 | 157             | 147 | 136 | 65 |
| 19.0 | 37                                      | 34   | 32   | 37.1 | 72              | 68 | 63 | 51 | 51                               | 48   | 45   | 31.3 | 101             | 95  | 88 | 57 | 81                               | 76    | 70    | 25.0 | 159             | 149 | 138 | 66 |
| 20.0 | 33                                      | 31   | 29   | 38.8 | 73              | 69 | 63 | 51 | 47                               | 44   | 41   | 32.8 | 102             | 96  | 89 | 57 | 74                               | 69    | 64    | 26.2 | 160             | 151 | 140 | 66 |
| 22.0 | 28                                      | 27   | 25   | 42.2 | 75              | 70 | 65 | 52 | 40                               | 37   | 34   | 35.7 | 104             | 98  | 91 | 58 | 62                               | 58    | 54    | 28.5 | 164             | 154 | 143 | 66 |
| 24.0 | 24                                      | 23   | 21   | 45.6 | 76              | 72 | 66 | 52 | 34                               | 32   | 30   | 38.5 | 106             | 100 | 93 | 58 | 53                               | 50    | 46    | 30.7 | 167             | 158 | 146 | 67 |
| 26.0 | 21                                      | 20   | 18   | 48.9 | 77              | 73 | 67 | 52 | 29                               | 28   | 26   | 41.4 | 108             | 102 | 94 | 58 | 46                               | 44    | 40    | 33.0 | 170             | 160 | 148 | 67 |
| 28.0 | 18                                      | 17   | 16   | 52.2 | 79              | 74 | 69 | 53 | 26                               | 24   | 22   | 44.2 | 110             | 104 | 96 | 59 | 41                               | 38    | 35    | 35.2 | 173             | 163 | 151 | 67 |
| 30.0 | 16                                      | 15   | 14   | 55.5 | 80              | 75 | 70 | 53 | 23                               | 21   | 20   | 46.9 | 112             | 106 | 98 | 59 | 36                               | 34    | 31    | 37.4 | 176             | 166 | 153 | 68 |

**Table P2:** Ponderosa pine stocking levels for the ABGR/CARU plant association (B-O province) and the ABGR/ARCO plant community type.

| QMD  | Climate Resilience; SDI 99; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 138; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 217; 55% of Max |       |       |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5815                                   | 5475 | 5062 | 2.9  | 32              | 30 | 28 | 36 | 8141                             | 7665 | 7087 | 2.5  | 44              | 42 | 39 | 42 | 12793                            | 12044 | 11137 | 2.0  | 70              | 66  | 61  | 50 |
| 1.5  | 2837                                   | 2671 | 2470 | 4.2  | 35              | 33 | 30 | 38 | 3972                             | 3739 | 3458 | 3.6  | 49              | 46 | 42 | 44 | 6241                             | 5876  | 5434  | 2.8  | 77              | 72  | 67  | 52 |
| 2.0  | 1705                                   | 1605 | 1484 | 5.4  | 37              | 35 | 32 | 39 | 2387                             | 2247 | 2078 | 4.6  | 52              | 49 | 45 | 45 | 3751                             | 3531  | 3266  | 3.7  | 82              | 77  | 71  | 53 |
| 2.5  | 1149                                   | 1081 | 1000 | 6.6  | 39              | 37 | 34 | 40 | 1608                             | 1514 | 1400 | 5.6  | 55              | 52 | 48 | 46 | 2527                             | 2379  | 2200  | 4.5  | 86              | 81  | 75  | 54 |
| 3.0  | 832                                    | 783  | 724  | 7.8  | 41              | 38 | 36 | 40 | 1165                             | 1096 | 1014 | 6.6  | 57              | 54 | 50 | 47 | 1830                             | 1723  | 1593  | 5.2  | 90              | 85  | 78  | 55 |
| 3.5  | 633                                    | 596  | 551  | 8.9  | 42              | 40 | 37 | 41 | 886                              | 835  | 772  | 7.5  | 59              | 56 | 52 | 47 | 1393                             | 1312  | 1213  | 6.0  | 93              | 88  | 81  | 56 |
| 4.0  | 500                                    | 471  | 435  | 10.0 | 44              | 41 | 38 | 42 | 700                              | 659  | 609  | 8.5  | 61              | 58 | 53 | 48 | 1100                             | 1035  | 957   | 6.8  | 96              | 90  | 84  | 56 |
| 4.5  | 406                                    | 382  | 353  | 11.1 | 45              | 42 | 39 | 42 | 568                              | 535  | 495  | 9.4  | 63              | 59 | 55 | 48 | 893                              | 841   | 777   | 7.5  | 99              | 93  | 86  | 57 |
| 5.0  | 337                                    | 317  | 293  | 12.2 | 46              | 43 | 40 | 43 | 472                              | 444  | 410  | 10.3 | 64              | 61 | 56 | 49 | 741                              | 698   | 645   | 8.2  | 101             | 95  | 88  | 57 |
| 5.5  | 285                                    | 268  | 248  | 13.3 | 47              | 44 | 41 | 43 | 398                              | 375  | 347  | 11.2 | 66              | 62 | 57 | 49 | 626                              | 589   | 545   | 9.0  | 103             | 97  | 90  | 58 |
| 6.0  | 244                                    | 230  | 212  | 14.4 | 48              | 45 | 42 | 43 | 341                              | 321  | 297  | 12.1 | 67              | 63 | 58 | 50 | 537                              | 505   | 467   | 9.7  | 105             | 99  | 92  | 58 |
| 6.5  | 212                                    | 199  | 184  | 15.4 | 49              | 46 | 42 | 44 | 296                              | 279  | 258  | 13.0 | 68              | 64 | 59 | 50 | 466                              | 438   | 405   | 10.4 | 107             | 101 | 93  | 58 |
| 7.0  | 186                                    | 175  | 162  | 16.5 | 50              | 47 | 43 | 44 | 260                              | 245  | 226  | 13.9 | 69              | 65 | 60 | 50 | 408                              | 385   | 356   | 11.1 | 109             | 103 | 95  | 59 |
| 7.5  | 164                                    | 155  | 143  | 17.5 | 50              | 47 | 44 | 44 | 230                              | 217  | 200  | 14.8 | 71              | 66 | 61 | 51 | 361                              | 340   | 315   | 11.8 | 111             | 104 | 97  | 59 |
| 8.0  | 147                                    | 138  | 128  | 18.5 | 51              | 48 | 45 | 45 | 205                              | 193  | 179  | 15.7 | 72              | 67 | 62 | 51 | 322                              | 304   | 281   | 12.5 | 113             | 106 | 98  | 59 |
| 8.5  | 132                                    | 124  | 115  | 19.5 | 52              | 49 | 45 | 45 | 184                              | 174  | 160  | 16.5 | 73              | 68 | 63 | 51 | 290                              | 273   | 252   | 13.2 | 114             | 107 | 99  | 59 |
| 9.0  | 119                                    | 112  | 104  | 20.6 | 53              | 49 | 46 | 45 | 167                              | 157  | 145  | 17.4 | 74              | 69 | 64 | 51 | 262                              | 246   | 228   | 13.9 | 116             | 109 | 101 | 60 |
| 9.5  | 108                                    | 102  | 94   | 21.6 | 53              | 50 | 46 | 45 | 151                              | 143  | 132  | 18.2 | 75              | 70 | 65 | 52 | 238                              | 224   | 207   | 14.5 | 117             | 110 | 102 | 60 |
| 10.0 | 99                                     | 93   | 86   | 22.6 | 54              | 51 | 47 | 46 | 138                              | 130  | 120  | 19.1 | 75              | 71 | 66 | 52 | 217                              | 205   | 189   | 15.2 | 118             | 112 | 103 | 60 |
| 11.0 | 83                                     | 79   | 73   | 24.6 | 55              | 52 | 48 | 46 | 117                              | 110  | 102  | 20.8 | 77              | 73 | 67 | 52 | 184                              | 173   | 160   | 16.6 | 121             | 114 | 105 | 61 |
| 12.0 | 72                                     | 67   | 62   | 26.5 | 56              | 53 | 49 | 46 | 100                              | 94   | 87   | 22.4 | 79              | 74 | 68 | 53 | 157                              | 148   | 137   | 17.9 | 124             | 116 | 108 | 61 |
| 13.0 | 62                                     | 58   | 54   | 28.5 | 57              | 54 | 50 | 47 | 87                               | 82   | 76   | 24.1 | 80              | 75 | 70 | 53 | 137                              | 129   | 119   | 19.2 | 126             | 118 | 110 | 61 |
| 14.0 | 54                                     | 51   | 47   | 30.4 | 58              | 55 | 51 | 47 | 76                               | 72   | 66   | 25.7 | 81              | 77 | 71 | 53 | 120                              | 113   | 104   | 20.5 | 128             | 121 | 111 | 62 |
| 15.0 | 48                                     | 45   | 42   | 32.3 | 59              | 56 | 51 | 47 | 67                               | 64   | 59   | 27.3 | 83              | 78 | 72 | 53 | 106                              | 100   | 92    | 21.8 | 130             | 122 | 113 | 62 |
| 16.0 | 43                                     | 40   | 37   | 34.2 | 60              | 56 | 52 | 48 | 60                               | 57   | 52   | 28.9 | 84              | 79 | 73 | 54 | 95                               | 89    | 82    | 23.1 | 132             | 124 | 115 | 62 |
| 17.0 | 39                                     | 36   | 34   | 36.1 | 61              | 57 | 53 | 48 | 54                               | 51   | 47   | 30.5 | 85              | 80 | 74 | 54 | 85                               | 80    | 74    | 24.3 | 134             | 126 | 117 | 62 |
| 18.0 | 35                                     | 33   | 30   | 38.0 | 62              | 58 | 54 | 48 | 49                               | 46   | 43   | 32.1 | 86              | 81 | 75 | 54 | 77                               | 72    | 67    | 25.6 | 136             | 128 | 118 | 63 |
| 19.0 | 32                                     | 30   | 28   | 39.8 | 62              | 59 | 54 | 48 | 44                               | 42   | 39   | 33.7 | 87              | 82 | 76 | 54 | 70                               | 66    | 61    | 26.9 | 137             | 129 | 120 | 63 |
| 20.0 | 29                                     | 27   | 25   | 41.7 | 63              | 59 | 55 | 48 | 41                               | 38   | 35   | 35.2 | 88              | 83 | 77 | 55 | 64                               | 60    | 55    | 28.1 | 139             | 131 | 121 | 63 |
| 22.0 | 24                                     | 23   | 21   | 45.3 | 65              | 61 | 56 | 49 | 34                               | 32   | 30   | 38.3 | 90              | 85 | 79 | 55 | 54                               | 51    | 47    | 30.6 | 142             | 134 | 124 | 63 |
| 24.0 | 21                                     | 20   | 18   | 49.0 | 66              | 62 | 57 | 49 | 29                               | 28   | 26   | 41.4 | 92              | 87 | 80 | 55 | 46                               | 43    | 40    | 33.0 | 145             | 136 | 126 | 64 |
| 26.0 | 18                                     | 17   | 16   | 52.6 | 67              | 63 | 58 | 50 | 25                               | 24   | 22   | 44.4 | 94              | 88 | 82 | 56 | 40                               | 38    | 35    | 35.4 | 148             | 139 | 129 | 64 |
| 28.0 | 16                                     | 15   | 14   | 56.1 | 68              | 64 | 59 | 50 | 22                               | 21   | 19   | 47.4 | 96              | 90 | 83 | 56 | 35                               | 33    | 31    | 37.8 | 150             | 141 | 131 | 65 |
| 30.0 | 14                                     | 13   | 12   | 59.7 | 69              | 65 | 60 | 50 | 20                               | 19   | 17   | 50.4 | 97              | 91 | 85 | 56 | 31                               | 29    | 27    | 40.2 | 153             | 144 | 133 | 65 |

**Table P3:** Ponderosa pine stocking levels for the ABGR/CAGE plant association (B-O province).

| QMD  | Climate Resilience; SDI 66; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 92; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 144; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3872                                   | 3645 | 3371 | 3.6  | 21              | 20 | 18 | 29 | 5420                            | 5103 | 4719 | 3.0  | 30              | 28 | 26 | 35 | 8518                             | 8019 | 7415 | 2.4  | 46              | 44 | 40 | 43 |
| 1.5  | 1889                                   | 1778 | 1644 | 5.2  | 23              | 22 | 20 | 30 | 2644                            | 2490 | 2302 | 4.4  | 32              | 31 | 28 | 36 | 4156                             | 3913 | 3618 | 3.5  | 51              | 48 | 44 | 45 |
| 2.0  | 1135                                   | 1069 | 988  | 6.7  | 25              | 23 | 22 | 31 | 1589                            | 1496 | 1384 | 5.6  | 35              | 33 | 30 | 37 | 2497                             | 2351 | 2174 | 4.5  | 54              | 51 | 47 | 46 |
| 2.5  | 765                                    | 720  | 666  | 8.1  | 26              | 25 | 23 | 32 | 1071                            | 1008 | 932  | 6.9  | 36              | 34 | 32 | 38 | 1683                             | 1584 | 1465 | 5.5  | 57              | 54 | 50 | 47 |
| 3.0  | 554                                    | 521  | 482  | 9.5  | 27              | 26 | 24 | 33 | 775                             | 730  | 675  | 8.1  | 38              | 36 | 33 | 39 | 1218                             | 1147 | 1061 | 6.4  | 60              | 56 | 52 | 47 |
| 3.5  | 422                                    | 397  | 367  | 10.9 | 28              | 27 | 25 | 34 | 590                             | 556  | 514  | 9.2  | 39              | 37 | 34 | 40 | 928                              | 873  | 807  | 7.4  | 62              | 58 | 54 | 48 |
| 4.0  | 333                                    | 313  | 290  | 12.3 | 29              | 27 | 25 | 34 | 466                             | 439  | 406  | 10.4 | 41              | 38 | 35 | 40 | 732                              | 689  | 638  | 8.3  | 64              | 60 | 56 | 49 |
| 4.5  | 270                                    | 254  | 235  | 13.6 | 30              | 28 | 26 | 35 | 378                             | 356  | 329  | 11.5 | 42              | 39 | 36 | 41 | 594                              | 560  | 518  | 9.2  | 66              | 62 | 57 | 49 |
| 5.0  | 224                                    | 211  | 195  | 15.0 | 31              | 29 | 27 | 35 | 314                             | 296  | 273  | 12.7 | 43              | 40 | 37 | 41 | 493                              | 464  | 429  | 10.1 | 67              | 63 | 59 | 50 |
| 5.5  | 189                                    | 178  | 165  | 16.3 | 31              | 29 | 27 | 36 | 265                             | 250  | 231  | 13.8 | 44              | 41 | 38 | 42 | 417                              | 392  | 363  | 11.0 | 69              | 65 | 60 | 50 |
| 6.0  | 162                                    | 153  | 141  | 17.6 | 32              | 30 | 28 | 36 | 227                             | 214  | 198  | 14.9 | 45              | 42 | 39 | 42 | 357                              | 336  | 311  | 11.9 | 70              | 66 | 61 | 50 |
| 6.5  | 141                                    | 133  | 123  | 18.9 | 32              | 31 | 28 | 36 | 197                             | 186  | 172  | 16.0 | 45              | 43 | 40 | 42 | 310                              | 292  | 270  | 12.7 | 71              | 67 | 62 | 51 |
| 7.0  | 124                                    | 116  | 108  | 20.2 | 33              | 31 | 29 | 37 | 173                             | 163  | 151  | 17.0 | 46              | 44 | 40 | 43 | 272                              | 256  | 237  | 13.6 | 73              | 68 | 63 | 51 |
| 7.5  | 109                                    | 103  | 95   | 21.4 | 34              | 32 | 29 | 37 | 153                             | 144  | 133  | 18.1 | 47              | 44 | 41 | 43 | 241                              | 227  | 210  | 14.5 | 74              | 70 | 64 | 51 |
| 8.0  | 98                                     | 92   | 85   | 22.7 | 34              | 32 | 30 | 37 | 137                             | 129  | 119  | 19.2 | 48              | 45 | 42 | 43 | 215                              | 202  | 187  | 15.3 | 75              | 71 | 65 | 52 |
| 8.5  | 88                                     | 83   | 76   | 24.0 | 35              | 33 | 30 | 37 | 123                             | 116  | 107  | 20.2 | 48              | 46 | 42 | 44 | 193                              | 182  | 168  | 16.1 | 76              | 72 | 66 | 52 |
| 9.0  | 79                                     | 75   | 69   | 25.2 | 35              | 33 | 30 | 38 | 111                             | 104  | 97   | 21.3 | 49              | 46 | 43 | 44 | 174                              | 164  | 152  | 17.0 | 77              | 73 | 67 | 52 |
| 9.5  | 72                                     | 68   | 63   | 26.4 | 35              | 33 | 31 | 38 | 101                             | 95   | 88   | 22.3 | 50              | 47 | 43 | 44 | 158                              | 149  | 138  | 17.8 | 78              | 73 | 68 | 52 |
| 10.0 | 66                                     | 62   | 57   | 27.7 | 36              | 34 | 31 | 38 | 92                              | 87   | 80   | 23.4 | 50              | 47 | 44 | 44 | 145                              | 136  | 126  | 18.6 | 79              | 74 | 69 | 53 |
| 11.0 | 56                                     | 52   | 48   | 30.1 | 37              | 35 | 32 | 38 | 78                              | 73   | 68   | 25.4 | 51              | 48 | 45 | 45 | 122                              | 115  | 106  | 20.3 | 81              | 76 | 70 | 53 |
| 12.0 | 48                                     | 45   | 41   | 32.5 | 37              | 35 | 33 | 39 | 67                              | 63   | 58   | 27.5 | 52              | 49 | 46 | 45 | 105                              | 99   | 91   | 21.9 | 82              | 77 | 72 | 53 |
| 13.0 | 41                                     | 39   | 36   | 34.9 | 38              | 36 | 33 | 39 | 58                              | 54   | 50   | 29.5 | 53              | 50 | 46 | 45 | 91                               | 86   | 79   | 23.5 | 84              | 79 | 73 | 54 |
| 14.0 | 36                                     | 34   | 32   | 37.3 | 39              | 36 | 34 | 39 | 51                              | 48   | 44   | 31.5 | 54              | 51 | 47 | 46 | 80                               | 75   | 69   | 25.1 | 85              | 80 | 74 | 54 |
| 15.0 | 32                                     | 30   | 28   | 39.6 | 39              | 37 | 34 | 40 | 45                              | 42   | 39   | 33.5 | 55              | 52 | 48 | 46 | 71                               | 66   | 61   | 26.7 | 87              | 82 | 75 | 54 |
| 16.0 | 29                                     | 27   | 25   | 41.9 | 40              | 38 | 35 | 40 | 40                              | 38   | 35   | 35.4 | 56              | 53 | 49 | 46 | 63                               | 59   | 55   | 28.3 | 88              | 83 | 77 | 55 |
| 17.0 | 26                                     | 24   | 22   | 44.2 | 41              | 38 | 35 | 40 | 36                              | 34   | 31   | 37.4 | 57              | 53 | 49 | 46 | 57                               | 53   | 49   | 29.8 | 89              | 84 | 78 | 55 |
| 18.0 | 23                                     | 22   | 20   | 46.5 | 41              | 39 | 36 | 41 | 33                              | 31   | 28   | 39.3 | 57              | 54 | 50 | 47 | 51                               | 48   | 44   | 31.4 | 90              | 85 | 79 | 55 |
| 19.0 | 21                                     | 20   | 18   | 48.8 | 42              | 39 | 36 | 41 | 30                              | 28   | 26   | 41.3 | 58              | 55 | 51 | 47 | 46                               | 44   | 40   | 32.9 | 91              | 86 | 80 | 55 |
| 20.0 | 19                                     | 18   | 17   | 51.1 | 42              | 40 | 37 | 41 | 27                              | 25   | 23   | 43.2 | 59              | 55 | 51 | 47 | 42                               | 40   | 37   | 34.4 | 93              | 87 | 81 | 56 |
| 22.0 | 16                                     | 15   | 14   | 55.6 | 43              | 40 | 37 | 41 | 23                              | 21   | 20   | 47.0 | 60              | 57 | 52 | 48 | 36                               | 34   | 31   | 37.5 | 95              | 89 | 82 | 56 |
| 24.0 | 14                                     | 13   | 12   | 60.0 | 44              | 41 | 38 | 42 | 20                              | 18   | 17   | 50.7 | 61              | 58 | 53 | 48 | 31                               | 29   | 27   | 40.5 | 96              | 91 | 84 | 56 |
| 26.0 | 12                                     | 11   | 11   | 64.4 | 45              | 42 | 39 | 42 | 17                              | 16   | 15   | 54.5 | 63              | 59 | 54 | 48 | 27                               | 25   | 23   | 43.4 | 98              | 93 | 86 | 57 |
| 28.0 | 11                                     | 10   | 9    | 68.8 | 45              | 43 | 40 | 42 | 15                              | 14   | 13   | 58.1 | 64              | 60 | 55 | 49 | 23                               | 22   | 20   | 46.4 | 100             | 94 | 87 | 57 |
| 30.0 | 9                                      | 9    | 8    | 73.1 | 46              | 43 | 40 | 43 | 13                              | 12   | 11   | 61.8 | 65              | 61 | 56 | 49 | 21                               | 19   | 18   | 49.3 | 102             | 96 | 88 | 57 |

**Table P4:** Ponderosa pine stocking levels for the ABGR/SPBE plant association (B-O province).

| QMD  | Climate Resilience; SDI 80; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 112; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 175; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4696                                   | 4421 | 4088 | 3.3  | 26              | 24 | 22 | 32 | 6574                             | 6190 | 5724 | 2.8  | 36              | 34 | 31 | 38 | 10331                            | 9727 | 8994 | 2.2  | 56              | 53  | 49  | 46 |
| 1.5  | 2291                                   | 2157 | 1995 | 4.7  | 28              | 26 | 24 | 34 | 3208                             | 3020 | 2793 | 4.0  | 39              | 37 | 34 | 40 | 5040                             | 4746 | 4388 | 3.2  | 62              | 58  | 54  | 48 |
| 2.0  | 1377                                   | 1296 | 1199 | 6.0  | 30              | 28 | 26 | 35 | 1928                             | 1815 | 1678 | 5.1  | 42              | 40 | 37 | 41 | 3029                             | 2852 | 2637 | 4.1  | 66              | 62  | 58  | 49 |
| 2.5  | 928                                    | 873  | 808  | 7.4  | 32              | 30 | 28 | 36 | 1299                             | 1223 | 1131 | 6.2  | 44              | 42 | 39 | 42 | 2041                             | 1921 | 1777 | 5.0  | 70              | 65  | 61  | 50 |
| 3.0  | 672                                    | 632  | 585  | 8.7  | 33              | 31 | 29 | 37 | 940                              | 885  | 819  | 7.3  | 46              | 43 | 40 | 43 | 1478                             | 1391 | 1287 | 5.8  | 73              | 68  | 63  | 51 |
| 3.5  | 511                                    | 481  | 445  | 9.9  | 34              | 32 | 30 | 37 | 716                              | 674  | 623  | 8.4  | 48              | 45 | 42 | 43 | 1125                             | 1059 | 979  | 6.7  | 75              | 71  | 65  | 52 |
| 4.0  | 404                                    | 380  | 351  | 11.2 | 35              | 33 | 31 | 38 | 565                              | 532  | 492  | 9.4  | 49              | 46 | 43 | 44 | 888                              | 836  | 773  | 7.5  | 78              | 73  | 67  | 52 |
| 4.5  | 328                                    | 309  | 285  | 12.4 | 36              | 34 | 32 | 38 | 459                              | 432  | 399  | 10.5 | 51              | 48 | 44 | 44 | 721                              | 679  | 628  | 8.4  | 80              | 75  | 69  | 53 |
| 5.0  | 272                                    | 256  | 237  | 13.6 | 37              | 35 | 32 | 39 | 381                              | 359  | 332  | 11.5 | 52              | 49 | 45 | 45 | 598                              | 563  | 521  | 9.2  | 82              | 77  | 71  | 53 |
| 5.5  | 230                                    | 216  | 200  | 14.8 | 38              | 36 | 33 | 39 | 322                              | 303  | 280  | 12.5 | 53              | 50 | 46 | 45 | 505                              | 476  | 440  | 10.0 | 83              | 79  | 73  | 54 |
| 6.0  | 197                                    | 185  | 171  | 16.0 | 39              | 36 | 34 | 39 | 276                              | 260  | 240  | 13.5 | 54              | 51 | 47 | 46 | 433                              | 408  | 377  | 10.8 | 85              | 80  | 74  | 54 |
| 6.5  | 171                                    | 161  | 149  | 17.2 | 39              | 37 | 34 | 40 | 239                              | 225  | 208  | 14.5 | 55              | 52 | 48 | 46 | 376                              | 354  | 327  | 11.6 | 87              | 82  | 75  | 54 |
| 7.0  | 150                                    | 141  | 131  | 18.3 | 40              | 38 | 35 | 40 | 210                              | 198  | 183  | 15.5 | 56              | 53 | 49 | 46 | 330                              | 311  | 287  | 12.3 | 88              | 83  | 77  | 55 |
| 7.5  | 133                                    | 125  | 116  | 19.5 | 41              | 38 | 35 | 40 | 186                              | 175  | 162  | 16.5 | 57              | 54 | 50 | 47 | 292                              | 275  | 254  | 13.1 | 90              | 84  | 78  | 55 |
| 8.0  | 118                                    | 111  | 103  | 20.6 | 41              | 39 | 36 | 41 | 166                              | 156  | 144  | 17.4 | 58              | 54 | 50 | 47 | 260                              | 245  | 227  | 13.9 | 91              | 86  | 79  | 55 |
| 8.5  | 106                                    | 100  | 93   | 21.7 | 42              | 39 | 36 | 41 | 149                              | 140  | 130  | 18.4 | 59              | 55 | 51 | 47 | 234                              | 220  | 204  | 14.7 | 92              | 87  | 80  | 55 |
| 9.0  | 96                                     | 90   | 84   | 22.9 | 42              | 40 | 37 | 41 | 135                              | 127  | 117  | 19.3 | 59              | 56 | 52 | 47 | 211                              | 199  | 184  | 15.4 | 93              | 88  | 81  | 56 |
| 9.5  | 87                                     | 82   | 76   | 24.0 | 43              | 40 | 37 | 41 | 122                              | 115  | 106  | 20.3 | 60              | 57 | 52 | 48 | 192                              | 181  | 167  | 16.2 | 95              | 89  | 82  | 56 |
| 10.0 | 80                                     | 75   | 69   | 25.1 | 43              | 41 | 38 | 42 | 112                              | 105  | 97   | 21.2 | 61              | 57 | 53 | 48 | 175                              | 165  | 153  | 16.9 | 96              | 90  | 83  | 56 |
| 11.0 | 67                                     | 63   | 59   | 27.3 | 44              | 42 | 39 | 42 | 94                               | 89   | 82   | 23.1 | 62              | 59 | 54 | 48 | 148                              | 140  | 129  | 18.4 | 98              | 92  | 85  | 57 |
| 12.0 | 58                                     | 54   | 50   | 29.5 | 45              | 43 | 39 | 42 | 81                               | 76   | 70   | 24.9 | 64              | 60 | 55 | 49 | 127                              | 120  | 111  | 19.9 | 100             | 94  | 87  | 57 |
| 13.0 | 50                                     | 47   | 44   | 31.7 | 46              | 43 | 40 | 43 | 70                               | 66   | 61   | 26.8 | 65              | 61 | 56 | 49 | 110                              | 104  | 96   | 21.4 | 102             | 96  | 88  | 57 |
| 14.0 | 44                                     | 41   | 38   | 33.8 | 47              | 44 | 41 | 43 | 62                               | 58   | 54   | 28.6 | 66              | 62 | 57 | 49 | 97                               | 91   | 84   | 22.8 | 103             | 97  | 90  | 58 |
| 15.0 | 39                                     | 37   | 34   | 36.0 | 48              | 45 | 42 | 43 | 54                               | 51   | 47   | 30.4 | 67              | 63 | 58 | 50 | 86                               | 81   | 75   | 24.2 | 105             | 99  | 91  | 58 |
| 16.0 | 35                                     | 33   | 30   | 38.1 | 48              | 46 | 42 | 44 | 49                               | 46   | 42   | 32.2 | 68              | 64 | 59 | 50 | 76                               | 72   | 66   | 25.7 | 107             | 100 | 93  | 58 |
| 17.0 | 31                                     | 29   | 27   | 40.2 | 49              | 46 | 43 | 44 | 44                               | 41   | 38   | 33.9 | 69              | 65 | 60 | 50 | 69                               | 65   | 60   | 27.1 | 108             | 102 | 94  | 58 |
| 18.0 | 28                                     | 27   | 25   | 42.3 | 50              | 47 | 43 | 44 | 39                               | 37   | 34   | 35.7 | 70              | 66 | 61 | 50 | 62                               | 58   | 54   | 28.5 | 110             | 103 | 95  | 59 |
| 19.0 | 26                                     | 24   | 22   | 44.3 | 50              | 47 | 44 | 44 | 36                               | 34   | 31   | 37.5 | 71              | 66 | 61 | 51 | 56                               | 53   | 49   | 29.9 | 111             | 104 | 97  | 59 |
| 20.0 | 23                                     | 22   | 20   | 46.4 | 51              | 48 | 44 | 45 | 33                               | 31   | 29   | 39.2 | 71              | 67 | 62 | 51 | 51                               | 48   | 45   | 31.3 | 112             | 106 | 98  | 59 |
| 22.0 | 20                                     | 19   | 17   | 50.5 | 52              | 49 | 45 | 45 | 28                               | 26   | 24   | 42.6 | 73              | 69 | 64 | 51 | 43                               | 41   | 38   | 34.0 | 115             | 108 | 100 | 60 |
| 24.0 | 17                                     | 16   | 15   | 54.5 | 53              | 50 | 46 | 45 | 24                               | 22   | 21   | 46.1 | 74              | 70 | 65 | 52 | 37                               | 35   | 32   | 36.7 | 117             | 110 | 102 | 60 |
| 26.0 | 15                                     | 14   | 13   | 58.5 | 54              | 51 | 47 | 46 | 21                               | 19   | 18   | 49.4 | 76              | 71 | 66 | 52 | 32                               | 30   | 28   | 39.4 | 119             | 112 | 104 | 60 |
| 28.0 | 13                                     | 12   | 11   | 62.5 | 55              | 52 | 48 | 46 | 18                               | 17   | 16   | 52.8 | 77              | 73 | 67 | 52 | 28                               | 27   | 25   | 42.1 | 121             | 114 | 106 | 61 |
| 30.0 | 11                                     | 11   | 10   | 66.4 | 56              | 53 | 49 | 46 | 16                               | 15   | 14   | 56.1 | 78              | 74 | 68 | 52 | 25                               | 24   | 22   | 44.8 | 123             | 116 | 107 | 61 |

**Table P5:** Ponderosa pine stocking levels for the ABGR/VAME plant association (B-O province) and the PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, and PICO(ABGR)/VAME/PTAQ plant community types.

| QMD  | Climate Resilience; SDI 91; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 128; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 201; 55% of Max |       |       |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5373                                   | 5059 | 4678 | 3.1  | 29              | 28 | 26 | 34 | 7522                             | 7082 | 6549 | 2.6  | 41              | 39 | 36 | 41 | 11821                            | 11130 | 10291 | 2.1  | 64              | 61  | 56  | 49 |
| 1.5  | 2622                                   | 2468 | 2282 | 4.4  | 32              | 30 | 28 | 36 | 3670                             | 3455 | 3195 | 3.7  | 45              | 42 | 39 | 42 | 5767                             | 5430  | 5021  | 3.0  | 71              | 67  | 62  | 51 |
| 2.0  | 1575                                   | 1483 | 1372 | 5.7  | 34              | 32 | 30 | 37 | 2206                             | 2077 | 1920 | 4.8  | 48              | 45 | 42 | 43 | 3466                             | 3263  | 3018  | 3.8  | 76              | 71  | 66  | 52 |
| 2.5  | 1061                                   | 999  | 924  | 6.9  | 36              | 34 | 31 | 38 | 1486                             | 1399 | 1294 | 5.8  | 51              | 48 | 44 | 44 | 2335                             | 2198  | 2033  | 4.6  | 80              | 75  | 69  | 53 |
| 3.0  | 769                                    | 724  | 669  | 8.1  | 38              | 36 | 33 | 39 | 1076                             | 1013 | 937  | 6.8  | 53              | 50 | 46 | 45 | 1691                             | 1592  | 1472  | 5.5  | 83              | 78  | 72  | 54 |
| 3.5  | 585                                    | 551  | 509  | 9.3  | 39              | 37 | 34 | 40 | 819                              | 771  | 713  | 7.8  | 55              | 52 | 48 | 46 | 1287                             | 1212  | 1121  | 6.3  | 86              | 81  | 75  | 54 |
| 4.0  | 462                                    | 435  | 402  | 10.4 | 40              | 38 | 35 | 40 | 647                              | 609  | 563  | 8.8  | 56              | 53 | 49 | 46 | 1016                             | 957   | 885   | 7.0  | 89              | 83  | 77  | 55 |
| 4.5  | 375                                    | 353  | 326  | 11.6 | 41              | 39 | 36 | 41 | 525                              | 494  | 457  | 9.8  | 58              | 55 | 50 | 47 | 825                              | 777   | 718   | 7.8  | 91              | 86  | 79  | 55 |
| 5.0  | 311                                    | 293  | 271  | 12.7 | 42              | 40 | 37 | 41 | 436                              | 410  | 379  | 10.7 | 59              | 56 | 52 | 47 | 685                              | 645   | 596   | 8.6  | 93              | 88  | 81  | 56 |
| 5.5  | 263                                    | 248  | 229  | 13.8 | 43              | 41 | 38 | 42 | 368                              | 347  | 320  | 11.7 | 61              | 57 | 53 | 48 | 578                              | 545   | 504   | 9.3  | 95              | 90  | 83  | 56 |
| 6.0  | 225                                    | 212  | 196  | 14.9 | 44              | 42 | 39 | 42 | 316                              | 297  | 275  | 12.6 | 62              | 58 | 54 | 48 | 496                              | 467   | 432   | 10.1 | 97              | 92  | 85  | 56 |
| 6.5  | 196                                    | 184  | 170  | 16.0 | 45              | 42 | 39 | 42 | 274                              | 258  | 238  | 13.6 | 63              | 59 | 55 | 48 | 430                              | 405   | 375   | 10.8 | 99              | 93  | 86  | 57 |
| 7.0  | 172                                    | 162  | 149  | 17.1 | 46              | 43 | 40 | 43 | 240                              | 226  | 209  | 14.5 | 64              | 60 | 56 | 49 | 377                              | 355   | 329   | 11.5 | 101             | 95  | 88  | 57 |
| 7.5  | 152                                    | 143  | 132  | 18.2 | 47              | 44 | 41 | 43 | 213                              | 200  | 185  | 15.4 | 65              | 61 | 57 | 49 | 334                              | 314   | 291   | 12.3 | 102             | 96  | 89  | 57 |
| 8.0  | 135                                    | 128  | 118  | 19.3 | 47              | 45 | 41 | 43 | 190                              | 179  | 165  | 16.3 | 66              | 62 | 58 | 49 | 298                              | 281   | 259   | 13.0 | 104             | 98  | 91  | 58 |
| 8.5  | 122                                    | 115  | 106  | 20.3 | 48              | 45 | 42 | 43 | 170                              | 160  | 148  | 17.2 | 67              | 63 | 58 | 50 | 268                              | 252   | 233   | 13.7 | 105             | 99  | 92  | 58 |
| 9.0  | 110                                    | 104  | 96   | 21.4 | 49              | 46 | 42 | 44 | 154                              | 145  | 134  | 18.1 | 68              | 64 | 59 | 50 | 242                              | 228   | 211   | 14.4 | 107             | 101 | 93  | 58 |
| 9.5  | 100                                    | 94   | 87   | 22.4 | 49              | 46 | 43 | 44 | 140                              | 132  | 122  | 19.0 | 69              | 65 | 60 | 50 | 220                              | 207   | 191   | 15.1 | 108             | 102 | 94  | 58 |
| 10.0 | 91                                     | 86   | 79   | 23.5 | 50              | 47 | 43 | 44 | 128                              | 120  | 111  | 19.8 | 70              | 66 | 61 | 50 | 201                              | 189   | 175   | 15.8 | 109             | 103 | 95  | 59 |
| 11.0 | 77                                     | 73   | 67   | 25.5 | 51              | 48 | 44 | 44 | 108                              | 102  | 94   | 21.6 | 71              | 67 | 62 | 51 | 170                              | 160   | 148   | 17.2 | 112             | 105 | 97  | 59 |
| 12.0 | 66                                     | 62   | 58   | 27.6 | 52              | 49 | 45 | 45 | 93                               | 87   | 81   | 23.3 | 73              | 68 | 63 | 51 | 145                              | 137   | 127   | 18.6 | 114             | 108 | 99  | 59 |
| 13.0 | 57                                     | 54   | 50   | 29.6 | 53              | 50 | 46 | 45 | 80                               | 76   | 70   | 25.0 | 74              | 70 | 64 | 51 | 126                              | 119   | 110   | 20.0 | 116             | 109 | 101 | 60 |
| 14.0 | 50                                     | 47   | 44   | 31.6 | 54              | 51 | 47 | 45 | 70                               | 66   | 61   | 26.7 | 75              | 71 | 66 | 52 | 111                              | 104   | 96    | 21.3 | 118             | 111 | 103 | 60 |
| 15.0 | 45                                     | 42   | 39   | 33.6 | 55              | 51 | 48 | 46 | 62                               | 59   | 54   | 28.4 | 76              | 72 | 67 | 52 | 98                               | 92    | 85    | 22.7 | 120             | 113 | 105 | 60 |
| 16.0 | 40                                     | 37   | 35   | 35.6 | 55              | 52 | 48 | 46 | 56                               | 52   | 48   | 30.1 | 78              | 73 | 68 | 52 | 87                               | 82    | 76    | 24.0 | 122             | 115 | 106 | 61 |
| 17.0 | 36                                     | 34   | 31   | 37.6 | 56              | 53 | 49 | 46 | 50                               | 47   | 43   | 31.7 | 79              | 74 | 69 | 53 | 78                               | 74    | 68    | 25.3 | 124             | 116 | 108 | 61 |
| 18.0 | 32                                     | 30   | 28   | 39.5 | 57              | 54 | 50 | 47 | 45                               | 42   | 39   | 33.4 | 80              | 75 | 69 | 53 | 71                               | 67    | 62    | 26.6 | 125             | 118 | 109 | 61 |
| 19.0 | 29                                     | 28   | 26   | 41.4 | 58              | 54 | 50 | 47 | 41                               | 39   | 36   | 35.0 | 81              | 76 | 70 | 53 | 64                               | 61    | 56    | 27.9 | 127             | 119 | 110 | 61 |
| 20.0 | 27                                     | 25   | 23   | 43.4 | 58              | 55 | 51 | 47 | 37                               | 35   | 33   | 36.6 | 82              | 77 | 71 | 53 | 59                               | 55    | 51    | 29.2 | 128             | 121 | 112 | 62 |
| 22.0 | 23                                     | 21   | 20   | 47.2 | 60              | 56 | 52 | 47 | 32                               | 30   | 28   | 39.9 | 84              | 79 | 73 | 54 | 50                               | 47    | 43    | 31.8 | 131             | 124 | 114 | 62 |
| 24.0 | 19                                     | 18   | 17   | 51.0 | 61              | 57 | 53 | 48 | 27                               | 26   | 24   | 43.1 | 85              | 80 | 74 | 54 | 43                               | 40    | 37    | 34.4 | 134             | 126 | 117 | 62 |
| 26.0 | 17                                     | 16   | 15   | 54.7 | 62              | 58 | 54 | 48 | 24                               | 22   | 20   | 46.2 | 87              | 82 | 76 | 54 | 37                               | 35    | 32    | 36.9 | 136             | 128 | 119 | 63 |
| 28.0 | 15                                     | 14   | 13   | 58.4 | 63              | 59 | 55 | 48 | 21                               | 19   | 18   | 49.4 | 88              | 83 | 77 | 55 | 32                               | 31    | 28    | 39.4 | 139             | 131 | 121 | 63 |
| 30.0 | 13                                     | 12   | 11   | 62.1 | 64              | 60 | 56 | 49 | 18                               | 17   | 16   | 52.5 | 90              | 84 | 78 | 55 | 29                               | 27    | 25    | 41.9 | 141             | 133 | 123 | 63 |

**Table P6:** Ponderosa pine stocking levels for the ABGR/VAME plant association (W-S province).

| QMD  | Climate Resilience; SDI 106; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 148; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 233; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6242                                    | 5877 | 5434 | 2.8  | 34              | 32 | 30 | 37 | 8738                             | 8227 | 7608 | 2.4  | 48              | 45 | 41 | 43 | 13732                            | 12929 | 11955 | 1.9  | 75              | 71  | 65  | 52 |
| 1.5  | 3045                                    | 2867 | 2651 | 4.1  | 37              | 35 | 33 | 39 | 4263                             | 4014 | 3712 | 3.4  | 52              | 49 | 46 | 45 | 6700                             | 6308  | 5833  | 2.7  | 82              | 77  | 72  | 53 |
| 2.0  | 1830                                    | 1723 | 1593 | 5.2  | 40              | 38 | 35 | 40 | 2562                             | 2412 | 2231 | 4.4  | 56              | 53 | 49 | 46 | 4026                             | 3791  | 3505  | 3.5  | 88              | 83  | 76  | 55 |
| 2.5  | 1233                                    | 1161 | 1073 | 6.4  | 42              | 40 | 37 | 41 | 1726                             | 1625 | 1503 | 5.4  | 59              | 55 | 51 | 47 | 2713                             | 2554  | 2362  | 4.3  | 92              | 87  | 81  | 56 |
| 3.0  | 893                                     | 841  | 777  | 7.5  | 44              | 41 | 38 | 42 | 1250                             | 1177 | 1088 | 6.3  | 61              | 58 | 53 | 48 | 1964                             | 1849  | 1710  | 5.1  | 96              | 91  | 84  | 56 |
| 3.5  | 680                                     | 640  | 592  | 8.6  | 45              | 43 | 40 | 42 | 952                              | 896  | 828  | 7.3  | 64              | 60 | 55 | 49 | 1495                             | 1408  | 1302  | 5.8  | 100             | 94  | 87  | 57 |
| 4.0  | 537                                     | 505  | 467  | 9.7  | 47              | 44 | 41 | 43 | 751                              | 707  | 654  | 8.2  | 66              | 62 | 57 | 49 | 1181                             | 1111  | 1028  | 6.5  | 103             | 97  | 90  | 58 |
| 4.5  | 436                                     | 410  | 379  | 10.7 | 48              | 45 | 42 | 43 | 610                              | 574  | 531  | 9.1  | 67              | 63 | 59 | 50 | 958                              | 902   | 834   | 7.2  | 106             | 100 | 92  | 58 |
| 5.0  | 362                                     | 340  | 315  | 11.8 | 49              | 46 | 43 | 44 | 506                              | 477  | 441  | 10.0 | 69              | 65 | 60 | 50 | 795                              | 749   | 692   | 8.0  | 108             | 102 | 94  | 58 |
| 5.5  | 305                                     | 288  | 266  | 12.8 | 50              | 47 | 44 | 44 | 428                              | 403  | 372  | 10.8 | 71              | 66 | 61 | 51 | 672                              | 633   | 585   | 8.7  | 111             | 104 | 97  | 59 |
| 6.0  | 262                                     | 246  | 228  | 13.9 | 51              | 48 | 45 | 45 | 367                              | 345  | 319  | 11.7 | 72              | 68 | 63 | 51 | 576                              | 542   | 501   | 9.3  | 113             | 106 | 98  | 59 |
| 6.5  | 227                                     | 214  | 198  | 14.9 | 52              | 49 | 46 | 45 | 318                              | 300  | 277  | 12.6 | 73              | 69 | 64 | 51 | 500                              | 471   | 435   | 10.0 | 115             | 108 | 100 | 60 |
| 7.0  | 199                                     | 188  | 174  | 15.9 | 53              | 50 | 46 | 45 | 279                              | 263  | 243  | 13.4 | 75              | 70 | 65 | 52 | 438                              | 413   | 382   | 10.7 | 117             | 110 | 102 | 60 |
| 7.5  | 176                                     | 166  | 154  | 16.9 | 54              | 51 | 47 | 46 | 247                              | 232  | 215  | 14.3 | 76              | 71 | 66 | 52 | 388                              | 365   | 338   | 11.4 | 119             | 112 | 104 | 60 |
| 8.0  | 157                                     | 148  | 137  | 17.9 | 55              | 52 | 48 | 46 | 220                              | 207  | 192  | 15.1 | 77              | 72 | 67 | 52 | 346                              | 326   | 301   | 12.1 | 121             | 114 | 105 | 60 |
| 8.5  | 141                                     | 133  | 123  | 18.9 | 56              | 52 | 48 | 46 | 198                              | 186  | 172  | 15.9 | 78              | 73 | 68 | 52 | 311                              | 293   | 271   | 12.7 | 123             | 115 | 107 | 61 |
| 9.0  | 128                                     | 120  | 111  | 19.8 | 56              | 53 | 49 | 46 | 179                              | 168  | 156  | 16.8 | 79              | 74 | 69 | 53 | 281                              | 265   | 245   | 13.4 | 124             | 117 | 108 | 61 |
| 9.5  | 116                                     | 109  | 101  | 20.8 | 57              | 54 | 50 | 47 | 163                              | 153  | 141  | 17.6 | 80              | 75 | 70 | 53 | 255                              | 240   | 222   | 14.0 | 126             | 118 | 109 | 61 |
| 10.0 | 106                                     | 100  | 92   | 21.8 | 58              | 54 | 50 | 47 | 148                              | 140  | 129  | 18.4 | 81              | 76 | 70 | 53 | 233                              | 220   | 203   | 14.7 | 127             | 120 | 111 | 61 |
| 11.0 | 90                                      | 84   | 78   | 23.7 | 59              | 56 | 51 | 47 | 125                              | 118  | 109  | 20.0 | 83              | 78 | 72 | 53 | 197                              | 185   | 172   | 16.0 | 130             | 122 | 113 | 62 |
| 12.0 | 77                                      | 72   | 67   | 25.6 | 60              | 57 | 52 | 48 | 107                              | 101  | 94   | 21.6 | 84              | 79 | 73 | 54 | 169                              | 159   | 147   | 17.3 | 133             | 125 | 115 | 62 |
| 13.0 | 67                                      | 63   | 58   | 27.5 | 61              | 58 | 53 | 48 | 93                               | 88   | 81   | 23.2 | 86              | 81 | 75 | 54 | 147                              | 138   | 128   | 18.5 | 135             | 127 | 118 | 63 |
| 14.0 | 58                                      | 55   | 51   | 29.3 | 62              | 59 | 54 | 48 | 82                               | 77   | 71   | 24.8 | 87              | 82 | 76 | 54 | 129                              | 121   | 112   | 19.8 | 137             | 129 | 120 | 63 |
| 15.0 | 52                                      | 49   | 45   | 31.2 | 63              | 60 | 55 | 49 | 72                               | 68   | 63   | 26.4 | 89              | 84 | 77 | 55 | 114                              | 107   | 99    | 21.0 | 140             | 131 | 122 | 63 |
| 16.0 | 46                                      | 43   | 40   | 33.0 | 64              | 61 | 56 | 49 | 65                               | 61   | 56   | 27.9 | 90              | 85 | 79 | 55 | 101                              | 96    | 88    | 22.3 | 142             | 133 | 123 | 63 |
| 17.0 | 41                                      | 39   | 36   | 34.8 | 65              | 61 | 57 | 49 | 58                               | 55   | 51   | 29.4 | 91              | 86 | 80 | 55 | 91                               | 86    | 79    | 23.5 | 144             | 135 | 125 | 64 |
| 18.0 | 37                                      | 35   | 33   | 36.6 | 66              | 62 | 58 | 49 | 52                               | 49   | 46   | 31.0 | 93              | 87 | 81 | 56 | 82                               | 78    | 72    | 24.7 | 146             | 137 | 127 | 64 |
| 19.0 | 34                                      | 32   | 30   | 38.4 | 67              | 63 | 58 | 50 | 48                               | 45   | 41   | 32.5 | 94              | 88 | 82 | 56 | 75                               | 70    | 65    | 25.9 | 147             | 139 | 128 | 64 |
| 20.0 | 31                                      | 29   | 27   | 40.2 | 68              | 64 | 59 | 50 | 44                               | 41   | 38   | 34.0 | 95              | 89 | 83 | 56 | 68                               | 64    | 60    | 27.1 | 149             | 140 | 130 | 64 |
| 22.0 | 26                                      | 25   | 23   | 43.8 | 69              | 65 | 60 | 50 | 37                               | 35   | 32   | 37.0 | 97              | 91 | 84 | 56 | 58                               | 54    | 50    | 29.5 | 152             | 144 | 133 | 65 |
| 24.0 | 23                                      | 21   | 20   | 47.3 | 71              | 67 | 62 | 51 | 32                               | 30   | 27   | 40.0 | 99              | 93 | 86 | 57 | 50                               | 47    | 43    | 31.9 | 156             | 146 | 135 | 65 |
| 26.0 | 20                                      | 18   | 17   | 50.7 | 72              | 68 | 63 | 51 | 27                               | 26   | 24   | 42.9 | 101             | 95 | 88 | 57 | 43                               | 40    | 37    | 34.2 | 158             | 149 | 138 | 66 |
| 28.0 | 17                                      | 16   | 15   | 54.2 | 73              | 69 | 64 | 51 | 24                               | 23   | 21   | 45.8 | 103             | 97 | 89 | 57 | 38                               | 35    | 33    | 36.5 | 161             | 152 | 140 | 66 |
| 30.0 | 15                                      | 14   | 13   | 57.6 | 74              | 70 | 65 | 51 | 21                               | 20   | 18   | 48.7 | 104             | 98 | 91 | 58 | 33                               | 31    | 29    | 38.8 | 164             | 154 | 143 | 66 |

**Table P7:** Ponderosa pine stocking levels for the ABGR/VASC (B-O province) plant association and the PICO(ABGR)/VASC/CARU plant community type.

| QMD  | Climate Resilience; SDI 54; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 75; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 118; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3165                                   | 2980 | 2755 | 4.0  | 17              | 16 | 15 | 25 | 4431                            | 4172 | 3858 | 3.4  | 24              | 23 | 21 | 31 | 6963                             | 6556 | 6062 | 2.7  | 38              | 36 | 33 | 39 |
| 1.5  | 1544                                   | 1454 | 1344 | 5.7  | 19              | 18 | 16 | 27 | 2162                            | 2035 | 1882 | 4.8  | 27              | 25 | 23 | 33 | 3397                             | 3198 | 2958 | 3.8  | 42              | 39 | 36 | 41 |
| 2.0  | 928                                    | 874  | 808  | 7.4  | 20              | 19 | 18 | 28 | 1299                            | 1223 | 1131 | 6.2  | 28              | 27 | 25 | 34 | 2042                             | 1922 | 1777 | 5.0  | 45              | 42 | 39 | 42 |
| 2.5  | 625                                    | 589  | 544  | 9.0  | 21              | 20 | 19 | 29 | 875                             | 824  | 762  | 7.6  | 30              | 28 | 26 | 35 | 1375                             | 1295 | 1197 | 6.0  | 47              | 44 | 41 | 43 |
| 3.0  | 453                                    | 426  | 394  | 10.5 | 22              | 21 | 19 | 29 | 634                             | 597  | 552  | 8.9  | 31              | 29 | 27 | 35 | 996                              | 938  | 867  | 7.1  | 49              | 46 | 43 | 44 |
| 3.5  | 345                                    | 324  | 300  | 12.1 | 23              | 22 | 20 | 30 | 483                             | 454  | 420  | 10.2 | 32              | 30 | 28 | 36 | 758                              | 714  | 660  | 8.1  | 51              | 48 | 44 | 44 |
| 4.0  | 272                                    | 256  | 237  | 13.6 | 24              | 22 | 21 | 31 | 381                             | 359  | 332  | 11.5 | 33              | 31 | 29 | 37 | 599                              | 564  | 521  | 9.2  | 52              | 49 | 45 | 45 |
| 4.5  | 221                                    | 208  | 192  | 15.1 | 24              | 23 | 21 | 31 | 309                             | 291  | 269  | 12.8 | 34              | 32 | 30 | 37 | 486                              | 458  | 423  | 10.2 | 54              | 51 | 47 | 45 |
| 5.0  | 183                                    | 173  | 160  | 16.6 | 25              | 24 | 22 | 32 | 257                             | 242  | 223  | 14.0 | 35              | 33 | 30 | 38 | 403                              | 380  | 351  | 11.2 | 55              | 52 | 48 | 46 |
| 5.5  | 155                                    | 146  | 135  | 18.0 | 26              | 24 | 22 | 32 | 217                             | 204  | 189  | 15.2 | 36              | 34 | 31 | 38 | 341                              | 321  | 297  | 12.2 | 56              | 53 | 49 | 46 |
| 6.0  | 133                                    | 125  | 116  | 19.5 | 26              | 25 | 23 | 32 | 186                             | 175  | 162  | 16.5 | 36              | 34 | 32 | 38 | 292                              | 275  | 254  | 13.1 | 57              | 54 | 50 | 47 |
| 6.5  | 115                                    | 108  | 100  | 20.9 | 27              | 25 | 23 | 33 | 161                             | 152  | 140  | 17.7 | 37              | 35 | 32 | 39 | 253                              | 239  | 221  | 14.1 | 58              | 55 | 51 | 47 |
| 7.0  | 101                                    | 95   | 88   | 22.3 | 27              | 25 | 24 | 33 | 141                             | 133  | 123  | 18.9 | 38              | 36 | 33 | 39 | 222                              | 209  | 194  | 15.0 | 59              | 56 | 52 | 47 |
| 7.5  | 89                                     | 84   | 78   | 23.7 | 27              | 26 | 24 | 33 | 125                             | 118  | 109  | 20.0 | 38              | 36 | 33 | 39 | 197                              | 185  | 171  | 16.0 | 60              | 57 | 53 | 48 |
| 8.0  | 80                                     | 75   | 69   | 25.1 | 28              | 26 | 24 | 33 | 112                             | 105  | 97   | 21.2 | 39              | 37 | 34 | 40 | 176                              | 165  | 153  | 16.9 | 61              | 58 | 53 | 48 |
| 8.5  | 72                                     | 67   | 62   | 26.5 | 28              | 27 | 25 | 34 | 100                             | 94   | 87   | 22.4 | 40              | 37 | 34 | 40 | 158                              | 148  | 137  | 17.9 | 62              | 58 | 54 | 48 |
| 9.0  | 65                                     | 61   | 56   | 27.9 | 29              | 27 | 25 | 34 | 91                              | 85   | 79   | 23.6 | 40              | 38 | 35 | 40 | 142                              | 134  | 124  | 18.8 | 63              | 59 | 55 | 48 |
| 9.5  | 59                                     | 55   | 51   | 29.2 | 29              | 27 | 25 | 34 | 82                              | 78   | 72   | 24.7 | 41              | 38 | 35 | 40 | 129                              | 122  | 113  | 19.7 | 64              | 60 | 55 | 49 |
| 10.0 | 54                                     | 51   | 47   | 30.6 | 29              | 28 | 26 | 34 | 75                              | 71   | 66   | 25.9 | 41              | 39 | 36 | 41 | 118                              | 111  | 103  | 20.6 | 64              | 61 | 56 | 49 |
| 11.0 | 45                                     | 43   | 40   | 33.3 | 30              | 28 | 26 | 35 | 64                              | 60   | 55   | 28.1 | 42              | 39 | 37 | 41 | 100                              | 94   | 87   | 22.4 | 66              | 62 | 57 | 49 |
| 12.0 | 39                                     | 37   | 34   | 35.9 | 31              | 29 | 27 | 35 | 54                              | 51   | 47   | 30.4 | 43              | 40 | 37 | 41 | 86                               | 81   | 75   | 24.2 | 67              | 63 | 59 | 50 |
| 13.0 | 34                                     | 32   | 29   | 38.6 | 31              | 29 | 27 | 36 | 47                              | 45   | 41   | 32.6 | 44              | 41 | 38 | 42 | 74                               | 70   | 65   | 26.0 | 69              | 64 | 60 | 50 |
| 14.0 | 30                                     | 28   | 26   | 41.2 | 32              | 30 | 28 | 36 | 41                              | 39   | 36   | 34.8 | 44              | 42 | 39 | 42 | 65                               | 61   | 57   | 27.8 | 70              | 66 | 61 | 50 |
| 15.0 | 26                                     | 25   | 23   | 43.8 | 32              | 30 | 28 | 36 | 37                              | 35   | 32   | 37.0 | 45              | 42 | 39 | 42 | 58                               | 54   | 50   | 29.5 | 71              | 67 | 62 | 51 |
| 16.0 | 23                                     | 22   | 20   | 46.4 | 33              | 31 | 28 | 36 | 33                              | 31   | 29   | 39.2 | 46              | 43 | 40 | 43 | 51                               | 48   | 45   | 31.3 | 72              | 68 | 63 | 51 |
| 17.0 | 21                                     | 20   | 18   | 48.9 | 33              | 31 | 29 | 37 | 29                              | 28   | 26   | 41.4 | 46              | 44 | 40 | 43 | 46                               | 44   | 40   | 33.0 | 73              | 69 | 63 | 51 |
| 18.0 | 19                                     | 18   | 17   | 51.5 | 34              | 32 | 29 | 37 | 27                              | 25   | 23   | 43.5 | 47              | 44 | 41 | 43 | 42                               | 39   | 36   | 34.7 | 74              | 70 | 64 | 51 |
| 19.0 | 17                                     | 16   | 15   | 54.0 | 34              | 32 | 30 | 37 | 24                              | 23   | 21   | 45.6 | 48              | 45 | 41 | 43 | 38                               | 36   | 33   | 36.4 | 75              | 70 | 65 | 52 |
| 20.0 | 16                                     | 15   | 14   | 56.5 | 34              | 32 | 30 | 37 | 22                              | 21   | 19   | 47.7 | 48              | 45 | 42 | 43 | 35                               | 33   | 30   | 38.1 | 76              | 71 | 66 | 52 |
| 22.0 | 13                                     | 13   | 12   | 61.5 | 35              | 33 | 31 | 38 | 19                              | 18   | 16   | 51.9 | 49              | 46 | 43 | 44 | 29                               | 28   | 25   | 41.4 | 77              | 73 | 67 | 52 |
| 24.0 | 11                                     | 11   | 10   | 66.4 | 36              | 34 | 31 | 38 | 16                              | 15   | 14   | 56.1 | 50              | 47 | 44 | 44 | 25                               | 24   | 22   | 44.8 | 79              | 74 | 69 | 53 |
| 26.0 | 10                                     | 9    | 9    | 71.3 | 37              | 34 | 32 | 38 | 14                              | 13   | 12   | 60.2 | 51              | 48 | 45 | 45 | 22                               | 21   | 19   | 48.0 | 80              | 76 | 70 | 53 |
| 28.0 | 9                                      | 8    | 8    | 76.1 | 37              | 35 | 32 | 39 | 12                              | 11   | 11   | 64.3 | 52              | 49 | 45 | 45 | 19                               | 18   | 17   | 51.3 | 82              | 77 | 71 | 53 |
| 30.0 | 8                                      | 7    | 7    | 80.9 | 38              | 36 | 33 | 39 | 11                              | 10   | 9    | 68.4 | 53              | 50 | 46 | 45 | 17                               | 16   | 15   | 54.5 | 83              | 78 | 72 | 54 |



**Table P8:** Ponderosa pine stocking levels for the ABLA2/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 95; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 133; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 208; 55% of Max |       |       |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5579                                   | 5253 | 4857 | 3.0  | 30              | 29 | 26 | 35 | 7811                             | 7354 | 6800 | 2.5  | 43              | 40 | 37 | 41 | 12274                            | 11556 | 10686 | 2.0  | 67              | 63  | 58  | 50 |
| 1.5  | 2722                                   | 2563 | 2370 | 4.3  | 33              | 31 | 29 | 37 | 3811                             | 3588 | 3318 | 3.6  | 47              | 44 | 41 | 43 | 5989                             | 5638  | 5214  | 2.9  | 73              | 69  | 64  | 51 |
| 2.0  | 1636                                   | 1540 | 1424 | 5.5  | 36              | 34 | 31 | 38 | 2290                             | 2156 | 1994 | 4.7  | 50              | 47 | 44 | 44 | 3599                             | 3388  | 3133  | 3.7  | 79              | 74  | 68  | 52 |
| 2.5  | 1102                                   | 1038 | 959  | 6.8  | 38              | 35 | 33 | 39 | 1543                             | 1453 | 1343 | 5.7  | 53              | 50 | 46 | 45 | 2425                             | 2283  | 2111  | 4.6  | 83              | 78  | 72  | 53 |
| 3.0  | 798                                    | 751  | 695  | 7.9  | 39              | 37 | 34 | 40 | 1117                             | 1052 | 973  | 6.7  | 55              | 52 | 48 | 46 | 1756                             | 1653  | 1529  | 5.4  | 86              | 81  | 75  | 54 |
| 3.5  | 608                                    | 572  | 529  | 9.1  | 41              | 38 | 35 | 40 | 851                              | 801  | 741  | 7.7  | 57              | 54 | 49 | 47 | 1337                             | 1258  | 1164  | 6.1  | 89              | 84  | 78  | 55 |
| 4.0  | 480                                    | 452  | 418  | 10.2 | 42              | 39 | 36 | 41 | 672                              | 632  | 585  | 8.7  | 59              | 55 | 51 | 47 | 1055                             | 994   | 919   | 6.9  | 92              | 87  | 80  | 55 |
| 4.5  | 389                                    | 367  | 339  | 11.4 | 43              | 40 | 37 | 41 | 545                              | 513  | 475  | 9.6  | 60              | 57 | 52 | 48 | 857                              | 807   | 746   | 7.7  | 95              | 89  | 82  | 56 |
| 5.0  | 323                                    | 304  | 281  | 12.5 | 44              | 41 | 38 | 42 | 452                              | 426  | 394  | 10.5 | 62              | 58 | 54 | 48 | 711                              | 669   | 619   | 8.4  | 97              | 91  | 84  | 56 |
| 5.5  | 273                                    | 257  | 238  | 13.6 | 45              | 42 | 39 | 42 | 382                              | 360  | 333  | 11.5 | 63              | 59 | 55 | 48 | 601                              | 565   | 523   | 9.2  | 99              | 93  | 86  | 57 |
| 6.0  | 234                                    | 220  | 204  | 14.7 | 46              | 43 | 40 | 43 | 328                              | 308  | 285  | 12.4 | 64              | 61 | 56 | 49 | 515                              | 485   | 448   | 9.9  | 101             | 95  | 88  | 57 |
| 6.5  | 203                                    | 191  | 177  | 15.7 | 47              | 44 | 41 | 43 | 284                              | 268  | 248  | 13.3 | 66              | 62 | 57 | 49 | 447                              | 421   | 389   | 10.6 | 103             | 97  | 90  | 58 |
| 7.0  | 178                                    | 168  | 155  | 16.8 | 48              | 45 | 41 | 43 | 249                              | 235  | 217  | 14.2 | 67              | 63 | 58 | 49 | 392                              | 369   | 341   | 11.3 | 105             | 99  | 91  | 58 |
| 7.5  | 158                                    | 148  | 137  | 17.9 | 48              | 46 | 42 | 44 | 221                              | 208  | 192  | 15.1 | 68              | 64 | 59 | 50 | 347                              | 327   | 302   | 12.0 | 106             | 100 | 93  | 58 |
| 8.0  | 141                                    | 132  | 122  | 18.9 | 49              | 46 | 43 | 44 | 197                              | 185  | 171  | 16.0 | 69              | 65 | 60 | 50 | 309                              | 291   | 269   | 12.8 | 108             | 102 | 94  | 58 |
| 8.5  | 126                                    | 119  | 110  | 20.0 | 50              | 47 | 43 | 44 | 177                              | 167  | 154  | 16.9 | 70              | 66 | 61 | 50 | 278                              | 262   | 242   | 13.5 | 110             | 103 | 95  | 59 |
| 9.0  | 114                                    | 107  | 99   | 21.0 | 50              | 47 | 44 | 44 | 160                              | 150  | 139  | 17.7 | 71              | 66 | 61 | 51 | 251                              | 236   | 219   | 14.2 | 111             | 104 | 97  | 59 |
| 9.5  | 104                                    | 98   | 90   | 22.0 | 51              | 48 | 44 | 45 | 145                              | 137  | 126  | 18.6 | 72              | 67 | 62 | 51 | 228                              | 215   | 199   | 14.8 | 112             | 106 | 98  | 59 |
| 10.0 | 95                                     | 89   | 82   | 23.0 | 52              | 49 | 45 | 45 | 133                              | 125  | 115  | 19.5 | 72              | 68 | 63 | 51 | 208                              | 196   | 181   | 15.5 | 114             | 107 | 99  | 59 |
| 11.0 | 80                                     | 75   | 70   | 25.1 | 53              | 50 | 46 | 45 | 112                              | 106  | 98   | 21.2 | 74              | 70 | 64 | 51 | 176                              | 166   | 153   | 16.9 | 116             | 109 | 101 | 60 |
| 12.0 | 69                                     | 65   | 60   | 27.1 | 54              | 51 | 47 | 46 | 96                               | 90   | 84   | 22.9 | 75              | 71 | 66 | 52 | 151                              | 142   | 131   | 18.3 | 119             | 112 | 103 | 60 |
| 13.0 | 60                                     | 56   | 52   | 29.1 | 55              | 52 | 48 | 46 | 83                               | 78   | 73   | 24.6 | 77              | 72 | 67 | 52 | 131                              | 123   | 114   | 19.6 | 121             | 114 | 105 | 60 |
| 14.0 | 52                                     | 49   | 45   | 31.0 | 56              | 53 | 49 | 46 | 73                               | 69   | 64   | 26.2 | 78              | 74 | 68 | 52 | 115                              | 108   | 100   | 20.9 | 123             | 116 | 107 | 61 |
| 15.0 | 46                                     | 44   | 40   | 33.0 | 57              | 53 | 49 | 46 | 65                               | 61   | 56   | 27.9 | 79              | 75 | 69 | 53 | 102                              | 96    | 89    | 22.2 | 125             | 118 | 109 | 61 |
| 16.0 | 41                                     | 39   | 36   | 34.9 | 58              | 54 | 50 | 47 | 58                               | 54   | 50   | 29.5 | 81              | 76 | 70 | 53 | 91                               | 85    | 79    | 23.5 | 127             | 119 | 110 | 61 |
| 17.0 | 37                                     | 35   | 32   | 36.9 | 58              | 55 | 51 | 47 | 52                               | 49   | 45   | 31.1 | 82              | 77 | 71 | 53 | 81                               | 77    | 71    | 24.8 | 128             | 121 | 112 | 62 |
| 18.0 | 33                                     | 32   | 29   | 38.8 | 59              | 56 | 52 | 47 | 47                               | 44   | 41   | 32.8 | 83              | 78 | 72 | 53 | 74                               | 69    | 64    | 26.1 | 130             | 123 | 113 | 62 |
| 19.0 | 30                                     | 29   | 26   | 40.7 | 60              | 56 | 52 | 47 | 43                               | 40   | 37   | 34.4 | 84              | 79 | 73 | 54 | 67                               | 63    | 58    | 27.4 | 132             | 124 | 115 | 62 |
| 20.0 | 28                                     | 26   | 24   | 42.6 | 61              | 57 | 53 | 48 | 39                               | 37   | 34   | 36.0 | 85              | 80 | 74 | 54 | 61                               | 58    | 53    | 28.7 | 133             | 126 | 116 | 62 |
| 22.0 | 23                                     | 22   | 20   | 46.3 | 62              | 58 | 54 | 48 | 33                               | 31   | 29   | 39.1 | 87              | 82 | 76 | 54 | 52                               | 49    | 45    | 31.2 | 136             | 128 | 119 | 63 |
| 24.0 | 20                                     | 19   | 18   | 50.0 | 63              | 60 | 55 | 48 | 28                               | 27   | 25   | 42.3 | 88              | 83 | 77 | 55 | 44                               | 42    | 39    | 33.7 | 139             | 131 | 121 | 63 |
| 26.0 | 17                                     | 16   | 15   | 53.7 | 64              | 61 | 56 | 49 | 24                               | 23   | 21   | 45.4 | 90              | 85 | 78 | 55 | 38                               | 36    | 33    | 36.2 | 142             | 133 | 123 | 63 |
| 28.0 | 15                                     | 14   | 13   | 57.3 | 65              | 62 | 57 | 49 | 21                               | 20   | 19   | 48.4 | 92              | 86 | 80 | 55 | 34                               | 32    | 29    | 38.6 | 144             | 136 | 125 | 64 |
| 30.0 | 14                                     | 13   | 12   | 60.9 | 67              | 63 | 58 | 49 | 19                               | 18   | 17   | 51.5 | 93              | 88 | 81 | 56 | 30                               | 28    | 26    | 41.1 | 146             | 138 | 127 | 64 |

**Table P9:** Ponderosa pine stocking levels for the PIPO/AGSP plant association (B-O province).

| QMD  | Climate Resilience; SDI 42; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 58; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 91; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 2444                                   | 2301 | 2127 | 4.5  | 13              | 13 | 12 | 20 | 3421                            | 3221 | 2978 | 3.8  | 19              | 18 | 16 | 26 | 5376                            | 5062 | 4680 | 3.1  | 29              | 28 | 26 | 34 |
| 1.5  | 1192                                   | 1123 | 1038 | 6.5  | 15              | 14 | 13 | 22 | 1669                            | 1572 | 1453 | 5.5  | 20              | 19 | 18 | 28 | 2623                            | 2470 | 2284 | 4.4  | 32              | 30 | 28 | 36 |
| 2.0  | 717                                    | 675  | 624  | 8.4  | 16              | 15 | 14 | 23 | 1003                            | 944  | 873  | 7.1  | 22              | 21 | 19 | 29 | 1576                            | 1484 | 1372 | 5.6  | 34              | 32 | 30 | 37 |
| 2.5  | 483                                    | 454  | 420  | 10.2 | 16              | 15 | 14 | 24 | 676                             | 636  | 588  | 8.6  | 23              | 22 | 20 | 30 | 1062                            | 1000 | 925  | 6.9  | 36              | 34 | 32 | 38 |
| 3.0  | 350                                    | 329  | 304  | 12.0 | 17              | 16 | 15 | 25 | 489                             | 461  | 426  | 10.1 | 24              | 23 | 21 | 31 | 769                             | 724  | 670  | 8.1  | 38              | 36 | 33 | 39 |
| 3.5  | 266                                    | 251  | 232  | 13.7 | 18              | 17 | 15 | 25 | 373                             | 351  | 324  | 11.6 | 25              | 23 | 22 | 31 | 585                             | 551  | 510  | 9.3  | 39              | 37 | 34 | 40 |
| 4.0  | 210                                    | 198  | 183  | 15.5 | 18              | 17 | 16 | 26 | 294                             | 277  | 256  | 13.1 | 26              | 24 | 22 | 32 | 462                             | 435  | 402  | 10.4 | 40              | 38 | 35 | 40 |
| 4.5  | 171                                    | 161  | 148  | 17.2 | 19              | 18 | 16 | 26 | 239                             | 225  | 208  | 14.5 | 26              | 25 | 23 | 33 | 375                             | 353  | 327  | 11.6 | 41              | 39 | 36 | 41 |
| 5.0  | 142                                    | 133  | 123  | 18.9 | 19              | 18 | 17 | 27 | 198                             | 187  | 173  | 15.9 | 27              | 25 | 24 | 33 | 311                             | 293  | 271  | 12.7 | 42              | 40 | 37 | 41 |
| 5.5  | 120                                    | 113  | 104  | 20.5 | 20              | 19 | 17 | 27 | 167                             | 158  | 146  | 17.3 | 28              | 26 | 24 | 33 | 263                             | 248  | 229  | 13.8 | 43              | 41 | 38 | 42 |
| 6.0  | 102                                    | 97   | 89   | 22.2 | 20              | 19 | 18 | 28 | 143                             | 135  | 125  | 18.7 | 28              | 27 | 25 | 34 | 225                             | 212  | 196  | 14.9 | 44              | 42 | 39 | 42 |
| 6.5  | 89                                     | 84   | 77   | 23.8 | 20              | 19 | 18 | 28 | 125                             | 117  | 108  | 20.1 | 29              | 27 | 25 | 34 | 196                             | 184  | 170  | 16.0 | 45              | 42 | 39 | 42 |
| 7.0  | 78                                     | 73   | 68   | 25.4 | 21              | 20 | 18 | 28 | 109                             | 103  | 95   | 21.5 | 29              | 27 | 25 | 34 | 172                             | 162  | 149  | 17.1 | 46              | 43 | 40 | 43 |
| 7.5  | 69                                     | 65   | 60   | 27.0 | 21              | 20 | 18 | 29 | 97                              | 91   | 84   | 22.8 | 30              | 28 | 26 | 35 | 152                             | 143  | 132  | 18.2 | 47              | 44 | 41 | 43 |
| 8.0  | 62                                     | 58   | 54   | 28.6 | 22              | 20 | 19 | 29 | 86                              | 81   | 75   | 24.2 | 30              | 28 | 26 | 35 | 136                             | 128  | 118  | 19.3 | 47              | 45 | 41 | 43 |
| 8.5  | 55                                     | 52   | 48   | 30.2 | 22              | 21 | 19 | 29 | 77                              | 73   | 67   | 25.5 | 31              | 29 | 27 | 35 | 122                             | 115  | 106  | 20.3 | 48              | 45 | 42 | 43 |
| 9.0  | 50                                     | 47   | 44   | 31.7 | 22              | 21 | 19 | 29 | 70                              | 66   | 61   | 26.8 | 31              | 29 | 27 | 35 | 110                             | 104  | 96   | 21.4 | 49              | 46 | 42 | 44 |
| 9.5  | 45                                     | 43   | 40   | 33.3 | 22              | 21 | 19 | 30 | 64                              | 60   | 55   | 28.1 | 31              | 29 | 27 | 36 | 100                             | 94   | 87   | 22.4 | 49              | 46 | 43 | 44 |
| 10.0 | 42                                     | 39   | 36   | 34.8 | 23              | 21 | 20 | 30 | 58                              | 55   | 51   | 29.4 | 32              | 30 | 28 | 36 | 91                              | 86   | 79   | 23.5 | 50              | 47 | 43 | 44 |
| 11.0 | 35                                     | 33   | 31   | 37.9 | 23              | 22 | 20 | 30 | 49                              | 46   | 43   | 32.0 | 32              | 30 | 28 | 36 | 77                              | 73   | 67   | 25.5 | 51              | 48 | 44 | 44 |
| 12.0 | 30                                     | 28   | 26   | 40.9 | 24              | 22 | 21 | 31 | 42                              | 40   | 37   | 34.6 | 33              | 31 | 29 | 37 | 66                              | 62   | 58   | 27.6 | 52              | 49 | 45 | 45 |
| 13.0 | 26                                     | 25   | 23   | 43.9 | 24              | 23 | 21 | 31 | 37                              | 34   | 32   | 37.1 | 34              | 32 | 29 | 37 | 57                              | 54   | 50   | 29.6 | 53              | 50 | 46 | 45 |
| 14.0 | 23                                     | 22   | 20   | 46.9 | 24              | 23 | 21 | 31 | 32                              | 30   | 28   | 39.6 | 34              | 32 | 30 | 37 | 50                              | 47   | 44   | 31.6 | 54              | 51 | 47 | 46 |
| 15.0 | 20                                     | 19   | 18   | 49.8 | 25              | 23 | 22 | 31 | 28                              | 27   | 25   | 42.1 | 35              | 33 | 30 | 38 | 45                              | 42   | 39   | 33.6 | 55              | 51 | 48 | 46 |
| 16.0 | 18                                     | 17   | 16   | 52.8 | 25              | 24 | 22 | 32 | 25                              | 24   | 22   | 44.6 | 35              | 33 | 31 | 38 | 40                              | 37   | 35   | 35.6 | 55              | 52 | 48 | 46 |
| 17.0 | 16                                     | 15   | 14   | 55.7 | 26              | 24 | 22 | 32 | 23                              | 21   | 20   | 47.1 | 36              | 34 | 31 | 38 | 36                              | 34   | 31   | 37.5 | 56              | 53 | 49 | 46 |
| 18.0 | 15                                     | 14   | 13   | 58.6 | 26              | 24 | 23 | 32 | 21                              | 19   | 18   | 49.5 | 36              | 34 | 32 | 38 | 32                              | 30   | 28   | 39.5 | 57              | 54 | 50 | 47 |
| 19.0 | 13                                     | 13   | 12   | 61.4 | 26              | 25 | 23 | 32 | 19                              | 18   | 16   | 51.9 | 37              | 35 | 32 | 39 | 29                              | 28   | 26   | 41.4 | 58              | 54 | 50 | 47 |
| 20.0 | 12                                     | 11   | 11   | 64.3 | 27              | 25 | 23 | 33 | 17                              | 16   | 15   | 54.3 | 37              | 35 | 32 | 39 | 27                              | 25   | 23   | 43.3 | 58              | 55 | 51 | 47 |
| 22.0 | 10                                     | 10   | 9    | 70.0 | 27              | 26 | 24 | 33 | 14                              | 14   | 13   | 59.1 | 38              | 36 | 33 | 39 | 23                              | 21   | 20   | 47.2 | 60              | 56 | 52 | 47 |
| 24.0 | 9                                      | 8    | 8    | 75.6 | 28              | 26 | 24 | 33 | 12                              | 12   | 11   | 63.9 | 39              | 36 | 34 | 39 | 19                              | 18   | 17   | 50.9 | 61              | 57 | 53 | 48 |
| 26.0 | 8                                      | 7    | 7    | 81.1 | 28              | 27 | 25 | 34 | 11                              | 10   | 9    | 68.5 | 39              | 37 | 34 | 40 | 17                              | 16   | 15   | 54.7 | 62              | 58 | 54 | 48 |
| 28.0 | 7                                      | 6    | 6    | 86.6 | 29              | 27 | 25 | 34 | 9                               | 9    | 8    | 73.2 | 40              | 38 | 35 | 40 | 15                              | 14   | 13   | 58.4 | 63              | 59 | 55 | 48 |
| 30.0 | 6                                      | 6    | 5    | 92.0 | 29              | 27 | 25 | 34 | 8                               | 8    | 7    | 77.8 | 41              | 38 | 36 | 40 | 13                              | 12   | 11   | 62.1 | 64              | 60 | 56 | 49 |

**Table P10:** Ponderosa pine stocking levels for the PIPO/AGSP (W-S province) and PIPO/PUTR/FEID-AGSP (B-O province) plant associations.

| QMD  | Climate Resilience; SDI 58; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 81; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 127; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3401                                   | 3202 | 2961 | 3.8  | 19              | 17 | 16 | 26 | 4761                            | 4482 | 4145 | 3.3  | 26              | 24 | 23 | 32 | 7481                             | 7044 | 6513 | 2.6  | 41              | 38 | 36 | 40 |
| 1.5  | 1659                                   | 1562 | 1444 | 5.5  | 20              | 19 | 18 | 28 | 2323                            | 2187 | 2022 | 4.7  | 29              | 27 | 25 | 34 | 3650                             | 3436 | 3178 | 3.7  | 45              | 42 | 39 | 42 |
| 2.0  | 997                                    | 939  | 868  | 7.1  | 22              | 20 | 19 | 29 | 1396                            | 1314 | 1215 | 6.0  | 30              | 29 | 27 | 35 | 2194                             | 2065 | 1910 | 4.8  | 48              | 45 | 42 | 43 |
| 2.5  | 672                                    | 632  | 585  | 8.7  | 23              | 22 | 20 | 30 | 940                             | 885  | 819  | 7.3  | 32              | 30 | 28 | 36 | 1478                             | 1391 | 1287 | 5.8  | 50              | 47 | 44 | 44 |
| 3.0  | 486                                    | 458  | 424  | 10.2 | 24              | 22 | 21 | 31 | 681                             | 641  | 593  | 8.6  | 33              | 31 | 29 | 37 | 1070                             | 1008 | 932  | 6.9  | 53              | 49 | 46 | 45 |
| 3.5  | 370                                    | 349  | 322  | 11.7 | 25              | 23 | 22 | 31 | 518                             | 488  | 451  | 9.9  | 35              | 33 | 30 | 37 | 815                              | 767  | 709  | 7.9  | 54              | 51 | 47 | 46 |
| 4.0  | 292                                    | 275  | 255  | 13.1 | 26              | 24 | 22 | 32 | 409                             | 385  | 356  | 11.1 | 36              | 34 | 31 | 38 | 643                              | 606  | 560  | 8.8  | 56              | 53 | 49 | 46 |
| 4.5  | 237                                    | 223  | 207  | 14.6 | 26              | 25 | 23 | 32 | 332                             | 313  | 289  | 12.3 | 37              | 35 | 32 | 38 | 522                              | 492  | 455  | 9.8  | 58              | 54 | 50 | 47 |
| 5.0  | 197                                    | 185  | 171  | 16.0 | 27              | 25 | 23 | 33 | 276                             | 260  | 240  | 13.5 | 38              | 35 | 33 | 39 | 433                              | 408  | 377  | 10.8 | 59              | 56 | 51 | 47 |
| 5.5  | 166                                    | 157  | 145  | 17.4 | 27              | 26 | 24 | 33 | 233                             | 219  | 203  | 14.7 | 38              | 36 | 33 | 39 | 366                              | 345  | 319  | 11.7 | 60              | 57 | 53 | 48 |
| 6.0  | 143                                    | 134  | 124  | 18.8 | 28              | 26 | 24 | 34 | 200                             | 188  | 174  | 15.9 | 39              | 37 | 34 | 40 | 314                              | 295  | 273  | 12.7 | 62              | 58 | 54 | 48 |
| 6.5  | 124                                    | 117  | 108  | 20.2 | 29              | 27 | 25 | 34 | 173                             | 163  | 151  | 17.0 | 40              | 38 | 35 | 40 | 272                              | 256  | 237  | 13.6 | 63              | 59 | 55 | 48 |
| 7.0  | 109                                    | 102  | 95   | 21.5 | 29              | 27 | 25 | 34 | 152                             | 143  | 132  | 18.2 | 41              | 38 | 35 | 40 | 239                              | 225  | 208  | 14.5 | 64              | 60 | 56 | 49 |
| 7.5  | 96                                     | 90   | 84   | 22.9 | 29              | 28 | 26 | 35 | 135                             | 127  | 117  | 19.3 | 41              | 39 | 36 | 41 | 211                              | 199  | 184  | 15.4 | 65              | 61 | 56 | 49 |
| 8.0  | 86                                     | 81   | 75   | 24.2 | 30              | 28 | 26 | 35 | 120                             | 113  | 104  | 20.5 | 42              | 39 | 36 | 41 | 189                              | 178  | 164  | 16.3 | 66              | 62 | 57 | 49 |
| 8.5  | 77                                     | 72   | 67   | 25.6 | 30              | 29 | 26 | 35 | 108                             | 101  | 94   | 21.6 | 42              | 40 | 37 | 41 | 169                              | 159  | 147  | 17.2 | 67              | 63 | 58 | 49 |
| 9.0  | 70                                     | 66   | 61   | 26.9 | 31              | 29 | 27 | 35 | 97                              | 92   | 85   | 22.7 | 43              | 41 | 37 | 41 | 153                              | 144  | 133  | 18.1 | 68              | 64 | 59 | 50 |
| 9.5  | 63                                     | 60   | 55   | 28.2 | 31              | 29 | 27 | 36 | 89                              | 83   | 77   | 23.8 | 44              | 41 | 38 | 42 | 139                              | 131  | 121  | 19.0 | 68              | 64 | 60 | 50 |
| 10.0 | 58                                     | 54   | 50   | 29.5 | 31              | 30 | 27 | 36 | 81                              | 76   | 70   | 24.9 | 44              | 42 | 38 | 42 | 127                              | 120  | 111  | 19.9 | 69              | 65 | 60 | 50 |
| 11.0 | 49                                     | 46   | 42   | 32.1 | 32              | 30 | 28 | 36 | 68                              | 64   | 59   | 27.1 | 45              | 42 | 39 | 42 | 107                              | 101  | 93   | 21.6 | 71              | 67 | 62 | 51 |
| 12.0 | 42                                     | 39   | 36   | 34.7 | 33              | 31 | 29 | 36 | 59                              | 55   | 51   | 29.3 | 46              | 43 | 40 | 43 | 92                               | 87   | 80   | 23.4 | 72              | 68 | 63 | 51 |
| 13.0 | 36                                     | 34   | 32   | 37.2 | 33              | 31 | 29 | 37 | 51                              | 48   | 44   | 31.5 | 47              | 44 | 41 | 43 | 80                               | 75   | 70   | 25.1 | 74              | 69 | 64 | 51 |
| 14.0 | 32                                     | 30   | 28   | 39.7 | 34              | 32 | 30 | 37 | 45                              | 42   | 39   | 33.6 | 48              | 45 | 41 | 43 | 70                               | 66   | 61   | 26.8 | 75              | 70 | 65 | 52 |
| 15.0 | 28                                     | 27   | 25   | 42.3 | 35              | 33 | 30 | 37 | 39                              | 37   | 34   | 35.7 | 48              | 46 | 42 | 44 | 62                               | 58   | 54   | 28.5 | 76              | 72 | 66 | 52 |
| 16.0 | 25                                     | 24   | 22   | 44.7 | 35              | 33 | 31 | 38 | 35                              | 33   | 31   | 37.8 | 49              | 46 | 43 | 44 | 55                               | 52   | 48   | 30.2 | 77              | 73 | 67 | 52 |
| 17.0 | 23                                     | 21   | 20   | 47.2 | 36              | 34 | 31 | 38 | 32                              | 30   | 28   | 39.9 | 50              | 47 | 43 | 44 | 50                               | 47   | 43   | 31.8 | 78              | 74 | 68 | 52 |
| 18.0 | 20                                     | 19   | 18   | 49.7 | 36              | 34 | 31 | 38 | 29                              | 27   | 25   | 42.0 | 50              | 48 | 44 | 44 | 45                               | 42   | 39   | 33.5 | 79              | 75 | 69 | 53 |
| 19.0 | 19                                     | 17   | 16   | 52.1 | 37              | 34 | 32 | 38 | 26                              | 24   | 23   | 44.0 | 51              | 48 | 44 | 45 | 41                               | 38   | 36   | 35.1 | 80              | 76 | 70 | 53 |
| 20.0 | 17                                     | 16   | 15   | 54.5 | 37              | 35 | 32 | 39 | 24                              | 22   | 21   | 46.1 | 52              | 49 | 45 | 45 | 37                               | 35   | 32   | 36.7 | 81              | 77 | 71 | 53 |
| 22.0 | 14                                     | 13   | 12   | 59.3 | 38              | 36 | 33 | 39 | 20                              | 19   | 17   | 50.1 | 53              | 50 | 46 | 45 | 31                               | 30   | 27   | 40.0 | 83              | 78 | 72 | 54 |
| 24.0 | 12                                     | 12   | 11   | 64.0 | 39              | 36 | 34 | 39 | 17                              | 16   | 15   | 54.1 | 54              | 51 | 47 | 46 | 27                               | 25   | 23   | 43.2 | 85              | 80 | 74 | 54 |
| 26.0 | 11                                     | 10   | 9    | 68.7 | 39              | 37 | 34 | 40 | 15                              | 14   | 13   | 58.1 | 55              | 52 | 48 | 46 | 23                               | 22   | 20   | 46.3 | 86              | 81 | 75 | 54 |
| 28.0 | 9                                      | 9    | 8    | 73.4 | 40              | 38 | 35 | 40 | 13                              | 12   | 11   | 62.0 | 56              | 53 | 49 | 46 | 21                               | 19   | 18   | 49.5 | 88              | 83 | 76 | 55 |
| 30.0 | 8                                      | 8    | 7    | 78.0 | 41              | 38 | 35 | 40 | 12                              | 11   | 10   | 65.9 | 57              | 53 | 49 | 46 | 18                               | 17   | 16   | 52.6 | 89              | 84 | 78 | 55 |

**Table P11:** Ponderosa pine stocking levels for the PIPO/ARTRV/FEID-AGSP plant association (B-O province).

| QMD  | Climate Resilience; SDI 59; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 83; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 131; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3504                                   | 3299 | 3050 | 3.8  | 19              | 18 | 17 | 27 | 4905                            | 4618 | 4270 | 3.2  | 27              | 25 | 23 | 33 | 7708                             | 7257 | 6711 | 2.6  | 42              | 40 | 37 | 41 |
| 1.5  | 1709                                   | 1609 | 1488 | 5.4  | 21              | 20 | 18 | 28 | 2393                            | 2253 | 2083 | 4.6  | 29              | 28 | 26 | 34 | 3761                             | 3541 | 3274 | 3.7  | 46              | 43 | 40 | 43 |
| 2.0  | 1027                                   | 967  | 894  | 7.0  | 22              | 21 | 20 | 30 | 1438                            | 1354 | 1252 | 5.9  | 31              | 30 | 27 | 36 | 2260                             | 2128 | 1968 | 4.7  | 49              | 46 | 43 | 44 |
| 2.5  | 692                                    | 652  | 603  | 8.5  | 24              | 22 | 21 | 30 | 969                             | 912  | 844  | 7.2  | 33              | 31 | 29 | 37 | 1523                             | 1434 | 1326 | 5.7  | 52              | 49 | 45 | 45 |
| 3.0  | 501                                    | 472  | 436  | 10.0 | 25              | 23 | 21 | 31 | 702                             | 661  | 611  | 8.5  | 34              | 32 | 30 | 37 | 1103                             | 1038 | 960  | 6.8  | 54              | 51 | 47 | 46 |
| 3.5  | 382                                    | 359  | 332  | 11.5 | 25              | 24 | 22 | 32 | 534                             | 503  | 465  | 9.7  | 36              | 34 | 31 | 38 | 839                              | 790  | 731  | 7.7  | 56              | 53 | 49 | 46 |
| 4.0  | 301                                    | 284  | 262  | 12.9 | 26              | 25 | 23 | 32 | 422                             | 397  | 367  | 10.9 | 37              | 35 | 32 | 39 | 663                              | 624  | 577  | 8.7  | 58              | 54 | 50 | 47 |
| 4.5  | 245                                    | 230  | 213  | 14.3 | 27              | 25 | 24 | 33 | 342                             | 322  | 298  | 12.1 | 38              | 36 | 33 | 39 | 538                              | 506  | 468  | 9.7  | 59              | 56 | 52 | 47 |
| 5.0  | 203                                    | 191  | 177  | 15.7 | 28              | 26 | 24 | 33 | 284                             | 267  | 247  | 13.3 | 39              | 36 | 34 | 39 | 446                              | 420  | 389  | 10.6 | 61              | 57 | 53 | 48 |
| 5.5  | 171                                    | 161  | 149  | 17.1 | 28              | 27 | 25 | 34 | 240                             | 226  | 209  | 14.5 | 40              | 37 | 34 | 40 | 377                              | 355  | 328  | 11.5 | 62              | 59 | 54 | 48 |
| 6.0  | 147                                    | 138  | 128  | 18.5 | 29              | 27 | 25 | 34 | 206                             | 194  | 179  | 15.6 | 40              | 38 | 35 | 40 | 323                              | 304  | 281  | 12.5 | 63              | 60 | 55 | 49 |
| 6.5  | 128                                    | 120  | 111  | 19.9 | 29              | 28 | 26 | 34 | 179                             | 168  | 155  | 16.8 | 41              | 39 | 36 | 41 | 281                              | 264  | 244  | 13.4 | 65              | 61 | 56 | 49 |
| 7.0  | 112                                    | 105  | 97   | 21.2 | 30              | 28 | 26 | 35 | 157                             | 147  | 136  | 17.9 | 42              | 39 | 36 | 41 | 246                              | 232  | 214  | 14.3 | 66              | 62 | 57 | 49 |
| 7.5  | 99                                     | 93   | 86   | 22.5 | 30              | 29 | 26 | 35 | 139                             | 130  | 121  | 19.0 | 43              | 40 | 37 | 41 | 218                              | 205  | 190  | 15.2 | 67              | 63 | 58 | 50 |
| 8.0  | 88                                     | 83   | 77   | 23.9 | 31              | 29 | 27 | 35 | 124                             | 116  | 108  | 20.2 | 43              | 41 | 38 | 41 | 194                              | 183  | 169  | 16.1 | 68              | 64 | 59 | 50 |
| 8.5  | 79                                     | 75   | 69   | 25.2 | 31              | 29 | 27 | 36 | 111                             | 105  | 97   | 21.3 | 44              | 41 | 38 | 42 | 175                              | 164  | 152  | 17.0 | 69              | 65 | 60 | 50 |
| 9.0  | 72                                     | 68   | 62   | 26.5 | 32              | 30 | 28 | 36 | 100                             | 95   | 87   | 22.4 | 44              | 42 | 39 | 42 | 158                              | 149  | 137  | 17.9 | 70              | 66 | 61 | 50 |
| 9.5  | 65                                     | 61   | 57   | 27.8 | 32              | 30 | 28 | 36 | 91                              | 86   | 79   | 23.5 | 45              | 42 | 39 | 42 | 143                              | 135  | 125  | 18.7 | 71              | 66 | 61 | 51 |
| 10.0 | 60                                     | 56   | 52   | 29.1 | 32              | 31 | 28 | 36 | 83                              | 78   | 73   | 24.6 | 45              | 43 | 40 | 42 | 131                              | 123  | 114  | 19.6 | 71              | 67 | 62 | 51 |
| 11.0 | 50                                     | 47   | 44   | 31.6 | 33              | 31 | 29 | 37 | 70                              | 66   | 61   | 26.7 | 46              | 44 | 40 | 43 | 111                              | 104  | 96   | 21.3 | 73              | 69 | 64 | 51 |
| 12.0 | 43                                     | 41   | 38   | 34.2 | 34              | 32 | 29 | 37 | 60                              | 57   | 53   | 28.9 | 47              | 45 | 41 | 43 | 95                               | 89   | 83   | 23.0 | 74              | 70 | 65 | 51 |
| 13.0 | 37                                     | 35   | 33   | 36.7 | 34              | 32 | 30 | 37 | 52                              | 49   | 46   | 31.0 | 48              | 45 | 42 | 44 | 82                               | 77   | 72   | 24.7 | 76              | 71 | 66 | 52 |
| 14.0 | 33                                     | 31   | 29   | 39.2 | 35              | 33 | 31 | 38 | 46                              | 43   | 40   | 33.1 | 49              | 46 | 43 | 44 | 72                               | 68   | 63   | 26.4 | 77              | 73 | 67 | 52 |
| 15.0 | 29                                     | 27   | 25   | 41.6 | 36              | 34 | 31 | 38 | 41                              | 38   | 35   | 35.2 | 50              | 47 | 43 | 44 | 64                               | 60   | 56   | 28.1 | 78              | 74 | 68 | 52 |
| 16.0 | 26                                     | 24   | 23   | 44.1 | 36              | 34 | 31 | 38 | 36                              | 34   | 32   | 37.2 | 51              | 48 | 44 | 44 | 57                               | 54   | 50   | 29.7 | 80              | 75 | 69 | 53 |
| 17.0 | 23                                     | 22   | 20   | 46.5 | 37              | 35 | 32 | 38 | 33                              | 31   | 28   | 39.3 | 51              | 48 | 45 | 45 | 51                               | 48   | 45   | 31.4 | 81              | 76 | 70 | 53 |
| 18.0 | 21                                     | 20   | 18   | 48.9 | 37              | 35 | 32 | 39 | 29                              | 28   | 26   | 41.3 | 52              | 49 | 45 | 45 | 46                               | 44   | 40   | 33.0 | 82              | 77 | 71 | 53 |
| 19.0 | 19                                     | 18   | 17   | 51.3 | 38              | 35 | 33 | 39 | 27                              | 25   | 23   | 43.4 | 53              | 50 | 46 | 45 | 42                               | 40   | 37   | 34.6 | 83              | 78 | 72 | 53 |
| 20.0 | 17                                     | 16   | 15   | 53.7 | 38              | 36 | 33 | 39 | 24                              | 23   | 21   | 45.4 | 53              | 50 | 46 | 45 | 38                               | 36   | 33   | 36.2 | 84              | 79 | 73 | 54 |
| 22.0 | 15                                     | 14   | 13   | 58.4 | 39              | 37 | 34 | 40 | 21                              | 19   | 18   | 49.4 | 54              | 51 | 47 | 46 | 32                               | 31   | 28   | 39.4 | 86              | 81 | 75 | 54 |
| 24.0 | 13                                     | 12   | 11   | 63.1 | 40              | 37 | 35 | 40 | 18                              | 17   | 15   | 53.3 | 56              | 52 | 48 | 46 | 28                               | 26   | 24   | 42.5 | 87              | 82 | 76 | 54 |
| 26.0 | 11                                     | 10   | 10   | 67.7 | 40              | 38 | 35 | 40 | 15                              | 14   | 13   | 57.2 | 57              | 53 | 49 | 46 | 24                               | 23   | 21   | 45.7 | 89              | 84 | 77 | 55 |
| 28.0 | 10                                     | 9    | 8    | 72.3 | 41              | 39 | 36 | 41 | 13                              | 13   | 12   | 61.1 | 58              | 54 | 50 | 47 | 21                               | 20   | 18   | 48.8 | 90              | 85 | 79 | 55 |
| 30.0 | 9                                      | 8    | 7    | 76.9 | 42              | 39 | 36 | 41 | 12                              | 11   | 10   | 65.0 | 58              | 55 | 51 | 47 | 19                               | 18   | 16   | 51.8 | 92              | 87 | 80 | 55 |

**Table P12:** Ponderosa pine stocking levels for the PIPO/CAGE plant association (B-O province).

| QMD  | Climate Resilience; SDI 63; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 88; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 138; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3695                                   | 3479 | 3217 | 3.7  | 20              | 19 | 18 | 28 | 5173                            | 4870 | 4504 | 3.1  | 28              | 27 | 25 | 34 | 8129                             | 7653 | 7077 | 2.5  | 44              | 42 | 39 | 42 |
| 1.5  | 1803                                   | 1697 | 1569 | 5.3  | 22              | 21 | 19 | 29 | 2524                            | 2376 | 2197 | 4.5  | 31              | 29 | 27 | 35 | 3966                             | 3734 | 3453 | 3.6  | 49              | 46 | 42 | 44 |
| 2.0  | 1083                                   | 1020 | 943  | 6.8  | 24              | 22 | 21 | 31 | 1517                            | 1428 | 1320 | 5.8  | 33              | 31 | 29 | 37 | 2383                             | 2244 | 2075 | 4.6  | 52              | 49 | 45 | 45 |
| 2.5  | 730                                    | 687  | 635  | 8.3  | 25              | 23 | 22 | 31 | 1022                            | 962  | 890  | 7.0  | 35              | 33 | 30 | 38 | 1606                             | 1512 | 1398 | 5.6  | 55              | 52 | 48 | 46 |
| 3.0  | 529                                    | 498  | 460  | 9.8  | 26              | 24 | 23 | 32 | 740                             | 697  | 644  | 8.2  | 36              | 34 | 32 | 38 | 1163                             | 1095 | 1012 | 6.6  | 57              | 54 | 50 | 47 |
| 3.5  | 402                                    | 379  | 350  | 11.2 | 27              | 25 | 23 | 33 | 563                             | 530  | 490  | 9.4  | 38              | 35 | 33 | 39 | 885                              | 833  | 771  | 7.5  | 59              | 56 | 51 | 47 |
| 4.0  | 318                                    | 299  | 277  | 12.6 | 28              | 26 | 24 | 33 | 445                             | 419  | 387  | 10.6 | 39              | 37 | 34 | 40 | 699                              | 658  | 608  | 8.5  | 61              | 57 | 53 | 48 |
| 4.5  | 258                                    | 243  | 225  | 14.0 | 28              | 27 | 25 | 34 | 361                             | 340  | 314  | 11.8 | 40              | 38 | 35 | 40 | 567                              | 534  | 494  | 9.4  | 63              | 59 | 55 | 48 |
| 5.0  | 214                                    | 201  | 186  | 15.3 | 29              | 27 | 25 | 34 | 300                             | 282  | 261  | 13.0 | 41              | 38 | 36 | 40 | 471                              | 443  | 410  | 10.3 | 64              | 60 | 56 | 49 |
| 5.5  | 181                                    | 170  | 157  | 16.7 | 30              | 28 | 26 | 35 | 253                             | 238  | 220  | 14.1 | 42              | 39 | 36 | 41 | 398                              | 374  | 346  | 11.2 | 66              | 62 | 57 | 49 |
| 6.0  | 155                                    | 146  | 135  | 18.0 | 30              | 29 | 26 | 35 | 217                             | 204  | 189  | 15.2 | 43              | 40 | 37 | 41 | 341                              | 321  | 297  | 12.1 | 67              | 63 | 58 | 50 |
| 6.5  | 135                                    | 127  | 117  | 19.3 | 31              | 29 | 27 | 35 | 188                             | 177  | 164  | 16.3 | 43              | 41 | 38 | 42 | 296                              | 279  | 258  | 13.0 | 68              | 64 | 59 | 50 |
| 7.0  | 118                                    | 111  | 103  | 20.6 | 32              | 30 | 27 | 36 | 165                             | 156  | 144  | 17.5 | 44              | 42 | 38 | 42 | 260                              | 244  | 226  | 13.9 | 69              | 65 | 60 | 50 |
| 7.5  | 104                                    | 98   | 91   | 21.9 | 32              | 30 | 28 | 36 | 146                             | 138  | 127  | 18.5 | 45              | 42 | 39 | 42 | 230                              | 216  | 200  | 14.8 | 70              | 66 | 61 | 50 |
| 8.0  | 93                                     | 88   | 81   | 23.2 | 33              | 31 | 28 | 36 | 130                             | 123  | 114  | 19.6 | 46              | 43 | 40 | 42 | 205                              | 193  | 178  | 15.7 | 72              | 67 | 62 | 51 |
| 8.5  | 84                                     | 79   | 73   | 24.5 | 33              | 31 | 29 | 37 | 117                             | 110  | 102  | 20.7 | 46              | 43 | 40 | 43 | 184                              | 173  | 160  | 16.5 | 73              | 68 | 63 | 51 |
| 9.0  | 76                                     | 71   | 66   | 25.8 | 33              | 31 | 29 | 37 | 106                             | 100  | 92   | 21.8 | 47              | 44 | 41 | 43 | 166                              | 157  | 145  | 17.4 | 73              | 69 | 64 | 51 |
| 9.5  | 69                                     | 65   | 60   | 27.1 | 34              | 32 | 29 | 37 | 96                              | 91   | 84   | 22.9 | 47              | 45 | 41 | 43 | 151                              | 142  | 132  | 18.2 | 74              | 70 | 65 | 51 |
| 10.0 | 63                                     | 59   | 55   | 28.3 | 34              | 32 | 30 | 37 | 88                              | 83   | 76   | 23.9 | 48              | 45 | 42 | 43 | 138                              | 130  | 120  | 19.1 | 75              | 71 | 66 | 52 |
| 11.0 | 53                                     | 50   | 46   | 30.8 | 35              | 33 | 30 | 38 | 74                              | 70   | 65   | 26.0 | 49              | 46 | 43 | 44 | 117                              | 110  | 102  | 20.8 | 77              | 72 | 67 | 52 |
| 12.0 | 45                                     | 43   | 40   | 33.3 | 36              | 34 | 31 | 38 | 64                              | 60   | 55   | 28.1 | 50              | 47 | 44 | 44 | 100                              | 94   | 87   | 22.4 | 79              | 74 | 68 | 52 |
| 13.0 | 39                                     | 37   | 34   | 35.7 | 36              | 34 | 32 | 38 | 55                              | 52   | 48   | 30.2 | 51              | 48 | 44 | 44 | 87                               | 82   | 76   | 24.1 | 80              | 75 | 70 | 53 |
| 14.0 | 35                                     | 33   | 30   | 38.1 | 37              | 35 | 32 | 39 | 48                              | 46   | 42   | 32.2 | 52              | 49 | 45 | 45 | 76                               | 72   | 66   | 25.7 | 81              | 77 | 71 | 53 |
| 15.0 | 31                                     | 29   | 27   | 40.5 | 38              | 35 | 33 | 39 | 43                              | 40   | 37   | 34.3 | 53              | 50 | 46 | 45 | 67                               | 63   | 59   | 27.3 | 83              | 78 | 72 | 53 |
| 16.0 | 27                                     | 26   | 24   | 42.9 | 38              | 36 | 33 | 39 | 38                              | 36   | 33   | 36.3 | 53              | 50 | 46 | 45 | 60                               | 57   | 52   | 28.9 | 84              | 79 | 73 | 54 |
| 17.0 | 25                                     | 23   | 21   | 45.3 | 39              | 36 | 34 | 39 | 34                              | 32   | 30   | 38.3 | 54              | 51 | 47 | 46 | 54                               | 51   | 47   | 30.5 | 85              | 80 | 74 | 54 |
| 18.0 | 22                                     | 21   | 19   | 47.6 | 39              | 37 | 34 | 40 | 31                              | 29   | 27   | 40.3 | 55              | 52 | 48 | 46 | 49                               | 46   | 42   | 32.1 | 86              | 81 | 75 | 54 |
| 19.0 | 20                                     | 19   | 18   | 50.0 | 40              | 37 | 35 | 40 | 28                              | 27   | 25   | 42.2 | 56              | 52 | 48 | 46 | 44                               | 42   | 39   | 33.7 | 87              | 82 | 76 | 54 |
| 20.0 | 18                                     | 17   | 16   | 52.3 | 40              | 38 | 35 | 40 | 26                              | 24   | 22   | 44.2 | 56              | 53 | 49 | 46 | 40                               | 38   | 35   | 35.3 | 88              | 83 | 77 | 55 |
| 22.0 | 16                                     | 15   | 14   | 56.9 | 41              | 39 | 36 | 41 | 22                              | 20   | 19   | 48.1 | 57              | 54 | 50 | 47 | 34                               | 32   | 30   | 38.4 | 90              | 85 | 79 | 55 |
| 24.0 | 13                                     | 13   | 12   | 61.4 | 42              | 39 | 36 | 41 | 19                              | 18   | 16   | 51.9 | 59              | 55 | 51 | 47 | 29                               | 28   | 26   | 41.4 | 92              | 87 | 80 | 55 |
| 26.0 | 12                                     | 11   | 10   | 66.0 | 43              | 40 | 37 | 41 | 16                              | 15   | 14   | 55.7 | 60              | 56 | 52 | 47 | 25                               | 24   | 22   | 44.5 | 94              | 88 | 82 | 56 |
| 28.0 | 10                                     | 10   | 9    | 70.4 | 43              | 41 | 38 | 42 | 14                              | 13   | 12   | 59.5 | 61              | 57 | 53 | 48 | 22                               | 21   | 19   | 47.5 | 95              | 90 | 83 | 56 |
| 30.0 | 9                                      | 8    | 8    | 74.9 | 44              | 41 | 38 | 42 | 13                              | 12   | 11   | 63.3 | 62              | 58 | 54 | 48 | 20                               | 19   | 17   | 50.5 | 97              | 91 | 84 | 56 |

**Table P13:** Ponderosa pine stocking levels for the PIPO/CELE/CAGE (B-O province) and PSME/PHMA (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 73; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 102; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 160; 55% of Max |      |      |      |                 |     |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC |
| 1.0  | 4269                                   | 4019 | 3717 | 3.4  | 23              | 22 | 20 | 30 | 5977                             | 5627 | 5203 | 2.9  | 33              | 31 | 28 | 36 | 9392                             | 8843 | 8177 | 2.3  | 51              | 48  | 45 | 45 |
| 1.5  | 2083                                   | 1961 | 1813 | 4.9  | 26              | 24 | 22 | 32 | 2916                             | 2745 | 2539 | 4.2  | 36              | 34 | 31 | 38 | 4582                             | 4314 | 3989 | 3.3  | 56              | 53  | 49 | 46 |
| 2.0  | 1252                                   | 1179 | 1090 | 6.3  | 27              | 26 | 24 | 33 | 1752                             | 1650 | 1526 | 5.4  | 38              | 36 | 33 | 39 | 2754                             | 2593 | 2397 | 4.3  | 60              | 57  | 52 | 48 |
| 2.5  | 843                                    | 794  | 734  | 7.7  | 29              | 27 | 25 | 34 | 1181                             | 1112 | 1028 | 6.5  | 40              | 38 | 35 | 40 | 1855                             | 1747 | 1615 | 5.2  | 63              | 60  | 55 | 48 |
| 3.0  | 611                                    | 575  | 532  | 9.1  | 30              | 28 | 26 | 35 | 855                              | 805  | 744  | 7.7  | 42              | 40 | 37 | 41 | 1344                             | 1265 | 1170 | 6.1  | 66              | 62  | 57 | 49 |
| 3.5  | 465                                    | 438  | 405  | 10.4 | 31              | 29 | 27 | 35 | 651                              | 613  | 567  | 8.8  | 43              | 41 | 38 | 42 | 1023                             | 963  | 890  | 7.0  | 68              | 64  | 59 | 50 |
| 4.0  | 367                                    | 346  | 320  | 11.7 | 32              | 30 | 28 | 36 | 514                              | 484  | 447  | 9.9  | 45              | 42 | 39 | 42 | 807                              | 760  | 703  | 7.9  | 70              | 66  | 61 | 50 |
| 4.5  | 298                                    | 281  | 259  | 13.0 | 33              | 31 | 29 | 37 | 417                              | 393  | 363  | 11.0 | 46              | 43 | 40 | 43 | 656                              | 617  | 571  | 8.8  | 72              | 68  | 63 | 51 |
| 5.0  | 247                                    | 233  | 215  | 14.3 | 34              | 32 | 29 | 37 | 346                              | 326  | 301  | 12.1 | 47              | 44 | 41 | 43 | 544                              | 512  | 474  | 9.6  | 74              | 70  | 65 | 51 |
| 5.5  | 209                                    | 197  | 182  | 15.5 | 34              | 32 | 30 | 37 | 292                              | 275  | 255  | 13.1 | 48              | 45 | 42 | 44 | 460                              | 433  | 400  | 10.5 | 76              | 71  | 66 | 52 |
| 6.0  | 179                                    | 169  | 156  | 16.8 | 35              | 33 | 31 | 38 | 251                              | 236  | 218  | 14.2 | 49              | 46 | 43 | 44 | 394                              | 371  | 343  | 11.3 | 77              | 73  | 67 | 52 |
| 6.5  | 155                                    | 146  | 135  | 18.0 | 36              | 34 | 31 | 38 | 218                              | 205  | 189  | 15.2 | 50              | 47 | 44 | 44 | 342                              | 322  | 298  | 12.1 | 79              | 74  | 69 | 53 |
| 7.0  | 136                                    | 128  | 119  | 19.2 | 36              | 34 | 32 | 38 | 191                              | 180  | 166  | 16.2 | 51              | 48 | 44 | 45 | 300                              | 282  | 261  | 13.0 | 80              | 75  | 70 | 53 |
| 7.5  | 121                                    | 114  | 105  | 20.4 | 37              | 35 | 32 | 39 | 169                              | 159  | 147  | 17.3 | 52              | 49 | 45 | 45 | 265                              | 250  | 231  | 13.8 | 81              | 77  | 71 | 53 |
| 8.0  | 108                                    | 101  | 94   | 21.6 | 38              | 35 | 33 | 39 | 151                              | 142  | 131  | 18.3 | 53              | 50 | 46 | 45 | 237                              | 223  | 206  | 14.6 | 83              | 78  | 72 | 53 |
| 8.5  | 97                                     | 91   | 84   | 22.8 | 38              | 36 | 33 | 39 | 135                              | 127  | 118  | 19.3 | 53              | 50 | 46 | 45 | 213                              | 200  | 185  | 15.4 | 84              | 79  | 73 | 54 |
| 9.0  | 87                                     | 82   | 76   | 24.0 | 39              | 36 | 34 | 39 | 122                              | 115  | 106  | 20.3 | 54              | 51 | 47 | 46 | 192                              | 181  | 167  | 16.2 | 85              | 80  | 74 | 54 |
| 9.5  | 79                                     | 75   | 69   | 25.2 | 39              | 37 | 34 | 40 | 111                              | 105  | 97   | 21.3 | 55              | 52 | 48 | 46 | 175                              | 164  | 152  | 17.0 | 86              | 81  | 75 | 54 |
| 10.0 | 73                                     | 68   | 63   | 26.3 | 40              | 37 | 34 | 40 | 102                              | 96   | 88   | 22.3 | 55              | 52 | 48 | 46 | 160                              | 150  | 139  | 17.8 | 87              | 82  | 76 | 54 |
| 11.0 | 61                                     | 58   | 53   | 28.7 | 40              | 38 | 35 | 40 | 86                               | 81   | 75   | 24.2 | 57              | 53 | 49 | 46 | 135                              | 127  | 117  | 19.3 | 89              | 84  | 77 | 55 |
| 12.0 | 53                                     | 49   | 46   | 31.0 | 41              | 39 | 36 | 41 | 74                               | 69   | 64   | 26.2 | 58              | 54 | 50 | 47 | 116                              | 109  | 101  | 20.9 | 91              | 85  | 79 | 55 |
| 13.0 | 46                                     | 43   | 40   | 33.2 | 42              | 40 | 37 | 41 | 64                               | 60   | 56   | 28.1 | 59              | 55 | 51 | 47 | 100                              | 94   | 87   | 22.4 | 92              | 87  | 80 | 56 |
| 14.0 | 40                                     | 38   | 35   | 35.5 | 43              | 40 | 37 | 41 | 56                               | 53   | 49   | 30.0 | 60              | 56 | 52 | 47 | 88                               | 83   | 77   | 23.9 | 94              | 88  | 82 | 56 |
| 15.0 | 35                                     | 33   | 31   | 37.7 | 43              | 41 | 38 | 42 | 50                               | 47   | 43   | 31.9 | 61              | 57 | 53 | 48 | 78                               | 73   | 68   | 25.4 | 95              | 90  | 83 | 56 |
| 16.0 | 32                                     | 30   | 27   | 39.9 | 44              | 41 | 38 | 42 | 44                               | 42   | 38   | 33.7 | 62              | 58 | 54 | 48 | 69                               | 65   | 60   | 26.9 | 97              | 91  | 84 | 56 |
| 17.0 | 28                                     | 27   | 25   | 42.1 | 45              | 42 | 39 | 42 | 40                               | 37   | 35   | 35.6 | 63              | 59 | 54 | 48 | 62                               | 59   | 54   | 28.4 | 98              | 93  | 86 | 57 |
| 18.0 | 26                                     | 24   | 22   | 44.3 | 45              | 43 | 39 | 42 | 36                               | 34   | 31   | 37.5 | 63              | 60 | 55 | 49 | 56                               | 53   | 49   | 29.9 | 100             | 94  | 87 | 57 |
| 19.0 | 23                                     | 22   | 20   | 46.5 | 46              | 43 | 40 | 43 | 33                               | 31   | 28   | 39.3 | 64              | 60 | 56 | 49 | 51                               | 48   | 45   | 31.3 | 101             | 95  | 88 | 57 |
| 20.0 | 21                                     | 20   | 19   | 48.6 | 46              | 44 | 40 | 43 | 30                               | 28   | 26   | 41.1 | 65              | 61 | 57 | 49 | 47                               | 44   | 41   | 32.8 | 102             | 96  | 89 | 57 |
| 22.0 | 18                                     | 17   | 16   | 52.9 | 47              | 45 | 41 | 43 | 25                               | 24   | 22   | 44.7 | 66              | 62 | 58 | 49 | 40                               | 37   | 34   | 35.7 | 104             | 98  | 91 | 58 |
| 24.0 | 15                                     | 14   | 13   | 57.2 | 48              | 46 | 42 | 44 | 22                               | 20   | 19   | 48.3 | 68              | 64 | 59 | 50 | 34                               | 32   | 29   | 38.5 | 106             | 100 | 93 | 58 |
| 26.0 | 13                                     | 13   | 12   | 61.4 | 49              | 46 | 43 | 44 | 19                               | 18   | 16   | 51.9 | 69              | 65 | 60 | 50 | 29                               | 28   | 26   | 41.4 | 108             | 102 | 94 | 58 |
| 28.0 | 12                                     | 11   | 10   | 65.5 | 50              | 47 | 44 | 44 | 16                               | 15   | 14   | 55.4 | 70              | 66 | 61 | 50 | 26                               | 24   | 22   | 44.2 | 110             | 104 | 96 | 59 |
| 30.0 | 10                                     | 10   | 9    | 69.6 | 51              | 48 | 44 | 44 | 15                               | 14   | 13   | 58.9 | 71              | 67 | 62 | 51 | 23                               | 21   | 20   | 47.0 | 112             | 105 | 98 | 59 |

**Table P14:** Ponderosa pine stocking levels for the PIPO/CELE/FEID-AGSP and PIPO/CELE/PONE plant associations (B-O province).

| QMD  | Climate Resilience; SDI 49; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 69; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 108; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 2885                                   | 2717 | 2512 | 4.2  | 16              | 15 | 14 | 23 | 4039                            | 3803 | 3517 | 3.5  | 22              | 21 | 19 | 29 | 6348                             | 5976 | 5526 | 2.8  | 35              | 33 | 30 | 37 |
| 1.5  | 1408                                   | 1325 | 1226 | 6.0  | 17              | 16 | 15 | 25 | 1971                            | 1856 | 1716 | 5.1  | 24              | 23 | 21 | 31 | 3097                             | 2916 | 2696 | 4.0  | 38              | 36 | 33 | 39 |
| 2.0  | 846                                    | 797  | 737  | 7.7  | 18              | 17 | 16 | 26 | 1184                            | 1115 | 1031 | 6.5  | 26              | 24 | 22 | 32 | 1861                             | 1752 | 1620 | 5.2  | 41              | 38 | 35 | 40 |
| 2.5  | 570                                    | 537  | 496  | 9.4  | 19              | 18 | 17 | 27 | 798                             | 751  | 695  | 7.9  | 27              | 26 | 24 | 33 | 1254                             | 1181 | 1092 | 6.3  | 43              | 40 | 37 | 41 |
| 3.0  | 413                                    | 389  | 359  | 11.0 | 20              | 19 | 18 | 28 | 578                             | 544  | 503  | 9.3  | 28              | 27 | 25 | 34 | 908                              | 855  | 791  | 7.4  | 45              | 42 | 39 | 42 |
| 3.5  | 314                                    | 296  | 274  | 12.7 | 21              | 20 | 18 | 28 | 440                             | 414  | 383  | 10.7 | 29              | 28 | 26 | 34 | 691                              | 651  | 602  | 8.5  | 46              | 43 | 40 | 43 |
| 4.0  | 248                                    | 234  | 216  | 14.2 | 22              | 20 | 19 | 29 | 347                             | 327  | 302  | 12.0 | 30              | 29 | 26 | 35 | 546                              | 514  | 475  | 9.6  | 48              | 45 | 41 | 43 |
| 4.5  | 201                                    | 190  | 175  | 15.8 | 22              | 21 | 19 | 29 | 282                             | 265  | 245  | 13.4 | 31              | 29 | 27 | 36 | 443                              | 417  | 386  | 10.7 | 49              | 46 | 43 | 44 |
| 5.0  | 167                                    | 157  | 145  | 17.3 | 23              | 21 | 20 | 30 | 234                             | 220  | 204  | 14.7 | 32              | 30 | 28 | 36 | 368                              | 346  | 320  | 11.7 | 50              | 47 | 44 | 44 |
| 5.5  | 141                                    | 133  | 123  | 18.9 | 23              | 22 | 20 | 30 | 198                             | 186  | 172  | 16.0 | 33              | 31 | 28 | 36 | 311                              | 292  | 270  | 12.7 | 51              | 48 | 45 | 45 |
| 6.0  | 121                                    | 114  | 105  | 20.4 | 24              | 22 | 21 | 31 | 169                             | 160  | 148  | 17.2 | 33              | 31 | 29 | 37 | 266                              | 251  | 232  | 13.7 | 52              | 49 | 46 | 45 |
| 6.5  | 105                                    | 99   | 91   | 21.9 | 24              | 23 | 21 | 31 | 147                             | 138  | 128  | 18.5 | 34              | 32 | 30 | 37 | 231                              | 218  | 201  | 14.8 | 53              | 50 | 46 | 45 |
| 7.0  | 92                                     | 87   | 80   | 23.4 | 25              | 23 | 21 | 31 | 129                             | 121  | 112  | 19.7 | 34              | 32 | 30 | 37 | 203                              | 191  | 176  | 15.8 | 54              | 51 | 47 | 46 |
| 7.5  | 82                                     | 77   | 71   | 24.8 | 25              | 24 | 22 | 32 | 114                             | 107  | 99   | 21.0 | 35              | 33 | 30 | 38 | 179                              | 169  | 156  | 16.7 | 55              | 52 | 48 | 46 |
| 8.0  | 73                                     | 68   | 63   | 26.3 | 25              | 24 | 22 | 32 | 102                             | 96   | 89   | 22.2 | 36              | 33 | 31 | 38 | 160                              | 151  | 139  | 17.7 | 56              | 53 | 49 | 46 |
| 8.5  | 65                                     | 62   | 57   | 27.7 | 26              | 24 | 22 | 32 | 91                              | 86   | 80   | 23.5 | 36              | 34 | 31 | 38 | 144                              | 135  | 125  | 18.7 | 57              | 53 | 49 | 46 |
| 9.0  | 59                                     | 56   | 51   | 29.2 | 26              | 25 | 23 | 32 | 83                              | 78   | 72   | 24.7 | 37              | 34 | 32 | 38 | 130                              | 122  | 113  | 19.7 | 57              | 54 | 50 | 47 |
| 9.5  | 54                                     | 51   | 47   | 30.6 | 26              | 25 | 23 | 33 | 75                              | 71   | 65   | 25.9 | 37              | 35 | 32 | 39 | 118                              | 111  | 103  | 20.6 | 58              | 55 | 51 | 47 |
| 10.0 | 49                                     | 46   | 43   | 32.0 | 27              | 25 | 23 | 33 | 69                              | 65   | 60   | 27.1 | 37              | 35 | 33 | 39 | 108                              | 101  | 94   | 21.6 | 59              | 55 | 51 | 47 |
| 11.0 | 41                                     | 39   | 36   | 34.9 | 27              | 26 | 24 | 33 | 58                              | 55   | 50   | 29.5 | 38              | 36 | 33 | 39 | 91                               | 86   | 79   | 23.5 | 60              | 57 | 52 | 48 |
| 12.0 | 35                                     | 33   | 31   | 37.6 | 28              | 26 | 24 | 34 | 50                              | 47   | 43   | 31.8 | 39              | 37 | 34 | 40 | 78                               | 74   | 68   | 25.4 | 61              | 58 | 53 | 48 |
| 13.0 | 31                                     | 29   | 27   | 40.4 | 28              | 27 | 25 | 34 | 43                              | 41   | 38   | 34.2 | 40              | 37 | 35 | 40 | 68                               | 64   | 59   | 27.2 | 62              | 59 | 54 | 48 |
| 14.0 | 27                                     | 25   | 24   | 43.2 | 29              | 27 | 25 | 34 | 38                              | 36   | 33   | 36.5 | 40              | 38 | 35 | 40 | 59                               | 56   | 52   | 29.1 | 64              | 60 | 55 | 49 |
| 15.0 | 24                                     | 23   | 21   | 45.9 | 29              | 28 | 26 | 34 | 33                              | 32   | 29   | 38.8 | 41              | 39 | 36 | 41 | 53                               | 50   | 46   | 30.9 | 65              | 61 | 56 | 49 |
| 16.0 | 21                                     | 20   | 19   | 48.6 | 30              | 28 | 26 | 35 | 30                              | 28   | 26   | 41.0 | 42              | 39 | 36 | 41 | 47                               | 44   | 41   | 32.7 | 66              | 62 | 57 | 49 |
| 17.0 | 19                                     | 18   | 17   | 51.2 | 30              | 28 | 26 | 35 | 27                              | 25   | 23   | 43.3 | 42              | 40 | 37 | 41 | 42                               | 40   | 37   | 34.5 | 66              | 63 | 58 | 49 |
| 18.0 | 17                                     | 16   | 15   | 53.9 | 31              | 29 | 27 | 35 | 24                              | 23   | 21   | 45.6 | 43              | 40 | 37 | 41 | 38                               | 36   | 33   | 36.3 | 67              | 63 | 59 | 50 |
| 19.0 | 16                                     | 15   | 14   | 56.5 | 31              | 29 | 27 | 35 | 22                              | 21   | 19   | 47.8 | 43              | 41 | 38 | 42 | 35                               | 33   | 30   | 38.1 | 68              | 64 | 59 | 50 |
| 20.0 | 14                                     | 14   | 13   | 59.2 | 31              | 30 | 27 | 36 | 20                              | 19   | 18   | 50.0 | 44              | 41 | 38 | 42 | 32                               | 30   | 28   | 39.9 | 69              | 65 | 60 | 50 |
| 22.0 | 12                                     | 11   | 11   | 64.4 | 32              | 30 | 28 | 36 | 17                              | 16   | 15   | 54.4 | 45              | 42 | 39 | 42 | 27                               | 25   | 23   | 43.4 | 70              | 66 | 61 | 50 |
| 24.0 | 10                                     | 10   | 9    | 69.5 | 33              | 31 | 28 | 36 | 15                              | 14   | 13   | 58.8 | 46              | 43 | 40 | 43 | 23                               | 22   | 20   | 46.9 | 72              | 68 | 63 | 51 |
| 26.0 | 9                                      | 9    | 8    | 74.6 | 33              | 31 | 29 | 37 | 13                              | 12   | 11   | 63.1 | 47              | 44 | 41 | 43 | 20                               | 19   | 17   | 50.3 | 73              | 69 | 64 | 51 |
| 28.0 | 8                                      | 7    | 7    | 79.7 | 34              | 32 | 29 | 37 | 11                              | 10   | 10   | 67.4 | 47              | 45 | 41 | 43 | 17                               | 16   | 15   | 53.7 | 75              | 70 | 65 | 52 |
| 30.0 | 7                                      | 7    | 6    | 84.7 | 34              | 32 | 30 | 37 | 10                              | 9    | 9    | 71.6 | 48              | 45 | 42 | 43 | 15                               | 15   | 13   | 57.1 | 76              | 71 | 66 | 52 |

**Table P15:** Ponderosa pine stocking levels for the PIPO/FEID and PSME/VAME plant associations (B-O province).

| QMD  | Climate Resilience; SDI 60; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 84; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 133; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3548                                   | 3340 | 3089 | 3.8  | 19              | 18 | 17 | 27 | 4967                            | 4676 | 4324 | 3.2  | 27              | 26 | 24 | 33 | 7805                             | 7349 | 6795 | 2.5  | 43              | 40 | 37 | 41 |
| 1.5  | 1731                                   | 1630 | 1507 | 5.4  | 21              | 20 | 18 | 29 | 2423                            | 2282 | 2110 | 4.6  | 30              | 28 | 26 | 35 | 3808                             | 3585 | 3315 | 3.6  | 47              | 44 | 41 | 43 |
| 2.0  | 1040                                   | 979  | 906  | 7.0  | 23              | 21 | 20 | 30 | 1456                            | 1371 | 1268 | 5.9  | 32              | 30 | 28 | 36 | 2289                             | 2155 | 1992 | 4.7  | 50              | 47 | 43 | 44 |
| 2.5  | 701                                    | 660  | 610  | 8.5  | 24              | 22 | 21 | 31 | 981                             | 924  | 854  | 7.2  | 33              | 31 | 29 | 37 | 1542                             | 1452 | 1342 | 5.7  | 53              | 49 | 46 | 45 |
| 3.0  | 508                                    | 478  | 442  | 10.0 | 25              | 23 | 22 | 31 | 711                             | 669  | 619  | 8.4  | 35              | 33 | 30 | 38 | 1117                             | 1051 | 972  | 6.7  | 55              | 52 | 48 | 46 |
| 3.5  | 386                                    | 364  | 336  | 11.4 | 26              | 24 | 22 | 32 | 541                             | 509  | 471  | 9.6  | 36              | 34 | 31 | 38 | 850                              | 800  | 740  | 7.7  | 57              | 53 | 49 | 47 |
| 4.0  | 305                                    | 287  | 266  | 12.8 | 27              | 25 | 23 | 33 | 427                             | 402  | 372  | 10.9 | 37              | 35 | 32 | 39 | 671                              | 632  | 584  | 8.7  | 59              | 55 | 51 | 47 |
| 4.5  | 248                                    | 233  | 216  | 14.3 | 27              | 26 | 24 | 33 | 347                             | 326  | 302  | 12.0 | 38              | 36 | 33 | 39 | 545                              | 513  | 474  | 9.6  | 60              | 57 | 52 | 48 |
| 5.0  | 205                                    | 193  | 179  | 15.6 | 28              | 26 | 24 | 34 | 288                             | 271  | 250  | 13.2 | 39              | 37 | 34 | 40 | 452                              | 426  | 394  | 10.5 | 62              | 58 | 54 | 48 |
| 5.5  | 174                                    | 163  | 151  | 17.0 | 29              | 27 | 25 | 34 | 243                             | 229  | 212  | 14.4 | 40              | 38 | 35 | 40 | 382                              | 360  | 332  | 11.5 | 63              | 59 | 55 | 48 |
| 6.0  | 149                                    | 140  | 130  | 18.4 | 29              | 28 | 25 | 34 | 208                             | 196  | 181  | 15.5 | 41              | 39 | 36 | 40 | 327                              | 308  | 285  | 12.4 | 64              | 61 | 56 | 49 |
| 6.5  | 129                                    | 122  | 112  | 19.7 | 30              | 28 | 26 | 35 | 181                             | 170  | 157  | 16.7 | 42              | 39 | 36 | 41 | 284                              | 268  | 247  | 13.3 | 65              | 62 | 57 | 49 |
| 7.0  | 113                                    | 107  | 99   | 21.1 | 30              | 29 | 26 | 35 | 159                             | 149  | 138  | 17.8 | 42              | 40 | 37 | 41 | 249                              | 235  | 217  | 14.2 | 67              | 63 | 58 | 49 |
| 7.5  | 100                                    | 94   | 87   | 22.4 | 31              | 29 | 27 | 35 | 140                             | 132  | 122  | 18.9 | 43              | 41 | 37 | 41 | 221                              | 208  | 192  | 15.1 | 68              | 64 | 59 | 50 |
| 8.0  | 89                                     | 84   | 78   | 23.7 | 31              | 29 | 27 | 36 | 125                             | 118  | 109  | 20.0 | 44              | 41 | 38 | 42 | 197                              | 185  | 171  | 16.0 | 69              | 65 | 60 | 50 |
| 8.5  | 80                                     | 76   | 70   | 25.0 | 32              | 30 | 28 | 36 | 112                             | 106  | 98   | 21.1 | 44              | 42 | 39 | 42 | 177                              | 166  | 154  | 16.9 | 70              | 66 | 61 | 50 |
| 9.0  | 73                                     | 68   | 63   | 26.3 | 32              | 30 | 28 | 36 | 102                             | 96   | 88   | 22.2 | 45              | 42 | 39 | 42 | 160                              | 150  | 139  | 17.7 | 71              | 66 | 61 | 51 |
| 9.5  | 66                                     | 62   | 57   | 27.6 | 32              | 31 | 28 | 36 | 92                              | 87   | 80   | 23.3 | 45              | 43 | 40 | 42 | 145                              | 137  | 126  | 18.6 | 71              | 67 | 62 | 51 |
| 10.0 | 60                                     | 57   | 52   | 28.9 | 33              | 31 | 29 | 36 | 84                              | 79   | 73   | 24.4 | 46              | 43 | 40 | 43 | 133                              | 125  | 115  | 19.5 | 72              | 68 | 63 | 51 |
| 11.0 | 51                                     | 48   | 44   | 31.4 | 34              | 32 | 29 | 37 | 71                              | 67   | 62   | 26.6 | 47              | 44 | 41 | 43 | 112                              | 105  | 97   | 21.2 | 74              | 70 | 64 | 51 |
| 12.0 | 44                                     | 41   | 38   | 34.0 | 34              | 32 | 30 | 37 | 61                              | 58   | 53   | 28.7 | 48              | 45 | 42 | 43 | 96                               | 90   | 84   | 22.9 | 75              | 71 | 66 | 52 |
| 13.0 | 38                                     | 36   | 33   | 36.4 | 35              | 33 | 30 | 38 | 53                              | 50   | 46   | 30.8 | 49              | 46 | 43 | 44 | 83                               | 78   | 73   | 24.6 | 77              | 72 | 67 | 52 |
| 14.0 | 33                                     | 31   | 29   | 38.9 | 36              | 33 | 31 | 38 | 46                              | 44   | 40   | 32.9 | 50              | 47 | 43 | 44 | 73                               | 69   | 64   | 26.2 | 78              | 74 | 68 | 52 |
| 15.0 | 29                                     | 28   | 26   | 41.4 | 36              | 34 | 31 | 38 | 41                              | 39   | 36   | 35.0 | 51              | 48 | 44 | 44 | 65                               | 61   | 56   | 27.9 | 79              | 75 | 69 | 53 |
| 16.0 | 26                                     | 25   | 23   | 43.8 | 37              | 34 | 32 | 38 | 37                              | 35   | 32   | 37.0 | 51              | 48 | 45 | 45 | 58                               | 54   | 50   | 29.5 | 81              | 76 | 70 | 53 |
| 17.0 | 24                                     | 22   | 21   | 46.2 | 37              | 35 | 32 | 39 | 33                              | 31   | 29   | 39.1 | 52              | 49 | 45 | 45 | 52                               | 49   | 45   | 31.2 | 82              | 77 | 71 | 53 |
| 18.0 | 21                                     | 20   | 19   | 48.6 | 38              | 35 | 33 | 39 | 30                              | 28   | 26   | 41.1 | 53              | 50 | 46 | 45 | 47                               | 44   | 41   | 32.8 | 83              | 78 | 72 | 53 |
| 19.0 | 19                                     | 18   | 17   | 51.0 | 38              | 36 | 33 | 39 | 27                              | 25   | 24   | 43.1 | 53              | 50 | 46 | 45 | 43                               | 40   | 37   | 34.4 | 84              | 79 | 73 | 54 |
| 20.0 | 18                                     | 17   | 15   | 53.4 | 39              | 36 | 34 | 39 | 25                              | 23   | 22   | 45.1 | 54              | 51 | 47 | 46 | 39                               | 37   | 34   | 36.0 | 85              | 80 | 74 | 54 |
| 22.0 | 15                                     | 14   | 13   | 58.1 | 39              | 37 | 34 | 40 | 21                              | 20   | 18   | 49.1 | 55              | 52 | 48 | 46 | 33                               | 31   | 29   | 39.1 | 87              | 82 | 75 | 54 |
| 24.0 | 13                                     | 12   | 11   | 62.7 | 40              | 38 | 35 | 40 | 18                              | 17   | 16   | 53.0 | 56              | 53 | 49 | 46 | 28                               | 26   | 25   | 42.3 | 88              | 83 | 77 | 55 |
| 26.0 | 11                                     | 10   | 10   | 67.3 | 41              | 39 | 36 | 40 | 16                              | 15   | 14   | 56.9 | 57              | 54 | 50 | 47 | 24                               | 23   | 21   | 45.4 | 90              | 85 | 78 | 55 |
| 28.0 | 10                                     | 9    | 8    | 71.9 | 42              | 39 | 36 | 41 | 14                              | 13   | 12   | 60.7 | 58              | 55 | 51 | 47 | 21                               | 20   | 19   | 48.5 | 92              | 86 | 80 | 55 |
| 30.0 | 9                                      | 8    | 8    | 76.4 | 42              | 40 | 37 | 41 | 12                              | 11   | 11   | 64.6 | 59              | 56 | 52 | 47 | 19                               | 18   | 17   | 51.5 | 93              | 88 | 81 | 56 |



**Table P16:** Ponderosa pine stocking levels for the PIPO/FEID (W-S province) and PIPO/PUTR/CAGE (B-O province) plant associations.

| QMD  | Climate Resilience; SDI 64; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 89; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 140; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3754                                   | 3534 | 3268 | 3.7  | 20              | 19 | 18 | 28 | 5255                            | 4948 | 4575 | 3.1  | 29              | 27 | 25 | 34 | 8259                             | 7775 | 7190 | 2.5  | 45              | 42 | 39 | 42 |
| 1.5  | 1831                                   | 1724 | 1594 | 5.2  | 22              | 21 | 20 | 30 | 2564                            | 2414 | 2232 | 4.4  | 31              | 30 | 27 | 36 | 4029                             | 3794 | 3508 | 3.5  | 49              | 47 | 43 | 44 |
| 2.0  | 1101                                   | 1036 | 958  | 6.8  | 24              | 23 | 21 | 31 | 1541                            | 1451 | 1342 | 5.7  | 34              | 32 | 29 | 37 | 2421                             | 2280 | 2108 | 4.6  | 53              | 50 | 46 | 45 |
| 2.5  | 742                                    | 698  | 646  | 8.2  | 25              | 24 | 22 | 32 | 1038                            | 977  | 904  | 7.0  | 35              | 33 | 31 | 38 | 1631                             | 1536 | 1420 | 5.6  | 56              | 52 | 48 | 46 |
| 3.0  | 537                                    | 506  | 468  | 9.7  | 26              | 25 | 23 | 32 | 752                             | 708  | 655  | 8.2  | 37              | 35 | 32 | 39 | 1181                             | 1112 | 1029 | 6.5  | 58              | 55 | 50 | 47 |
| 3.5  | 409                                    | 385  | 356  | 11.1 | 27              | 26 | 24 | 33 | 572                             | 539  | 498  | 9.4  | 38              | 36 | 33 | 39 | 899                              | 847  | 783  | 7.5  | 60              | 57 | 52 | 48 |
| 4.0  | 323                                    | 304  | 281  | 12.5 | 28              | 27 | 25 | 34 | 452                             | 425  | 393  | 10.6 | 39              | 37 | 34 | 40 | 710                              | 668  | 618  | 8.4  | 62              | 58 | 54 | 48 |
| 4.5  | 262                                    | 247  | 228  | 13.9 | 29              | 27 | 25 | 34 | 367                             | 345  | 319  | 11.7 | 41              | 38 | 35 | 40 | 576                              | 543  | 502  | 9.3  | 64              | 60 | 55 | 49 |
| 5.0  | 217                                    | 205  | 189  | 15.2 | 30              | 28 | 26 | 35 | 304                             | 287  | 265  | 12.9 | 42              | 39 | 36 | 41 | 478                              | 450  | 416  | 10.3 | 65              | 61 | 57 | 49 |
| 5.5  | 184                                    | 173  | 160  | 16.5 | 30              | 29 | 26 | 35 | 257                             | 242  | 224  | 14.0 | 42              | 40 | 37 | 41 | 404                              | 380  | 352  | 11.2 | 67              | 63 | 58 | 49 |
| 6.0  | 157                                    | 148  | 137  | 17.9 | 31              | 29 | 27 | 35 | 220                             | 208  | 192  | 15.1 | 43              | 41 | 38 | 42 | 346                              | 326  | 302  | 12.1 | 68              | 64 | 59 | 50 |
| 6.5  | 137                                    | 129  | 119  | 19.2 | 31              | 30 | 27 | 36 | 191                             | 180  | 167  | 16.2 | 44              | 42 | 38 | 42 | 301                              | 283  | 262  | 12.9 | 69              | 65 | 60 | 50 |
| 7.0  | 120                                    | 113  | 104  | 20.5 | 32              | 30 | 28 | 36 | 168                             | 158  | 146  | 17.3 | 45              | 42 | 39 | 42 | 264                              | 248  | 230  | 13.8 | 70              | 66 | 61 | 50 |
| 7.5  | 106                                    | 100  | 92   | 21.8 | 33              | 31 | 28 | 36 | 149                             | 140  | 129  | 18.4 | 46              | 43 | 40 | 42 | 233                              | 220  | 203  | 14.7 | 72              | 67 | 62 | 51 |
| 8.0  | 95                                     | 89   | 82   | 23.1 | 33              | 31 | 29 | 37 | 132                             | 125  | 115  | 19.5 | 46              | 44 | 40 | 43 | 208                              | 196  | 181  | 15.5 | 73              | 68 | 63 | 51 |
| 8.5  | 85                                     | 80   | 74   | 24.3 | 33              | 32 | 29 | 37 | 119                             | 112  | 104  | 20.6 | 47              | 44 | 41 | 43 | 187                              | 176  | 163  | 16.4 | 74              | 69 | 64 | 51 |
| 9.0  | 77                                     | 72   | 67   | 25.6 | 34              | 32 | 30 | 37 | 108                             | 101  | 94   | 21.6 | 48              | 45 | 41 | 43 | 169                              | 159  | 147  | 17.3 | 75              | 70 | 65 | 52 |
| 9.5  | 70                                     | 66   | 61   | 26.8 | 34              | 32 | 30 | 37 | 98                              | 92   | 85   | 22.7 | 48              | 45 | 42 | 43 | 154                              | 145  | 134  | 18.1 | 76              | 71 | 66 | 52 |
| 10.0 | 64                                     | 60   | 56   | 28.1 | 35              | 33 | 30 | 38 | 89                              | 84   | 78   | 23.7 | 49              | 46 | 42 | 44 | 140                              | 132  | 122  | 18.9 | 76              | 72 | 67 | 52 |
| 11.0 | 54                                     | 51   | 47   | 30.6 | 36              | 33 | 31 | 38 | 75                              | 71   | 66   | 25.8 | 50              | 47 | 43 | 44 | 118                              | 112  | 103  | 20.6 | 78              | 74 | 68 | 52 |
| 12.0 | 46                                     | 43   | 40   | 33.0 | 36              | 34 | 32 | 38 | 65                              | 61   | 56   | 27.9 | 51              | 48 | 44 | 44 | 102                              | 96   | 88   | 22.3 | 80              | 75 | 69 | 53 |
| 13.0 | 40                                     | 38   | 35   | 35.4 | 37              | 35 | 32 | 39 | 56                              | 53   | 49   | 29.9 | 52              | 49 | 45 | 45 | 88                               | 83   | 77   | 23.9 | 81              | 76 | 71 | 53 |
| 14.0 | 35                                     | 33   | 31   | 37.8 | 38              | 35 | 33 | 39 | 49                              | 46   | 43   | 32.0 | 53              | 50 | 46 | 45 | 77                               | 73   | 67   | 25.5 | 83              | 78 | 72 | 53 |
| 15.0 | 31                                     | 29   | 27   | 40.2 | 38              | 36 | 33 | 39 | 44                              | 41   | 38   | 34.0 | 53              | 50 | 47 | 45 | 68                               | 64   | 60   | 27.1 | 84              | 79 | 73 | 54 |
| 16.0 | 28                                     | 26   | 24   | 42.6 | 39              | 36 | 34 | 39 | 39                              | 37   | 34   | 36.0 | 54              | 51 | 47 | 46 | 61                               | 57   | 53   | 28.7 | 85              | 80 | 74 | 54 |
| 17.0 | 25                                     | 23   | 22   | 44.9 | 39              | 37 | 34 | 40 | 35                              | 33   | 30   | 38.0 | 55              | 52 | 48 | 46 | 55                               | 52   | 48   | 30.3 | 86              | 81 | 75 | 54 |
| 18.0 | 23                                     | 21   | 20   | 47.3 | 40              | 37 | 35 | 40 | 32                              | 30   | 27   | 39.9 | 56              | 52 | 49 | 46 | 50                               | 47   | 43   | 31.9 | 88              | 82 | 76 | 55 |
| 19.0 | 20                                     | 19   | 18   | 49.6 | 40              | 38 | 35 | 40 | 29                              | 27   | 25   | 41.9 | 56              | 53 | 49 | 46 | 45                               | 42   | 39   | 33.4 | 89              | 83 | 77 | 55 |
| 20.0 | 19                                     | 18   | 16   | 51.9 | 41              | 38 | 36 | 40 | 26                              | 25   | 23   | 43.8 | 57              | 54 | 50 | 47 | 41                               | 39   | 36   | 35.0 | 90              | 84 | 78 | 55 |
| 22.0 | 16                                     | 15   | 14   | 56.4 | 42              | 39 | 36 | 41 | 22                              | 21   | 19   | 47.7 | 58              | 55 | 51 | 47 | 35                               | 33   | 30   | 38.1 | 92              | 86 | 80 | 55 |
| 24.0 | 14                                     | 13   | 12   | 61.0 | 43              | 40 | 37 | 41 | 19                              | 18   | 16   | 51.5 | 60              | 56 | 52 | 47 | 30                               | 28   | 26   | 41.1 | 94              | 88 | 81 | 56 |
| 26.0 | 12                                     | 11   | 10   | 65.4 | 43              | 41 | 38 | 42 | 16                              | 15   | 14   | 55.3 | 61              | 57 | 53 | 48 | 26                               | 24   | 23   | 44.1 | 95              | 90 | 83 | 56 |
| 28.0 | 10                                     | 10   | 9    | 69.9 | 44              | 41 | 38 | 42 | 14                              | 14   | 13   | 59.0 | 62              | 58 | 54 | 48 | 23                               | 21   | 20   | 47.1 | 97              | 91 | 84 | 56 |
| 30.0 | 9                                      | 9    | 8    | 74.3 | 45              | 42 | 39 | 42 | 13                              | 12   | 11   | 62.8 | 63              | 59 | 55 | 48 | 20                               | 19   | 17   | 50.1 | 98              | 93 | 86 | 57 |

**Table P17:** Ponderosa pine stocking levels for the PIPO/PUTR/CARO (B-O province) and PIPO/SYAL (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 75; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 105; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 166; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4431                                   | 4172 | 3858 | 3.4  | 24              | 23 | 21 | 31 | 6203                             | 5841 | 5401 | 2.8  | 34              | 32 | 29 | 37 | 9748                             | 9178 | 8487 | 2.3  | 53              | 50  | 46  | 45 |
| 1.5  | 2162                                   | 2035 | 1882 | 4.8  | 27              | 25 | 23 | 33 | 3027                             | 2850 | 2635 | 4.1  | 37              | 35 | 32 | 39 | 4756                             | 4478 | 4141 | 3.3  | 58              | 55  | 51  | 47 |
| 2.0  | 1299                                   | 1223 | 1131 | 6.2  | 28              | 27 | 25 | 34 | 1819                             | 1713 | 1584 | 5.3  | 40              | 37 | 35 | 40 | 2858                             | 2691 | 2488 | 4.2  | 62              | 59  | 54  | 48 |
| 2.5  | 875                                    | 824  | 762  | 7.6  | 30              | 28 | 26 | 35 | 1225                             | 1154 | 1067 | 6.4  | 42              | 39 | 36 | 41 | 1926                             | 1813 | 1676 | 5.1  | 66              | 62  | 57  | 49 |
| 3.0  | 634                                    | 597  | 552  | 8.9  | 31              | 29 | 27 | 35 | 887                              | 836  | 773  | 7.5  | 44              | 41 | 38 | 42 | 1395                             | 1313 | 1214 | 6.0  | 68              | 64  | 60  | 50 |
| 3.5  | 483                                    | 454  | 420  | 10.2 | 32              | 30 | 28 | 36 | 676                              | 636  | 588  | 8.6  | 45              | 42 | 39 | 42 | 1062                             | 999  | 924  | 6.9  | 71              | 67  | 62  | 51 |
| 4.0  | 381                                    | 359  | 332  | 11.5 | 33              | 31 | 29 | 37 | 533                              | 502  | 464  | 9.7  | 47              | 44 | 41 | 43 | 838                              | 789  | 730  | 7.7  | 73              | 69  | 64  | 51 |
| 4.5  | 309                                    | 291  | 269  | 12.8 | 34              | 32 | 30 | 37 | 433                              | 408  | 377  | 10.8 | 48              | 45 | 42 | 43 | 680                              | 641  | 592  | 8.6  | 75              | 71  | 65  | 52 |
| 5.0  | 257                                    | 242  | 223  | 14.0 | 35              | 33 | 30 | 38 | 359                              | 338  | 313  | 11.8 | 49              | 46 | 43 | 44 | 565                              | 532  | 492  | 9.4  | 77              | 72  | 67  | 52 |
| 5.5  | 217                                    | 204  | 189  | 15.2 | 36              | 34 | 31 | 38 | 304                              | 286  | 264  | 12.9 | 50              | 47 | 44 | 44 | 477                              | 449  | 415  | 10.3 | 79              | 74  | 69  | 53 |
| 6.0  | 186                                    | 175  | 162  | 16.5 | 36              | 34 | 32 | 38 | 260                              | 245  | 227  | 13.9 | 51              | 48 | 44 | 45 | 409                              | 385  | 356  | 11.1 | 80              | 76  | 70  | 53 |
| 6.5  | 161                                    | 152  | 140  | 17.7 | 37              | 35 | 32 | 39 | 226                              | 213  | 197  | 14.9 | 52              | 49 | 45 | 45 | 355                              | 334  | 309  | 11.9 | 82              | 77  | 71  | 53 |
| 7.0  | 141                                    | 133  | 123  | 18.9 | 38              | 36 | 33 | 39 | 198                              | 186  | 172  | 15.9 | 53              | 50 | 46 | 45 | 311                              | 293  | 271  | 12.7 | 83              | 78  | 72  | 54 |
| 7.5  | 125                                    | 118  | 109  | 20.0 | 38              | 36 | 33 | 39 | 175                              | 165  | 153  | 16.9 | 54              | 51 | 47 | 45 | 275                              | 259  | 240  | 13.5 | 85              | 80  | 74  | 54 |
| 8.0  | 112                                    | 105  | 97   | 21.2 | 39              | 37 | 34 | 40 | 156                              | 147  | 136  | 17.9 | 55              | 51 | 48 | 46 | 246                              | 231  | 214  | 14.3 | 86              | 81  | 75  | 54 |
| 8.5  | 100                                    | 94   | 87   | 22.4 | 40              | 37 | 34 | 40 | 140                              | 132  | 122  | 18.9 | 55              | 52 | 48 | 46 | 221                              | 208  | 192  | 15.1 | 87              | 82  | 76  | 54 |
| 9.0  | 91                                     | 85   | 79   | 23.6 | 40              | 38 | 35 | 40 | 127                              | 120  | 111  | 19.9 | 56              | 53 | 49 | 46 | 199                              | 188  | 174  | 15.9 | 88              | 83  | 77  | 55 |
| 9.5  | 82                                     | 78   | 72   | 24.7 | 41              | 38 | 35 | 40 | 115                              | 109  | 100  | 20.9 | 57              | 53 | 49 | 46 | 181                              | 171  | 158  | 16.7 | 89              | 84  | 78  | 55 |
| 10.0 | 75                                     | 71   | 66   | 25.9 | 41              | 39 | 36 | 41 | 105                              | 99   | 92   | 21.9 | 57              | 54 | 50 | 47 | 166                              | 156  | 144  | 17.4 | 90              | 85  | 79  | 55 |
| 11.0 | 64                                     | 60   | 55   | 28.1 | 42              | 39 | 37 | 41 | 89                               | 84   | 77   | 23.8 | 59              | 55 | 51 | 47 | 140                              | 132  | 122  | 19.0 | 92              | 87  | 80  | 55 |
| 12.0 | 54                                     | 51   | 47   | 30.4 | 43              | 40 | 37 | 41 | 76                               | 72   | 66   | 25.7 | 60              | 56 | 52 | 47 | 120                              | 113  | 104  | 20.5 | 94              | 89  | 82  | 56 |
| 13.0 | 47                                     | 45   | 41   | 32.6 | 44              | 41 | 38 | 42 | 66                               | 62   | 58   | 27.6 | 61              | 57 | 53 | 48 | 104                              | 98   | 91   | 22.0 | 96              | 90  | 83  | 56 |
| 14.0 | 41                                     | 39   | 36   | 34.8 | 44              | 42 | 39 | 42 | 58                               | 55   | 51   | 29.4 | 62              | 58 | 54 | 48 | 91                               | 86   | 79   | 23.5 | 98              | 92  | 85  | 57 |
| 15.0 | 37                                     | 35   | 32   | 37.0 | 45              | 42 | 39 | 42 | 51                               | 48   | 45   | 31.3 | 63              | 59 | 55 | 48 | 81                               | 76   | 70   | 25.0 | 99              | 93  | 86  | 57 |
| 16.0 | 33                                     | 31   | 29   | 39.2 | 46              | 43 | 40 | 43 | 46                               | 43   | 40   | 33.1 | 64              | 60 | 56 | 49 | 72                               | 68   | 63   | 26.4 | 101             | 95  | 88  | 57 |
| 17.0 | 29                                     | 28   | 26   | 41.4 | 46              | 44 | 40 | 43 | 41                               | 39   | 36   | 34.9 | 65              | 61 | 57 | 49 | 65                               | 61   | 56   | 27.9 | 102             | 96  | 89  | 57 |
| 18.0 | 27                                     | 25   | 23   | 43.5 | 47              | 44 | 41 | 43 | 37                               | 35   | 32   | 36.8 | 66              | 62 | 57 | 49 | 58                               | 55   | 51   | 29.3 | 103             | 97  | 90  | 58 |
| 19.0 | 24                                     | 23   | 21   | 45.6 | 48              | 45 | 41 | 43 | 34                               | 32   | 29   | 38.6 | 67              | 63 | 58 | 49 | 53                               | 50   | 46   | 30.8 | 105             | 99  | 91  | 58 |
| 20.0 | 22                                     | 21   | 19   | 47.7 | 48              | 45 | 42 | 43 | 31                               | 29   | 27   | 40.4 | 67              | 63 | 59 | 50 | 49                               | 46   | 42   | 32.2 | 106             | 100 | 92  | 58 |
| 22.0 | 19                                     | 18   | 16   | 51.9 | 49              | 46 | 43 | 44 | 26                               | 25   | 23   | 43.9 | 69              | 65 | 60 | 50 | 41                               | 39   | 36   | 35.0 | 108             | 102 | 94  | 58 |
| 24.0 | 16                                     | 15   | 14   | 56.1 | 50              | 47 | 44 | 44 | 22                               | 21   | 19   | 47.4 | 70              | 66 | 61 | 50 | 35                               | 33   | 31   | 37.8 | 110             | 104 | 96  | 59 |
| 26.0 | 14                                     | 13   | 12   | 60.2 | 51              | 48 | 45 | 45 | 19                               | 18   | 17   | 50.9 | 72              | 67 | 62 | 51 | 31                               | 29   | 27   | 40.6 | 112             | 106 | 98  | 59 |
| 28.0 | 12                                     | 11   | 11   | 64.3 | 52              | 49 | 45 | 45 | 17                               | 16   | 15   | 54.4 | 73              | 69 | 63 | 51 | 27                               | 25   | 23   | 43.4 | 114             | 108 | 100 | 59 |
| 30.0 | 11                                     | 10   | 9    | 68.4 | 53              | 50 | 46 | 45 | 15                               | 14   | 13   | 57.8 | 74              | 70 | 64 | 51 | 24                               | 22   | 21   | 46.1 | 116             | 109 | 101 | 60 |

**Table P18:** Ponderosa pine stocking levels for the PIPO/SPBE (W-S province) and PSME/CAGE (B-O province) plant associations.

| QMD  | Climate Resilience; SDI 69; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 97; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 152; 55% of Max |      |      |      |                 |     |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC |
| 1.0  | 4063                                   | 3825 | 3537 | 3.5  | 22              | 21 | 19 | 29 | 5688                            | 5355 | 4952 | 3.0  | 31              | 29 | 27 | 35 | 8939                             | 8416 | 7782 | 2.4  | 49              | 46  | 42 | 44 |
| 1.5  | 1982                                   | 1866 | 1726 | 5.0  | 24              | 23 | 21 | 31 | 2775                            | 2613 | 2416 | 4.3  | 34              | 32 | 30 | 37 | 4361                             | 4106 | 3797 | 3.4  | 54              | 50  | 47 | 45 |
| 2.0  | 1191                                   | 1122 | 1037 | 6.5  | 26              | 24 | 23 | 32 | 1668                            | 1570 | 1452 | 5.5  | 36              | 34 | 32 | 38 | 2621                             | 2468 | 2282 | 4.4  | 57              | 54  | 50 | 47 |
| 2.5  | 803                                    | 756  | 699  | 7.9  | 27              | 26 | 24 | 33 | 1124                            | 1058 | 978  | 6.7  | 38              | 36 | 33 | 39 | 1766                             | 1662 | 1537 | 5.3  | 60              | 57  | 52 | 48 |
| 3.0  | 581                                    | 547  | 506  | 9.3  | 29              | 27 | 25 | 34 | 814                             | 766  | 708  | 7.9  | 40              | 38 | 35 | 40 | 1279                             | 1204 | 1113 | 6.3  | 63              | 59  | 55 | 48 |
| 3.5  | 442                                    | 417  | 385  | 10.7 | 30              | 28 | 26 | 35 | 619                             | 583  | 539  | 9.0  | 41              | 39 | 36 | 41 | 973                              | 916  | 847  | 7.2  | 65              | 61  | 57 | 49 |
| 4.0  | 349                                    | 329  | 304  | 12.0 | 30              | 29 | 27 | 35 | 489                             | 460  | 426  | 10.1 | 43              | 40 | 37 | 41 | 768                              | 724  | 669  | 8.1  | 67              | 63  | 58 | 50 |
| 4.5  | 284                                    | 267  | 247  | 13.3 | 31              | 29 | 27 | 36 | 397                             | 374  | 346  | 11.3 | 44              | 41 | 38 | 42 | 624                              | 587  | 543  | 9.0  | 69              | 65  | 60 | 50 |
| 5.0  | 235                                    | 222  | 205  | 14.6 | 32              | 30 | 28 | 36 | 329                             | 310  | 287  | 12.4 | 45              | 42 | 39 | 42 | 518                              | 487  | 451  | 9.9  | 71              | 66  | 61 | 51 |
| 5.5  | 199                                    | 187  | 173  | 15.9 | 33              | 31 | 29 | 36 | 278                             | 262  | 242  | 13.4 | 46              | 43 | 40 | 43 | 437                              | 412  | 381  | 10.7 | 72              | 68  | 63 | 51 |
| 6.0  | 170                                    | 160  | 148  | 17.2 | 33              | 32 | 29 | 37 | 239                             | 225  | 208  | 14.5 | 47              | 44 | 41 | 43 | 375                              | 353  | 326  | 11.6 | 74              | 69  | 64 | 51 |
| 6.5  | 148                                    | 139  | 129  | 18.4 | 34              | 32 | 30 | 37 | 207                             | 195  | 180  | 15.6 | 48              | 45 | 42 | 43 | 325                              | 306  | 283  | 12.4 | 75              | 71  | 65 | 52 |
| 7.0  | 130                                    | 122  | 113  | 19.7 | 35              | 33 | 30 | 37 | 182                             | 171  | 158  | 16.6 | 49              | 46 | 42 | 44 | 285                              | 269  | 248  | 13.3 | 76              | 72  | 66 | 52 |
| 7.5  | 115                                    | 108  | 100  | 20.9 | 35              | 33 | 31 | 38 | 161                             | 151  | 140  | 17.7 | 49              | 46 | 43 | 44 | 253                              | 238  | 220  | 14.1 | 77              | 73  | 67 | 52 |
| 8.0  | 102                                    | 96   | 89   | 22.2 | 36              | 34 | 31 | 38 | 143                             | 135  | 125  | 18.7 | 50              | 47 | 44 | 44 | 225                              | 212  | 196  | 14.9 | 79              | 74  | 68 | 53 |
| 8.5  | 92                                     | 87   | 80   | 23.4 | 36              | 34 | 32 | 38 | 129                             | 121  | 112  | 19.8 | 51              | 48 | 44 | 44 | 202                              | 191  | 176  | 15.8 | 80              | 75  | 69 | 53 |
| 9.0  | 83                                     | 78   | 72   | 24.6 | 37              | 35 | 32 | 39 | 116                             | 110  | 101  | 20.8 | 51              | 48 | 45 | 45 | 183                              | 172  | 159  | 16.6 | 81              | 76  | 70 | 53 |
| 9.5  | 76                                     | 71   | 66   | 25.8 | 37              | 35 | 32 | 39 | 106                             | 100  | 92   | 21.8 | 52              | 49 | 45 | 45 | 166                              | 157  | 145  | 17.4 | 82              | 77  | 71 | 53 |
| 10.0 | 69                                     | 65   | 60   | 27.0 | 38              | 35 | 33 | 39 | 97                              | 91   | 84   | 22.8 | 53              | 50 | 46 | 45 | 152                              | 143  | 132  | 18.2 | 83              | 78  | 72 | 53 |
| 11.0 | 58                                     | 55   | 51   | 29.4 | 38              | 36 | 33 | 39 | 82                              | 77   | 71   | 24.8 | 54              | 51 | 47 | 46 | 128                              | 121  | 112  | 19.8 | 85              | 80  | 74 | 54 |
| 12.0 | 50                                     | 47   | 44   | 31.7 | 39              | 37 | 34 | 40 | 70                              | 66   | 61   | 26.8 | 55              | 52 | 48 | 46 | 110                              | 104  | 96   | 21.4 | 86              | 81  | 75 | 54 |
| 13.0 | 43                                     | 41   | 38   | 34.1 | 40              | 38 | 35 | 40 | 61                              | 57   | 53   | 28.8 | 56              | 53 | 49 | 46 | 95                               | 90   | 83   | 23.0 | 88              | 83  | 77 | 55 |
| 14.0 | 38                                     | 36   | 33   | 36.4 | 41              | 38 | 35 | 40 | 53                              | 50   | 46   | 30.7 | 57              | 54 | 50 | 47 | 84                               | 79   | 73   | 24.5 | 89              | 84  | 78 | 55 |
| 15.0 | 34                                     | 32   | 29   | 38.7 | 41              | 39 | 36 | 41 | 47                              | 44   | 41   | 32.7 | 58              | 54 | 50 | 47 | 74                               | 70   | 64   | 26.1 | 91              | 86  | 79 | 55 |
| 16.0 | 30                                     | 28   | 26   | 40.9 | 42              | 39 | 37 | 41 | 42                              | 40   | 37   | 34.6 | 59              | 55 | 51 | 47 | 66                               | 62   | 58   | 27.6 | 92              | 87  | 80 | 55 |
| 17.0 | 27                                     | 25   | 23   | 43.2 | 43              | 40 | 37 | 41 | 38                              | 36   | 33   | 36.5 | 60              | 56 | 52 | 47 | 59                               | 56   | 52   | 29.1 | 94              | 88  | 81 | 56 |
| 18.0 | 24                                     | 23   | 21   | 45.4 | 43              | 41 | 38 | 41 | 34                              | 32   | 30   | 38.4 | 60              | 57 | 53 | 48 | 54                               | 50   | 47   | 30.6 | 95              | 89  | 83 | 56 |
| 19.0 | 22                                     | 21   | 19   | 47.6 | 44              | 41 | 38 | 42 | 31                              | 29   | 27   | 40.3 | 61              | 57 | 53 | 48 | 49                               | 46   | 42   | 32.1 | 96              | 90  | 84 | 56 |
| 20.0 | 20                                     | 19   | 18   | 49.9 | 44              | 42 | 38 | 42 | 28                              | 27   | 25   | 42.1 | 62              | 58 | 54 | 48 | 45                               | 42   | 39   | 33.6 | 97              | 91  | 85 | 56 |
| 22.0 | 17                                     | 16   | 15   | 54.3 | 45              | 42 | 39 | 42 | 24                              | 23   | 21   | 45.9 | 63              | 59 | 55 | 48 | 38                               | 35   | 33   | 36.6 | 99              | 93  | 86 | 57 |
| 24.0 | 15                                     | 14   | 13   | 58.6 | 46              | 43 | 40 | 43 | 21                              | 19   | 18   | 49.5 | 64              | 61 | 56 | 49 | 32                               | 30   | 28   | 39.5 | 101             | 95  | 88 | 57 |
| 26.0 | 13                                     | 12   | 11   | 62.9 | 47              | 44 | 41 | 43 | 18                              | 17   | 15   | 53.2 | 66              | 62 | 57 | 49 | 28                               | 26   | 24   | 42.4 | 103             | 97  | 90 | 58 |
| 28.0 | 11                                     | 11   | 10   | 67.2 | 48              | 45 | 42 | 43 | 16                              | 15   | 14   | 56.8 | 67              | 63 | 58 | 49 | 25                               | 23   | 21   | 45.3 | 105             | 99  | 91 | 58 |
| 30.0 | 10                                     | 9    | 9    | 71.4 | 48              | 46 | 42 | 44 | 14                              | 13   | 12   | 60.3 | 68              | 64 | 59 | 50 | 22                               | 20   | 19   | 48.1 | 107             | 100 | 93 | 58 |

**Table P19:** Ponderosa pine stocking levels for the PIPO/SYAL plant association (B-O province).

| QMD  | Climate Resilience; SDI 99; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 139; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 219; 55% of Max |       |       |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5859                                   | 5516 | 5101 | 2.9  | 32              | 30 | 28 | 36 | 8203                             | 7723 | 7141 | 2.5  | 45              | 42 | 39 | 42 | 12890                            | 12136 | 11222 | 2.0  | 70              | 66  | 61  | 50 |
| 1.5  | 2859                                   | 2691 | 2489 | 4.2  | 35              | 33 | 31 | 38 | 4002                             | 3768 | 3484 | 3.5  | 49              | 46 | 43 | 44 | 6289                             | 5921  | 5475  | 2.8  | 77              | 73  | 67  | 52 |
| 2.0  | 1718                                   | 1617 | 1496 | 5.4  | 37              | 35 | 33 | 39 | 2405                             | 2264 | 2094 | 4.6  | 52              | 49 | 46 | 45 | 3779                             | 3558  | 3290  | 3.6  | 82              | 78  | 72  | 53 |
| 2.5  | 1157                                   | 1090 | 1008 | 6.6  | 39              | 37 | 34 | 40 | 1620                             | 1526 | 1411 | 5.6  | 55              | 52 | 48 | 46 | 2546                             | 2397  | 2217  | 4.4  | 87              | 82  | 76  | 54 |
| 3.0  | 838                                    | 789  | 730  | 7.7  | 41              | 39 | 36 | 41 | 1173                             | 1105 | 1022 | 6.5  | 58              | 54 | 50 | 47 | 1844                             | 1736  | 1605  | 5.2  | 91              | 85  | 79  | 55 |
| 3.5  | 638                                    | 601  | 555  | 8.9  | 43              | 40 | 37 | 41 | 893                              | 841  | 778  | 7.5  | 60              | 56 | 52 | 47 | 1404                             | 1321  | 1222  | 6.0  | 94              | 88  | 82  | 56 |
| 4.0  | 504                                    | 474  | 439  | 10.0 | 44              | 41 | 38 | 42 | 705                              | 664  | 614  | 8.4  | 62              | 58 | 54 | 48 | 1108                             | 1043  | 965   | 6.7  | 97              | 91  | 84  | 56 |
| 4.5  | 409                                    | 385  | 356  | 11.1 | 45              | 43 | 39 | 42 | 572                              | 539  | 498  | 9.4  | 63              | 60 | 55 | 48 | 900                              | 847   | 783   | 7.5  | 99              | 94  | 87  | 57 |
| 5.0  | 339                                    | 319  | 295  | 12.2 | 46              | 44 | 40 | 43 | 475                              | 447  | 414  | 10.3 | 65              | 61 | 56 | 49 | 747                              | 703   | 650   | 8.2  | 102             | 96  | 89  | 57 |
| 5.5  | 287                                    | 270  | 250  | 13.2 | 47              | 45 | 41 | 43 | 401                              | 378  | 349  | 11.2 | 66              | 62 | 58 | 49 | 631                              | 594   | 549   | 8.9  | 104             | 98  | 91  | 58 |
| 6.0  | 246                                    | 231  | 214  | 14.3 | 48              | 45 | 42 | 44 | 344                              | 324  | 300  | 12.1 | 68              | 64 | 59 | 50 | 541                              | 509   | 471   | 9.6  | 106             | 100 | 92  | 58 |
| 6.5  | 213                                    | 201  | 186  | 15.4 | 49              | 46 | 43 | 44 | 299                              | 281  | 260  | 13.0 | 69              | 65 | 60 | 50 | 469                              | 442   | 409   | 10.4 | 108             | 102 | 94  | 58 |
| 7.0  | 187                                    | 176  | 163  | 16.4 | 50              | 47 | 44 | 44 | 262                              | 247  | 228  | 13.9 | 70              | 66 | 61 | 50 | 412                              | 387   | 358   | 11.1 | 110             | 104 | 96  | 59 |
| 7.5  | 166                                    | 156  | 144  | 17.4 | 51              | 48 | 44 | 44 | 232                              | 218  | 202  | 14.7 | 71              | 67 | 62 | 51 | 364                              | 343   | 317   | 11.8 | 112             | 105 | 97  | 59 |
| 8.0  | 148                                    | 139  | 129  | 18.5 | 52              | 49 | 45 | 45 | 207                              | 195  | 180  | 15.6 | 72              | 68 | 63 | 51 | 325                              | 306   | 283   | 12.4 | 113             | 107 | 99  | 59 |
| 8.5  | 133                                    | 125  | 115  | 19.5 | 52              | 49 | 46 | 45 | 186                              | 175  | 162  | 16.5 | 73              | 69 | 64 | 51 | 292                              | 275   | 254   | 13.1 | 115             | 108 | 100 | 60 |
| 9.0  | 120                                    | 113  | 104  | 20.5 | 53              | 50 | 46 | 45 | 168                              | 158  | 146  | 17.3 | 74              | 70 | 65 | 51 | 264                              | 248   | 230   | 13.8 | 117             | 110 | 101 | 60 |
| 9.5  | 109                                    | 103  | 95   | 21.5 | 54              | 50 | 47 | 45 | 153                              | 144  | 133  | 18.2 | 75              | 71 | 65 | 52 | 240                              | 226   | 209   | 14.5 | 118             | 111 | 103 | 60 |
| 10.0 | 100                                    | 94   | 87   | 22.5 | 54              | 51 | 47 | 46 | 139                              | 131  | 121  | 19.0 | 76              | 72 | 66 | 52 | 219                              | 206   | 191   | 15.2 | 119             | 112 | 104 | 60 |
| 11.0 | 84                                     | 79   | 73   | 24.5 | 55              | 52 | 48 | 46 | 118                              | 111  | 102  | 20.7 | 78              | 73 | 68 | 52 | 185                              | 174   | 161   | 16.5 | 122             | 115 | 106 | 61 |
| 12.0 | 72                                     | 68   | 63   | 26.4 | 57              | 53 | 49 | 46 | 101                              | 95   | 88   | 22.3 | 79              | 75 | 69 | 53 | 159                              | 149   | 138   | 17.8 | 125             | 117 | 108 | 61 |
| 13.0 | 63                                     | 59   | 54   | 28.4 | 58              | 54 | 50 | 47 | 88                               | 82   | 76   | 24.0 | 81              | 76 | 70 | 53 | 138                              | 130   | 120   | 19.1 | 127             | 119 | 110 | 61 |
| 14.0 | 55                                     | 52   | 48   | 30.3 | 59              | 55 | 51 | 47 | 77                               | 72   | 67   | 25.6 | 82              | 77 | 71 | 53 | 121                              | 114   | 105   | 20.4 | 129             | 121 | 112 | 62 |
| 15.0 | 49                                     | 46   | 42   | 32.2 | 60              | 56 | 52 | 47 | 68                               | 64   | 59   | 27.2 | 83              | 79 | 73 | 54 | 107                              | 101   | 93    | 21.7 | 131             | 123 | 114 | 62 |
| 16.0 | 43                                     | 41   | 38   | 34.1 | 60              | 57 | 53 | 48 | 61                               | 57   | 53   | 28.8 | 85              | 80 | 74 | 54 | 95                               | 90    | 83    | 23.0 | 133             | 125 | 116 | 62 |
| 17.0 | 39                                     | 37   | 34   | 36.0 | 61              | 58 | 53 | 48 | 54                               | 51   | 47   | 30.4 | 86              | 81 | 75 | 54 | 86                               | 81    | 75    | 24.2 | 135             | 127 | 117 | 63 |
| 18.0 | 35                                     | 33   | 31   | 37.8 | 62              | 58 | 54 | 48 | 49                               | 46   | 43   | 32.0 | 87              | 82 | 76 | 54 | 77                               | 73    | 67    | 25.5 | 137             | 129 | 119 | 63 |
| 19.0 | 32                                     | 30   | 28   | 39.7 | 63              | 59 | 55 | 48 | 45                               | 42   | 39   | 33.5 | 88              | 83 | 77 | 55 | 70                               | 66    | 61    | 26.8 | 138             | 130 | 120 | 63 |
| 20.0 | 29                                     | 27   | 25   | 41.5 | 64              | 60 | 55 | 49 | 41                               | 38   | 36   | 35.1 | 89              | 84 | 78 | 55 | 64                               | 60    | 56    | 28.0 | 140             | 132 | 122 | 63 |
| 22.0 | 25                                     | 23   | 21   | 45.2 | 65              | 61 | 57 | 49 | 35                               | 32   | 30   | 38.2 | 91              | 86 | 79 | 55 | 54                               | 51    | 47    | 30.5 | 143             | 135 | 125 | 64 |
| 24.0 | 21                                     | 20   | 18   | 48.8 | 66              | 62 | 58 | 49 | 30                               | 28   | 26   | 41.2 | 93              | 87 | 81 | 56 | 46                               | 44    | 40    | 32.9 | 146             | 137 | 127 | 64 |
| 26.0 | 18                                     | 17   | 16   | 52.4 | 68              | 64 | 59 | 50 | 26                               | 24   | 22   | 44.3 | 95              | 89 | 82 | 56 | 40                               | 38    | 35    | 35.3 | 149             | 140 | 129 | 64 |
| 28.0 | 16                                     | 15   | 14   | 55.9 | 69              | 65 | 60 | 50 | 23                               | 21   | 20   | 47.3 | 96              | 91 | 84 | 56 | 35                               | 33    | 31    | 37.7 | 151             | 142 | 132 | 65 |
| 30.0 | 14                                     | 13   | 12   | 59.4 | 70              | 66 | 61 | 50 | 20                               | 19   | 17   | 50.2 | 98              | 92 | 85 | 57 | 31                               | 29    | 27    | 40.1 | 154             | 145 | 134 | 65 |

**Table P20:** Ponderosa pine stocking levels for the PIPO/SYOR and PSME/CARU plant associations (B-O province).

| QMD  | Climate Resilience; SDI 81; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 114; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 179; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4784                                   | 4504 | 4165 | 3.2  | 26              | 25 | 23 | 32 | 6698                             | 6306 | 5831 | 2.7  | 37              | 34 | 32 | 38 | 10526                            | 9910 | 9164 | 2.2  | 57              | 54  | 50  | 47 |
| 1.5  | 2334                                   | 2198 | 2032 | 4.6  | 29              | 27 | 25 | 34 | 3268                             | 3077 | 2845 | 3.9  | 40              | 38 | 35 | 40 | 5135                             | 4835 | 4471 | 3.1  | 63              | 59  | 55  | 48 |
| 2.0  | 1403                                   | 1321 | 1221 | 6.0  | 31              | 29 | 27 | 35 | 1964                             | 1849 | 1710 | 5.1  | 43              | 40 | 37 | 41 | 3086                             | 2906 | 2687 | 4.0  | 67              | 63  | 59  | 50 |
| 2.5  | 945                                    | 890  | 823  | 7.3  | 32              | 30 | 28 | 36 | 1323                             | 1246 | 1152 | 6.2  | 45              | 42 | 39 | 42 | 2079                             | 1958 | 1810 | 4.9  | 71              | 67  | 62  | 51 |
| 3.0  | 684                                    | 644  | 596  | 8.6  | 34              | 32 | 29 | 37 | 958                              | 902  | 834  | 7.2  | 47              | 44 | 41 | 43 | 1506                             | 1418 | 1311 | 5.8  | 74              | 70  | 64  | 51 |
| 3.5  | 521                                    | 491  | 454  | 9.8  | 35              | 33 | 30 | 38 | 729                              | 687  | 635  | 8.3  | 49              | 46 | 42 | 44 | 1146                             | 1079 | 998  | 6.6  | 77              | 72  | 67  | 52 |
| 4.0  | 411                                    | 387  | 358  | 11.1 | 36              | 34 | 31 | 38 | 576                              | 542  | 501  | 9.3  | 50              | 47 | 44 | 44 | 905                              | 852  | 788  | 7.5  | 79              | 74  | 69  | 53 |
| 4.5  | 334                                    | 314  | 291  | 12.3 | 37              | 35 | 32 | 39 | 467                              | 440  | 407  | 10.4 | 52              | 49 | 45 | 45 | 735                              | 692  | 640  | 8.3  | 81              | 76  | 71  | 53 |
| 5.0  | 277                                    | 261  | 241  | 13.5 | 38              | 36 | 33 | 39 | 388                              | 365  | 338  | 11.4 | 53              | 50 | 46 | 45 | 610                              | 574  | 531  | 9.1  | 83              | 78  | 72  | 54 |
| 5.5  | 234                                    | 220  | 204  | 14.7 | 39              | 36 | 34 | 39 | 328                              | 309  | 285  | 12.4 | 54              | 51 | 47 | 46 | 515                              | 485  | 448  | 9.9  | 85              | 80  | 74  | 54 |
| 6.0  | 201                                    | 189  | 175  | 15.8 | 39              | 37 | 34 | 40 | 281                              | 265  | 245  | 13.4 | 55              | 52 | 48 | 46 | 441                              | 416  | 384  | 10.7 | 87              | 82  | 75  | 54 |
| 6.5  | 174                                    | 164  | 152  | 17.0 | 40              | 38 | 35 | 40 | 244                              | 230  | 212  | 14.4 | 56              | 53 | 49 | 46 | 383                              | 361  | 334  | 11.5 | 88              | 83  | 77  | 55 |
| 7.0  | 153                                    | 144  | 133  | 18.1 | 41              | 38 | 36 | 40 | 214                              | 201  | 186  | 15.3 | 57              | 54 | 50 | 47 | 336                              | 316  | 293  | 12.2 | 90              | 85  | 78  | 55 |
| 7.5  | 135                                    | 127  | 118  | 19.3 | 41              | 39 | 36 | 41 | 189                              | 178  | 165  | 16.3 | 58              | 55 | 51 | 47 | 297                              | 280  | 259  | 13.0 | 91              | 86  | 79  | 55 |
| 8.0  | 121                                    | 114  | 105  | 20.4 | 42              | 40 | 37 | 41 | 169                              | 159  | 147  | 17.3 | 59              | 55 | 51 | 47 | 265                              | 250  | 231  | 13.8 | 93              | 87  | 81  | 56 |
| 8.5  | 108                                    | 102  | 94   | 21.5 | 43              | 40 | 37 | 41 | 152                              | 143  | 132  | 18.2 | 60              | 56 | 52 | 47 | 238                              | 224  | 207  | 14.5 | 94              | 88  | 82  | 56 |
| 9.0  | 98                                     | 92   | 85   | 22.7 | 43              | 41 | 38 | 42 | 137                              | 129  | 119  | 19.2 | 61              | 57 | 53 | 48 | 215                              | 203  | 188  | 15.3 | 95              | 90  | 83  | 56 |
| 9.5  | 89                                     | 84   | 77   | 23.8 | 44              | 41 | 38 | 42 | 125                              | 117  | 108  | 20.1 | 61              | 58 | 53 | 48 | 196                              | 184  | 170  | 16.0 | 96              | 91  | 84  | 56 |
| 10.0 | 81                                     | 76   | 71   | 24.9 | 44              | 42 | 39 | 42 | 114                              | 107  | 99   | 21.0 | 62              | 58 | 54 | 48 | 179                              | 168  | 156  | 16.8 | 97              | 92  | 85  | 56 |
| 11.0 | 69                                     | 65   | 60   | 27.1 | 45              | 43 | 39 | 42 | 96                               | 90   | 84   | 22.9 | 63              | 60 | 55 | 49 | 151                              | 142  | 131  | 18.3 | 100             | 94  | 87  | 57 |
| 12.0 | 59                                     | 55   | 51   | 29.2 | 46              | 44 | 40 | 43 | 82                               | 78   | 72   | 24.7 | 65              | 61 | 56 | 49 | 129                              | 122  | 113  | 19.7 | 102             | 96  | 89  | 57 |
| 13.0 | 51                                     | 48   | 44   | 31.4 | 47              | 44 | 41 | 43 | 71                               | 67   | 62   | 26.5 | 66              | 62 | 57 | 49 | 112                              | 106  | 98   | 21.2 | 104             | 97  | 90  | 58 |
| 14.0 | 45                                     | 42   | 39   | 33.5 | 48              | 45 | 42 | 43 | 63                               | 59   | 55   | 28.3 | 67              | 63 | 58 | 50 | 99                               | 93   | 86   | 22.6 | 105             | 99  | 92  | 58 |
| 15.0 | 40                                     | 37   | 35   | 35.6 | 49              | 46 | 42 | 44 | 55                               | 52   | 48   | 30.1 | 68              | 64 | 59 | 50 | 87                               | 82   | 76   | 24.0 | 107             | 101 | 93  | 58 |
| 16.0 | 35                                     | 33   | 31   | 37.7 | 49              | 46 | 43 | 44 | 50                               | 47   | 43   | 31.9 | 69              | 65 | 60 | 50 | 78                               | 73   | 68   | 25.4 | 109             | 102 | 95  | 59 |
| 17.0 | 32                                     | 30   | 28   | 39.8 | 50              | 47 | 44 | 44 | 44                               | 42   | 39   | 33.6 | 70              | 66 | 61 | 50 | 70                               | 66   | 61   | 26.8 | 110             | 104 | 96  | 59 |
| 18.0 | 29                                     | 27   | 25   | 41.9 | 51              | 48 | 44 | 44 | 40                               | 38   | 35   | 35.4 | 71              | 67 | 62 | 51 | 63                               | 59   | 55   | 28.2 | 112             | 105 | 97  | 59 |
| 19.0 | 26                                     | 25   | 23   | 43.9 | 51              | 48 | 45 | 45 | 37                               | 34   | 32   | 37.1 | 72              | 68 | 63 | 51 | 57                               | 54   | 50   | 29.6 | 113             | 106 | 98  | 59 |
| 20.0 | 24                                     | 22   | 21   | 45.9 | 52              | 49 | 45 | 45 | 33                               | 31   | 29   | 38.8 | 73              | 69 | 63 | 51 | 52                               | 49   | 46   | 31.0 | 114             | 108 | 100 | 59 |
| 22.0 | 20                                     | 19   | 18   | 50.0 | 53              | 50 | 46 | 45 | 28                               | 27   | 25   | 42.3 | 74              | 70 | 65 | 51 | 44                               | 42   | 39   | 33.7 | 117             | 110 | 102 | 60 |
| 24.0 | 17                                     | 16   | 15   | 54.0 | 54              | 51 | 47 | 46 | 24                               | 23   | 21   | 45.6 | 76              | 71 | 66 | 52 | 38                               | 36   | 33   | 36.4 | 119             | 112 | 104 | 60 |
| 26.0 | 15                                     | 14   | 13   | 58.0 | 55              | 52 | 48 | 46 | 21                               | 20   | 18   | 49.0 | 77              | 73 | 67 | 52 | 33                               | 31   | 29   | 39.1 | 121             | 114 | 106 | 61 |
| 28.0 | 13                                     | 12   | 11   | 61.9 | 56              | 53 | 49 | 46 | 18                               | 17   | 16   | 52.3 | 79              | 74 | 68 | 53 | 29                               | 27   | 25   | 41.7 | 124             | 116 | 108 | 61 |
| 30.0 | 12                                     | 11   | 10   | 65.8 | 57              | 54 | 50 | 47 | 16                               | 15   | 14   | 55.6 | 80              | 75 | 70 | 53 | 26                               | 24   | 22   | 44.4 | 126             | 118 | 109 | 61 |

**Table P21:** Ponderosa pine stocking levels for the PSME/ACGL-PHMA plant association (W-S province).

| QMD  | Climate Resilience; SDI 88; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 123; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 193; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5167                                   | 4865 | 4498 | 3.1  | 28              | 27 | 25 | 34 | 7234                             | 6811 | 6298 | 2.6  | 39              | 37 | 34 | 40 | 11368                            | 10703 | 9897 | 2.1  | 62              | 58  | 54  | 48 |
| 1.5  | 2521                                   | 2373 | 2195 | 4.5  | 31              | 29 | 27 | 35 | 3529                             | 3323 | 3073 | 3.8  | 43              | 41 | 38 | 42 | 5546                             | 5222  | 4828 | 3.0  | 68              | 64  | 59  | 50 |
| 2.0  | 1515                                   | 1426 | 1319 | 5.8  | 33              | 31 | 29 | 37 | 2121                             | 1997 | 1847 | 4.9  | 46              | 44 | 40 | 43 | 3333                             | 3138  | 2902 | 3.9  | 73              | 68  | 63  | 51 |
| 2.5  | 1021                                   | 961  | 889  | 7.0  | 35              | 33 | 30 | 38 | 1429                             | 1345 | 1244 | 5.9  | 49              | 46 | 42 | 44 | 2246                             | 2114  | 1955 | 4.7  | 77              | 72  | 67  | 52 |
| 3.0  | 739                                    | 696  | 644  | 8.2  | 36              | 34 | 32 | 38 | 1035                             | 974  | 901  | 7.0  | 51              | 48 | 44 | 44 | 1626                             | 1531  | 1416 | 5.6  | 80              | 75  | 69  | 53 |
| 3.5  | 563                                    | 530  | 490  | 9.5  | 38              | 35 | 33 | 39 | 788                              | 742  | 686  | 8.0  | 53              | 50 | 46 | 45 | 1238                             | 1165  | 1078 | 6.4  | 83              | 78  | 72  | 53 |
| 4.0  | 444                                    | 418  | 387  | 10.6 | 39              | 36 | 34 | 39 | 622                              | 586  | 541  | 9.0  | 54              | 51 | 47 | 46 | 977                              | 920   | 851  | 7.2  | 85              | 80  | 74  | 54 |
| 4.5  | 361                                    | 340  | 314  | 11.8 | 40              | 38 | 35 | 40 | 505                              | 475  | 440  | 10.0 | 56              | 53 | 49 | 46 | 793                              | 747   | 691  | 8.0  | 88              | 83  | 76  | 55 |
| 5.0  | 299                                    | 282  | 261  | 13.0 | 41              | 38 | 36 | 40 | 419                              | 394  | 365  | 11.0 | 57              | 54 | 50 | 47 | 658                              | 620   | 573  | 8.7  | 90              | 85  | 78  | 55 |
| 5.5  | 253                                    | 238  | 220  | 14.1 | 42              | 39 | 36 | 41 | 354                              | 333  | 308  | 11.9 | 58              | 55 | 51 | 47 | 556                              | 524   | 484  | 9.5  | 92              | 86  | 80  | 55 |
| 6.0  | 217                                    | 204  | 189  | 15.2 | 43              | 40 | 37 | 41 | 303                              | 286  | 264  | 12.9 | 60              | 56 | 52 | 47 | 477                              | 449   | 415  | 10.3 | 94              | 88  | 82  | 56 |
| 6.5  | 188                                    | 177  | 164  | 16.4 | 43              | 41 | 38 | 42 | 263                              | 248  | 229  | 13.8 | 61              | 57 | 53 | 48 | 414                              | 390   | 360  | 11.0 | 95              | 90  | 83  | 56 |
| 7.0  | 165                                    | 155  | 144  | 17.5 | 44              | 42 | 38 | 42 | 231                              | 217  | 201  | 14.8 | 62              | 58 | 54 | 48 | 363                              | 342   | 316  | 11.8 | 97              | 91  | 84  | 56 |
| 7.5  | 146                                    | 137  | 127  | 18.6 | 45              | 42 | 39 | 42 | 204                              | 192  | 178  | 15.7 | 63              | 59 | 55 | 48 | 321                              | 302   | 280  | 12.5 | 99              | 93  | 86  | 57 |
| 8.0  | 130                                    | 123  | 113  | 19.7 | 45              | 43 | 40 | 42 | 182                              | 172  | 159  | 16.6 | 64              | 60 | 55 | 49 | 287                              | 270   | 249  | 13.2 | 100             | 94  | 87  | 57 |
| 8.5  | 117                                    | 110  | 102  | 20.7 | 46              | 43 | 40 | 43 | 164                              | 154  | 143  | 17.5 | 65              | 61 | 56 | 49 | 257                              | 242   | 224  | 14.0 | 101             | 95  | 88  | 57 |
| 9.0  | 106                                    | 100  | 92   | 21.8 | 47              | 44 | 41 | 43 | 148                              | 139  | 129  | 18.4 | 65              | 62 | 57 | 49 | 233                              | 219   | 203  | 14.7 | 103             | 97  | 89  | 57 |
| 9.5  | 96                                     | 90   | 84   | 22.9 | 47              | 45 | 41 | 43 | 135                              | 127  | 117  | 19.3 | 66              | 62 | 58 | 49 | 211                              | 199   | 184  | 15.4 | 104             | 98  | 91  | 58 |
| 10.0 | 88                                     | 83   | 76   | 23.9 | 48              | 45 | 42 | 43 | 123                              | 116  | 107  | 20.2 | 67              | 63 | 58 | 50 | 193                              | 182   | 168  | 16.1 | 105             | 99  | 92  | 58 |
| 11.0 | 74                                     | 70   | 65   | 26.0 | 49              | 46 | 43 | 44 | 104                              | 98   | 90   | 22.0 | 68              | 64 | 60 | 50 | 163                              | 154   | 142  | 17.6 | 108             | 101 | 94  | 58 |
| 12.0 | 64                                     | 60   | 55   | 28.1 | 50              | 47 | 43 | 44 | 89                               | 84   | 77   | 23.8 | 70              | 66 | 61 | 50 | 140                              | 132   | 122  | 19.0 | 110             | 103 | 96  | 59 |
| 13.0 | 55                                     | 52   | 48   | 30.2 | 51              | 48 | 44 | 44 | 77                               | 73   | 67   | 25.5 | 71              | 67 | 62 | 51 | 121                              | 114   | 106  | 20.4 | 112             | 105 | 97  | 59 |
| 14.0 | 48                                     | 46   | 42   | 32.2 | 52              | 49 | 45 | 45 | 68                               | 64   | 59   | 27.3 | 72              | 68 | 63 | 51 | 106                              | 100   | 93   | 21.7 | 114             | 107 | 99  | 59 |
| 15.0 | 43                                     | 40   | 37   | 34.3 | 53              | 49 | 46 | 45 | 60                               | 56   | 52   | 29.0 | 74              | 69 | 64 | 51 | 94                               | 89    | 82   | 23.1 | 116             | 109 | 101 | 60 |
| 16.0 | 38                                     | 36   | 33   | 36.3 | 53              | 50 | 46 | 45 | 53                               | 50   | 47   | 30.7 | 75              | 70 | 65 | 52 | 84                               | 79    | 73   | 24.5 | 117             | 110 | 102 | 60 |
| 17.0 | 34                                     | 32   | 30   | 38.3 | 54              | 51 | 47 | 46 | 48                               | 45   | 42   | 32.4 | 76              | 71 | 66 | 52 | 75                               | 71    | 66   | 25.8 | 119             | 112 | 104 | 60 |
| 18.0 | 31                                     | 29   | 27   | 40.3 | 55              | 52 | 48 | 46 | 43                               | 41   | 38   | 34.0 | 77              | 72 | 67 | 52 | 68                               | 64    | 59   | 27.2 | 121             | 113 | 105 | 60 |
| 19.0 | 28                                     | 27   | 25   | 42.3 | 55              | 52 | 48 | 46 | 39                               | 37   | 34   | 35.7 | 78              | 73 | 68 | 52 | 62                               | 58    | 54   | 28.5 | 122             | 115 | 106 | 61 |
| 20.0 | 26                                     | 24   | 22   | 44.2 | 56              | 53 | 49 | 46 | 36                               | 34   | 31   | 37.4 | 79              | 74 | 68 | 52 | 57                               | 53    | 49   | 29.8 | 123             | 116 | 108 | 61 |
| 22.0 | 22                                     | 20   | 19   | 48.1 | 57              | 54 | 50 | 47 | 30                               | 29   | 26   | 40.7 | 80              | 76 | 70 | 53 | 48                               | 45    | 42   | 32.4 | 126             | 119 | 110 | 61 |
| 24.0 | 19                                     | 18   | 16   | 52.0 | 59              | 55 | 51 | 47 | 26                               | 25   | 23   | 43.9 | 82              | 77 | 71 | 53 | 41                               | 39    | 36   | 35.0 | 129             | 121 | 112 | 62 |
| 26.0 | 16                                     | 15   | 14   | 55.8 | 60              | 56 | 52 | 47 | 23                               | 21   | 20   | 47.1 | 83              | 79 | 73 | 54 | 36                               | 33    | 31   | 37.6 | 131             | 123 | 114 | 62 |
| 28.0 | 14                                     | 13   | 12   | 59.6 | 61              | 57 | 53 | 48 | 20                               | 19   | 17   | 50.3 | 85              | 80 | 74 | 54 | 31                               | 29    | 27   | 40.1 | 133             | 126 | 116 | 62 |
| 30.0 | 13                                     | 12   | 11   | 63.3 | 62              | 58 | 54 | 48 | 18                               | 17   | 15   | 53.5 | 86              | 81 | 75 | 54 | 28                               | 26    | 24   | 42.7 | 136             | 128 | 118 | 63 |

**Table P22:** Ponderosa pine stocking levels for the PSME/CARU and PSME/SYOR plant associations (W-S province).

| QMD  | Climate Resilience; SDI 113; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 158; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 248; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6639                                    | 6251 | 5780 | 2.8  | 36              | 34 | 32 | 38 | 9295                             | 8751 | 8092 | 2.3  | 51              | 48  | 44 | 44 | 14606                            | 13752 | 12716 | 1.9  | 80              | 75  | 69  | 53 |
| 1.5  | 3239                                    | 3050 | 2820 | 3.9  | 40              | 37 | 35 | 40 | 4535                             | 4270 | 3948 | 3.3  | 56              | 52  | 48 | 46 | 7126                             | 6709  | 6204  | 2.7  | 87              | 82  | 76  | 54 |
| 2.0  | 1947                                    | 1833 | 1695 | 5.1  | 42              | 40 | 37 | 41 | 2725                             | 2566 | 2373 | 4.3  | 59              | 56  | 52 | 47 | 4283                             | 4032  | 3729  | 3.4  | 93              | 88  | 81  | 56 |
| 2.5  | 1311                                    | 1235 | 1142 | 6.2  | 45              | 42 | 39 | 42 | 1836                             | 1729 | 1598 | 5.2  | 63              | 59  | 54 | 48 | 2885                             | 2716  | 2512  | 4.2  | 98              | 93  | 86  | 57 |
| 3.0  | 950                                     | 894  | 827  | 7.3  | 47              | 44 | 41 | 43 | 1330                             | 1252 | 1158 | 6.2  | 65              | 61  | 57 | 49 | 2089                             | 1967  | 1819  | 4.9  | 103             | 97  | 89  | 57 |
| 3.5  | 723                                     | 681  | 629  | 8.3  | 48              | 45 | 42 | 44 | 1012                             | 953  | 881  | 7.0  | 68              | 64  | 59 | 50 | 1591                             | 1497  | 1385  | 5.6  | 106             | 100 | 93  | 58 |
| 4.0  | 571                                     | 537  | 497  | 9.4  | 50              | 47 | 43 | 44 | 799                              | 752  | 696  | 7.9  | 70              | 66  | 61 | 50 | 1256                             | 1182  | 1093  | 6.3  | 110             | 103 | 95  | 59 |
| 4.5  | 463                                     | 436  | 403  | 10.4 | 51              | 48 | 45 | 45 | 649                              | 611  | 565  | 8.8  | 72              | 67  | 62 | 51 | 1019                             | 960   | 888   | 7.0  | 113             | 106 | 98  | 59 |
| 5.0  | 385                                     | 362  | 335  | 11.4 | 52              | 49 | 46 | 45 | 538                              | 507  | 469  | 9.7  | 73              | 69  | 64 | 51 | 846                              | 796   | 737   | 7.7  | 115             | 109 | 100 | 60 |
| 5.5  | 325                                     | 306  | 283  | 12.4 | 54              | 50 | 47 | 45 | 455                              | 428  | 396  | 10.5 | 75              | 71  | 65 | 52 | 715                              | 673   | 622   | 8.4  | 118             | 111 | 103 | 60 |
| 6.0  | 278                                     | 262  | 242  | 13.4 | 55              | 51 | 48 | 46 | 390                              | 367  | 339  | 11.4 | 77              | 72  | 67 | 52 | 613                              | 577   | 533   | 9.1  | 120             | 113 | 105 | 60 |
| 6.5  | 242                                     | 228  | 210  | 14.4 | 56              | 52 | 48 | 46 | 338                              | 319  | 295  | 12.2 | 78              | 73  | 68 | 52 | 532                              | 501   | 463   | 9.7  | 123             | 115 | 107 | 61 |
| 7.0  | 212                                     | 200  | 185  | 15.4 | 57              | 53 | 49 | 46 | 297                              | 279  | 258  | 13.0 | 79              | 75  | 69 | 53 | 466                              | 439   | 406   | 10.4 | 125             | 117 | 109 | 61 |
| 7.5  | 188                                     | 177  | 163  | 16.4 | 58              | 54 | 50 | 47 | 263                              | 247  | 229  | 13.8 | 81              | 76  | 70 | 53 | 413                              | 389   | 359   | 11.0 | 127             | 119 | 110 | 61 |
| 8.0  | 167                                     | 158  | 146  | 17.3 | 58              | 55 | 51 | 47 | 234                              | 221  | 204  | 14.7 | 82              | 77  | 71 | 53 | 368                              | 347   | 321   | 11.7 | 129             | 121 | 112 | 62 |
| 8.5  | 150                                     | 142  | 131  | 18.3 | 59              | 56 | 52 | 47 | 210                              | 198  | 183  | 15.5 | 83              | 78  | 72 | 53 | 331                              | 311   | 288   | 12.3 | 130             | 123 | 113 | 62 |
| 9.0  | 136                                     | 128  | 118  | 19.2 | 60              | 57 | 52 | 48 | 190                              | 179  | 166  | 16.3 | 84              | 79  | 73 | 54 | 299                              | 281   | 260   | 13.0 | 132             | 124 | 115 | 62 |
| 9.5  | 123                                     | 116  | 107  | 20.2 | 61              | 57 | 53 | 48 | 173                              | 163  | 150  | 17.1 | 85              | 80  | 74 | 54 | 272                              | 256   | 236   | 13.6 | 134             | 126 | 116 | 62 |
| 10.0 | 113                                     | 106  | 98   | 21.1 | 61              | 58 | 54 | 48 | 158                              | 149  | 137  | 17.9 | 86              | 81  | 75 | 54 | 248                              | 234   | 216   | 14.2 | 135             | 127 | 118 | 63 |
| 11.0 | 95                                      | 90   | 83   | 23.0 | 63              | 59 | 55 | 48 | 133                              | 126  | 116  | 19.4 | 88              | 83  | 77 | 55 | 210                              | 197   | 182   | 15.5 | 138             | 130 | 120 | 63 |
| 12.0 | 82                                      | 77   | 71   | 24.8 | 64              | 60 | 56 | 49 | 114                              | 108  | 100  | 21.0 | 90              | 85  | 78 | 55 | 180                              | 169   | 156   | 16.7 | 141             | 133 | 123 | 63 |
| 13.0 | 71                                      | 67   | 62   | 26.6 | 65              | 61 | 57 | 49 | 99                               | 93   | 86   | 22.5 | 91              | 86  | 80 | 55 | 156                              | 147   | 136   | 18.0 | 144             | 135 | 125 | 64 |
| 14.0 | 62                                      | 59   | 54   | 28.4 | 66              | 63 | 58 | 49 | 87                               | 82   | 76   | 24.0 | 93              | 88  | 81 | 56 | 137                              | 129   | 119   | 19.2 | 146             | 138 | 127 | 64 |
| 15.0 | 55                                      | 52   | 48   | 30.2 | 68              | 64 | 59 | 50 | 77                               | 73   | 67   | 25.6 | 95              | 89  | 82 | 56 | 121                              | 114   | 105   | 20.4 | 149             | 140 | 129 | 64 |
| 16.0 | 49                                      | 46   | 43   | 32.0 | 69              | 65 | 60 | 50 | 69                               | 65   | 60   | 27.1 | 96              | 90  | 84 | 56 | 108                              | 102   | 94    | 21.6 | 151             | 142 | 131 | 65 |
| 17.0 | 44                                      | 41   | 38   | 33.8 | 69              | 65 | 60 | 50 | 62                               | 58   | 54   | 28.6 | 97              | 92  | 85 | 56 | 97                               | 91    | 84    | 22.8 | 153             | 144 | 133 | 65 |
| 18.0 | 40                                      | 38   | 35   | 35.5 | 70              | 66 | 61 | 50 | 56                               | 53   | 49   | 30.0 | 99              | 93  | 86 | 57 | 88                               | 83    | 76    | 24.0 | 155             | 146 | 135 | 65 |
| 19.0 | 36                                      | 34   | 32   | 37.3 | 71              | 67 | 62 | 51 | 51                               | 48   | 44   | 31.5 | 100             | 94  | 87 | 57 | 80                               | 75    | 69    | 25.1 | 157             | 148 | 137 | 65 |
| 20.0 | 33                                      | 31   | 29   | 39.0 | 72              | 68 | 63 | 51 | 46                               | 44   | 40   | 33.0 | 101             | 95  | 88 | 57 | 73                               | 68    | 63    | 26.3 | 159             | 149 | 138 | 66 |
| 22.0 | 28                                      | 26   | 24   | 42.4 | 74              | 69 | 64 | 51 | 39                               | 37   | 34   | 35.9 | 103             | 97  | 90 | 58 | 61                               | 58    | 53    | 28.6 | 162             | 153 | 141 | 66 |
| 24.0 | 24                                      | 23   | 21   | 45.8 | 75              | 71 | 65 | 52 | 34                               | 32   | 29   | 38.7 | 105             | 99  | 92 | 58 | 53                               | 50    | 46    | 30.9 | 165             | 156 | 144 | 66 |
| 26.0 | 21                                      | 20   | 18   | 49.2 | 77              | 72 | 67 | 52 | 29                               | 27   | 25   | 41.6 | 107             | 101 | 93 | 58 | 46                               | 43    | 40    | 33.2 | 169             | 159 | 147 | 67 |
| 28.0 | 18                                      | 17   | 16   | 52.5 | 78              | 73 | 68 | 52 | 26                               | 24   | 22   | 44.4 | 109             | 103 | 95 | 59 | 40                               | 38    | 35    | 35.4 | 171             | 161 | 149 | 67 |
| 30.0 | 16                                      | 15   | 14   | 55.8 | 79              | 75 | 69 | 53 | 23                               | 21   | 20   | 47.2 | 111             | 104 | 97 | 59 | 35                               | 33    | 31    | 37.7 | 174             | 164 | 152 | 67 |



**Table P23:** Ponderosa pine stocking levels for the PSME/HODI plant association (B-O province).

| QMD  | Climate Resilience; SDI 106; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 149; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 234; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6256                                    | 5890 | 5447 | 2.8  | 34              | 32 | 30 | 37 | 8759                             | 8247 | 7626 | 2.4  | 48              | 45 | 42 | 43 | 13764                            | 12959 | 11983 | 1.9  | 75              | 71  | 65  | 52 |
| 1.5  | 3052                                    | 2874 | 2657 | 4.1  | 37              | 35 | 33 | 39 | 4273                             | 4023 | 3720 | 3.4  | 52              | 49 | 46 | 45 | 6715                             | 6323  | 5846  | 2.7  | 82              | 78  | 72  | 53 |
| 2.0  | 1834                                    | 1727 | 1597 | 5.2  | 40              | 38 | 35 | 40 | 2568                             | 2418 | 2236 | 4.4  | 56              | 53 | 49 | 46 | 4036                             | 3800  | 3514  | 3.5  | 88              | 83  | 77  | 55 |
| 2.5  | 1236                                    | 1164 | 1076 | 6.4  | 42              | 40 | 37 | 41 | 1730                             | 1629 | 1506 | 5.4  | 59              | 56 | 51 | 47 | 2719                             | 2560  | 2367  | 4.3  | 93              | 87  | 81  | 56 |
| 3.0  | 895                                     | 843  | 779  | 7.5  | 44              | 41 | 38 | 42 | 1253                             | 1180 | 1091 | 6.3  | 62              | 58 | 54 | 48 | 1969                             | 1854  | 1714  | 5.1  | 97              | 91  | 84  | 56 |
| 3.5  | 681                                     | 641  | 593  | 8.6  | 46              | 43 | 40 | 42 | 954                              | 898  | 830  | 7.3  | 64              | 60 | 55 | 49 | 1499                             | 1411  | 1305  | 5.8  | 100             | 94  | 87  | 57 |
| 4.0  | 538                                     | 506  | 468  | 9.7  | 47              | 44 | 41 | 43 | 753                              | 709  | 656  | 8.2  | 66              | 62 | 57 | 49 | 1183                             | 1114  | 1030  | 6.5  | 103             | 97  | 90  | 58 |
| 4.5  | 437                                     | 411  | 380  | 10.7 | 48              | 45 | 42 | 43 | 611                              | 576  | 532  | 9.1  | 68              | 64 | 59 | 50 | 961                              | 904   | 836   | 7.2  | 106             | 100 | 92  | 58 |
| 5.0  | 362                                     | 341  | 315  | 11.8 | 49              | 47 | 43 | 44 | 507                              | 478  | 442  | 10.0 | 69              | 65 | 60 | 50 | 797                              | 751   | 694   | 7.9  | 109             | 102 | 95  | 59 |
| 5.5  | 306                                     | 288  | 267  | 12.8 | 51              | 48 | 44 | 44 | 429                              | 403  | 373  | 10.8 | 71              | 67 | 62 | 51 | 673                              | 634   | 586   | 8.6  | 111             | 105 | 97  | 59 |
| 6.0  | 262                                     | 247  | 228  | 13.8 | 52              | 49 | 45 | 45 | 367                              | 346  | 320  | 11.7 | 72              | 68 | 63 | 51 | 577                              | 544   | 503   | 9.3  | 113             | 107 | 99  | 59 |
| 6.5  | 228                                     | 214  | 198  | 14.9 | 52              | 49 | 46 | 45 | 319                              | 300  | 278  | 12.6 | 73              | 69 | 64 | 51 | 501                              | 472   | 436   | 10.0 | 115             | 109 | 101 | 60 |
| 7.0  | 200                                     | 188  | 174  | 15.9 | 53              | 50 | 46 | 45 | 280                              | 263  | 243  | 13.4 | 75              | 70 | 65 | 52 | 439                              | 414   | 383   | 10.7 | 117             | 111 | 102 | 60 |
| 7.5  | 177                                     | 166  | 154  | 16.9 | 54              | 51 | 47 | 46 | 248                              | 233  | 215  | 14.3 | 76              | 71 | 66 | 52 | 389                              | 366   | 339   | 11.4 | 119             | 112 | 104 | 60 |
| 8.0  | 158                                     | 148  | 137  | 17.9 | 55              | 52 | 48 | 46 | 221                              | 208  | 192  | 15.1 | 77              | 73 | 67 | 52 | 347                              | 327   | 302   | 12.0 | 121             | 114 | 105 | 61 |
| 8.5  | 142                                     | 133  | 123  | 18.8 | 56              | 53 | 49 | 46 | 198                              | 187  | 173  | 15.9 | 78              | 74 | 68 | 52 | 312                              | 293   | 271   | 12.7 | 123             | 116 | 107 | 61 |
| 9.0  | 128                                     | 121  | 111  | 19.8 | 57              | 53 | 49 | 46 | 179                              | 169  | 156  | 16.8 | 79              | 75 | 69 | 53 | 282                              | 265   | 245   | 13.4 | 124             | 117 | 108 | 61 |
| 9.5  | 116                                     | 110  | 101  | 20.8 | 57              | 54 | 50 | 47 | 163                              | 153  | 142  | 17.6 | 80              | 75 | 70 | 53 | 256                              | 241   | 223   | 14.0 | 126             | 119 | 110 | 61 |
| 10.0 | 106                                     | 100  | 93   | 21.8 | 58              | 55 | 50 | 47 | 149                              | 140  | 130  | 18.4 | 81              | 76 | 71 | 53 | 234                              | 220   | 204   | 14.7 | 127             | 120 | 111 | 61 |
| 11.0 | 90                                      | 85   | 78   | 23.7 | 59              | 56 | 52 | 47 | 126                              | 118  | 109  | 20.0 | 83              | 78 | 72 | 53 | 197                              | 186   | 172   | 16.0 | 130             | 123 | 113 | 62 |
| 12.0 | 77                                      | 72   | 67   | 25.6 | 60              | 57 | 53 | 48 | 108                              | 101  | 94   | 21.6 | 85              | 80 | 74 | 54 | 169                              | 159   | 147   | 17.2 | 133             | 125 | 116 | 62 |
| 13.0 | 67                                      | 63   | 58   | 27.4 | 62              | 58 | 54 | 48 | 93                               | 88   | 81   | 23.2 | 86              | 81 | 75 | 54 | 147                              | 138   | 128   | 18.5 | 135             | 127 | 118 | 63 |
| 14.0 | 59                                      | 55   | 51   | 29.3 | 63              | 59 | 55 | 48 | 82                               | 77   | 71   | 24.8 | 88              | 83 | 76 | 55 | 129                              | 121   | 112   | 19.8 | 138             | 130 | 120 | 63 |
| 15.0 | 52                                      | 49   | 45   | 31.2 | 64              | 60 | 55 | 49 | 73                               | 68   | 63   | 26.3 | 89              | 84 | 78 | 55 | 114                              | 107   | 99    | 21.0 | 140             | 132 | 122 | 63 |
| 16.0 | 46                                      | 44   | 40   | 33.0 | 65              | 61 | 56 | 49 | 65                               | 61   | 56   | 27.9 | 90              | 85 | 79 | 55 | 102                              | 96    | 89    | 22.2 | 142             | 134 | 124 | 63 |
| 17.0 | 42                                      | 39   | 36   | 34.8 | 65              | 62 | 57 | 49 | 58                               | 55   | 51   | 29.4 | 92              | 86 | 80 | 55 | 91                               | 86    | 80    | 23.5 | 144             | 136 | 125 | 64 |
| 18.0 | 38                                      | 35   | 33   | 36.6 | 66              | 62 | 58 | 49 | 53                               | 49   | 46   | 30.9 | 93              | 87 | 81 | 56 | 83                               | 78    | 72    | 24.7 | 146             | 137 | 127 | 64 |
| 19.0 | 34                                      | 32   | 30   | 38.4 | 67              | 63 | 58 | 50 | 48                               | 45   | 42   | 32.5 | 94              | 89 | 82 | 56 | 75                               | 71    | 65    | 25.9 | 148             | 139 | 129 | 64 |
| 20.0 | 31                                      | 29   | 27   | 40.2 | 68              | 64 | 59 | 50 | 44                               | 41   | 38   | 34.0 | 95              | 90 | 83 | 56 | 69                               | 65    | 60    | 27.1 | 150             | 141 | 130 | 64 |
| 22.0 | 26                                      | 25   | 23   | 43.7 | 69              | 65 | 60 | 50 | 37                               | 35   | 32   | 36.9 | 97              | 92 | 85 | 56 | 58                               | 55    | 50    | 29.5 | 153             | 144 | 133 | 65 |
| 24.0 | 23                                      | 21   | 20   | 47.2 | 71              | 67 | 62 | 51 | 32                               | 30   | 27   | 39.9 | 99              | 93 | 86 | 57 | 50                               | 47    | 43    | 31.8 | 156             | 147 | 136 | 65 |
| 26.0 | 20                                      | 18   | 17   | 50.7 | 72              | 68 | 63 | 51 | 27                               | 26   | 24   | 42.8 | 101             | 95 | 88 | 57 | 43                               | 41    | 38    | 34.2 | 159             | 150 | 138 | 66 |
| 28.0 | 17                                      | 16   | 15   | 54.1 | 73              | 69 | 64 | 51 | 24                               | 23   | 21   | 45.7 | 103             | 97 | 90 | 57 | 38                               | 36    | 33    | 36.5 | 162             | 152 | 141 | 66 |
| 30.0 | 15                                      | 14   | 13   | 57.5 | 75              | 70 | 65 | 52 | 21                               | 20   | 19   | 48.6 | 104             | 98 | 91 | 58 | 33                               | 31    | 29    | 38.8 | 164             | 155 | 143 | 66 |



**Table P24:** Ponderosa pine stocking levels for the PSME/PHMA and PSME/SYAL plant associations (B-O province).

| QMD  | Climate Resilience; SDI 85; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 119; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 188; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5020                                   | 4726 | 4370 | 3.2  | 27              | 26 | 24 | 33 | 7028                             | 6617 | 6118 | 2.7  | 38              | 36 | 33 | 39 | 11044                            | 10398 | 9615 | 2.1  | 60              | 57  | 52  | 48 |
| 1.5  | 2449                                   | 2306 | 2132 | 4.5  | 30              | 28 | 26 | 35 | 3429                             | 3228 | 2985 | 3.8  | 42              | 40 | 37 | 41 | 5388                             | 5073  | 4691 | 3.1  | 66              | 62  | 58  | 49 |
| 2.0  | 1472                                   | 1386 | 1281 | 5.8  | 32              | 30 | 28 | 36 | 2061                             | 1940 | 1794 | 4.9  | 45              | 42 | 39 | 42 | 3238                             | 3049  | 2819 | 3.9  | 71              | 67  | 62  | 51 |
| 2.5  | 992                                    | 934  | 863  | 7.1  | 34              | 32 | 29 | 37 | 1388                             | 1307 | 1209 | 6.0  | 47              | 45 | 41 | 43 | 2182                             | 2054  | 1899 | 4.8  | 74              | 70  | 65  | 51 |
| 3.0  | 718                                    | 676  | 625  | 8.4  | 35              | 33 | 31 | 38 | 1005                             | 947  | 875  | 7.1  | 49              | 46 | 43 | 44 | 1580                             | 1487  | 1375 | 5.6  | 78              | 73  | 68  | 52 |
| 3.5  | 547                                    | 515  | 476  | 9.6  | 37              | 34 | 32 | 38 | 765                              | 721  | 666  | 8.1  | 51              | 48 | 45 | 45 | 1203                             | 1132  | 1047 | 6.5  | 80              | 76  | 70  | 53 |
| 4.0  | 432                                    | 406  | 376  | 10.8 | 38              | 35 | 33 | 39 | 604                              | 569  | 526  | 9.1  | 53              | 50 | 46 | 45 | 949                              | 894   | 827  | 7.3  | 83              | 78  | 72  | 53 |
| 4.5  | 350                                    | 330  | 305  | 12.0 | 39              | 36 | 34 | 39 | 490                              | 462  | 427  | 10.1 | 54              | 51 | 47 | 46 | 771                              | 726   | 671  | 8.1  | 85              | 80  | 74  | 54 |
| 5.0  | 291                                    | 274  | 253  | 13.2 | 40              | 37 | 35 | 40 | 407                              | 383  | 354  | 11.1 | 56              | 52 | 48 | 46 | 640                              | 602   | 557  | 8.9  | 87              | 82  | 76  | 54 |
| 5.5  | 246                                    | 231  | 214  | 14.3 | 41              | 38 | 35 | 40 | 344                              | 324  | 299  | 12.1 | 57              | 53 | 49 | 46 | 540                              | 509   | 470  | 9.6  | 89              | 84  | 78  | 55 |
| 6.0  | 211                                    | 198  | 183  | 15.5 | 41              | 39 | 36 | 41 | 295                              | 278  | 257  | 13.1 | 58              | 54 | 50 | 47 | 463                              | 436   | 403  | 10.4 | 91              | 86  | 79  | 55 |
| 6.5  | 183                                    | 172  | 159  | 16.6 | 42              | 40 | 37 | 41 | 256                              | 241  | 223  | 14.0 | 59              | 56 | 51 | 47 | 402                              | 379   | 350  | 11.2 | 93              | 87  | 81  | 56 |
| 7.0  | 160                                    | 151  | 140  | 17.7 | 43              | 40 | 37 | 41 | 224                              | 211  | 195  | 15.0 | 60              | 56 | 52 | 48 | 353                              | 332   | 307  | 11.9 | 94              | 89  | 82  | 56 |
| 7.5  | 142                                    | 134  | 123  | 18.8 | 44              | 41 | 38 | 42 | 199                              | 187  | 173  | 15.9 | 61              | 57 | 53 | 48 | 312                              | 294   | 272  | 12.7 | 96              | 90  | 83  | 56 |
| 8.0  | 127                                    | 119  | 110  | 19.9 | 44              | 42 | 38 | 42 | 177                              | 167  | 154  | 16.9 | 62              | 58 | 54 | 48 | 278                              | 262   | 242  | 13.4 | 97              | 91  | 85  | 56 |
| 8.5  | 114                                    | 107  | 99   | 21.0 | 45              | 42 | 39 | 42 | 159                              | 150  | 139  | 17.8 | 63              | 59 | 55 | 48 | 250                              | 235   | 218  | 14.2 | 99              | 93  | 86  | 57 |
| 9.0  | 103                                    | 97   | 89   | 22.1 | 45              | 43 | 40 | 42 | 144                              | 135  | 125  | 18.7 | 64              | 60 | 55 | 49 | 226                              | 213   | 197  | 14.9 | 100             | 94  | 87  | 57 |
| 9.5  | 93                                     | 88   | 81   | 23.2 | 46              | 43 | 40 | 43 | 131                              | 123  | 114  | 19.6 | 64              | 61 | 56 | 49 | 205                              | 193   | 179  | 15.6 | 101             | 95  | 88  | 57 |
| 10.0 | 85                                     | 80   | 74   | 24.3 | 46              | 44 | 40 | 43 | 119                              | 112  | 104  | 20.5 | 65              | 61 | 57 | 49 | 188                              | 177   | 163  | 16.4 | 102             | 96  | 89  | 57 |
| 11.0 | 72                                     | 68   | 63   | 26.4 | 48              | 45 | 41 | 43 | 101                              | 95   | 88   | 22.3 | 67              | 63 | 58 | 49 | 158                              | 149   | 138  | 17.8 | 105             | 98  | 91  | 58 |
| 12.0 | 62                                     | 58   | 54   | 28.5 | 48              | 46 | 42 | 44 | 86                               | 81   | 75   | 24.1 | 68              | 64 | 59 | 50 | 136                              | 128   | 118  | 19.2 | 107             | 100 | 93  | 58 |
| 13.0 | 54                                     | 50   | 47   | 30.6 | 49              | 46 | 43 | 44 | 75                               | 71   | 65   | 25.9 | 69              | 65 | 60 | 50 | 118                              | 111   | 103  | 20.7 | 109             | 102 | 95  | 59 |
| 14.0 | 47                                     | 44   | 41   | 32.7 | 50              | 47 | 44 | 44 | 66                               | 62   | 57   | 27.7 | 70              | 66 | 61 | 50 | 103                              | 97    | 90   | 22.1 | 111             | 104 | 96  | 59 |
| 15.0 | 42                                     | 39   | 36   | 34.8 | 51              | 48 | 44 | 45 | 58                               | 55   | 51   | 29.4 | 71              | 67 | 62 | 51 | 92                               | 86    | 80   | 23.4 | 112             | 106 | 98  | 59 |
| 16.0 | 37                                     | 35   | 32   | 36.8 | 52              | 49 | 45 | 45 | 52                               | 49   | 45   | 31.1 | 73              | 68 | 63 | 51 | 82                               | 77    | 71   | 24.8 | 114             | 107 | 99  | 59 |
| 17.0 | 33                                     | 31   | 29   | 38.8 | 53              | 49 | 46 | 45 | 47                               | 44   | 41   | 32.8 | 74              | 69 | 64 | 51 | 73                               | 69    | 64   | 26.2 | 116             | 109 | 101 | 60 |
| 18.0 | 30                                     | 28   | 26   | 40.9 | 53              | 50 | 46 | 45 | 42                               | 40   | 37   | 34.5 | 75              | 70 | 65 | 52 | 66                               | 62    | 58   | 27.6 | 117             | 110 | 102 | 60 |
| 19.0 | 27                                     | 26   | 24   | 42.9 | 54              | 51 | 47 | 46 | 38                               | 36   | 33   | 36.2 | 75              | 71 | 66 | 52 | 60                               | 57    | 52   | 28.9 | 119             | 112 | 103 | 60 |
| 20.0 | 25                                     | 24   | 22   | 44.9 | 55              | 51 | 47 | 46 | 35                               | 33   | 30   | 37.9 | 76              | 72 | 66 | 52 | 55                               | 52    | 48   | 30.2 | 120             | 113 | 104 | 60 |
| 22.0 | 21                                     | 20   | 18   | 48.8 | 56              | 52 | 49 | 46 | 30                               | 28   | 26   | 41.2 | 78              | 73 | 68 | 52 | 46                               | 44    | 40   | 32.9 | 123             | 115 | 107 | 61 |
| 24.0 | 18                                     | 17   | 16   | 52.7 | 57              | 54 | 50 | 47 | 25                               | 24   | 22   | 44.6 | 80              | 75 | 69 | 53 | 40                               | 37    | 35   | 35.5 | 125             | 118 | 109 | 61 |
| 26.0 | 16                                     | 15   | 14   | 56.6 | 58              | 55 | 50 | 47 | 22                               | 21   | 19   | 47.8 | 81              | 76 | 71 | 53 | 35                               | 33    | 30   | 38.1 | 127             | 120 | 111 | 61 |
| 28.0 | 14                                     | 13   | 12   | 60.4 | 59              | 55 | 51 | 47 | 19                               | 18   | 17   | 51.1 | 82              | 78 | 72 | 53 | 30                               | 29    | 26   | 40.7 | 130             | 122 | 113 | 62 |
| 30.0 | 12                                     | 11   | 11   | 64.2 | 60              | 56 | 52 | 47 | 17                               | 16   | 15   | 54.3 | 84              | 79 | 73 | 54 | 27                               | 25    | 23   | 43.3 | 132             | 124 | 115 | 62 |

**Table P25:** Ponderosa pine stocking levels for the PSME/SPBE plant association (W-S province).

| QMD  | Climate Resilience; SDI 110; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 154; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 243; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6492                                    | 6112 | 5652 | 2.8  | 35              | 33 | 31 | 38 | 9089                             | 8557 | 7913 | 2.4  | 50              | 47  | 43 | 44 | 14282                            | 13447 | 12434 | 1.9  | 78              | 73  | 68  | 52 |
| 1.5  | 3167                                    | 2982 | 2758 | 4.0  | 39              | 37 | 34 | 40 | 4434                             | 4175 | 3861 | 3.4  | 54              | 51  | 47 | 46 | 6968                             | 6561  | 6067  | 2.7  | 86              | 81  | 74  | 54 |
| 2.0  | 1904                                    | 1792 | 1657 | 5.1  | 42              | 39 | 36 | 41 | 2665                             | 2509 | 2320 | 4.3  | 58              | 55  | 51 | 47 | 4188                             | 3943  | 3646  | 3.5  | 91              | 86  | 80  | 55 |
| 2.5  | 1282                                    | 1207 | 1116 | 6.3  | 44              | 41 | 38 | 42 | 1795                             | 1690 | 1563 | 5.3  | 61              | 58  | 53 | 48 | 2821                             | 2656  | 2456  | 4.2  | 96              | 91  | 84  | 56 |
| 3.0  | 929                                     | 874  | 809  | 7.4  | 46              | 43 | 40 | 42 | 1300                             | 1224 | 1132 | 6.2  | 64              | 60  | 56 | 49 | 2043                             | 1924  | 1779  | 5.0  | 100             | 94  | 87  | 57 |
| 3.5  | 707                                     | 666  | 615  | 8.4  | 47              | 44 | 41 | 43 | 990                              | 932  | 862  | 7.1  | 66              | 62  | 58 | 49 | 1555                             | 1464  | 1354  | 5.7  | 104             | 98  | 90  | 58 |
| 4.0  | 558                                     | 525  | 486  | 9.5  | 49              | 46 | 42 | 44 | 781                              | 736  | 680  | 8.0  | 68              | 64  | 59 | 50 | 1228                             | 1156  | 1069  | 6.4  | 107             | 101 | 93  | 58 |
| 4.5  | 453                                     | 427  | 394  | 10.5 | 50              | 47 | 44 | 44 | 634                              | 597  | 552  | 8.9  | 70              | 66  | 61 | 50 | 997                              | 939   | 868   | 7.1  | 110             | 104 | 96  | 59 |
| 5.0  | 376                                     | 354  | 327  | 11.6 | 51              | 48 | 45 | 45 | 526                              | 496  | 458  | 9.8  | 72              | 68  | 62 | 51 | 827                              | 779   | 720   | 7.8  | 113             | 106 | 98  | 59 |
| 5.5  | 318                                     | 299  | 277  | 12.6 | 52              | 49 | 46 | 45 | 445                              | 419  | 387  | 10.6 | 73              | 69  | 64 | 51 | 699                              | 658   | 608   | 8.5  | 115             | 109 | 100 | 60 |
| 6.0  | 272                                     | 256  | 237  | 13.6 | 53              | 50 | 47 | 45 | 381                              | 359  | 332  | 11.5 | 75              | 70  | 65 | 52 | 599                              | 564   | 522   | 9.2  | 118             | 111 | 102 | 60 |
| 6.5  | 236                                     | 223  | 206  | 14.6 | 54              | 51 | 47 | 46 | 331                              | 312  | 288  | 12.3 | 76              | 72  | 66 | 52 | 520                              | 490   | 453   | 9.8  | 120             | 113 | 104 | 60 |
| 7.0  | 207                                     | 195  | 180  | 15.6 | 55              | 52 | 48 | 46 | 290                              | 273  | 253  | 13.2 | 78              | 73  | 68 | 52 | 456                              | 429   | 397   | 10.5 | 122             | 115 | 106 | 61 |
| 7.5  | 183                                     | 173  | 160  | 16.6 | 56              | 53 | 49 | 46 | 257                              | 242  | 224  | 14.0 | 79              | 74  | 69 | 53 | 404                              | 380   | 351   | 11.2 | 124             | 117 | 108 | 61 |
| 8.0  | 164                                     | 154  | 142  | 17.5 | 57              | 54 | 50 | 47 | 229                              | 216  | 199  | 14.8 | 80              | 75  | 70 | 53 | 360                              | 339   | 313   | 11.8 | 126             | 118 | 109 | 61 |
| 8.5  | 147                                     | 138  | 128  | 18.5 | 58              | 55 | 50 | 47 | 206                              | 194  | 179  | 15.6 | 81              | 76  | 71 | 53 | 323                              | 304   | 282   | 12.5 | 127             | 120 | 111 | 61 |
| 9.0  | 133                                     | 125  | 116  | 19.5 | 59              | 55 | 51 | 47 | 186                              | 175  | 162  | 16.4 | 82              | 77  | 72 | 53 | 292                              | 275   | 254   | 13.1 | 129             | 122 | 112 | 62 |
| 9.5  | 121                                     | 114  | 105  | 20.4 | 59              | 56 | 52 | 47 | 169                              | 159  | 147  | 17.3 | 83              | 78  | 72 | 54 | 266                              | 250   | 231   | 13.8 | 131             | 123 | 114 | 62 |
| 10.0 | 110                                     | 104  | 96   | 21.4 | 60              | 57 | 52 | 48 | 154                              | 145  | 134  | 18.1 | 84              | 79  | 73 | 54 | 243                              | 228   | 211   | 14.4 | 132             | 125 | 115 | 62 |
| 11.0 | 93                                      | 88   | 81   | 23.2 | 61              | 58 | 54 | 48 | 130                              | 123  | 114  | 19.6 | 86              | 81  | 75 | 54 | 205                              | 193   | 178   | 15.7 | 135             | 127 | 118 | 63 |
| 12.0 | 80                                      | 75   | 70   | 25.1 | 63              | 59 | 55 | 48 | 112                              | 105  | 97   | 21.2 | 88              | 83  | 76 | 55 | 176                              | 165   | 153   | 16.9 | 138             | 130 | 120 | 63 |
| 13.0 | 69                                      | 65   | 60   | 26.9 | 64              | 60 | 56 | 49 | 97                               | 91   | 84   | 22.8 | 89              | 84  | 78 | 55 | 152                              | 144   | 133   | 18.2 | 141             | 132 | 122 | 63 |
| 14.0 | 61                                      | 57   | 53   | 28.8 | 65              | 61 | 57 | 49 | 85                               | 80   | 74   | 24.3 | 91              | 86  | 79 | 55 | 134                              | 126   | 116   | 19.4 | 143             | 135 | 124 | 64 |
| 15.0 | 54                                      | 51   | 47   | 30.6 | 66              | 62 | 57 | 49 | 75                               | 71   | 66   | 25.8 | 92              | 87  | 80 | 56 | 118                              | 111   | 103   | 20.6 | 145             | 137 | 126 | 64 |
| 16.0 | 48                                      | 45   | 42   | 32.4 | 67              | 63 | 58 | 50 | 67                               | 63   | 58   | 27.4 | 94              | 88  | 82 | 56 | 106                              | 99    | 92    | 21.8 | 147             | 139 | 128 | 64 |
| 17.0 | 43                                      | 41   | 38   | 34.2 | 68              | 64 | 59 | 50 | 60                               | 57   | 53   | 28.9 | 95              | 90  | 83 | 56 | 95                               | 89    | 83    | 23.0 | 149             | 141 | 130 | 64 |
| 18.0 | 39                                      | 37   | 34   | 35.9 | 69              | 65 | 60 | 50 | 55                               | 51   | 47   | 30.4 | 96              | 91  | 84 | 56 | 86                               | 81    | 75    | 24.2 | 151             | 143 | 132 | 65 |
| 19.0 | 35                                      | 33   | 31   | 37.7 | 70              | 66 | 61 | 50 | 50                               | 47   | 43   | 31.9 | 98              | 92  | 85 | 57 | 78                               | 73    | 68    | 25.4 | 153             | 144 | 133 | 65 |
| 20.0 | 32                                      | 30   | 28   | 39.4 | 71              | 66 | 61 | 50 | 45                               | 43   | 39   | 33.3 | 99              | 93  | 86 | 57 | 71                               | 67    | 62    | 26.6 | 155             | 146 | 135 | 65 |
| 22.0 | 27                                      | 26   | 24   | 42.9 | 72              | 68 | 63 | 51 | 38                               | 36   | 33   | 36.3 | 101             | 95  | 88 | 57 | 60                               | 57    | 52    | 28.9 | 159             | 149 | 138 | 66 |
| 24.0 | 23                                      | 22   | 20   | 46.4 | 74              | 69 | 64 | 51 | 33                               | 31   | 29   | 39.2 | 103             | 97  | 90 | 58 | 52                               | 48    | 45    | 31.3 | 162             | 152 | 141 | 66 |
| 26.0 | 20                                      | 19   | 18   | 49.8 | 75              | 71 | 65 | 52 | 28                               | 27   | 25   | 42.1 | 105             | 99  | 91 | 58 | 45                               | 42    | 39    | 33.5 | 165             | 155 | 143 | 66 |
| 28.0 | 18                                      | 17   | 16   | 53.1 | 76              | 72 | 66 | 52 | 25                               | 23   | 22   | 44.9 | 107             | 100 | 93 | 58 | 39                               | 37    | 34    | 35.8 | 168             | 158 | 146 | 67 |
| 30.0 | 16                                      | 15   | 14   | 56.5 | 77              | 73 | 67 | 52 | 22                               | 21   | 19   | 47.7 | 108             | 102 | 94 | 58 | 35                               | 33    | 30    | 38.1 | 170             | 160 | 148 | 67 |

**Table P26:** Ponderosa pine stocking levels for the PSME/SYAL plant association (W-S province).

| QMD  | Climate Resilience; SDI 104; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 146; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 229; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6124                                    | 5766 | 5332 | 2.9  | 33              | 31 | 29 | 37 | 8574                             | 8072 | 7464 | 2.4  | 47              | 44 | 41 | 43 | 13473                            | 12685 | 11729 | 1.9  | 73              | 69  | 64  | 51 |
| 1.5  | 2988                                    | 2813 | 2601 | 4.1  | 37              | 35 | 32 | 38 | 4183                             | 3938 | 3642 | 3.5  | 51              | 48 | 45 | 45 | 6573                             | 6189  | 5723  | 2.8  | 81              | 76  | 70  | 53 |
| 2.0  | 1796                                    | 1691 | 1563 | 5.3  | 39              | 37 | 34 | 40 | 2514                             | 2367 | 2189 | 4.5  | 55              | 52 | 48 | 46 | 3950                             | 3719  | 3439  | 3.6  | 86              | 81  | 75  | 54 |
| 2.5  | 1210                                    | 1139 | 1053 | 6.4  | 41              | 39 | 36 | 41 | 1694                             | 1595 | 1474 | 5.4  | 58              | 54 | 50 | 47 | 2661                             | 2506  | 2317  | 4.3  | 91              | 85  | 79  | 55 |
| 3.0  | 876                                     | 825  | 763  | 7.6  | 43              | 40 | 37 | 41 | 1226                             | 1155 | 1068 | 6.4  | 60              | 57 | 52 | 48 | 1927                             | 1815  | 1678  | 5.1  | 95              | 89  | 82  | 56 |
| 3.5  | 667                                     | 628  | 581  | 8.7  | 45              | 42 | 39 | 42 | 934                              | 879  | 813  | 7.3  | 62              | 59 | 54 | 48 | 1467                             | 1381  | 1277  | 5.9  | 98              | 92  | 85  | 57 |
| 4.0  | 526                                     | 496  | 458  | 9.8  | 46              | 43 | 40 | 43 | 737                              | 694  | 642  | 8.3  | 64              | 61 | 56 | 49 | 1158                             | 1091  | 1008  | 6.6  | 101             | 95  | 88  | 57 |
| 4.5  | 427                                     | 402  | 372  | 10.8 | 47              | 44 | 41 | 43 | 598                              | 563  | 521  | 9.2  | 66              | 62 | 58 | 49 | 940                              | 885   | 819   | 7.3  | 104             | 98  | 90  | 58 |
| 5.0  | 355                                     | 334  | 309  | 11.9 | 48              | 46 | 42 | 44 | 497                              | 468  | 432  | 10.1 | 68              | 64 | 59 | 50 | 780                              | 735   | 679   | 8.0  | 106             | 100 | 93  | 58 |
| 5.5  | 300                                     | 282  | 261  | 13.0 | 49              | 47 | 43 | 44 | 419                              | 395  | 365  | 11.0 | 69              | 65 | 60 | 50 | 659                              | 621   | 574   | 8.7  | 109             | 102 | 95  | 59 |
| 6.0  | 257                                     | 242  | 224  | 14.0 | 50              | 47 | 44 | 44 | 360                              | 339  | 313  | 11.8 | 71              | 66 | 61 | 51 | 565                              | 532   | 492   | 9.4  | 111             | 104 | 97  | 59 |
| 6.5  | 223                                     | 210  | 194  | 15.0 | 51              | 48 | 45 | 45 | 312                              | 294  | 272  | 12.7 | 72              | 68 | 63 | 51 | 490                              | 462   | 427   | 10.1 | 113             | 106 | 98  | 59 |
| 7.0  | 196                                     | 184  | 170  | 16.0 | 52              | 49 | 45 | 45 | 274                              | 258  | 238  | 13.6 | 73              | 69 | 64 | 51 | 430                              | 405   | 374   | 10.8 | 115             | 108 | 100 | 60 |
| 7.5  | 173                                     | 163  | 151  | 17.0 | 53              | 50 | 46 | 45 | 242                              | 228  | 211  | 14.4 | 74              | 70 | 65 | 51 | 381                              | 358   | 331   | 11.5 | 117             | 110 | 102 | 60 |
| 8.0  | 154                                     | 145  | 134  | 18.1 | 54              | 51 | 47 | 46 | 216                              | 203  | 188  | 15.3 | 75              | 71 | 66 | 52 | 340                              | 320   | 296   | 12.2 | 119             | 112 | 103 | 60 |
| 8.5  | 139                                     | 131  | 121  | 19.0 | 55              | 51 | 48 | 46 | 194                              | 183  | 169  | 16.1 | 76              | 72 | 67 | 52 | 305                              | 287   | 266   | 12.8 | 120             | 113 | 105 | 60 |
| 9.0  | 125                                     | 118  | 109  | 20.0 | 55              | 52 | 48 | 46 | 175                              | 165  | 153  | 16.9 | 78              | 73 | 67 | 52 | 276                              | 260   | 240   | 13.5 | 122             | 115 | 106 | 61 |
| 9.5  | 114                                     | 107  | 99   | 21.0 | 56              | 53 | 49 | 46 | 159                              | 150  | 139  | 17.8 | 78              | 74 | 68 | 52 | 251                              | 236   | 218   | 14.2 | 123             | 116 | 107 | 61 |
| 10.0 | 104                                     | 98   | 91   | 22.0 | 57              | 53 | 49 | 46 | 146                              | 137  | 127  | 18.6 | 79              | 75 | 69 | 53 | 229                              | 215   | 199   | 14.8 | 125             | 117 | 109 | 61 |
| 11.0 | 88                                      | 83   | 76   | 23.9 | 58              | 55 | 50 | 47 | 123                              | 116  | 107  | 20.2 | 81              | 76 | 71 | 53 | 193                              | 182   | 168   | 16.1 | 128             | 120 | 111 | 61 |
| 12.0 | 75                                      | 71   | 66   | 25.8 | 59              | 56 | 51 | 47 | 105                              | 99   | 92   | 21.8 | 83              | 78 | 72 | 53 | 166                              | 156   | 144   | 17.4 | 130             | 123 | 113 | 62 |
| 13.0 | 65                                      | 62   | 57   | 27.7 | 60              | 57 | 52 | 48 | 92                               | 86   | 80   | 23.4 | 84              | 79 | 73 | 54 | 144                              | 135   | 125   | 18.7 | 133             | 125 | 115 | 62 |
| 14.0 | 57                                      | 54   | 50   | 29.6 | 61              | 58 | 53 | 48 | 80                               | 76   | 70   | 25.0 | 86              | 81 | 75 | 54 | 126                              | 119   | 110   | 20.0 | 135             | 127 | 117 | 63 |
| 15.0 | 51                                      | 48   | 44   | 31.5 | 62              | 59 | 54 | 48 | 71                               | 67   | 62   | 26.6 | 87              | 82 | 76 | 54 | 112                              | 105   | 97    | 21.2 | 137             | 129 | 119 | 63 |
| 16.0 | 45                                      | 43   | 39   | 33.3 | 63              | 60 | 55 | 48 | 63                               | 60   | 55   | 28.2 | 88              | 83 | 77 | 55 | 100                              | 94    | 87    | 22.5 | 139             | 131 | 121 | 63 |
| 17.0 | 41                                      | 38   | 35   | 35.2 | 64              | 60 | 56 | 49 | 57                               | 54   | 50   | 29.7 | 90              | 84 | 78 | 55 | 89                               | 84    | 78    | 23.7 | 141             | 133 | 123 | 63 |
| 18.0 | 37                                      | 35   | 32   | 37.0 | 65              | 61 | 57 | 49 | 51                               | 48   | 45   | 31.3 | 91              | 86 | 79 | 55 | 81                               | 76    | 70    | 24.9 | 143             | 134 | 124 | 64 |
| 19.0 | 33                                      | 31   | 29   | 38.8 | 66              | 62 | 57 | 49 | 47                               | 44   | 41   | 32.8 | 92              | 87 | 80 | 55 | 73                               | 69    | 64    | 26.2 | 145             | 136 | 126 | 64 |
| 20.0 | 30                                      | 29   | 27   | 40.6 | 67              | 63 | 58 | 49 | 43                               | 40   | 37   | 34.3 | 93              | 88 | 81 | 56 | 67                               | 63    | 58    | 27.4 | 146             | 138 | 127 | 64 |
| 22.0 | 26                                      | 24   | 22   | 44.2 | 68              | 64 | 59 | 50 | 36                               | 34   | 31   | 37.3 | 95              | 90 | 83 | 56 | 57                               | 53    | 49    | 29.8 | 150             | 141 | 130 | 64 |
| 24.0 | 22                                      | 21   | 19   | 47.7 | 69              | 65 | 60 | 50 | 31                               | 29   | 27   | 40.3 | 97              | 91 | 85 | 56 | 49                               | 46    | 42    | 32.2 | 153             | 144 | 133 | 65 |
| 26.0 | 19                                      | 18   | 17   | 51.2 | 71              | 67 | 62 | 51 | 27                               | 25   | 23   | 43.3 | 99              | 93 | 86 | 57 | 42                               | 40    | 37    | 34.5 | 155             | 146 | 135 | 65 |
| 28.0 | 17                                      | 16   | 15   | 54.7 | 72              | 68 | 63 | 51 | 24                               | 22   | 20   | 46.2 | 101             | 95 | 88 | 57 | 37                               | 35    | 32    | 36.9 | 158             | 149 | 138 | 65 |
| 30.0 | 15                                      | 14   | 13   | 58.1 | 73              | 69 | 64 | 51 | 21                               | 20   | 18   | 49.1 | 102             | 96 | 89 | 57 | 33                               | 31    | 28    | 39.2 | 161             | 151 | 140 | 66 |

**Table D1:** Douglas-fir stocking levels for the ABGR/ACGL plant association (B-O province).

| QMD  | Climate Resilience; SDI 75; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 105; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 166; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2435                                   | 2293 | 2120 | 4.5  | 13              | 13 | 12 | 41 | 3409                             | 3210 | 2968 | 3.8  | 19              | 18 | 16 | 46 | 5357                             | 5044 | 4664 | 3.1  | 29              | 28  | 25  | 53 |
| 1.5  | 1320                                   | 1243 | 1149 | 6.2  | 16              | 15 | 14 | 44 | 1848                             | 1740 | 1609 | 5.2  | 23              | 21 | 20 | 49 | 2904                             | 2734 | 2528 | 4.2  | 36              | 34  | 31  | 56 |
| 2.0  | 855                                    | 805  | 744  | 7.7  | 19              | 18 | 16 | 46 | 1197                             | 1127 | 1042 | 6.5  | 26              | 25 | 23 | 51 | 1881                             | 1771 | 1638 | 5.2  | 41              | 39  | 36  | 58 |
| 2.5  | 610                                    | 575  | 531  | 9.1  | 21              | 20 | 18 | 48 | 855                              | 805  | 744  | 7.7  | 29              | 27 | 25 | 53 | 1343                             | 1264 | 1169 | 6.1  | 46              | 43  | 40  | 60 |
| 3.0  | 464                                    | 436  | 404  | 10.4 | 23              | 21 | 20 | 49 | 649                              | 611  | 565  | 8.8  | 32              | 30 | 28 | 54 | 1020                             | 960  | 888  | 7.0  | 50              | 47  | 44  | 62 |
| 3.5  | 367                                    | 346  | 320  | 11.7 | 25              | 23 | 21 | 50 | 514                              | 484  | 448  | 9.9  | 34              | 32 | 30 | 56 | 808                              | 761  | 703  | 7.9  | 54              | 51  | 47  | 63 |
| 4.0  | 300                                    | 283  | 261  | 12.9 | 26              | 25 | 23 | 51 | 420                              | 396  | 366  | 10.9 | 37              | 35 | 32 | 57 | 660                              | 622  | 575  | 8.7  | 58              | 54  | 50  | 64 |
| 4.5  | 251                                    | 237  | 219  | 14.1 | 28              | 26 | 24 | 52 | 352                              | 331  | 306  | 12.0 | 39              | 37 | 34 | 58 | 553                              | 520  | 481  | 9.5  | 61              | 57  | 53  | 65 |
| 5.0  | 214                                    | 202  | 187  | 15.3 | 29              | 28 | 25 | 53 | 300                              | 282  | 261  | 12.9 | 41              | 39 | 36 | 58 | 472                              | 444  | 410  | 10.3 | 64              | 61  | 56  | 66 |
| 5.5  | 186                                    | 175  | 162  | 16.5 | 31              | 29 | 27 | 54 | 260                              | 245  | 226  | 13.9 | 43              | 40 | 37 | 59 | 408                              | 384  | 355  | 11.1 | 67              | 63  | 59  | 66 |
| 6.0  | 163                                    | 153  | 142  | 17.6 | 32              | 30 | 28 | 54 | 228                              | 215  | 198  | 14.9 | 45              | 42 | 39 | 60 | 358                              | 337  | 312  | 11.9 | 70              | 66  | 61  | 67 |
| 6.5  | 144                                    | 136  | 126  | 18.7 | 33              | 31 | 29 | 55 | 202                              | 190  | 176  | 15.8 | 47              | 44 | 41 | 60 | 317                              | 299  | 276  | 12.6 | 73              | 69  | 64  | 68 |
| 7.0  | 129                                    | 121  | 112  | 19.8 | 34              | 32 | 30 | 56 | 181                              | 170  | 157  | 16.7 | 48              | 45 | 42 | 61 | 284                              | 267  | 247  | 13.3 | 76              | 71  | 66  | 68 |
| 7.5  | 116                                    | 109  | 101  | 20.8 | 36              | 34 | 31 | 56 | 163                              | 153  | 142  | 17.6 | 50              | 47 | 43 | 61 | 256                              | 241  | 223  | 14.0 | 78              | 74  | 68  | 69 |
| 8.0  | 105                                    | 99   | 92   | 21.8 | 37              | 35 | 32 | 57 | 148                              | 139  | 128  | 18.5 | 52              | 48 | 45 | 62 | 232                              | 218  | 202  | 14.7 | 81              | 76  | 70  | 69 |
| 8.5  | 96                                     | 91   | 84   | 22.9 | 38              | 36 | 33 | 57 | 135                              | 127  | 117  | 19.3 | 53              | 50 | 46 | 62 | 212                              | 199  | 184  | 15.4 | 83              | 79  | 73  | 70 |
| 9.0  | 88                                     | 83   | 77   | 23.9 | 39              | 37 | 34 | 58 | 124                              | 116  | 108  | 20.2 | 55              | 51 | 48 | 63 | 194                              | 183  | 169  | 16.1 | 86              | 81  | 75  | 70 |
| 9.5  | 81                                     | 77   | 71   | 24.9 | 40              | 38 | 35 | 58 | 114                              | 107  | 99   | 21.0 | 56              | 53 | 49 | 63 | 179                              | 168  | 156  | 16.8 | 88              | 83  | 77  | 71 |
| 10.0 | 75                                     | 71   | 66   | 25.9 | 41              | 39 | 36 | 58 | 105                              | 99   | 92   | 21.9 | 57              | 54 | 50 | 64 | 166                              | 156  | 144  | 17.4 | 90              | 85  | 79  | 71 |
| 11.0 | 65                                     | 61   | 57   | 27.8 | 43              | 40 | 37 | 59 | 91                               | 86   | 79   | 23.5 | 60              | 57 | 52 | 64 | 143                              | 135  | 125  | 18.7 | 95              | 89  | 82  | 72 |
| 12.0 | 57                                     | 54   | 50   | 29.7 | 45              | 42 | 39 | 60 | 80                               | 75   | 70   | 25.1 | 63              | 59 | 55 | 65 | 126                              | 118  | 109  | 20.0 | 99              | 93  | 86  | 72 |
| 13.0 | 51                                     | 48   | 44   | 31.5 | 47              | 44 | 41 | 60 | 71                               | 67   | 62   | 26.6 | 65              | 62 | 57 | 66 | 111                              | 105  | 97   | 21.2 | 103             | 97  | 89  | 73 |
| 14.0 | 45                                     | 43   | 39   | 33.3 | 48              | 46 | 42 | 61 | 63                               | 60   | 55   | 28.2 | 68              | 64 | 59 | 66 | 100                              | 94   | 87   | 22.5 | 106             | 100 | 93  | 74 |
| 15.0 | 41                                     | 38   | 36   | 35.1 | 50              | 47 | 44 | 62 | 57                               | 54   | 50   | 29.7 | 70              | 66 | 61 | 67 | 90                               | 84   | 78   | 23.7 | 110             | 104 | 96  | 74 |
| 16.0 | 37                                     | 35   | 32   | 36.9 | 52              | 49 | 45 | 62 | 52                               | 49   | 45   | 31.2 | 72              | 68 | 63 | 67 | 81                               | 77   | 71   | 24.9 | 114             | 107 | 99  | 75 |
| 17.0 | 34                                     | 32   | 29   | 38.6 | 53              | 50 | 46 | 63 | 47                               | 45   | 41   | 32.6 | 75              | 70 | 65 | 68 | 74                               | 70   | 65   | 26.0 | 117             | 110 | 102 | 75 |
| 18.0 | 31                                     | 29   | 27   | 40.3 | 55              | 52 | 48 | 63 | 43                               | 41   | 38   | 34.1 | 77              | 72 | 67 | 68 | 68                               | 64   | 59   | 27.2 | 120             | 113 | 105 | 76 |
| 19.0 | 29                                     | 27   | 25   | 42.0 | 56              | 53 | 49 | 63 | 40                               | 38   | 35   | 35.5 | 79              | 74 | 69 | 69 | 63                               | 59   | 55   | 28.3 | 124             | 116 | 108 | 76 |
| 20.0 | 26                                     | 25   | 23   | 43.6 | 58              | 54 | 50 | 64 | 37                               | 35   | 32   | 36.9 | 81              | 76 | 70 | 69 | 58                               | 55   | 51   | 29.4 | 127             | 119 | 110 | 76 |
| 22.0 | 23                                     | 22   | 20   | 46.9 | 60              | 57 | 53 | 65 | 32                               | 30   | 28   | 39.6 | 85              | 80 | 74 | 70 | 50                               | 47   | 44   | 31.6 | 133             | 125 | 116 | 77 |
| 24.0 | 20                                     | 19   | 17   | 50.1 | 63              | 59 | 55 | 65 | 28                               | 26   | 24   | 42.3 | 88              | 83 | 77 | 71 | 44                               | 42   | 38   | 33.8 | 139             | 131 | 121 | 78 |
| 26.0 | 18                                     | 17   | 15   | 53.2 | 66              | 62 | 57 | 66 | 25                               | 23   | 22   | 45.0 | 92              | 86 | 80 | 71 | 39                               | 37   | 34   | 35.9 | 144             | 136 | 126 | 78 |
| 28.0 | 16                                     | 15   | 14   | 56.3 | 68              | 64 | 59 | 66 | 22                               | 21   | 19   | 47.5 | 95              | 90 | 83 | 72 | 35                               | 33   | 30   | 37.9 | 150             | 141 | 130 | 79 |
| 30.0 | 14                                     | 13   | 12   | 59.3 | 70              | 66 | 61 | 67 | 20                               | 19   | 17   | 50.1 | 98              | 93 | 86 | 72 | 32                               | 30   | 27   | 40.0 | 155             | 146 | 135 | 80 |

**Table D2:** Douglas-fir stocking levels for the ABGR/ACGL, ABGR/ACGL-PHMA, ABGR/CARU, ABGR/CLUN, ABGR/LIBO2, ABGR/SPBE, ABLA2/VAME, ABLA2/VASC/POPU, PSME/CARU, and PSME/SYAL (W-S province); and ABGR/CLUN, ABGR/LIBO2, ABGR/TABR/LIBO2, and ABGR/VAME (B-O province) plant associations, and the ABLA2/POPU, PICO(ABGR)/ALSI, PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, PICO(ABGR)/VAME-LIBO2, PICO(ABGR)/VAME/PTAQ, and PICO(ABLA2)/VASC/POPU plant community types.

| QMD  | Climate Resilience; SDI 119; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 166; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 261; 55% of Max |      |      |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3843                                    | 3618 | 3345 | 3.6  | 21              | 20  | 18 | 48 | 5380                             | 5065 | 4684 | 3.1  | 29              | 28  | 26  | 53 | 8454                             | 7959 | 7360 | 2.4  | 46              | 43  | 40  | 60 |
| 1.5  | 2083                                    | 1961 | 1814 | 4.9  | 26              | 24  | 22 | 51 | 2917                             | 2746 | 2539 | 4.2  | 36              | 34  | 31  | 56 | 4583                             | 4315 | 3990 | 3.3  | 56              | 53  | 49  | 63 |
| 2.0  | 1349                                    | 1270 | 1175 | 6.1  | 29              | 28  | 26 | 53 | 1889                             | 1778 | 1644 | 5.2  | 41              | 39  | 36  | 58 | 2968                             | 2795 | 2584 | 4.1  | 65              | 61  | 56  | 66 |
| 2.5  | 963                                     | 907  | 839  | 7.2  | 33              | 31  | 29 | 55 | 1349                             | 1270 | 1174 | 6.1  | 46              | 43  | 40  | 60 | 2119                             | 1995 | 1845 | 4.9  | 72              | 68  | 63  | 67 |
| 3.0  | 731                                     | 689  | 637  | 8.3  | 36              | 34  | 31 | 56 | 1024                             | 964  | 892  | 7.0  | 50              | 47  | 44  | 62 | 1609                             | 1515 | 1401 | 5.6  | 79              | 74  | 69  | 69 |
| 3.5  | 580                                     | 546  | 505  | 9.3  | 39              | 36  | 34 | 57 | 811                              | 764  | 706  | 7.9  | 54              | 51  | 47  | 63 | 1275                             | 1200 | 1110 | 6.3  | 85              | 80  | 74  | 70 |
| 4.0  | 474                                     | 446  | 412  | 10.3 | 41              | 39  | 36 | 59 | 663                              | 624  | 577  | 8.7  | 58              | 54  | 50  | 64 | 1042                             | 981  | 907  | 6.9  | 91              | 86  | 79  | 71 |
| 4.5  | 397                                     | 373  | 345  | 11.3 | 44              | 41  | 38 | 59 | 555                              | 523  | 483  | 9.5  | 61              | 58  | 53  | 65 | 872                              | 821  | 759  | 7.6  | 96              | 91  | 84  | 72 |
| 5.0  | 338                                     | 318  | 294  | 12.2 | 46              | 43  | 40 | 60 | 473                              | 446  | 412  | 10.3 | 65              | 61  | 56  | 66 | 744                              | 701  | 648  | 8.2  | 101             | 96  | 88  | 73 |
| 5.5  | 293                                     | 276  | 255  | 13.1 | 48              | 45  | 42 | 61 | 410                              | 386  | 357  | 11.1 | 68              | 64  | 59  | 66 | 644                              | 607  | 561  | 8.8  | 106             | 100 | 93  | 74 |
| 6.0  | 257                                     | 242  | 224  | 14.0 | 50              | 47  | 44 | 62 | 360                              | 339  | 313  | 11.8 | 71              | 66  | 61  | 67 | 565                              | 532  | 492  | 9.4  | 111             | 104 | 97  | 74 |
| 6.5  | 228                                     | 214  | 198  | 14.9 | 52              | 49  | 46 | 62 | 319                              | 300  | 277  | 12.6 | 73              | 69  | 64  | 68 | 501                              | 471  | 436  | 10.0 | 115             | 109 | 100 | 75 |
| 7.0  | 203                                     | 192  | 177  | 15.7 | 54              | 51  | 47 | 63 | 285                              | 268  | 248  | 13.3 | 76              | 72  | 66  | 68 | 448                              | 421  | 390  | 10.6 | 120             | 113 | 104 | 75 |
| 7.5  | 183                                     | 173  | 160  | 16.6 | 56              | 53  | 49 | 63 | 257                              | 242  | 223  | 14.0 | 79              | 74  | 69  | 69 | 403                              | 380  | 351  | 11.2 | 124             | 117 | 108 | 76 |
| 8.0  | 166                                     | 157  | 145  | 17.4 | 58              | 55  | 51 | 64 | 233                              | 219  | 203  | 14.7 | 81              | 77  | 71  | 69 | 366                              | 345  | 319  | 11.7 | 128             | 120 | 111 | 77 |
| 8.5  | 152                                     | 143  | 132  | 18.2 | 60              | 56  | 52 | 64 | 212                              | 200  | 185  | 15.4 | 84              | 79  | 73  | 70 | 334                              | 314  | 291  | 12.3 | 132             | 124 | 115 | 77 |
| 9.0  | 139                                     | 131  | 121  | 19.0 | 62              | 58  | 54 | 65 | 195                              | 184  | 170  | 16.1 | 86              | 81  | 75  | 70 | 306                              | 288  | 267  | 12.8 | 135             | 127 | 118 | 77 |
| 9.5  | 128                                     | 121  | 112  | 19.8 | 63              | 59  | 55 | 65 | 180                              | 169  | 156  | 16.7 | 88              | 83  | 77  | 71 | 282                              | 266  | 246  | 13.3 | 139             | 131 | 121 | 78 |
| 10.0 | 119                                     | 112  | 103  | 20.6 | 65              | 61  | 56 | 66 | 166                              | 157  | 145  | 17.4 | 91              | 85  | 79  | 71 | 261                              | 246  | 227  | 13.9 | 142             | 134 | 124 | 78 |
| 11.0 | 103                                     | 97   | 90   | 22.1 | 68              | 64  | 59 | 66 | 144                              | 136  | 125  | 18.7 | 95              | 89  | 83  | 72 | 226                              | 213  | 197  | 14.9 | 149             | 141 | 130 | 79 |
| 12.0 | 90                                      | 85   | 79   | 23.6 | 71              | 67  | 62 | 67 | 126                              | 119  | 110  | 20.0 | 99              | 93  | 86  | 72 | 198                              | 187  | 173  | 15.9 | 156             | 147 | 136 | 80 |
| 13.0 | 80                                      | 75   | 70   | 25.1 | 74              | 69  | 64 | 68 | 112                              | 105  | 97   | 21.2 | 103             | 97  | 90  | 73 | 176                              | 166  | 153  | 16.9 | 162             | 153 | 141 | 80 |
| 14.0 | 71                                      | 67   | 62   | 26.5 | 76              | 72  | 66 | 68 | 100                              | 94   | 87   | 22.4 | 107             | 101 | 93  | 74 | 157                              | 148  | 137  | 17.9 | 168             | 158 | 146 | 81 |
| 15.0 | 64                                      | 61   | 56   | 28.0 | 79              | 74  | 69 | 69 | 90                               | 85   | 78   | 23.6 | 111             | 104 | 96  | 74 | 142                              | 133  | 123  | 18.8 | 174             | 164 | 151 | 81 |
| 16.0 | 58                                      | 55   | 51   | 29.3 | 82              | 77  | 71 | 69 | 82                               | 77   | 71   | 24.8 | 114             | 107 | 99  | 75 | 128                              | 121  | 112  | 19.8 | 179             | 169 | 156 | 82 |
| 17.0 | 53                                      | 50   | 46   | 30.7 | 84              | 79  | 73 | 70 | 75                               | 70   | 65   | 26.0 | 118             | 111 | 102 | 75 | 117                              | 110  | 102  | 20.7 | 185             | 174 | 161 | 82 |
| 18.0 | 49                                      | 46   | 43   | 32.1 | 86              | 81  | 75 | 70 | 68                               | 64   | 60   | 27.1 | 121             | 114 | 105 | 76 | 108                              | 101  | 94   | 21.6 | 190             | 179 | 165 | 83 |
| 19.0 | 45                                      | 42   | 39   | 33.4 | 89              | 84  | 77 | 71 | 63                               | 59   | 55   | 28.2 | 124             | 117 | 108 | 76 | 99                               | 93   | 86   | 22.5 | 195             | 184 | 170 | 83 |
| 20.0 | 42                                      | 39   | 36   | 34.7 | 91              | 86  | 79 | 71 | 58                               | 55   | 51   | 29.4 | 127             | 120 | 111 | 76 | 92                               | 86   | 80   | 23.4 | 200             | 188 | 174 | 84 |
| 22.0 | 36                                      | 34   | 31   | 37.3 | 95              | 90  | 83 | 72 | 51                               | 48   | 44   | 31.5 | 133             | 126 | 116 | 77 | 79                               | 75   | 69   | 25.2 | 210             | 197 | 183 | 84 |
| 24.0 | 32                                      | 30   | 28   | 39.9 | 99              | 94  | 87 | 72 | 44                               | 42   | 39   | 33.7 | 139             | 131 | 121 | 78 | 70                               | 66   | 61   | 26.9 | 219             | 206 | 191 | 85 |
| 26.0 | 28                                      | 26   | 24   | 42.3 | 103             | 97  | 90 | 73 | 39                               | 37   | 34   | 35.8 | 145             | 136 | 126 | 79 | 62                               | 58   | 54   | 28.5 | 228             | 214 | 198 | 86 |
| 28.0 | 25                                      | 24   | 22   | 44.8 | 107             | 101 | 93 | 74 | 35                               | 33   | 31   | 37.8 | 150             | 141 | 131 | 79 | 55                               | 52   | 48   | 30.2 | 236             | 222 | 205 | 86 |
| 30.0 | 23                                      | 21   | 20   | 47.2 | 111             | 104 | 97 | 74 | 32                               | 30   | 28   | 39.9 | 155             | 146 | 135 | 80 | 50                               | 47   | 43   | 31.8 | 244             | 230 | 213 | 87 |

**Table D3:** Douglas-fir stocking levels for the ABGR/CARU plant association (B-O province) and ABGR/ARCO plant community type.

| QMD  | Climate Resilience; SDI 112; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 156; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 245; 55% of Max |      |      |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3608                                    | 3397 | 3141 | 3.7  | 20              | 19 | 17 | 47 | 5051                             | 4756 | 4398 | 3.2  | 28              | 26  | 24  | 52 | 7938                             | 7473 | 6911 | 2.5  | 43              | 41  | 38  | 59 |
| 1.5  | 1956                                    | 1842 | 1703 | 5.1  | 24              | 23 | 21 | 50 | 2738                             | 2578 | 2384 | 4.3  | 34              | 32  | 29  | 55 | 4303                             | 4052 | 3746 | 3.4  | 53              | 50  | 46  | 62 |
| 2.0  | 1267                                    | 1193 | 1103 | 6.3  | 28              | 26 | 24 | 52 | 1774                             | 1670 | 1544 | 5.3  | 39              | 36  | 34  | 57 | 2787                             | 2624 | 2426 | 4.2  | 61              | 57  | 53  | 65 |
| 2.5  | 904                                     | 852  | 787  | 7.5  | 31              | 29 | 27 | 54 | 1266                             | 1192 | 1102 | 6.3  | 43              | 41  | 38  | 59 | 1990                             | 1873 | 1732 | 5.0  | 68              | 64  | 59  | 66 |
| 3.0  | 687                                     | 647  | 598  | 8.6  | 34              | 32 | 29 | 55 | 962                              | 905  | 837  | 7.2  | 47              | 44  | 41  | 61 | 1511                             | 1423 | 1315 | 5.8  | 74              | 70  | 65  | 68 |
| 3.5  | 544                                     | 512  | 474  | 9.6  | 36              | 34 | 32 | 56 | 762                              | 717  | 663  | 8.1  | 51              | 48  | 44  | 62 | 1197                             | 1127 | 1042 | 6.5  | 80              | 75  | 70  | 69 |
| 4.0  | 445                                     | 419  | 387  | 10.6 | 39              | 37 | 34 | 58 | 623                              | 586  | 542  | 9.0  | 54              | 51  | 47  | 63 | 979                              | 921  | 852  | 7.2  | 85              | 80  | 74  | 70 |
| 4.5  | 372                                     | 351  | 324  | 11.6 | 41              | 39 | 36 | 58 | 521                              | 491  | 454  | 9.8  | 58              | 54  | 50  | 64 | 819                              | 771  | 713  | 7.8  | 90              | 85  | 79  | 71 |
| 5.0  | 318                                     | 299  | 276  | 12.6 | 43              | 41 | 38 | 59 | 445                              | 419  | 387  | 10.6 | 61              | 57  | 53  | 65 | 699                              | 658  | 608  | 8.5  | 95              | 90  | 83  | 72 |
| 5.5  | 275                                     | 259  | 239  | 13.5 | 45              | 43 | 40 | 60 | 385                              | 362  | 335  | 11.4 | 64              | 60  | 55  | 65 | 605                              | 570  | 527  | 9.1  | 100             | 94  | 87  | 73 |
| 6.0  | 241                                     | 227  | 210  | 14.4 | 47              | 45 | 41 | 61 | 338                              | 318  | 294  | 12.2 | 66              | 62  | 58  | 66 | 531                              | 499  | 462  | 9.7  | 104             | 98  | 91  | 73 |
| 6.5  | 214                                     | 201  | 186  | 15.3 | 49              | 46 | 43 | 61 | 299                              | 282  | 260  | 13.0 | 69              | 65  | 60  | 67 | 470                              | 443  | 409  | 10.3 | 108             | 102 | 94  | 74 |
| 7.0  | 191                                     | 180  | 166  | 16.2 | 51              | 48 | 44 | 62 | 267                              | 252  | 233  | 13.7 | 71              | 67  | 62  | 67 | 420                              | 396  | 366  | 10.9 | 112             | 106 | 98  | 74 |
| 7.5  | 172                                     | 162  | 150  | 17.1 | 53              | 50 | 46 | 62 | 241                              | 227  | 210  | 14.4 | 74              | 70  | 64  | 68 | 379                              | 357  | 330  | 11.5 | 116             | 109 | 101 | 75 |
| 8.0  | 156                                     | 147  | 136  | 17.9 | 55              | 51 | 47 | 63 | 219                              | 206  | 190  | 15.2 | 76              | 72  | 66  | 68 | 344                              | 323  | 299  | 12.1 | 120             | 113 | 104 | 76 |
| 8.5  | 143                                     | 134  | 124  | 18.8 | 56              | 53 | 49 | 63 | 200                              | 188  | 174  | 15.9 | 79              | 74  | 68  | 69 | 314                              | 295  | 273  | 12.7 | 124             | 116 | 108 | 76 |
| 9.0  | 131                                     | 123  | 114  | 19.6 | 58              | 54 | 50 | 64 | 183                              | 172  | 159  | 16.6 | 81              | 76  | 70  | 69 | 288                              | 271  | 250  | 13.2 | 127             | 120 | 111 | 76 |
| 9.5  | 120                                     | 113  | 105  | 20.4 | 59              | 56 | 52 | 64 | 169                              | 159  | 147  | 17.3 | 83              | 78  | 72  | 70 | 265                              | 250  | 231  | 13.8 | 130             | 123 | 114 | 77 |
| 10.0 | 112                                     | 105  | 97   | 21.2 | 61              | 57 | 53 | 65 | 156                              | 147  | 136  | 18.0 | 85              | 80  | 74  | 70 | 245                              | 231  | 214  | 14.3 | 134             | 126 | 116 | 77 |
| 11.0 | 97                                      | 91   | 84   | 22.8 | 64              | 60 | 55 | 65 | 135                              | 127  | 118  | 19.3 | 89              | 84  | 78  | 71 | 212                              | 200  | 185  | 15.4 | 140             | 132 | 122 | 78 |
| 12.0 | 85                                      | 80   | 74   | 24.4 | 66              | 63 | 58 | 66 | 119                              | 112  | 103  | 20.6 | 93              | 88  | 81  | 71 | 186                              | 175  | 162  | 16.4 | 146             | 138 | 127 | 79 |
| 13.0 | 75                                      | 71   | 65   | 25.9 | 69              | 65 | 60 | 67 | 105                              | 99   | 91   | 21.9 | 97              | 91  | 84  | 72 | 165                              | 155  | 144  | 17.5 | 152             | 143 | 132 | 79 |
| 14.0 | 67                                      | 63   | 58   | 27.4 | 72              | 68 | 62 | 67 | 94                               | 88   | 82   | 23.1 | 100             | 95  | 87  | 73 | 148                              | 139  | 128  | 18.5 | 158             | 149 | 137 | 80 |
| 15.0 | 60                                      | 57   | 53   | 28.8 | 74              | 70 | 65 | 68 | 85                               | 80   | 74   | 24.4 | 104             | 98  | 90  | 73 | 133                              | 125  | 116  | 19.4 | 163             | 154 | 142 | 80 |
| 16.0 | 55                                      | 52   | 48   | 30.3 | 77              | 72 | 67 | 68 | 77                               | 72   | 67   | 25.6 | 107             | 101 | 93  | 74 | 121                              | 114  | 105  | 20.4 | 168             | 159 | 147 | 81 |
| 17.0 | 50                                      | 47   | 44   | 31.7 | 79              | 74 | 69 | 69 | 70                               | 66   | 61   | 26.8 | 110             | 104 | 96  | 74 | 110                              | 104  | 96   | 21.4 | 174             | 163 | 151 | 81 |
| 18.0 | 46                                      | 43   | 40   | 33.1 | 81              | 76 | 71 | 69 | 64                               | 61   | 56   | 28.0 | 114             | 107 | 99  | 75 | 101                              | 95   | 88   | 22.3 | 178             | 168 | 155 | 82 |
| 19.0 | 42                                      | 40   | 37   | 34.5 | 83              | 78 | 73 | 70 | 59                               | 56   | 52   | 29.1 | 117             | 110 | 102 | 75 | 93                               | 88   | 81   | 23.2 | 183             | 173 | 160 | 82 |
| 20.0 | 39                                      | 37   | 34   | 35.8 | 85              | 80 | 74 | 70 | 55                               | 52   | 48   | 30.3 | 120             | 113 | 104 | 75 | 86                               | 81   | 75   | 24.2 | 188             | 177 | 164 | 83 |
| 22.0 | 34                                      | 32   | 30   | 38.5 | 89              | 84 | 78 | 71 | 47                               | 45   | 41   | 32.6 | 125             | 118 | 109 | 76 | 75                               | 70   | 65   | 26.0 | 197             | 185 | 171 | 83 |
| 24.0 | 30                                      | 28   | 26   | 41.1 | 93              | 88 | 81 | 71 | 42                               | 39   | 36   | 34.8 | 131             | 123 | 114 | 77 | 65                               | 62   | 57   | 27.7 | 205             | 193 | 179 | 84 |
| 26.0 | 26                                      | 25   | 23   | 43.7 | 97              | 91 | 85 | 72 | 37                               | 35   | 32   | 36.9 | 136             | 128 | 118 | 78 | 58                               | 55   | 50   | 29.5 | 214             | 201 | 186 | 85 |
| 28.0 | 24                                      | 22   | 21   | 46.2 | 101             | 95 | 88 | 73 | 33                               | 31   | 29   | 39.1 | 141             | 133 | 123 | 78 | 52                               | 49   | 45   | 31.2 | 222             | 209 | 193 | 85 |
| 30.0 | 21                                      | 20   | 18   | 48.7 | 104             | 98 | 91 | 73 | 30                               | 28   | 26   | 41.1 | 146             | 137 | 127 | 79 | 47                               | 44   | 41   | 32.8 | 229             | 216 | 200 | 86 |

**Table D4:** Douglas-fir stocking levels for the ABGR/CAGE plant association (B-O province).

| QMD  | Climate Resilience; SDI 94; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 132; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 207; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3042                                   | 2864 | 2648 | 4.1  | 17              | 16 | 14 | 44 | 4258                             | 4009 | 3707 | 3.4  | 23              | 22  | 20  | 49 | 6692                             | 6300 | 5826 | 2.7  | 36              | 34  | 32  | 57 |
| 1.5  | 1649                                   | 1553 | 1436 | 5.5  | 20              | 19 | 18 | 47 | 2309                             | 2174 | 2010 | 4.7  | 28              | 27  | 25  | 53 | 3628                             | 3416 | 3158 | 3.7  | 45              | 42  | 39  | 60 |
| 2.0  | 1068                                   | 1006 | 930  | 6.9  | 23              | 22 | 20 | 50 | 1495                             | 1408 | 1302 | 5.8  | 33              | 31  | 28  | 55 | 2350                             | 2212 | 2046 | 4.6  | 51              | 48  | 45  | 62 |
| 2.5  | 762                                    | 718  | 664  | 8.1  | 26              | 24 | 23 | 51 | 1067                             | 1005 | 929  | 6.9  | 36              | 34  | 32  | 56 | 1677                             | 1579 | 1460 | 5.5  | 57              | 54  | 50  | 64 |
| 3.0  | 579                                    | 545  | 504  | 9.3  | 28              | 27 | 25 | 53 | 811                              | 763  | 706  | 7.9  | 40              | 37  | 35  | 58 | 1274                             | 1199 | 1109 | 6.3  | 63              | 59  | 54  | 65 |
| 3.5  | 459                                    | 432  | 399  | 10.5 | 31              | 29 | 27 | 54 | 642                              | 605  | 559  | 8.8  | 43              | 40  | 37  | 59 | 1009                             | 950  | 879  | 7.1  | 67              | 63  | 59  | 66 |
| 4.0  | 375                                    | 353  | 326  | 11.6 | 33              | 31 | 28 | 55 | 525                              | 494  | 457  | 9.8  | 46              | 43  | 40  | 60 | 825                              | 777  | 718  | 7.8  | 72              | 68  | 63  | 67 |
| 4.5  | 314                                    | 296  | 273  | 12.7 | 35              | 33 | 30 | 56 | 439                              | 414  | 383  | 10.7 | 49              | 46  | 42  | 61 | 691                              | 650  | 601  | 8.5  | 76              | 72  | 66  | 68 |
| 5.0  | 268                                    | 252  | 233  | 13.7 | 37              | 34 | 32 | 57 | 375                              | 353  | 326  | 11.6 | 51              | 48  | 44  | 62 | 589                              | 555  | 513  | 9.2  | 80              | 76  | 70  | 69 |
| 5.5  | 232                                    | 218  | 202  | 14.7 | 38              | 36 | 33 | 57 | 325                              | 306  | 283  | 12.4 | 54              | 50  | 47  | 63 | 510                              | 480  | 444  | 9.9  | 84              | 79  | 73  | 70 |
| 6.0  | 203                                    | 191  | 177  | 15.7 | 40              | 38 | 35 | 58 | 285                              | 268  | 248  | 13.3 | 56              | 53  | 49  | 63 | 447                              | 421  | 389  | 10.6 | 88              | 83  | 76  | 71 |
| 6.5  | 180                                    | 170  | 157  | 16.7 | 42              | 39 | 36 | 59 | 252                              | 237  | 220  | 14.1 | 58              | 55  | 51  | 64 | 396                              | 373  | 345  | 11.3 | 91              | 86  | 80  | 71 |
| 7.0  | 161                                    | 152  | 140  | 17.7 | 43              | 41 | 37 | 59 | 226                              | 212  | 196  | 14.9 | 60              | 57  | 52  | 64 | 354                              | 334  | 309  | 11.9 | 95              | 89  | 82  | 72 |
| 7.5  | 145                                    | 137  | 126  | 18.6 | 45              | 42 | 39 | 60 | 203                              | 191  | 177  | 15.7 | 62              | 59  | 54  | 65 | 319                              | 301  | 278  | 12.6 | 98              | 92  | 85  | 72 |
| 8.0  | 132                                    | 124  | 115  | 19.5 | 46              | 43 | 40 | 60 | 184                              | 174  | 160  | 16.5 | 64              | 61  | 56  | 66 | 290                              | 273  | 252  | 13.2 | 101             | 95  | 88  | 73 |
| 8.5  | 120                                    | 113  | 105  | 20.5 | 47              | 45 | 41 | 61 | 168                              | 158  | 146  | 17.3 | 66              | 62  | 58  | 66 | 264                              | 249  | 230  | 13.8 | 104             | 98  | 91  | 73 |
| 9.0  | 110                                    | 104  | 96   | 21.4 | 49              | 46 | 42 | 61 | 154                              | 145  | 134  | 18.1 | 68              | 64  | 59  | 66 | 242                              | 228  | 211  | 14.4 | 107             | 101 | 93  | 74 |
| 9.5  | 102                                    | 96   | 88   | 22.3 | 50              | 47 | 44 | 62 | 142                              | 134  | 124  | 18.8 | 70              | 66  | 61  | 67 | 223                              | 210  | 195  | 15.0 | 110             | 104 | 96  | 74 |
| 10.0 | 94                                     | 89   | 82   | 23.1 | 51              | 48 | 45 | 62 | 132                              | 124  | 115  | 19.6 | 72              | 68  | 62  | 67 | 207                              | 195  | 180  | 15.6 | 113             | 106 | 98  | 75 |
| 11.0 | 81                                     | 77   | 71   | 24.9 | 54              | 51 | 47 | 63 | 114                              | 107  | 99   | 21.0 | 75              | 71  | 65  | 68 | 179                              | 169  | 156  | 16.8 | 118             | 111 | 103 | 75 |
| 12.0 | 71                                     | 67   | 62   | 26.5 | 56              | 53 | 49 | 63 | 100                              | 94   | 87   | 22.4 | 78              | 74  | 68  | 69 | 157                              | 148  | 137  | 17.9 | 123             | 116 | 107 | 76 |
| 13.0 | 63                                     | 60   | 55   | 28.2 | 58              | 55 | 51 | 64 | 89                               | 83   | 77   | 23.8 | 82              | 77  | 71  | 69 | 139                              | 131  | 121  | 19.0 | 128             | 121 | 112 | 77 |
| 14.0 | 57                                     | 53   | 49   | 29.8 | 60              | 57 | 53 | 65 | 79                               | 75   | 69   | 25.2 | 85              | 80  | 74  | 70 | 124                              | 117  | 108  | 20.1 | 133             | 125 | 116 | 77 |
| 15.0 | 51                                     | 48   | 44   | 31.4 | 63              | 59 | 54 | 65 | 71                               | 67   | 62   | 26.6 | 88              | 82  | 76  | 70 | 112                              | 106  | 98   | 21.2 | 138             | 130 | 120 | 78 |
| 16.0 | 46                                     | 44   | 40   | 33.0 | 65              | 61 | 56 | 66 | 65                               | 61   | 56   | 27.9 | 90              | 85  | 79  | 71 | 102                              | 96   | 89   | 22.2 | 142             | 134 | 124 | 78 |
| 17.0 | 42                                     | 40   | 37   | 34.5 | 66              | 63 | 58 | 66 | 59                               | 56   | 51   | 29.2 | 93              | 88  | 81  | 71 | 93                               | 87   | 81   | 23.3 | 146             | 138 | 127 | 79 |
| 18.0 | 39                                     | 36   | 34   | 36.1 | 68              | 64 | 60 | 67 | 54                               | 51   | 47   | 30.5 | 96              | 90  | 83  | 72 | 85                               | 80   | 74   | 24.3 | 150             | 142 | 131 | 79 |
| 19.0 | 36                                     | 34   | 31   | 37.6 | 70              | 66 | 61 | 67 | 50                               | 47   | 43   | 31.7 | 98              | 93  | 86  | 72 | 78                               | 74   | 68   | 25.3 | 154             | 145 | 134 | 80 |
| 20.0 | 33                                     | 31   | 29   | 39.0 | 72              | 68 | 63 | 67 | 46                               | 44   | 40   | 33.0 | 101             | 95  | 88  | 73 | 73                               | 68   | 63   | 26.3 | 158             | 149 | 138 | 80 |
| 22.0 | 29                                     | 27   | 25   | 42.0 | 75              | 71 | 66 | 68 | 40                               | 38   | 35   | 35.5 | 106             | 99  | 92  | 73 | 63                               | 59   | 55   | 28.3 | 166             | 156 | 145 | 81 |
| 24.0 | 25                                     | 24   | 22   | 44.8 | 79              | 74 | 69 | 69 | 35                               | 33   | 31   | 37.9 | 110             | 104 | 96  | 74 | 55                               | 52   | 48   | 30.2 | 173             | 163 | 151 | 81 |
| 26.0 | 22                                     | 21   | 19   | 47.6 | 82              | 77 | 71 | 69 | 31                               | 29   | 27   | 40.2 | 115             | 108 | 100 | 75 | 49                               | 46   | 43   | 32.1 | 180             | 170 | 157 | 82 |
| 28.0 | 20                                     | 19   | 17   | 50.3 | 85              | 80 | 74 | 70 | 28                               | 26   | 24   | 42.5 | 119             | 112 | 103 | 75 | 44                               | 41   | 38   | 33.9 | 187             | 176 | 163 | 83 |
| 30.0 | 18                                     | 17   | 16   | 53.0 | 88              | 83 | 76 | 71 | 25                               | 24   | 22   | 44.8 | 123             | 116 | 107 | 76 | 39                               | 37   | 34   | 35.7 | 193             | 182 | 168 | 83 |



**Table D5:** Douglas-fir stocking levels for the ABGR/SPBE plant association (B-O province).

| QMD  | Climate Resilience; SDI 62; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 87; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 136; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2006                                   | 1889 | 1747 | 5.0  | 11              | 10 | 10 | 38 | 2809                            | 2644 | 2445 | 4.2  | 15              | 14 | 13 | 43 | 4414                             | 4156 | 3843 | 3.4  | 24              | 23  | 21  | 50 |
| 1.5  | 1088                                   | 1024 | 947  | 6.8  | 13              | 13 | 12 | 41 | 1523                            | 1434 | 1326 | 5.7  | 19              | 18 | 16 | 46 | 2393                             | 2253 | 2083 | 4.6  | 29              | 28  | 26  | 53 |
| 2.0  | 704                                    | 663  | 613  | 8.5  | 15              | 14 | 13 | 43 | 986                             | 929  | 859  | 7.1  | 22              | 20 | 19 | 48 | 1550                             | 1459 | 1349 | 5.7  | 34              | 32  | 29  | 55 |
| 2.5  | 503                                    | 474  | 438  | 10.0 | 17              | 16 | 15 | 45 | 704                             | 663  | 613  | 8.5  | 24              | 23 | 21 | 50 | 1106                             | 1042 | 963  | 6.7  | 38              | 36  | 33  | 57 |
| 3.0  | 382                                    | 360  | 332  | 11.5 | 19              | 18 | 16 | 46 | 535                             | 503  | 465  | 9.7  | 26              | 25 | 23 | 51 | 840                              | 791  | 731  | 7.7  | 41              | 39  | 36  | 58 |
| 3.5  | 303                                    | 285  | 263  | 12.9 | 20              | 19 | 18 | 47 | 424                             | 399  | 369  | 10.9 | 28              | 27 | 25 | 53 | 666                              | 627  | 580  | 8.7  | 44              | 42  | 39  | 60 |
| 4.0  | 247                                    | 233  | 215  | 14.3 | 22              | 20 | 19 | 48 | 346                             | 326  | 301  | 12.1 | 30              | 28 | 26 | 54 | 544                              | 512  | 474  | 9.6  | 47              | 45  | 41  | 61 |
| 4.5  | 207                                    | 195  | 180  | 15.6 | 23              | 22 | 20 | 49 | 290                             | 273  | 252  | 13.2 | 32              | 30 | 28 | 54 | 455                              | 429  | 397  | 10.5 | 50              | 47  | 44  | 62 |
| 5.0  | 177                                    | 166  | 154  | 16.9 | 24              | 23 | 21 | 50 | 247                             | 233  | 215  | 14.3 | 34              | 32 | 29 | 55 | 388                              | 366  | 338  | 11.4 | 53              | 50  | 46  | 62 |
| 5.5  | 153                                    | 144  | 133  | 18.1 | 25              | 24 | 22 | 51 | 214                             | 202  | 186  | 15.3 | 35              | 33 | 31 | 56 | 336                              | 317  | 293  | 12.2 | 56              | 52  | 48  | 63 |
| 6.0  | 134                                    | 126  | 117  | 19.4 | 26              | 25 | 23 | 51 | 188                             | 177  | 163  | 16.4 | 37              | 35 | 32 | 57 | 295                              | 278  | 257  | 13.1 | 58              | 55  | 50  | 64 |
| 6.5  | 119                                    | 112  | 103  | 20.6 | 27              | 26 | 24 | 52 | 166                             | 157  | 145  | 17.4 | 38              | 36 | 33 | 57 | 261                              | 246  | 228  | 13.9 | 60              | 57  | 52  | 64 |
| 7.0  | 106                                    | 100  | 92   | 21.8 | 28              | 27 | 25 | 53 | 149                             | 140  | 129  | 18.4 | 40              | 37 | 35 | 58 | 234                              | 220  | 203  | 14.7 | 62              | 59  | 54  | 65 |
| 7.5  | 96                                     | 90   | 83   | 22.9 | 29              | 28 | 26 | 53 | 134                             | 126  | 117  | 19.4 | 41              | 39 | 36 | 58 | 211                              | 198  | 183  | 15.5 | 65              | 61  | 56  | 66 |
| 8.0  | 87                                     | 82   | 76   | 24.1 | 30              | 29 | 26 | 54 | 122                             | 114  | 106  | 20.3 | 42              | 40 | 37 | 59 | 191                              | 180  | 166  | 16.2 | 67              | 63  | 58  | 66 |
| 8.5  | 79                                     | 75   | 69   | 25.2 | 31              | 29 | 27 | 54 | 111                             | 104  | 97   | 21.3 | 44              | 41 | 38 | 59 | 174                              | 164  | 152  | 17.0 | 69              | 65  | 60  | 67 |
| 9.0  | 73                                     | 68   | 63   | 26.3 | 32              | 30 | 28 | 55 | 102                             | 96   | 89   | 22.2 | 45              | 42 | 39 | 60 | 160                              | 151  | 139  | 17.7 | 71              | 67  | 62  | 67 |
| 9.5  | 67                                     | 63   | 58   | 27.4 | 33              | 31 | 29 | 55 | 94                              | 88   | 82   | 23.2 | 46              | 43 | 40 | 60 | 147                              | 139  | 128  | 18.5 | 73              | 68  | 63  | 67 |
| 10.0 | 62                                     | 58   | 54   | 28.5 | 34              | 32 | 29 | 55 | 87                              | 82   | 76   | 24.1 | 47              | 45 | 41 | 61 | 136                              | 128  | 119  | 19.2 | 74              | 70  | 65  | 68 |
| 11.0 | 54                                     | 51   | 47   | 30.6 | 35              | 33 | 31 | 56 | 75                              | 71   | 65   | 25.9 | 50              | 47 | 43 | 61 | 118                              | 111  | 103  | 20.6 | 78              | 73  | 68  | 69 |
| 12.0 | 47                                     | 44   | 41   | 32.7 | 37              | 35 | 32 | 57 | 66                              | 62   | 57   | 27.6 | 52              | 49 | 45 | 62 | 104                              | 98   | 90   | 22.0 | 81              | 77  | 71  | 69 |
| 13.0 | 42                                     | 39   | 36   | 34.7 | 38              | 36 | 33 | 57 | 58                              | 55   | 51   | 29.3 | 54              | 51 | 47 | 63 | 92                               | 86   | 80   | 23.4 | 85              | 80  | 74  | 70 |
| 14.0 | 37                                     | 35   | 32   | 36.7 | 40              | 38 | 35 | 58 | 52                              | 49   | 45   | 31.0 | 56              | 53 | 49 | 63 | 82                               | 77   | 71   | 24.8 | 88              | 83  | 76  | 70 |
| 15.0 | 34                                     | 32   | 29   | 38.7 | 41              | 39 | 36 | 58 | 47                              | 44   | 41   | 32.7 | 58              | 54 | 50 | 64 | 74                               | 70   | 64   | 26.1 | 91              | 85  | 79  | 71 |
| 16.0 | 30                                     | 29   | 27   | 40.6 | 43              | 40 | 37 | 59 | 43                              | 40   | 37   | 34.3 | 60              | 56 | 52 | 64 | 67                               | 63   | 58   | 27.4 | 94              | 88  | 82  | 72 |
| 17.0 | 28                                     | 26   | 24   | 42.5 | 44              | 41 | 38 | 59 | 39                              | 37   | 34   | 35.9 | 61              | 58 | 53 | 65 | 61                               | 58   | 53   | 28.7 | 96              | 91  | 84  | 72 |
| 18.0 | 26                                     | 24   | 22   | 44.4 | 45              | 42 | 39 | 60 | 36                              | 34   | 31   | 37.5 | 63              | 59 | 55 | 65 | 56                               | 53   | 49   | 29.9 | 99              | 93  | 86  | 72 |
| 19.0 | 24                                     | 22   | 20   | 46.2 | 46              | 44 | 40 | 60 | 33                              | 31   | 29   | 39.1 | 65              | 61 | 56 | 66 | 52                               | 49   | 45   | 31.2 | 102             | 96  | 89  | 73 |
| 20.0 | 22                                     | 20   | 19   | 48.1 | 47              | 45 | 41 | 61 | 30                              | 29   | 27   | 40.6 | 66              | 63 | 58 | 66 | 48                               | 45   | 42   | 32.4 | 104             | 98  | 91  | 73 |
| 22.0 | 19                                     | 18   | 16   | 51.7 | 50              | 47 | 43 | 61 | 26                              | 25   | 23   | 43.7 | 70              | 66 | 61 | 67 | 41                               | 39   | 36   | 34.8 | 109             | 103 | 95  | 74 |
| 24.0 | 17                                     | 16   | 14   | 55.2 | 52              | 49 | 45 | 62 | 23                              | 22   | 20   | 46.6 | 73              | 68 | 63 | 67 | 36                               | 34   | 32   | 37.2 | 114             | 108 | 99  | 75 |
| 26.0 | 15                                     | 14   | 13   | 58.6 | 54              | 51 | 47 | 63 | 21                              | 19   | 18   | 49.5 | 76              | 71 | 66 | 68 | 32                               | 30   | 28   | 39.5 | 119             | 112 | 103 | 75 |
| 28.0 | 13                                     | 12   | 11   | 62.0 | 56              | 53 | 49 | 63 | 18                              | 17   | 16   | 52.4 | 78              | 74 | 68 | 69 | 29                               | 27   | 25   | 41.8 | 123             | 116 | 107 | 76 |
| 30.0 | 12                                     | 11   | 10   | 65.3 | 58              | 55 | 50 | 64 | 17                              | 16   | 14   | 55.2 | 81              | 76 | 71 | 69 | 26                               | 24   | 23   | 44.0 | 127             | 120 | 111 | 76 |



**Table D6:** Douglas-fir stocking levels for the ABGR/VASC-LIBO2 (B-O province) and ABGR/VAME (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 108; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 152; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 239; 55% of Max |      |      |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3511                                    | 3306 | 3057 | 3.8  | 19              | 18 | 17 | 46 | 4915                             | 4628 | 4279 | 3.2  | 27              | 25  | 23  | 52 | 7724                             | 7272 | 6725 | 2.6  | 42              | 40  | 37  | 59 |
| 1.5  | 1903                                    | 1792 | 1657 | 5.1  | 23              | 22 | 20 | 50 | 2665                             | 2509 | 2320 | 4.3  | 33              | 31  | 28  | 55 | 4187                             | 3943 | 3646 | 3.5  | 51              | 48  | 45  | 62 |
| 2.0  | 1233                                    | 1161 | 1073 | 6.4  | 27              | 25 | 23 | 52 | 1726                             | 1625 | 1503 | 5.4  | 38              | 35  | 33  | 57 | 2712                             | 2553 | 2361 | 4.3  | 59              | 56  | 52  | 64 |
| 2.5  | 880                                     | 829  | 766  | 7.6  | 30              | 28 | 26 | 53 | 1232                             | 1160 | 1073 | 6.4  | 42              | 40  | 37  | 59 | 1936                             | 1823 | 1686 | 5.1  | 66              | 62  | 57  | 66 |
| 3.0  | 668                                     | 629  | 582  | 8.7  | 33              | 31 | 29 | 55 | 936                              | 881  | 815  | 7.3  | 46              | 43  | 40  | 60 | 1470                             | 1384 | 1280 | 5.8  | 72              | 68  | 63  | 67 |
| 3.5  | 530                                     | 499  | 461  | 9.7  | 35              | 33 | 31 | 56 | 741                              | 698  | 645  | 8.2  | 50              | 47  | 43  | 61 | 1165                             | 1097 | 1014 | 6.6  | 78              | 73  | 68  | 69 |
| 4.0  | 433                                     | 408  | 377  | 10.8 | 38              | 36 | 33 | 57 | 606                              | 571  | 528  | 9.1  | 53              | 50  | 46  | 62 | 952                              | 897  | 829  | 7.3  | 83              | 78  | 72  | 70 |
| 4.5  | 362                                     | 341  | 315  | 11.8 | 40              | 38 | 35 | 58 | 507                              | 478  | 442  | 10.0 | 56              | 53  | 49  | 63 | 797                              | 750  | 694  | 7.9  | 88              | 83  | 77  | 71 |
| 5.0  | 309                                     | 291  | 269  | 12.8 | 42              | 40 | 37 | 59 | 433                              | 407  | 377  | 10.8 | 59              | 56  | 51  | 64 | 680                              | 640  | 592  | 8.6  | 93              | 87  | 81  | 71 |
| 5.5  | 268                                     | 252  | 233  | 13.7 | 44              | 42 | 38 | 60 | 375                              | 353  | 326  | 11.6 | 62              | 58  | 54  | 65 | 589                              | 554  | 513  | 9.2  | 97              | 91  | 85  | 72 |
| 6.0  | 235                                     | 221  | 204  | 14.6 | 46              | 43 | 40 | 60 | 329                              | 309  | 286  | 12.4 | 65              | 61  | 56  | 66 | 516                              | 486  | 449  | 9.9  | 101             | 95  | 88  | 73 |
| 6.5  | 208                                     | 196  | 181  | 15.6 | 48              | 45 | 42 | 61 | 291                              | 274  | 253  | 13.1 | 67              | 63  | 58  | 66 | 457                              | 431  | 398  | 10.5 | 105             | 99  | 92  | 73 |
| 7.0  | 186                                     | 175  | 162  | 16.4 | 50              | 47 | 43 | 61 | 260                              | 245  | 227  | 13.9 | 70              | 65  | 61  | 67 | 409                              | 385  | 356  | 11.1 | 109             | 103 | 95  | 74 |
| 7.5  | 168                                     | 158  | 146  | 17.3 | 51              | 48 | 45 | 62 | 235                              | 221  | 204  | 14.6 | 72              | 68  | 63  | 67 | 369                              | 347  | 321  | 11.7 | 113             | 106 | 98  | 75 |
| 8.0  | 152                                     | 143  | 132  | 18.2 | 53              | 50 | 46 | 62 | 213                              | 200  | 185  | 15.4 | 74              | 70  | 65  | 68 | 334                              | 315  | 291  | 12.3 | 117             | 110 | 102 | 75 |
| 8.5  | 139                                     | 131  | 121  | 19.0 | 55              | 51 | 48 | 63 | 194                              | 183  | 169  | 16.1 | 77              | 72  | 67  | 68 | 305                              | 287  | 266  | 12.8 | 120             | 113 | 105 | 76 |
| 9.0  | 127                                     | 120  | 111  | 19.9 | 56              | 53 | 49 | 63 | 178                              | 168  | 155  | 16.8 | 79              | 74  | 68  | 69 | 280                              | 263  | 244  | 13.4 | 124             | 116 | 108 | 76 |
| 9.5  | 117                                     | 110  | 102  | 20.7 | 58              | 54 | 50 | 64 | 164                              | 155  | 143  | 17.5 | 81              | 76  | 70  | 69 | 258                              | 243  | 225  | 14.0 | 127             | 120 | 111 | 76 |
| 10.0 | 109                                     | 102  | 94   | 21.5 | 59              | 56 | 52 | 64 | 152                              | 143  | 132  | 18.2 | 83              | 78  | 72  | 70 | 239                              | 225  | 208  | 14.5 | 130             | 123 | 113 | 77 |
| 11.0 | 94                                      | 88   | 82   | 23.1 | 62              | 58 | 54 | 65 | 132                              | 124  | 115  | 19.6 | 87              | 82  | 76  | 70 | 207                              | 195  | 180  | 15.6 | 136             | 128 | 119 | 78 |
| 12.0 | 82                                      | 78   | 72   | 24.7 | 65              | 61 | 56 | 66 | 115                              | 109  | 100  | 20.9 | 91              | 85  | 79  | 71 | 181                              | 171  | 158  | 16.7 | 142             | 134 | 124 | 78 |
| 13.0 | 73                                      | 69   | 64   | 26.2 | 67              | 63 | 59 | 66 | 102                              | 96   | 89   | 22.2 | 94              | 89  | 82  | 72 | 161                              | 151  | 140  | 17.7 | 148             | 139 | 129 | 79 |
| 14.0 | 65                                      | 61   | 57   | 27.8 | 70              | 66 | 61 | 67 | 91                               | 86   | 80   | 23.5 | 98              | 92  | 85  | 72 | 144                              | 135  | 125  | 18.7 | 154             | 145 | 134 | 79 |
| 15.0 | 59                                      | 55   | 51   | 29.2 | 72              | 68 | 63 | 67 | 82                               | 78   | 72   | 24.7 | 101             | 95  | 88  | 73 | 129                              | 122  | 113  | 19.7 | 159             | 150 | 138 | 80 |
| 16.0 | 53                                      | 50   | 46   | 30.7 | 75              | 70 | 65 | 68 | 75                               | 70   | 65   | 25.9 | 104             | 98  | 91  | 73 | 117                              | 111  | 102  | 20.7 | 164             | 154 | 143 | 81 |
| 17.0 | 49                                      | 46   | 42   | 32.1 | 77              | 72 | 67 | 68 | 68                               | 64   | 59   | 27.2 | 107             | 101 | 94  | 74 | 107                              | 101  | 93   | 21.7 | 169             | 159 | 147 | 81 |
| 18.0 | 45                                      | 42   | 39   | 33.6 | 79              | 74 | 69 | 69 | 63                               | 59   | 54   | 28.4 | 111             | 104 | 96  | 74 | 98                               | 93   | 86   | 22.6 | 174             | 163 | 151 | 81 |
| 19.0 | 41                                      | 39   | 36   | 35.0 | 81              | 76 | 71 | 69 | 58                               | 54   | 50   | 29.5 | 113             | 107 | 99  | 75 | 91                               | 85   | 79   | 23.6 | 178             | 168 | 155 | 82 |
| 20.0 | 38                                      | 36   | 33   | 36.3 | 83              | 78 | 72 | 70 | 53                               | 50   | 46   | 30.7 | 116             | 110 | 101 | 75 | 84                               | 79   | 73   | 24.5 | 183             | 172 | 159 | 82 |
| 22.0 | 33                                      | 31   | 29   | 39.0 | 87              | 82 | 76 | 70 | 46                               | 43   | 40   | 33.0 | 122             | 115 | 106 | 76 | 73                               | 68   | 63   | 26.3 | 192             | 180 | 167 | 83 |
| 24.0 | 29                                      | 27   | 25   | 41.7 | 91              | 86 | 79 | 71 | 40                               | 38   | 35   | 35.2 | 127             | 120 | 111 | 76 | 64                               | 60   | 55   | 28.1 | 200             | 188 | 174 | 84 |
| 26.0 | 26                                      | 24   | 22   | 44.3 | 95              | 89 | 82 | 72 | 36                               | 34   | 31   | 37.4 | 132             | 125 | 115 | 77 | 56                               | 53   | 49   | 29.9 | 208             | 196 | 181 | 84 |
| 28.0 | 23                                      | 22   | 20   | 46.8 | 98              | 92 | 85 | 72 | 32                               | 30   | 28   | 39.6 | 137             | 129 | 119 | 78 | 50                               | 47   | 44   | 31.6 | 216             | 203 | 188 | 85 |
| 30.0 | 21                                      | 19   | 18   | 49.4 | 101             | 95 | 88 | 73 | 29                               | 27   | 25   | 41.7 | 142             | 134 | 124 | 78 | 45                               | 43   | 40   | 33.3 | 223             | 210 | 194 | 85 |

**Table D7:** Douglas-fir stocking levels for the ABGR/VASC (B-O province) and PSME/ACGL-PHMA (W-S province) plant associations, and the PICO(ABGR)/VASC/CARU plant community type.

| QMD  | Climate Resilience; SDI 86; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 120; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 188; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2775                                   | 2612 | 2416 | 4.3  | 15              | 14 | 13 | 43 | 3885                             | 3657 | 3382 | 3.6  | 21              | 20  | 18 | 48 | 6105                             | 5747 | 5315 | 2.9  | 33              | 31  | 29  | 55 |
| 1.5  | 1504                                   | 1416 | 1310 | 5.8  | 18              | 17 | 16 | 46 | 2106                             | 1983 | 1834 | 4.9  | 26              | 24  | 23 | 51 | 3309                             | 3116 | 2881 | 3.9  | 41              | 38  | 35  | 58 |
| 2.0  | 974                                    | 917  | 848  | 7.2  | 21              | 20 | 19 | 48 | 1364                             | 1284 | 1187 | 6.1  | 30              | 28  | 26 | 53 | 2143                             | 2018 | 1866 | 4.8  | 47              | 44  | 41  | 60 |
| 2.5  | 696                                    | 655  | 606  | 8.5  | 24              | 22 | 21 | 50 | 974                              | 917  | 848  | 7.2  | 33              | 31  | 29 | 55 | 1530                             | 1441 | 1332 | 5.7  | 52              | 49  | 45  | 62 |
| 3.0  | 528                                    | 497  | 460  | 9.8  | 26              | 24 | 23 | 51 | 739                              | 696  | 644  | 8.2  | 36              | 34  | 32 | 56 | 1162                             | 1094 | 1012 | 6.6  | 57              | 54  | 50  | 64 |
| 3.5  | 418                                    | 394  | 364  | 11.0 | 28              | 26 | 24 | 52 | 586                              | 552  | 510  | 9.3  | 39              | 37  | 34 | 58 | 921                              | 867  | 802  | 7.4  | 62              | 58  | 54  | 65 |
| 4.0  | 342                                    | 322  | 298  | 12.1 | 30              | 28 | 26 | 53 | 479                              | 451  | 417  | 10.2 | 42              | 39  | 36 | 59 | 753                              | 709  | 655  | 8.2  | 66              | 62  | 57  | 66 |
| 4.5  | 286                                    | 270  | 249  | 13.3 | 32              | 30 | 28 | 54 | 401                              | 377  | 349  | 11.2 | 44              | 42  | 39 | 60 | 630                              | 593  | 548  | 8.9  | 70              | 66  | 61  | 67 |
| 5.0  | 244                                    | 230  | 213  | 14.4 | 33              | 31 | 29 | 55 | 342                              | 322  | 298  | 12.1 | 47              | 44  | 41 | 60 | 537                              | 506  | 468  | 9.7  | 73              | 69  | 64  | 68 |
| 5.5  | 211                                    | 199  | 184  | 15.4 | 35              | 33 | 30 | 56 | 296                              | 279  | 258  | 13.0 | 49              | 46  | 43 | 61 | 465                              | 438  | 405  | 10.4 | 77              | 72  | 67  | 68 |
| 6.0  | 185                                    | 175  | 161  | 16.5 | 36              | 34 | 32 | 57 | 260                              | 244  | 226  | 13.9 | 51              | 48  | 44 | 62 | 408                              | 384  | 355  | 11.1 | 80              | 75  | 70  | 69 |
| 6.5  | 164                                    | 155  | 143  | 17.5 | 38              | 36 | 33 | 57 | 230                              | 217  | 200  | 14.8 | 53              | 50  | 46 | 62 | 362                              | 340  | 315  | 11.8 | 83              | 78  | 73  | 70 |
| 7.0  | 147                                    | 138  | 128  | 18.5 | 39              | 37 | 34 | 58 | 206                              | 194  | 179  | 15.6 | 55              | 52  | 48 | 63 | 323                              | 304  | 281  | 12.5 | 86              | 81  | 75  | 70 |
| 7.5  | 132                                    | 125  | 115  | 19.5 | 41              | 38 | 35 | 58 | 185                              | 175  | 161  | 16.5 | 57              | 54  | 50 | 64 | 291                              | 274  | 254  | 13.1 | 89              | 84  | 78  | 71 |
| 8.0  | 120                                    | 113  | 105  | 20.5 | 42              | 39 | 37 | 59 | 168                              | 158  | 146  | 17.3 | 59              | 55  | 51 | 64 | 264                              | 249  | 230  | 13.8 | 92              | 87  | 80  | 71 |
| 8.5  | 110                                    | 103  | 95   | 21.4 | 43              | 41 | 38 | 59 | 153                              | 144  | 134  | 18.1 | 60              | 57  | 53 | 65 | 241                              | 227  | 210  | 14.4 | 95              | 89  | 83  | 72 |
| 9.0  | 101                                    | 95   | 88   | 22.4 | 44              | 42 | 39 | 60 | 141                              | 133  | 123  | 18.9 | 62              | 59  | 54 | 65 | 221                              | 208  | 193  | 15.1 | 98              | 92  | 85  | 72 |
| 9.5  | 93                                     | 87   | 81   | 23.3 | 46              | 43 | 40 | 60 | 130                              | 122  | 113  | 19.7 | 64              | 60  | 56 | 65 | 204                              | 192  | 177  | 15.7 | 100             | 94  | 87  | 73 |
| 10.0 | 86                                     | 81   | 75   | 24.2 | 47              | 44 | 41 | 60 | 120                              | 113  | 105  | 20.5 | 65              | 62  | 57 | 66 | 189                              | 178  | 164  | 16.3 | 103             | 97  | 90  | 73 |
| 11.0 | 74                                     | 70   | 65   | 26.0 | 49              | 46 | 43 | 61 | 104                              | 98   | 91   | 22.0 | 69              | 65  | 60 | 67 | 163                              | 154  | 142  | 17.5 | 108             | 102 | 94  | 74 |
| 12.0 | 65                                     | 61   | 57   | 27.8 | 51              | 48 | 45 | 62 | 91                               | 86   | 79   | 23.5 | 72              | 67  | 62 | 67 | 143                              | 135  | 125  | 18.7 | 113             | 106 | 98  | 74 |
| 13.0 | 58                                     | 54   | 50   | 29.5 | 53              | 50 | 46 | 62 | 81                               | 76   | 70   | 25.0 | 74              | 70  | 65 | 68 | 127                              | 120  | 111  | 19.9 | 117             | 110 | 102 | 75 |
| 14.0 | 52                                     | 49   | 45   | 31.2 | 55              | 52 | 48 | 63 | 72                               | 68   | 63   | 26.4 | 77              | 73  | 67 | 68 | 114                              | 107  | 99   | 21.1 | 121             | 114 | 106 | 76 |
| 15.0 | 46                                     | 44   | 40   | 32.9 | 57              | 54 | 50 | 64 | 65                               | 61   | 57   | 27.8 | 80              | 75  | 70 | 69 | 102                              | 96   | 89   | 22.2 | 126             | 118 | 109 | 76 |
| 16.0 | 42                                     | 40   | 37   | 34.5 | 59              | 55 | 51 | 64 | 59                               | 56   | 51   | 29.2 | 82              | 78  | 72 | 69 | 93                               | 87   | 81   | 23.3 | 130             | 122 | 113 | 77 |
| 17.0 | 38                                     | 36   | 34   | 36.2 | 61              | 57 | 53 | 65 | 54                               | 51   | 47   | 30.6 | 85              | 80  | 74 | 70 | 85                               | 80   | 74   | 24.4 | 133             | 126 | 116 | 77 |
| 18.0 | 35                                     | 33   | 31   | 37.7 | 62              | 59 | 54 | 65 | 49                               | 47   | 43   | 31.9 | 87              | 82  | 76 | 70 | 78                               | 73   | 68   | 25.4 | 137             | 129 | 119 | 78 |
| 19.0 | 33                                     | 31   | 28   | 39.3 | 64              | 60 | 56 | 65 | 46                               | 43   | 40   | 33.2 | 90              | 84  | 78 | 71 | 72                               | 67   | 62   | 26.5 | 141             | 133 | 123 | 78 |
| 20.0 | 30                                     | 28   | 26   | 40.9 | 66              | 62 | 57 | 66 | 42                               | 40   | 37   | 34.5 | 92              | 87  | 80 | 71 | 66                               | 62   | 58   | 27.6 | 145             | 136 | 126 | 79 |
| 22.0 | 26                                     | 25   | 23   | 43.9 | 69              | 65 | 60 | 67 | 37                               | 34   | 32   | 37.1 | 96              | 91  | 84 | 72 | 57                               | 54   | 50   | 29.6 | 151             | 143 | 132 | 79 |
| 24.0 | 23                                     | 22   | 20   | 46.9 | 72              | 68 | 63 | 67 | 32                               | 30   | 28   | 39.6 | 101             | 95  | 88 | 73 | 50                               | 47   | 44   | 31.6 | 158             | 149 | 138 | 80 |
| 26.0 | 20                                     | 19   | 18   | 49.8 | 75              | 70 | 65 | 68 | 28                               | 27   | 25   | 42.1 | 105             | 98  | 91 | 73 | 45                               | 42   | 39   | 33.6 | 164             | 155 | 143 | 81 |
| 28.0 | 18                                     | 17   | 16   | 52.7 | 77              | 73 | 67 | 68 | 25                               | 24   | 22   | 44.5 | 108             | 102 | 94 | 74 | 40                               | 38   | 35   | 35.5 | 170             | 160 | 148 | 81 |
| 30.0 | 16                                     | 15   | 14   | 55.5 | 80              | 75 | 70 | 69 | 23                               | 22   | 20   | 46.9 | 112             | 106 | 98 | 74 | 36                               | 34   | 31   | 37.4 | 176             | 166 | 153 | 82 |

**Table D8:** Douglas-fir stocking levels for the ABLA2/VASC plant association (B-O province) and the PICO(ABLA2)/VASC plant community type.

| QMD  | Climate Resilience; SDI 114; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 160; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 252; 55% of Max |      |      |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3705                                    | 3488 | 3226 | 3.7  | 20              | 19  | 18 | 47 | 5187                             | 4884 | 4516 | 3.1  | 28              | 27  | 25  | 53 | 8151                             | 7674 | 7097 | 2.5  | 44              | 42  | 39  | 60 |
| 1.5  | 2009                                    | 1891 | 1749 | 5.0  | 25              | 23  | 21 | 50 | 2812                             | 2648 | 2448 | 4.2  | 35              | 32  | 30  | 56 | 4419                             | 4161 | 3847 | 3.4  | 54              | 51  | 47  | 63 |
| 2.0  | 1301                                    | 1225 | 1133 | 6.2  | 28              | 27  | 25 | 53 | 1821                             | 1715 | 1586 | 5.3  | 40              | 37  | 35  | 58 | 2862                             | 2695 | 2492 | 4.2  | 62              | 59  | 54  | 65 |
| 2.5  | 929                                     | 874  | 809  | 7.4  | 32              | 30  | 28 | 54 | 1300                             | 1224 | 1132 | 6.2  | 44              | 42  | 39  | 60 | 2043                             | 1924 | 1779 | 5.0  | 70              | 66  | 61  | 67 |
| 3.0  | 705                                     | 664  | 614  | 8.4  | 35              | 33  | 30 | 56 | 987                              | 930  | 860  | 7.1  | 48              | 46  | 42  | 61 | 1552                             | 1461 | 1351 | 5.7  | 76              | 72  | 66  | 68 |
| 3.5  | 559                                     | 526  | 486  | 9.5  | 37              | 35  | 33 | 57 | 782                              | 737  | 681  | 8.0  | 52              | 49  | 46  | 62 | 1229                             | 1157 | 1070 | 6.4  | 82              | 77  | 72  | 69 |
| 4.0  | 457                                     | 430  | 398  | 10.5 | 40              | 38  | 35 | 58 | 639                              | 602  | 557  | 8.9  | 56              | 53  | 49  | 63 | 1005                             | 946  | 875  | 7.1  | 88              | 83  | 76  | 70 |
| 4.5  | 382                                     | 360  | 333  | 11.5 | 42              | 40  | 37 | 59 | 535                              | 504  | 466  | 9.7  | 59              | 56  | 51  | 64 | 841                              | 792  | 732  | 7.7  | 93              | 87  | 81  | 71 |
| 5.0  | 326                                     | 307  | 284  | 12.4 | 44              | 42  | 39 | 60 | 457                              | 430  | 397  | 10.5 | 62              | 59  | 54  | 65 | 717                              | 675  | 625  | 8.4  | 98              | 92  | 85  | 72 |
| 5.5  | 282                                     | 266  | 246  | 13.3 | 47              | 44  | 41 | 60 | 395                              | 372  | 344  | 11.3 | 65              | 61  | 57  | 66 | 621                              | 585  | 541  | 9.0  | 103             | 97  | 89  | 73 |
| 6.0  | 248                                     | 233  | 216  | 14.3 | 49              | 46  | 42 | 61 | 347                              | 326  | 302  | 12.0 | 68              | 64  | 59  | 66 | 545                              | 513  | 474  | 9.6  | 107             | 101 | 93  | 74 |
| 6.5  | 219                                     | 207  | 191  | 15.1 | 51              | 48  | 44 | 62 | 307                              | 289  | 267  | 12.8 | 71              | 67  | 62  | 67 | 483                              | 455  | 420  | 10.2 | 111             | 105 | 97  | 74 |
| 7.0  | 196                                     | 185  | 171  | 16.0 | 52              | 49  | 46 | 62 | 275                              | 259  | 239  | 13.5 | 73              | 69  | 64  | 68 | 432                              | 406  | 376  | 10.8 | 115             | 109 | 100 | 75 |
| 7.5  | 177                                     | 166  | 154  | 16.9 | 54              | 51  | 47 | 63 | 248                              | 233  | 215  | 14.3 | 76              | 71  | 66  | 68 | 389                              | 366  | 339  | 11.4 | 119             | 112 | 104 | 75 |
| 8.0  | 160                                     | 151  | 140  | 17.7 | 56              | 53  | 49 | 63 | 225                              | 211  | 195  | 15.0 | 78              | 74  | 68  | 69 | 353                              | 332  | 307  | 11.9 | 123             | 116 | 107 | 76 |
| 8.5  | 146                                     | 138  | 127  | 18.5 | 58              | 54  | 50 | 64 | 205                              | 193  | 178  | 15.7 | 81              | 76  | 70  | 69 | 322                              | 303  | 280  | 12.5 | 127             | 119 | 110 | 76 |
| 9.0  | 134                                     | 126  | 117  | 19.4 | 59              | 56  | 52 | 64 | 188                              | 177  | 164  | 16.4 | 83              | 78  | 72  | 70 | 295                              | 278  | 257  | 13.1 | 130             | 123 | 114 | 77 |
| 9.5  | 124                                     | 116  | 108  | 20.2 | 61              | 57  | 53 | 65 | 173                              | 163  | 151  | 17.0 | 85              | 80  | 74  | 70 | 272                              | 256  | 237  | 13.6 | 134             | 126 | 117 | 77 |
| 10.0 | 115                                     | 108  | 100  | 21.0 | 62              | 59  | 54 | 65 | 160                              | 151  | 140  | 17.7 | 87              | 82  | 76  | 70 | 252                              | 237  | 219  | 14.1 | 137             | 129 | 120 | 78 |
| 11.0 | 99                                      | 93   | 86   | 22.5 | 65              | 62  | 57 | 66 | 139                              | 131  | 121  | 19.0 | 92              | 86  | 80  | 71 | 218                              | 205  | 190  | 15.2 | 144             | 136 | 125 | 78 |
| 12.0 | 87                                      | 82   | 76   | 24.1 | 68              | 64  | 59 | 66 | 122                              | 115  | 106  | 20.3 | 96              | 90  | 83  | 72 | 191                              | 180  | 167  | 16.2 | 150             | 141 | 131 | 79 |
| 13.0 | 77                                      | 73   | 67   | 25.6 | 71              | 67  | 62 | 67 | 108                              | 102  | 94   | 21.6 | 99              | 94  | 87  | 72 | 170                              | 160  | 148  | 17.2 | 156             | 147 | 136 | 80 |
| 14.0 | 69                                      | 65   | 60   | 27.0 | 74              | 69  | 64 | 68 | 96                               | 91   | 84   | 22.8 | 103             | 97  | 90  | 73 | 152                              | 143  | 132  | 18.2 | 162             | 153 | 141 | 80 |
| 15.0 | 62                                      | 58   | 54   | 28.5 | 76              | 72  | 66 | 68 | 87                               | 82   | 76   | 24.1 | 107             | 100 | 93  | 74 | 137                              | 129  | 119  | 19.2 | 168             | 158 | 146 | 81 |
| 16.0 | 56                                      | 53   | 49   | 29.9 | 79              | 74  | 68 | 69 | 79                               | 74   | 69   | 25.3 | 110             | 104 | 96  | 74 | 124                              | 117  | 108  | 20.2 | 173             | 163 | 151 | 81 |
| 17.0 | 51                                      | 48   | 45   | 31.3 | 81              | 76  | 71 | 69 | 72                               | 68   | 63   | 26.4 | 113             | 107 | 99  | 75 | 113                              | 106  | 98   | 21.1 | 178             | 168 | 155 | 82 |
| 18.0 | 47                                      | 44   | 41   | 32.7 | 83              | 78  | 73 | 70 | 66                               | 62   | 57   | 27.6 | 117             | 110 | 102 | 75 | 104                              | 98   | 90   | 22.0 | 183             | 173 | 160 | 82 |
| 19.0 | 43                                      | 41   | 38   | 34.0 | 86              | 81  | 74 | 70 | 61                               | 57   | 53   | 28.8 | 120             | 113 | 104 | 75 | 96                               | 90   | 83   | 22.9 | 188             | 177 | 164 | 83 |
| 20.0 | 40                                      | 38   | 35   | 35.4 | 88              | 83  | 76 | 70 | 56                               | 53   | 49   | 29.9 | 123             | 116 | 107 | 76 | 88                               | 83   | 77   | 23.8 | 193             | 182 | 168 | 83 |
| 22.0 | 35                                      | 33   | 30   | 38.0 | 92              | 87  | 80 | 71 | 49                               | 46   | 42   | 32.1 | 129             | 121 | 112 | 77 | 77                               | 72   | 67   | 25.6 | 202             | 190 | 176 | 84 |
| 24.0 | 31                                      | 29   | 27   | 40.6 | 96              | 90  | 83 | 72 | 43                               | 40   | 37   | 34.3 | 134             | 126 | 117 | 77 | 67                               | 63   | 58   | 27.4 | 211             | 199 | 184 | 85 |
| 26.0 | 27                                      | 25   | 24   | 43.1 | 100             | 94  | 87 | 73 | 38                               | 36   | 33   | 36.4 | 140             | 131 | 122 | 78 | 60                               | 56   | 52   | 29.1 | 219             | 207 | 191 | 85 |
| 28.0 | 24                                      | 23   | 21   | 45.6 | 103             | 97  | 90 | 73 | 34                               | 32   | 29   | 38.5 | 145             | 136 | 126 | 79 | 53                               | 50   | 46   | 30.7 | 228             | 214 | 198 | 86 |
| 30.0 | 22                                      | 21   | 19   | 48.0 | 107             | 101 | 93 | 74 | 31                               | 29   | 27   | 40.6 | 150             | 141 | 130 | 79 | 48                               | 45   | 42   | 32.4 | 235             | 222 | 205 | 86 |

**Table D9:** Douglas-fir stocking levels for the PSME/CAGE plant association (B-O province).

| QMD  | Climate Resilience; SDI 88; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 123; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 193; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2840                                   | 2673 | 2472 | 4.2  | 15              | 15 | 13 | 43 | 3975                             | 3743 | 3461 | 3.6  | 22              | 20  | 19  | 48 | 6247                             | 5882 | 5439 | 2.8  | 34              | 32  | 30  | 55 |
| 1.5  | 1539                                   | 1449 | 1340 | 5.7  | 19              | 18 | 16 | 46 | 2155                             | 2029 | 1876 | 4.8  | 26              | 25  | 23  | 51 | 3387                             | 3189 | 2948 | 3.9  | 42              | 39  | 36  | 59 |
| 2.0  | 997                                    | 939  | 868  | 7.1  | 22              | 20 | 19 | 48 | 1396                             | 1314 | 1215 | 6.0  | 30              | 29  | 27  | 54 | 2193                             | 2065 | 1910 | 4.8  | 48              | 45  | 42  | 61 |
| 2.5  | 712                                    | 670  | 620  | 8.4  | 24              | 23 | 21 | 50 | 997                              | 938  | 868  | 7.1  | 34              | 32  | 30  | 55 | 1566                             | 1474 | 1363 | 5.7  | 53              | 50  | 46  | 63 |
| 3.0  | 540                                    | 509  | 471  | 9.6  | 27              | 25 | 23 | 52 | 757                              | 712  | 659  | 8.2  | 37              | 35  | 32  | 57 | 1189                             | 1120 | 1035 | 6.5  | 58              | 55  | 51  | 64 |
| 3.5  | 428                                    | 403  | 373  | 10.8 | 29              | 27 | 25 | 53 | 600                              | 564  | 522  | 9.2  | 40              | 38  | 35  | 58 | 942                              | 887  | 820  | 7.3  | 63              | 59  | 55  | 65 |
| 4.0  | 350                                    | 330  | 305  | 12.0 | 31              | 29 | 27 | 54 | 490                              | 461  | 427  | 10.1 | 43              | 40  | 37  | 59 | 770                              | 725  | 670  | 8.1  | 67              | 63  | 59  | 66 |
| 4.5  | 293                                    | 276  | 255  | 13.1 | 32              | 30 | 28 | 55 | 410                              | 386  | 357  | 11.1 | 45              | 43  | 39  | 60 | 645                              | 607  | 561  | 8.8  | 71              | 67  | 62  | 67 |
| 5.0  | 250                                    | 235  | 218  | 14.2 | 34              | 32 | 30 | 55 | 350                              | 329  | 305  | 12.0 | 48              | 45  | 42  | 61 | 550                              | 518  | 479  | 9.6  | 75              | 71  | 65  | 68 |
| 5.5  | 216                                    | 204  | 188  | 15.2 | 36              | 34 | 31 | 56 | 303                              | 285  | 264  | 12.9 | 50              | 47  | 44  | 62 | 476                              | 448  | 415  | 10.3 | 79              | 74  | 68  | 69 |
| 6.0  | 190                                    | 179  | 165  | 16.3 | 37              | 35 | 32 | 57 | 266                              | 250  | 231  | 13.8 | 52              | 49  | 45  | 62 | 418                              | 393  | 363  | 11.0 | 82              | 77  | 71  | 69 |
| 6.5  | 168                                    | 158  | 146  | 17.3 | 39              | 36 | 34 | 57 | 235                              | 222  | 205  | 14.6 | 54              | 51  | 47  | 63 | 370                              | 348  | 322  | 11.7 | 85              | 80  | 74  | 70 |
| 7.0  | 150                                    | 142  | 131  | 18.3 | 40              | 38 | 35 | 58 | 211                              | 198  | 183  | 15.5 | 56              | 53  | 49  | 63 | 331                              | 311  | 288  | 12.3 | 88              | 83  | 77  | 71 |
| 7.5  | 135                                    | 128  | 118  | 19.3 | 42              | 39 | 36 | 59 | 190                              | 179  | 165  | 16.3 | 58              | 55  | 51  | 64 | 298                              | 281  | 260  | 13.0 | 91              | 86  | 80  | 71 |
| 8.0  | 123                                    | 116  | 107  | 20.2 | 43              | 40 | 37 | 59 | 172                              | 162  | 150  | 17.1 | 60              | 57  | 52  | 64 | 270                              | 255  | 235  | 13.6 | 94              | 89  | 82  | 72 |
| 8.5  | 112                                    | 106  | 98   | 21.2 | 44              | 42 | 38 | 60 | 157                              | 148  | 137  | 17.9 | 62              | 58  | 54  | 65 | 247                              | 232  | 215  | 14.3 | 97              | 92  | 85  | 72 |
| 9.0  | 103                                    | 97   | 90   | 22.1 | 45              | 43 | 40 | 60 | 144                              | 136  | 125  | 18.7 | 64              | 60  | 55  | 65 | 226                              | 213  | 197  | 14.9 | 100             | 94  | 87  | 73 |
| 9.5  | 95                                     | 89   | 83   | 23.0 | 47              | 44 | 41 | 60 | 133                              | 125  | 116  | 19.5 | 65              | 62  | 57  | 66 | 209                              | 196  | 182  | 15.5 | 103             | 97  | 89  | 73 |
| 10.0 | 88                                     | 83   | 76   | 23.9 | 48              | 45 | 42 | 61 | 123                              | 116  | 107  | 20.2 | 67              | 63  | 58  | 66 | 193                              | 182  | 168  | 16.1 | 105             | 99  | 92  | 73 |
| 11.0 | 76                                     | 72   | 66   | 25.7 | 50              | 47 | 44 | 62 | 106                              | 100  | 93   | 21.7 | 70              | 66  | 61  | 67 | 167                              | 157  | 146  | 17.3 | 110             | 104 | 96  | 74 |
| 12.0 | 67                                     | 63   | 58   | 27.5 | 52              | 49 | 46 | 62 | 93                               | 88   | 81   | 23.2 | 73              | 69  | 64  | 68 | 147                              | 138  | 128  | 18.5 | 115             | 108 | 100 | 75 |
| 13.0 | 59                                     | 56   | 51   | 29.2 | 54              | 51 | 47 | 63 | 83                               | 78   | 72   | 24.7 | 76              | 72  | 66  | 68 | 130                              | 122  | 113  | 19.7 | 120             | 113 | 104 | 75 |
| 14.0 | 53                                     | 50   | 46   | 30.9 | 56              | 53 | 49 | 63 | 74                               | 70   | 64   | 26.1 | 79              | 74  | 69  | 69 | 116                              | 109  | 101  | 20.8 | 124             | 117 | 108 | 76 |
| 15.0 | 48                                     | 45   | 41   | 32.5 | 58              | 55 | 51 | 64 | 67                               | 63   | 58   | 27.5 | 82              | 77  | 71  | 69 | 105                              | 99   | 91   | 21.9 | 128             | 121 | 112 | 77 |
| 16.0 | 43                                     | 41   | 38   | 34.1 | 60              | 57 | 52 | 64 | 60                               | 57   | 53   | 28.9 | 84              | 79  | 73  | 70 | 95                               | 89   | 83   | 23.0 | 133             | 125 | 115 | 77 |
| 17.0 | 39                                     | 37   | 34   | 35.7 | 62              | 58 | 54 | 65 | 55                               | 52   | 48   | 30.2 | 87              | 82  | 76  | 70 | 87                               | 82   | 75   | 24.1 | 137             | 129 | 119 | 78 |
| 18.0 | 36                                     | 34   | 31   | 37.3 | 64              | 60 | 56 | 65 | 51                               | 48   | 44   | 31.5 | 89              | 84  | 78  | 71 | 79                               | 75   | 69   | 25.2 | 140             | 132 | 122 | 78 |
| 19.0 | 33                                     | 31   | 29   | 38.9 | 66              | 62 | 57 | 66 | 47                               | 44   | 41   | 32.9 | 92              | 86  | 80  | 71 | 73                               | 69   | 64   | 26.2 | 144             | 136 | 126 | 78 |
| 20.0 | 31                                     | 29   | 27   | 40.4 | 67              | 63 | 59 | 66 | 43                               | 41   | 38   | 34.1 | 94              | 89  | 82  | 72 | 68                               | 64   | 59   | 27.2 | 148             | 139 | 129 | 79 |
| 22.0 | 27                                     | 25   | 23   | 43.4 | 70              | 66 | 61 | 67 | 37                               | 35   | 33   | 36.7 | 99              | 93  | 86  | 72 | 59                               | 55   | 51   | 29.3 | 155             | 146 | 135 | 80 |
| 24.0 | 23                                     | 22   | 20   | 46.4 | 73              | 69 | 64 | 68 | 33                               | 31   | 29   | 39.2 | 103             | 97  | 90  | 73 | 51                               | 48   | 45   | 31.3 | 162             | 152 | 141 | 80 |
| 26.0 | 21                                     | 20   | 18   | 49.3 | 76              | 72 | 67 | 68 | 29                               | 27   | 25   | 41.6 | 107             | 101 | 93  | 74 | 46                               | 43   | 40   | 33.2 | 168             | 158 | 146 | 81 |
| 28.0 | 19                                     | 17   | 16   | 52.1 | 79              | 75 | 69 | 69 | 26                               | 24   | 23   | 44.0 | 111             | 104 | 97  | 74 | 41                               | 38   | 36   | 35.1 | 174             | 164 | 152 | 82 |
| 30.0 | 17                                     | 16   | 15   | 54.9 | 82              | 77 | 71 | 69 | 23                               | 22   | 20   | 46.4 | 115             | 108 | 100 | 75 | 37                               | 35   | 32   | 37.0 | 180             | 170 | 157 | 82 |

**Table D10:** Douglas-fir stocking levels for the PSME/CARU plant association (B-O province).

| QMD  | Climate Resilience; SDI 83; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 116; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 182; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2670                                   | 2513 | 2324 | 4.3  | 15              | 14 | 13 | 42 | 3738                             | 3519 | 3254 | 3.7  | 20              | 19  | 18 | 47 | 5873                             | 5530 | 5113 | 2.9  | 32              | 30  | 28  | 54 |
| 1.5  | 1447                                   | 1363 | 1260 | 5.9  | 18              | 17 | 15 | 45 | 2026                             | 1908 | 1764 | 5.0  | 25              | 23  | 22 | 51 | 3184                             | 2998 | 2772 | 4.0  | 39              | 37  | 34  | 58 |
| 2.0  | 937                                    | 883  | 816  | 7.3  | 20              | 19 | 18 | 48 | 1312                             | 1236 | 1142 | 6.2  | 29              | 27  | 25 | 53 | 2062                             | 1942 | 1795 | 4.9  | 45              | 42  | 39  | 60 |
| 2.5  | 669                                    | 630  | 583  | 8.7  | 23              | 21 | 20 | 49 | 937                              | 882  | 816  | 7.3  | 32              | 30  | 28 | 54 | 1472                             | 1386 | 1282 | 5.8  | 50              | 47  | 44  | 62 |
| 3.0  | 508                                    | 478  | 442  | 9.9  | 25              | 23 | 22 | 51 | 711                              | 670  | 619  | 8.4  | 35              | 33  | 30 | 56 | 1118                             | 1053 | 973  | 6.7  | 55              | 52  | 48  | 63 |
| 3.5  | 403                                    | 379  | 351  | 11.2 | 27              | 25 | 23 | 52 | 564                              | 531  | 491  | 9.4  | 38              | 35  | 33 | 57 | 886                              | 834  | 771  | 7.5  | 59              | 56  | 52  | 64 |
| 4.0  | 329                                    | 310  | 287  | 12.4 | 29              | 27 | 25 | 53 | 461                              | 434  | 401  | 10.4 | 40              | 38  | 35 | 58 | 724                              | 682  | 630  | 8.3  | 63              | 59  | 55  | 65 |
| 4.5  | 275                                    | 259  | 240  | 13.5 | 30              | 29 | 26 | 54 | 386                              | 363  | 336  | 11.4 | 43              | 40  | 37 | 59 | 606                              | 571  | 528  | 9.1  | 67              | 63  | 58  | 66 |
| 5.0  | 235                                    | 221  | 205  | 14.6 | 32              | 30 | 28 | 54 | 329                              | 310  | 286  | 12.4 | 45              | 42  | 39 | 60 | 517                              | 487  | 450  | 9.9  | 70              | 66  | 61  | 67 |
| 5.5  | 203                                    | 192  | 177  | 15.7 | 34              | 32 | 29 | 55 | 285                              | 268  | 248  | 13.3 | 47              | 44  | 41 | 61 | 448                              | 421  | 390  | 10.6 | 74              | 70  | 64  | 68 |
| 6.0  | 178                                    | 168  | 155  | 16.8 | 35              | 33 | 30 | 56 | 250                              | 235  | 217  | 14.2 | 49              | 46  | 43 | 61 | 393                              | 370  | 342  | 11.3 | 77              | 73  | 67  | 68 |
| 6.5  | 158                                    | 149  | 138  | 17.8 | 36              | 34 | 32 | 57 | 221                              | 208  | 193  | 15.1 | 51              | 48  | 44 | 62 | 348                              | 327  | 303  | 12.0 | 80              | 75  | 70  | 69 |
| 7.0  | 141                                    | 133  | 123  | 18.9 | 38              | 36 | 33 | 57 | 198                              | 186  | 172  | 15.9 | 53              | 50  | 46 | 62 | 311                              | 293  | 271  | 12.7 | 83              | 78  | 72  | 70 |
| 7.5  | 127                                    | 120  | 111  | 19.9 | 39              | 37 | 34 | 58 | 178                              | 168  | 155  | 16.8 | 55              | 52  | 48 | 63 | 280                              | 264  | 244  | 13.4 | 86              | 81  | 75  | 70 |
| 8.0  | 116                                    | 109  | 101  | 20.9 | 40              | 38 | 35 | 58 | 162                              | 152  | 141  | 17.6 | 56              | 53  | 49 | 63 | 254                              | 239  | 221  | 14.1 | 89              | 84  | 77  | 71 |
| 8.5  | 105                                    | 99   | 92   | 21.8 | 42              | 39 | 36 | 59 | 148                              | 139  | 129  | 18.5 | 58              | 55  | 51 | 64 | 232                              | 218  | 202  | 14.7 | 91              | 86  | 80  | 71 |
| 9.0  | 97                                     | 91   | 84   | 22.8 | 43              | 40 | 37 | 59 | 135                              | 127  | 118  | 19.3 | 60              | 56  | 52 | 64 | 213                              | 200  | 185  | 15.4 | 94              | 89  | 82  | 72 |
| 9.5  | 89                                     | 84   | 78   | 23.8 | 44              | 41 | 38 | 59 | 125                              | 118  | 109  | 20.1 | 61              | 58  | 53 | 65 | 196                              | 185  | 171  | 16.0 | 97              | 91  | 84  | 72 |
| 10.0 | 83                                     | 78   | 72   | 24.7 | 45              | 42 | 39 | 60 | 116                              | 109  | 101  | 20.9 | 63              | 59  | 55 | 65 | 182                              | 171  | 158  | 16.6 | 99              | 93  | 86  | 72 |
| 11.0 | 71                                     | 67   | 62   | 26.5 | 47              | 44 | 41 | 61 | 100                              | 94   | 87   | 22.4 | 66              | 62  | 57 | 66 | 157                              | 148  | 137  | 17.9 | 104             | 98  | 90  | 73 |
| 12.0 | 63                                     | 59   | 55   | 28.3 | 49              | 46 | 43 | 61 | 88                               | 83   | 76   | 23.9 | 69              | 65  | 60 | 67 | 138                              | 130  | 120  | 19.1 | 108             | 102 | 94  | 74 |
| 13.0 | 56                                     | 52   | 48   | 30.1 | 51              | 48 | 45 | 62 | 78                               | 73   | 68   | 25.4 | 72              | 67  | 62 | 67 | 122                              | 115  | 106  | 20.3 | 113             | 106 | 98  | 74 |
| 14.0 | 50                                     | 47   | 43   | 31.8 | 53              | 50 | 46 | 62 | 69                               | 65   | 60   | 26.9 | 74              | 70  | 65 | 68 | 109                              | 103  | 95   | 21.5 | 117             | 110 | 102 | 75 |
| 15.0 | 45                                     | 42   | 39   | 33.5 | 55              | 52 | 48 | 63 | 63                               | 59   | 55   | 28.3 | 77              | 72  | 67 | 68 | 98                               | 93   | 86   | 22.6 | 121             | 114 | 105 | 76 |
| 16.0 | 41                                     | 38   | 35   | 35.2 | 57              | 53 | 49 | 64 | 57                               | 53   | 49   | 29.8 | 79              | 75  | 69 | 69 | 89                               | 84   | 78   | 23.7 | 125             | 117 | 109 | 76 |
| 17.0 | 37                                     | 35   | 32   | 36.9 | 58              | 55 | 51 | 64 | 52                               | 49   | 45   | 31.2 | 82              | 77  | 71 | 69 | 81                               | 77   | 71   | 24.9 | 128             | 121 | 112 | 77 |
| 18.0 | 34                                     | 32   | 30   | 38.5 | 60              | 57 | 52 | 64 | 48                               | 45   | 41   | 32.5 | 84              | 79  | 73 | 70 | 75                               | 70   | 65   | 25.9 | 132             | 124 | 115 | 77 |
| 19.0 | 31                                     | 29   | 27   | 40.1 | 62              | 58 | 54 | 65 | 44                               | 41   | 38   | 33.9 | 86              | 81  | 75 | 70 | 69                               | 65   | 60   | 27.0 | 136             | 128 | 118 | 77 |
| 20.0 | 29                                     | 27   | 25   | 41.7 | 63              | 59 | 55 | 65 | 41                               | 38   | 35   | 35.2 | 88              | 83  | 77 | 71 | 64                               | 60   | 55   | 28.1 | 139             | 131 | 121 | 78 |
| 22.0 | 25                                     | 24   | 22   | 44.8 | 66              | 62 | 58 | 66 | 35                               | 33   | 31   | 37.8 | 93              | 87  | 81 | 71 | 55                               | 52   | 48   | 30.2 | 146             | 137 | 127 | 79 |
| 24.0 | 22                                     | 21   | 19   | 47.8 | 69              | 65 | 60 | 67 | 31                               | 29   | 27   | 40.4 | 97              | 91  | 84 | 72 | 48                               | 46   | 42   | 32.2 | 152             | 143 | 132 | 79 |
| 26.0 | 19                                     | 18   | 17   | 50.8 | 72              | 68 | 63 | 67 | 27                               | 26   | 24   | 42.9 | 101             | 95  | 88 | 73 | 43                               | 40   | 37   | 34.2 | 158             | 149 | 138 | 80 |
| 28.0 | 17                                     | 16   | 15   | 53.7 | 75              | 70 | 65 | 68 | 24                               | 23   | 21   | 45.4 | 104             | 98  | 91 | 73 | 38                               | 36   | 33   | 36.2 | 164             | 154 | 143 | 81 |
| 30.0 | 16                                     | 15   | 14   | 56.6 | 77              | 73 | 67 | 68 | 22                               | 21   | 19   | 47.8 | 108             | 102 | 94 | 74 | 35                               | 33   | 30   | 38.2 | 170             | 160 | 148 | 81 |

**Table D11:** Douglas-fir stocking levels for the PSME/HODI plant association (B-O province).

| QMD  | Climate Resilience; SDI 80; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 112; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 175; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2581                                   | 2430 | 2247 | 4.4  | 14              | 13 | 12 | 42 | 3613                             | 3402 | 3145 | 3.7  | 20              | 19 | 17 | 47 | 5677                             | 5345 | 4943 | 3.0  | 31              | 29  | 27  | 54 |
| 1.5  | 1399                                   | 1317 | 1218 | 6.0  | 17              | 16 | 15 | 45 | 1959                             | 1844 | 1705 | 5.1  | 24              | 23 | 21 | 50 | 3078                             | 2898 | 2680 | 4.0  | 38              | 36  | 33  | 57 |
| 2.0  | 906                                    | 853  | 789  | 7.5  | 20              | 19 | 17 | 47 | 1269                             | 1194 | 1104 | 6.3  | 28              | 26 | 24 | 52 | 1993                             | 1877 | 1735 | 5.0  | 43              | 41  | 38  | 59 |
| 2.5  | 647                                    | 609  | 563  | 8.8  | 22              | 21 | 19 | 49 | 906                              | 853  | 788  | 7.5  | 31              | 29 | 27 | 54 | 1423                             | 1340 | 1239 | 5.9  | 49              | 46  | 42  | 61 |
| 3.0  | 491                                    | 462  | 428  | 10.1 | 24              | 23 | 21 | 50 | 688                              | 647  | 599  | 8.6  | 34              | 32 | 29 | 55 | 1081                             | 1017 | 941  | 6.8  | 53              | 50  | 46  | 62 |
| 3.5  | 389                                    | 366  | 339  | 11.4 | 26              | 24 | 23 | 51 | 545                              | 513  | 474  | 9.6  | 36              | 34 | 32 | 56 | 856                              | 806  | 745  | 7.7  | 57              | 54  | 50  | 64 |
| 4.0  | 318                                    | 300  | 277  | 12.6 | 28              | 26 | 24 | 52 | 445                              | 419  | 388  | 10.6 | 39              | 37 | 34 | 58 | 700                              | 659  | 609  | 8.5  | 61              | 58  | 53  | 65 |
| 4.5  | 266                                    | 251  | 232  | 13.7 | 29              | 28 | 26 | 53 | 373                              | 351  | 325  | 11.6 | 41              | 39 | 36 | 58 | 586                              | 552  | 510  | 9.3  | 65              | 61  | 56  | 66 |
| 5.0  | 227                                    | 214  | 198  | 14.9 | 31              | 29 | 27 | 54 | 318                              | 299  | 277  | 12.6 | 43              | 41 | 38 | 59 | 500                              | 470  | 435  | 10.0 | 68              | 64  | 59  | 66 |
| 5.5  | 197                                    | 185  | 171  | 16.0 | 32              | 31 | 28 | 55 | 275                              | 259  | 240  | 13.5 | 45              | 43 | 40 | 60 | 433                              | 407  | 377  | 10.8 | 71              | 67  | 62  | 67 |
| 6.0  | 172                                    | 162  | 150  | 17.1 | 34              | 32 | 29 | 55 | 241                              | 227  | 210  | 14.4 | 47              | 45 | 41 | 61 | 379                              | 357  | 330  | 11.5 | 75              | 70  | 65  | 68 |
| 6.5  | 153                                    | 144  | 133  | 18.1 | 35              | 33 | 31 | 56 | 214                              | 201  | 186  | 15.3 | 49              | 46 | 43 | 61 | 336                              | 317  | 293  | 12.2 | 77              | 73  | 67  | 68 |
| 7.0  | 137                                    | 129  | 119  | 19.2 | 37              | 34 | 32 | 57 | 191                              | 180  | 167  | 16.2 | 51              | 48 | 45 | 62 | 301                              | 283  | 262  | 12.9 | 80              | 76  | 70  | 69 |
| 7.5  | 123                                    | 116  | 107  | 20.2 | 38              | 36 | 33 | 57 | 172                              | 162  | 150  | 17.1 | 53              | 50 | 46 | 62 | 271                              | 255  | 236  | 13.6 | 83              | 78  | 72  | 70 |
| 8.0  | 112                                    | 105  | 97   | 21.2 | 39              | 37 | 34 | 58 | 156                              | 147  | 136  | 17.9 | 55              | 51 | 48 | 63 | 246                              | 231  | 214  | 14.3 | 86              | 81  | 75  | 70 |
| 8.5  | 102                                    | 96   | 89   | 22.2 | 40              | 38 | 35 | 58 | 143                              | 134  | 124  | 18.8 | 56              | 53 | 49 | 63 | 224                              | 211  | 195  | 15.0 | 88              | 83  | 77  | 71 |
| 9.0  | 94                                     | 88   | 81   | 23.2 | 41              | 39 | 36 | 58 | 131                              | 123  | 114  | 19.6 | 58              | 54 | 50 | 64 | 206                              | 194  | 179  | 15.6 | 91              | 86  | 79  | 71 |
| 9.5  | 86                                     | 81   | 75   | 24.2 | 42              | 40 | 37 | 59 | 121                              | 114  | 105  | 20.4 | 59              | 56 | 52 | 64 | 190                              | 178  | 165  | 16.3 | 93              | 88  | 81  | 71 |
| 10.0 | 80                                     | 75   | 69   | 25.1 | 43              | 41 | 38 | 59 | 112                              | 105  | 97   | 21.2 | 61              | 57 | 53 | 65 | 175                              | 165  | 153  | 16.9 | 96              | 90  | 83  | 72 |
| 11.0 | 69                                     | 65   | 60   | 27.0 | 46              | 43 | 40 | 60 | 97                               | 91   | 84   | 22.8 | 64              | 60 | 56 | 65 | 152                              | 143  | 132  | 18.2 | 100             | 94  | 87  | 73 |
| 12.0 | 61                                     | 57   | 53   | 28.8 | 48              | 45 | 41 | 61 | 85                               | 80   | 74   | 24.4 | 67              | 63 | 58 | 66 | 133                              | 125  | 116  | 19.4 | 105             | 99  | 91  | 73 |
| 13.0 | 54                                     | 51   | 47   | 30.6 | 49              | 47 | 43 | 61 | 75                               | 71   | 65   | 25.9 | 69              | 65 | 60 | 67 | 118                              | 111  | 103  | 20.6 | 109             | 102 | 95  | 74 |
| 14.0 | 48                                     | 45   | 42   | 32.4 | 51              | 48 | 45 | 62 | 67                               | 63   | 58   | 27.4 | 72              | 68 | 63 | 67 | 106                              | 99   | 92   | 21.8 | 113             | 106 | 98  | 75 |
| 15.0 | 43                                     | 41   | 38   | 34.1 | 53              | 50 | 46 | 62 | 61                               | 57   | 53   | 28.8 | 74              | 70 | 65 | 68 | 95                               | 90   | 83   | 23.0 | 117             | 110 | 102 | 75 |
| 16.0 | 39                                     | 37   | 34   | 35.8 | 55              | 52 | 48 | 63 | 55                               | 52   | 48   | 30.3 | 77              | 72 | 67 | 68 | 86                               | 81   | 75   | 24.1 | 120             | 113 | 105 | 76 |
| 17.0 | 36                                     | 34   | 31   | 37.5 | 56              | 53 | 49 | 63 | 50                               | 47   | 44   | 31.7 | 79              | 74 | 69 | 69 | 79                               | 74   | 69   | 25.3 | 124             | 117 | 108 | 76 |
| 18.0 | 33                                     | 31   | 29   | 39.1 | 58              | 55 | 51 | 64 | 46                               | 43   | 40   | 33.1 | 81              | 76 | 71 | 69 | 72                               | 68   | 63   | 26.4 | 128             | 120 | 111 | 77 |
| 19.0 | 30                                     | 28   | 26   | 40.8 | 60              | 56 | 52 | 64 | 42                               | 40   | 37   | 34.5 | 83              | 79 | 73 | 70 | 67                               | 63   | 58   | 27.5 | 131             | 123 | 114 | 77 |
| 20.0 | 28                                     | 26   | 24   | 42.4 | 61              | 58 | 53 | 65 | 39                               | 37   | 34   | 35.8 | 86              | 81 | 74 | 70 | 62                               | 58   | 54   | 28.6 | 134             | 127 | 117 | 77 |
| 22.0 | 24                                     | 23   | 21   | 45.5 | 64              | 60 | 56 | 65 | 34                               | 32   | 30   | 38.5 | 90              | 84 | 78 | 71 | 53                               | 50   | 46   | 30.7 | 141             | 133 | 123 | 78 |
| 24.0 | 21                                     | 20   | 19   | 48.6 | 67              | 63 | 58 | 66 | 30                               | 28   | 26   | 41.1 | 94              | 88 | 81 | 72 | 47                               | 44   | 41   | 32.8 | 147             | 138 | 128 | 79 |
| 26.0 | 19                                     | 18   | 16   | 51.7 | 69              | 65 | 60 | 67 | 26                               | 25   | 23   | 43.7 | 97              | 92 | 85 | 72 | 41                               | 39   | 36   | 34.8 | 153             | 144 | 133 | 79 |
| 28.0 | 17                                     | 16   | 15   | 54.6 | 72              | 68 | 63 | 67 | 24                               | 22   | 21   | 46.2 | 101             | 95 | 88 | 73 | 37                               | 35   | 32   | 36.8 | 158             | 149 | 138 | 80 |
| 30.0 | 15                                     | 14   | 13   | 57.6 | 75              | 70 | 65 | 68 | 21                               | 20   | 19   | 48.6 | 104             | 98 | 91 | 73 | 33                               | 31   | 29   | 38.8 | 164             | 154 | 143 | 81 |

**Table D12:** Douglas-fir stocking levels for the PSME/PHMA plant association (B-O province).

| QMD  | Climate Resilience; SDI 70; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 98; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 155; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2273                                   | 2140 | 1979 | 4.7  | 12              | 12 | 11 | 40 | 3183                            | 2996 | 2771 | 4.0  | 17              | 16 | 15 | 45 | 5001                             | 4709 | 4354 | 3.2  | 27              | 26  | 24  | 52 |
| 1.5  | 1232                                   | 1160 | 1073 | 6.4  | 15              | 14 | 13 | 43 | 1725                            | 1624 | 1502 | 5.4  | 21              | 20 | 18 | 48 | 2711                             | 2553 | 2360 | 4.3  | 33              | 31  | 29  | 55 |
| 2.0  | 798                                    | 751  | 695  | 7.9  | 17              | 16 | 15 | 45 | 1117                            | 1052 | 973  | 6.7  | 24              | 23 | 21 | 50 | 1756                             | 1653 | 1529 | 5.4  | 38              | 36  | 33  | 57 |
| 2.5  | 570                                    | 537  | 496  | 9.4  | 19              | 18 | 17 | 47 | 798                             | 751  | 695  | 7.9  | 27              | 26 | 24 | 52 | 1254                             | 1180 | 1091 | 6.3  | 43              | 40  | 37  | 59 |
| 3.0  | 433                                    | 407  | 377  | 10.8 | 21              | 20 | 18 | 48 | 606                             | 570  | 527  | 9.1  | 30              | 28 | 26 | 53 | 952                              | 896  | 829  | 7.3  | 47              | 44  | 41  | 60 |
| 3.5  | 343                                    | 323  | 298  | 12.1 | 23              | 22 | 20 | 49 | 480                             | 452  | 418  | 10.2 | 32              | 30 | 28 | 55 | 754                              | 710  | 657  | 8.2  | 50              | 47  | 44  | 62 |
| 4.0  | 280                                    | 264  | 244  | 13.4 | 24              | 23 | 21 | 50 | 392                             | 369  | 342  | 11.3 | 34              | 32 | 30 | 56 | 617                              | 580  | 537  | 9.0  | 54              | 51  | 47  | 63 |
| 4.5  | 235                                    | 221  | 204  | 14.6 | 26              | 24 | 23 | 51 | 328                             | 309  | 286  | 12.4 | 36              | 34 | 32 | 56 | 516                              | 486  | 449  | 9.9  | 57              | 54  | 50  | 64 |
| 5.0  | 200                                    | 188  | 174  | 15.9 | 27              | 26 | 24 | 52 | 280                             | 264  | 244  | 13.4 | 38              | 36 | 33 | 57 | 440                              | 414  | 383  | 10.7 | 60              | 57  | 52  | 64 |
| 5.5  | 173                                    | 163  | 151  | 17.0 | 29              | 27 | 25 | 53 | 243                             | 228  | 211  | 14.4 | 40              | 38 | 35 | 58 | 381                              | 359  | 332  | 11.5 | 63              | 59  | 55  | 65 |
| 6.0  | 152                                    | 143  | 132  | 18.2 | 30              | 28 | 26 | 53 | 213                             | 200  | 185  | 15.4 | 42              | 39 | 36 | 59 | 334                              | 315  | 291  | 12.3 | 66              | 62  | 57  | 66 |
| 6.5  | 135                                    | 127  | 117  | 19.3 | 31              | 29 | 27 | 54 | 188                             | 177  | 164  | 16.3 | 43              | 41 | 38 | 59 | 296                              | 279  | 258  | 13.0 | 68              | 64  | 59  | 66 |
| 7.0  | 120                                    | 113  | 105  | 20.4 | 32              | 30 | 28 | 55 | 169                             | 159  | 147  | 17.3 | 45              | 42 | 39 | 60 | 265                              | 249  | 231  | 13.8 | 71              | 67  | 62  | 67 |
| 7.5  | 108                                    | 102  | 94   | 21.5 | 33              | 31 | 29 | 55 | 152                             | 143  | 132  | 18.2 | 47              | 44 | 41 | 60 | 239                              | 225  | 208  | 14.5 | 73              | 69  | 64  | 68 |
| 8.0  | 98                                     | 93   | 86   | 22.6 | 34              | 32 | 30 | 56 | 138                             | 130  | 120  | 19.1 | 48              | 45 | 42 | 61 | 216                              | 204  | 188  | 15.2 | 76              | 71  | 66  | 68 |
| 8.5  | 90                                     | 85   | 78   | 23.7 | 35              | 33 | 31 | 56 | 126                             | 118  | 109  | 20.0 | 50              | 47 | 43 | 61 | 198                              | 186  | 172  | 16.0 | 78              | 73  | 68  | 69 |
| 9.0  | 82                                     | 78   | 72   | 24.7 | 36              | 34 | 32 | 56 | 115                             | 109  | 100  | 20.9 | 51              | 48 | 44 | 62 | 181                              | 171  | 158  | 16.7 | 80              | 75  | 70  | 69 |
| 9.5  | 76                                     | 71   | 66   | 25.7 | 37              | 35 | 33 | 57 | 106                             | 100  | 93   | 21.8 | 52              | 49 | 46 | 62 | 167                              | 157  | 145  | 17.4 | 82              | 77  | 72  | 69 |
| 10.0 | 70                                     | 66   | 61   | 26.8 | 38              | 36 | 33 | 57 | 98                              | 93   | 86   | 22.6 | 54              | 51 | 47 | 63 | 155                              | 146  | 135  | 18.0 | 84              | 79  | 73  | 70 |
| 11.0 | 61                                     | 57   | 53   | 28.8 | 40              | 38 | 35 | 58 | 85                              | 80   | 74   | 24.3 | 56              | 53 | 49 | 63 | 134                              | 126  | 117  | 19.4 | 88              | 83  | 77  | 71 |
| 12.0 | 53                                     | 50   | 46   | 30.7 | 42              | 39 | 36 | 59 | 75                              | 70   | 65   | 26.0 | 59              | 55 | 51 | 64 | 117                              | 110  | 102  | 20.7 | 92              | 87  | 80  | 71 |
| 13.0 | 47                                     | 45   | 41   | 32.6 | 44              | 41 | 38 | 59 | 66                              | 62   | 58   | 27.6 | 61              | 57 | 53 | 65 | 104                              | 98   | 91   | 22.0 | 96              | 90  | 83  | 72 |
| 14.0 | 42                                     | 40   | 37   | 34.5 | 45              | 43 | 39 | 60 | 59                              | 56   | 52   | 29.2 | 63              | 60 | 55 | 65 | 93                               | 88   | 81   | 23.3 | 99              | 94  | 87  | 72 |
| 15.0 | 38                                     | 36   | 33   | 36.3 | 47              | 44 | 41 | 60 | 53                              | 50   | 46   | 30.7 | 65              | 62 | 57 | 66 | 84                               | 79   | 73   | 24.5 | 103             | 97  | 90  | 73 |
| 16.0 | 35                                     | 33   | 30   | 38.2 | 48              | 45 | 42 | 61 | 48                              | 46   | 42   | 32.2 | 68              | 64 | 59 | 66 | 76                               | 72   | 66   | 25.7 | 106             | 100 | 92  | 74 |
| 17.0 | 32                                     | 30   | 27   | 39.9 | 50              | 47 | 43 | 61 | 44                              | 42   | 38   | 33.8 | 70              | 66 | 61 | 67 | 69                               | 65   | 60   | 26.9 | 109             | 103 | 95  | 74 |
| 18.0 | 29                                     | 27   | 25   | 41.7 | 51              | 48 | 44 | 62 | 40                              | 38   | 35   | 35.2 | 72              | 67 | 62 | 67 | 64                               | 60   | 55   | 28.1 | 112             | 106 | 98  | 74 |
| 19.0 | 27                                     | 25   | 23   | 43.4 | 52              | 49 | 46 | 62 | 37                              | 35   | 32   | 36.7 | 73              | 69 | 64 | 68 | 59                               | 55   | 51   | 29.3 | 115             | 109 | 101 | 75 |
| 20.0 | 25                                     | 23   | 21   | 45.2 | 54              | 51 | 47 | 63 | 35                              | 33   | 30   | 38.2 | 75              | 71 | 66 | 68 | 54                               | 51   | 47   | 30.4 | 118             | 111 | 103 | 75 |
| 22.0 | 21                                     | 20   | 19   | 48.5 | 56              | 53 | 49 | 63 | 30                              | 28   | 26   | 41.0 | 79              | 74 | 69 | 69 | 47                               | 44   | 41   | 32.7 | 124             | 117 | 108 | 76 |
| 24.0 | 19                                     | 18   | 16   | 51.8 | 59              | 55 | 51 | 64 | 26                              | 25   | 23   | 43.8 | 82              | 78 | 72 | 69 | 41                               | 39   | 36   | 34.9 | 129             | 122 | 113 | 77 |
| 26.0 | 17                                     | 16   | 14   | 55.1 | 61              | 58 | 53 | 65 | 23                              | 22   | 20   | 46.5 | 86              | 81 | 75 | 70 | 37                               | 34   | 32   | 37.1 | 135             | 127 | 117 | 77 |
| 28.0 | 15                                     | 14   | 13   | 58.2 | 63              | 60 | 55 | 65 | 21                              | 20   | 18   | 49.2 | 89              | 84 | 77 | 71 | 33                               | 31   | 28   | 39.3 | 140             | 131 | 122 | 78 |
| 30.0 | 13                                     | 13   | 12   | 61.3 | 66              | 62 | 57 | 66 | 19                              | 18   | 16   | 51.8 | 92              | 87 | 80 | 71 | 29                               | 28   | 26   | 41.4 | 144             | 136 | 126 | 78 |



**Table D13:** Douglas-fir stocking levels for the PSME/PHMA plant association (W-S province).

| QMD  | Climate Resilience; SDI 97; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 136; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 213; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3139                                   | 2955 | 2733 | 4.0  | 17              | 16 | 15 | 45 | 4394                             | 4137 | 3826 | 3.4  | 24              | 23  | 21  | 50 | 6905                             | 6502 | 6012 | 2.7  | 38              | 35  | 33  | 57 |
| 1.5  | 1702                                   | 1602 | 1481 | 5.4  | 21              | 20 | 18 | 48 | 2382                             | 2243 | 2074 | 4.6  | 29              | 28  | 25  | 53 | 3744                             | 3525 | 3259 | 3.7  | 46              | 43  | 40  | 60 |
| 2.0  | 1102                                   | 1038 | 959  | 6.8  | 24              | 23 | 21 | 50 | 1543                             | 1453 | 1343 | 5.7  | 34              | 32  | 29  | 55 | 2425                             | 2283 | 2111 | 4.6  | 53              | 50  | 46  | 62 |
| 2.5  | 787                                    | 741  | 685  | 8.0  | 27              | 25 | 23 | 52 | 1102                             | 1037 | 959  | 6.8  | 38              | 35  | 33  | 57 | 1731                             | 1630 | 1507 | 5.4  | 59              | 56  | 51  | 64 |
| 3.0  | 597                                    | 563  | 520  | 9.2  | 29              | 28 | 26 | 53 | 836                              | 788  | 728  | 7.8  | 41              | 39  | 36  | 58 | 1314                             | 1238 | 1144 | 6.2  | 65              | 61  | 56  | 66 |
| 3.5  | 473                                    | 446  | 412  | 10.3 | 32              | 30 | 28 | 54 | 663                              | 624  | 577  | 8.7  | 44              | 42  | 39  | 60 | 1041                             | 981  | 907  | 6.9  | 70              | 66  | 61  | 67 |
| 4.0  | 387                                    | 364  | 337  | 11.4 | 34              | 32 | 29 | 55 | 542                              | 510  | 472  | 9.6  | 47              | 45  | 41  | 61 | 851                              | 802  | 741  | 7.7  | 74              | 70  | 65  | 68 |
| 4.5  | 324                                    | 305  | 282  | 12.5 | 36              | 34 | 31 | 56 | 453                              | 427  | 395  | 10.5 | 50              | 47  | 44  | 62 | 713                              | 671  | 620  | 8.4  | 79              | 74  | 69  | 69 |
| 5.0  | 276                                    | 260  | 241  | 13.5 | 38              | 35 | 33 | 57 | 387                              | 364  | 337  | 11.4 | 53              | 50  | 46  | 62 | 608                              | 572  | 529  | 9.1  | 83              | 78  | 72  | 70 |
| 5.5  | 239                                    | 225  | 208  | 14.5 | 39              | 37 | 34 | 58 | 335                              | 315  | 292  | 12.3 | 55              | 52  | 48  | 63 | 526                              | 496  | 458  | 9.8  | 87              | 82  | 76  | 70 |
| 6.0  | 210                                    | 198  | 183  | 15.5 | 41              | 39 | 36 | 58 | 294                              | 277  | 256  | 13.1 | 58              | 54  | 50  | 64 | 462                              | 435  | 402  | 10.4 | 91              | 85  | 79  | 71 |
| 6.5  | 186                                    | 175  | 162  | 16.4 | 43              | 40 | 37 | 59 | 260                              | 245  | 227  | 13.9 | 60              | 56  | 52  | 64 | 409                              | 385  | 356  | 11.1 | 94              | 89  | 82  | 72 |
| 7.0  | 166                                    | 156  | 145  | 17.4 | 44              | 42 | 39 | 60 | 233                              | 219  | 203  | 14.7 | 62              | 59  | 54  | 65 | 366                              | 344  | 318  | 11.7 | 98              | 92  | 85  | 72 |
| 7.5  | 150                                    | 141  | 130  | 18.3 | 46              | 43 | 40 | 60 | 210                              | 197  | 183  | 15.5 | 64              | 61  | 56  | 66 | 329                              | 310  | 287  | 12.4 | 101             | 95  | 88  | 73 |
| 8.0  | 136                                    | 128  | 118  | 19.2 | 47              | 45 | 41 | 61 | 190                              | 179  | 166  | 16.3 | 66              | 63  | 58  | 66 | 299                              | 281  | 260  | 13.0 | 104             | 98  | 91  | 73 |
| 8.5  | 124                                    | 117  | 108  | 20.1 | 49              | 46 | 43 | 61 | 174                              | 163  | 151  | 17.0 | 68              | 64  | 60  | 67 | 273                              | 257  | 237  | 13.6 | 107             | 101 | 94  | 74 |
| 9.0  | 114                                    | 107  | 99   | 21.0 | 50              | 47 | 44 | 62 | 159                              | 150  | 139  | 17.8 | 70              | 66  | 61  | 67 | 250                              | 236  | 218  | 14.2 | 111             | 104 | 96  | 74 |
| 9.5  | 105                                    | 99   | 91   | 21.9 | 52              | 49 | 45 | 62 | 147                              | 138  | 128  | 18.5 | 72              | 68  | 63  | 67 | 231                              | 217  | 201  | 14.8 | 114             | 107 | 99  | 75 |
| 10.0 | 97                                     | 91   | 84   | 22.8 | 53              | 50 | 46 | 62 | 136                              | 128  | 118  | 19.2 | 74              | 70  | 64  | 68 | 213                              | 201  | 186  | 15.4 | 116             | 110 | 101 | 75 |
| 11.0 | 84                                     | 79   | 73   | 24.5 | 55              | 52 | 48 | 63 | 118                              | 111  | 102  | 20.7 | 78              | 73  | 68  | 69 | 185                              | 174  | 161  | 16.5 | 122             | 115 | 106 | 76 |
| 12.0 | 74                                     | 69   | 64   | 26.1 | 58              | 54 | 50 | 64 | 103                              | 97   | 90   | 22.1 | 81              | 76  | 71  | 69 | 162                              | 153  | 141  | 17.6 | 127             | 120 | 111 | 76 |
| 13.0 | 65                                     | 61   | 57   | 27.8 | 60              | 57 | 52 | 64 | 91                               | 86   | 80   | 23.5 | 84              | 79  | 73  | 70 | 144                              | 135  | 125  | 18.7 | 132             | 125 | 115 | 77 |
| 14.0 | 58                                     | 55   | 51   | 29.4 | 62              | 59 | 54 | 65 | 82                               | 77   | 71   | 24.8 | 87              | 82  | 76  | 70 | 128                              | 121  | 112  | 19.8 | 137             | 129 | 119 | 78 |
| 15.0 | 53                                     | 50   | 46   | 30.9 | 65              | 61 | 56 | 66 | 74                               | 69   | 64   | 26.1 | 90              | 85  | 79  | 71 | 116                              | 109  | 101  | 20.9 | 142             | 134 | 124 | 78 |
| 16.0 | 48                                     | 45   | 42   | 32.5 | 67              | 63 | 58 | 66 | 67                               | 63   | 58   | 27.4 | 93              | 88  | 81  | 71 | 105                              | 99   | 91   | 21.9 | 147             | 138 | 128 | 79 |
| 17.0 | 44                                     | 41   | 38   | 34.0 | 69              | 65 | 60 | 67 | 61                               | 57   | 53   | 28.7 | 96              | 90  | 84  | 72 | 96                               | 90   | 83   | 22.9 | 151             | 142 | 131 | 79 |
| 18.0 | 40                                     | 38   | 35   | 35.5 | 71              | 66 | 61 | 67 | 56                               | 53   | 49   | 30.0 | 99              | 93  | 86  | 72 | 88                               | 83   | 76   | 23.9 | 155             | 146 | 135 | 80 |
| 19.0 | 37                                     | 35   | 32   | 37.0 | 72              | 68 | 63 | 67 | 52                               | 49   | 45   | 31.2 | 101             | 96  | 88  | 73 | 81                               | 76   | 70   | 24.9 | 159             | 150 | 139 | 80 |
| 20.0 | 34                                     | 32   | 30   | 38.4 | 74              | 70 | 65 | 68 | 48                               | 45   | 42   | 32.5 | 104             | 98  | 91  | 73 | 75                               | 71   | 65   | 25.9 | 163             | 154 | 142 | 80 |
| 22.0 | 29                                     | 28   | 26   | 41.3 | 78              | 73 | 68 | 69 | 41                               | 39   | 36   | 34.9 | 109             | 103 | 95  | 74 | 65                               | 61   | 56   | 27.8 | 171             | 161 | 149 | 81 |
| 24.0 | 26                                     | 24   | 23   | 44.1 | 81              | 76 | 71 | 69 | 36                               | 34   | 32   | 37.3 | 114             | 107 | 99  | 75 | 57                               | 54   | 50   | 29.7 | 179             | 168 | 156 | 82 |
| 26.0 | 23                                     | 22   | 20   | 46.8 | 84              | 80 | 74 | 70 | 32                               | 30   | 28   | 39.6 | 118             | 111 | 103 | 75 | 50                               | 47   | 44   | 31.6 | 186             | 175 | 162 | 83 |
| 28.0 | 20                                     | 19   | 18   | 49.5 | 88              | 82 | 76 | 70 | 29                               | 27   | 25   | 41.9 | 123             | 115 | 107 | 76 | 45                               | 42   | 39   | 33.4 | 193             | 181 | 168 | 83 |
| 30.0 | 18                                     | 17   | 16   | 52.2 | 91              | 85 | 79 | 71 | 26                               | 24   | 23   | 44.1 | 127             | 119 | 110 | 76 | 41                               | 38   | 35   | 35.2 | 199             | 188 | 174 | 84 |



**Table D14:** Douglas-fir stocking levels for the PSME/SPBE plant association (W-S province).

| QMD  | Climate Resilience; SDI 116; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 162; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 255; 55% of Max |      |      |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 3754                                    | 3534 | 3268 | 3.7  | 20              | 19  | 18 | 48 | 5255                             | 4948 | 4575 | 3.1  | 29              | 27  | 25  | 53 | 8258                             | 7775 | 7190 | 2.5  | 45              | 42  | 39  | 60 |
| 1.5  | 2035                                    | 1916 | 1772 | 5.0  | 25              | 24  | 22 | 51 | 2849                             | 2682 | 2480 | 4.2  | 35              | 33  | 30  | 56 | 4477                             | 4215 | 3898 | 3.4  | 55              | 52  | 48  | 63 |
| 2.0  | 1318                                    | 1241 | 1147 | 6.2  | 29              | 27  | 25 | 53 | 1845                             | 1737 | 1606 | 5.2  | 40              | 38  | 35  | 58 | 2900                             | 2730 | 2524 | 4.2  | 63              | 60  | 55  | 65 |
| 2.5  | 941                                     | 886  | 819  | 7.3  | 32              | 30  | 28 | 55 | 1317                             | 1240 | 1147 | 6.2  | 45              | 42  | 39  | 60 | 2070                             | 1949 | 1802 | 4.9  | 71              | 66  | 61  | 67 |
| 3.0  | 715                                     | 673  | 622  | 8.4  | 35              | 33  | 31 | 56 | 1000                             | 942  | 871  | 7.1  | 49              | 46  | 43  | 61 | 1572                             | 1480 | 1369 | 5.7  | 77              | 73  | 67  | 68 |
| 3.5  | 566                                     | 533  | 493  | 9.4  | 38              | 36  | 33 | 57 | 793                              | 746  | 690  | 8.0  | 53              | 50  | 46  | 62 | 1245                             | 1173 | 1084 | 6.4  | 83              | 78  | 72  | 70 |
| 4.0  | 463                                     | 436  | 403  | 10.4 | 40              | 38  | 35 | 58 | 648                              | 610  | 564  | 8.8  | 57              | 53  | 49  | 63 | 1018                             | 958  | 886  | 7.0  | 89              | 84  | 77  | 71 |
| 4.5  | 387                                     | 365  | 337  | 11.4 | 43              | 40  | 37 | 59 | 542                              | 511  | 472  | 9.6  | 60              | 56  | 52  | 64 | 852                              | 802  | 742  | 7.7  | 94              | 89  | 82  | 72 |
| 5.0  | 330                                     | 311  | 288  | 12.3 | 45              | 42  | 39 | 60 | 463                              | 435  | 403  | 10.4 | 63              | 59  | 55  | 65 | 727                              | 684  | 633  | 8.3  | 99              | 93  | 86  | 72 |
| 5.5  | 286                                     | 269  | 249  | 13.3 | 47              | 44  | 41 | 61 | 401                              | 377  | 349  | 11.2 | 66              | 62  | 58  | 66 | 629                              | 593  | 548  | 8.9  | 104             | 98  | 90  | 73 |
| 6.0  | 251                                     | 236  | 218  | 14.2 | 49              | 46  | 43 | 61 | 351                              | 331  | 306  | 12.0 | 69              | 65  | 60  | 67 | 552                              | 520  | 480  | 9.5  | 108             | 102 | 94  | 74 |
| 6.5  | 222                                     | 209  | 194  | 15.0 | 51              | 48  | 45 | 62 | 311                              | 293  | 271  | 12.7 | 72              | 68  | 62  | 67 | 489                              | 460  | 426  | 10.1 | 113             | 106 | 98  | 75 |
| 7.0  | 199                                     | 187  | 173  | 15.9 | 53              | 50  | 46 | 62 | 278                              | 262  | 242  | 13.4 | 74              | 70  | 65  | 68 | 437                              | 412  | 381  | 10.7 | 117             | 110 | 102 | 75 |
| 7.5  | 179                                     | 169  | 156  | 16.8 | 55              | 52  | 48 | 63 | 251                              | 236  | 218  | 14.2 | 77              | 72  | 67  | 68 | 394                              | 371  | 343  | 11.3 | 121             | 114 | 105 | 76 |
| 8.0  | 162                                     | 153  | 141  | 17.6 | 57              | 53  | 49 | 64 | 227                              | 214  | 198  | 14.9 | 79              | 75  | 69  | 69 | 357                              | 337  | 311  | 11.9 | 125             | 117 | 109 | 76 |
| 8.5  | 148                                     | 140  | 129  | 18.4 | 58              | 55  | 51 | 64 | 208                              | 195  | 181  | 15.6 | 82              | 77  | 71  | 69 | 326                              | 307  | 284  | 12.4 | 129             | 121 | 112 | 77 |
| 9.0  | 136                                     | 128  | 118  | 19.2 | 60              | 57  | 52 | 64 | 190                              | 179  | 166  | 16.3 | 84              | 79  | 73  | 70 | 299                              | 282  | 260  | 13.0 | 132             | 124 | 115 | 77 |
| 9.5  | 125                                     | 118  | 109  | 20.0 | 62              | 58  | 54 | 65 | 175                              | 165  | 153  | 16.9 | 86              | 81  | 75  | 70 | 276                              | 260  | 240  | 13.5 | 136             | 128 | 118 | 77 |
| 10.0 | 116                                     | 109  | 101  | 20.8 | 63              | 60  | 55 | 65 | 162                              | 153  | 141  | 17.6 | 89              | 83  | 77  | 71 | 255                              | 240  | 222  | 14.0 | 139             | 131 | 121 | 78 |
| 11.0 | 100                                     | 95   | 87   | 22.4 | 66              | 62  | 58 | 66 | 141                              | 132  | 122  | 18.9 | 93              | 87  | 81  | 71 | 221                              | 208  | 192  | 15.1 | 146             | 137 | 127 | 79 |
| 12.0 | 88                                      | 83   | 77   | 23.9 | 69              | 65  | 60 | 67 | 123                              | 116  | 107  | 20.2 | 97              | 91  | 84  | 72 | 194                              | 182  | 169  | 16.1 | 152             | 143 | 133 | 79 |
| 13.0 | 78                                      | 73   | 68   | 25.4 | 72              | 68  | 63 | 67 | 109                              | 103  | 95   | 21.5 | 101             | 95  | 88  | 73 | 172                              | 162  | 150  | 17.1 | 158             | 149 | 138 | 80 |
| 14.0 | 70                                      | 66   | 61   | 26.8 | 75              | 70  | 65 | 68 | 98                               | 92   | 85   | 22.7 | 104             | 98  | 91  | 73 | 154                              | 145  | 134  | 18.1 | 164             | 155 | 143 | 81 |
| 15.0 | 63                                      | 59   | 55   | 28.3 | 77              | 73  | 67 | 68 | 88                               | 83   | 77   | 23.9 | 108             | 102 | 94  | 74 | 138                              | 130  | 120  | 19.1 | 170             | 160 | 148 | 81 |
| 16.0 | 57                                      | 54   | 50   | 29.7 | 80              | 75  | 69 | 69 | 80                               | 75   | 70   | 25.1 | 112             | 105 | 97  | 74 | 126                              | 118  | 109  | 20.0 | 175             | 165 | 153 | 82 |
| 17.0 | 52                                      | 49   | 45   | 31.1 | 82              | 77  | 71 | 69 | 73                               | 69   | 63   | 26.3 | 115             | 108 | 100 | 75 | 115                              | 108  | 100  | 21.0 | 181             | 170 | 157 | 82 |
| 18.0 | 48                                      | 45   | 42   | 32.5 | 84              | 79  | 73 | 70 | 67                               | 63   | 58   | 27.4 | 118             | 111 | 103 | 75 | 105                              | 99   | 91   | 21.9 | 186             | 175 | 162 | 83 |
| 19.0 | 44                                      | 41   | 38   | 33.8 | 87              | 82  | 75 | 70 | 62                               | 58   | 54   | 28.6 | 121             | 114 | 106 | 76 | 97                               | 91   | 84   | 22.8 | 191             | 179 | 166 | 83 |
| 20.0 | 41                                      | 38   | 35   | 35.1 | 89              | 84  | 77 | 71 | 57                               | 54   | 50   | 29.7 | 124             | 117 | 108 | 76 | 90                               | 84   | 78   | 23.7 | 195             | 184 | 170 | 83 |
| 22.0 | 35                                      | 33   | 31   | 37.8 | 93              | 88  | 81 | 71 | 49                               | 46   | 43   | 31.9 | 130             | 123 | 113 | 77 | 78                               | 73   | 68   | 25.5 | 205             | 193 | 178 | 84 |
| 24.0 | 31                                      | 29   | 27   | 40.3 | 97              | 91  | 85 | 72 | 43                               | 41   | 38   | 34.1 | 136             | 128 | 118 | 78 | 68                               | 64   | 59   | 27.2 | 214             | 201 | 186 | 85 |
| 26.0 | 27                                      | 26   | 24   | 42.8 | 101             | 95  | 88 | 73 | 38                               | 36   | 33   | 36.2 | 141             | 133 | 123 | 78 | 60                               | 57   | 52   | 28.9 | 222             | 209 | 194 | 85 |
| 28.0 | 25                                      | 23   | 21   | 45.3 | 105             | 99  | 91 | 73 | 34                               | 32   | 30   | 38.3 | 147             | 138 | 128 | 79 | 54                               | 51   | 47   | 30.5 | 231             | 217 | 201 | 86 |
| 30.0 | 22                                      | 21   | 19   | 47.7 | 108             | 102 | 94 | 74 | 31                               | 29   | 27   | 40.3 | 152             | 143 | 132 | 79 | 49                               | 46   | 42   | 32.2 | 238             | 225 | 208 | 87 |

**Table D15:** Douglas-fir stocking levels for the PSME/SYAL plant association (B-O province).

| QMD  | Climate Resilience; SDI 77; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 108; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 170; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 2500                                   | 2354 | 2176 | 4.5  | 14              | 13 | 12 | 41 | 3500                             | 3295 | 3047 | 3.8  | 19              | 18 | 17 | 46 | 5499                             | 5178 | 4788 | 3.0  | 30              | 28  | 26  | 53 |
| 1.5  | 1355                                   | 1276 | 1180 | 6.1  | 17              | 16 | 14 | 44 | 1897                             | 1786 | 1652 | 5.1  | 23              | 22 | 20 | 50 | 2981                             | 2807 | 2596 | 4.1  | 37              | 34  | 32  | 57 |
| 2.0  | 878                                    | 826  | 764  | 7.6  | 19              | 18 | 17 | 46 | 1229                             | 1157 | 1070 | 6.4  | 27              | 25 | 23 | 52 | 1931                             | 1818 | 1681 | 5.1  | 42              | 40  | 37  | 59 |
| 2.5  | 627                                    | 590  | 546  | 9.0  | 21              | 20 | 19 | 48 | 877                              | 826  | 764  | 7.6  | 30              | 28 | 26 | 53 | 1379                             | 1298 | 1200 | 6.0  | 47              | 44  | 41  | 61 |
| 3.0  | 476                                    | 448  | 414  | 10.3 | 23              | 22 | 20 | 50 | 666                              | 627  | 580  | 8.7  | 33              | 31 | 28 | 55 | 1047                             | 986  | 911  | 6.9  | 51              | 48  | 45  | 62 |
| 3.5  | 377                                    | 355  | 328  | 11.6 | 25              | 24 | 22 | 51 | 528                              | 497  | 460  | 9.8  | 35              | 33 | 31 | 56 | 829                              | 781  | 722  | 7.8  | 55              | 52  | 48  | 63 |
| 4.0  | 308                                    | 290  | 268  | 12.8 | 27              | 25 | 23 | 52 | 431                              | 406  | 376  | 10.8 | 38              | 35 | 33 | 57 | 678                              | 638  | 590  | 8.6  | 59              | 56  | 52  | 64 |
| 4.5  | 258                                    | 243  | 225  | 14.0 | 28              | 27 | 25 | 53 | 361                              | 340  | 314  | 11.8 | 40              | 38 | 35 | 58 | 568                              | 534  | 494  | 9.4  | 63              | 59  | 55  | 65 |
| 5.0  | 220                                    | 207  | 192  | 15.1 | 30              | 28 | 26 | 53 | 308                              | 290  | 268  | 12.8 | 42              | 40 | 37 | 59 | 484                              | 456  | 421  | 10.2 | 66              | 62  | 57  | 66 |
| 5.5  | 191                                    | 179  | 166  | 16.2 | 31              | 30 | 27 | 54 | 267                              | 251  | 232  | 13.7 | 44              | 41 | 38 | 59 | 419                              | 395  | 365  | 11.0 | 69              | 65  | 60  | 67 |
| 6.0  | 167                                    | 157  | 145  | 17.4 | 33              | 31 | 29 | 55 | 234                              | 220  | 204  | 14.7 | 46              | 43 | 40 | 60 | 368                              | 346  | 320  | 11.7 | 72              | 68  | 63  | 67 |
| 6.5  | 148                                    | 139  | 129  | 18.4 | 34              | 32 | 30 | 55 | 207                              | 195  | 180  | 15.6 | 48              | 45 | 42 | 61 | 326                              | 307  | 284  | 12.4 | 75              | 71  | 65  | 68 |
| 7.0  | 132                                    | 125  | 115  | 19.5 | 35              | 33 | 31 | 56 | 185                              | 174  | 161  | 16.5 | 50              | 47 | 43 | 61 | 291                              | 274  | 254  | 13.1 | 78              | 73  | 68  | 69 |
| 7.5  | 119                                    | 112  | 104  | 20.5 | 37              | 34 | 32 | 57 | 167                              | 157  | 145  | 17.4 | 51              | 48 | 45 | 62 | 262                              | 247  | 228  | 13.8 | 81              | 76  | 70  | 69 |
| 8.0  | 108                                    | 102  | 94   | 21.6 | 38              | 36 | 33 | 57 | 151                              | 143  | 132  | 18.2 | 53              | 50 | 46 | 62 | 238                              | 224  | 207  | 14.5 | 83              | 78  | 72  | 70 |
| 8.5  | 99                                     | 93   | 86   | 22.6 | 39              | 37 | 34 | 58 | 138                              | 130  | 120  | 19.1 | 54              | 51 | 47 | 63 | 217                              | 205  | 189  | 15.2 | 86              | 81  | 75  | 70 |
| 9.0  | 91                                     | 85   | 79   | 23.6 | 40              | 38 | 35 | 58 | 127                              | 119  | 110  | 19.9 | 56              | 53 | 49 | 63 | 199                              | 188  | 173  | 15.9 | 88              | 83  | 77  | 71 |
| 9.5  | 83                                     | 79   | 73   | 24.5 | 41              | 39 | 36 | 58 | 117                              | 110  | 102  | 20.7 | 58              | 54 | 50 | 64 | 184                              | 173  | 160  | 16.6 | 90              | 85  | 79  | 71 |
| 10.0 | 77                                     | 73   | 67   | 25.5 | 42              | 40 | 37 | 59 | 108                              | 102  | 94   | 21.6 | 59              | 56 | 51 | 64 | 170                              | 160  | 148  | 17.2 | 93              | 87  | 81  | 71 |
| 11.0 | 67                                     | 63   | 58   | 27.4 | 44              | 42 | 38 | 60 | 94                               | 88   | 82   | 23.2 | 62              | 58 | 54 | 65 | 147                              | 139  | 128  | 18.5 | 97              | 91  | 85  | 72 |
| 12.0 | 59                                     | 55   | 51   | 29.3 | 46              | 43 | 40 | 60 | 82                               | 77   | 71   | 24.7 | 64              | 61 | 56 | 66 | 129                              | 122  | 112  | 19.7 | 101             | 95  | 88  | 73 |
| 13.0 | 52                                     | 49   | 45   | 31.1 | 48              | 45 | 42 | 61 | 73                               | 69   | 63   | 26.3 | 67              | 63 | 58 | 66 | 114                              | 108  | 100  | 21.0 | 105             | 99  | 92  | 73 |
| 14.0 | 46                                     | 44   | 40   | 32.9 | 50              | 47 | 43 | 61 | 65                               | 61   | 57   | 27.8 | 70              | 65 | 61 | 67 | 102                              | 96   | 89   | 22.2 | 109             | 103 | 95  | 74 |
| 15.0 | 42                                     | 39   | 36   | 34.7 | 51              | 48 | 45 | 62 | 59                               | 55   | 51   | 29.3 | 72              | 68 | 63 | 67 | 92                               | 87   | 80   | 23.4 | 113             | 106 | 98  | 75 |
| 16.0 | 38                                     | 36   | 33   | 36.4 | 53              | 50 | 46 | 62 | 53                               | 50   | 46   | 30.8 | 74              | 70 | 65 | 68 | 84                               | 79   | 73   | 24.5 | 117             | 110 | 102 | 75 |
| 17.0 | 35                                     | 33   | 30   | 38.1 | 55              | 51 | 48 | 63 | 49                               | 46   | 42   | 32.2 | 77              | 72 | 67 | 68 | 76                               | 72   | 66   | 25.7 | 120             | 113 | 105 | 76 |
| 18.0 | 32                                     | 30   | 28   | 39.8 | 56              | 53 | 49 | 63 | 45                               | 42   | 39   | 33.6 | 79              | 74 | 68 | 69 | 70                               | 66   | 61   | 26.8 | 124             | 116 | 108 | 76 |
| 19.0 | 29                                     | 28   | 26   | 41.4 | 58              | 54 | 50 | 64 | 41                               | 39   | 36   | 35.0 | 81              | 76 | 70 | 69 | 64                               | 61   | 56   | 27.9 | 127             | 120 | 111 | 76 |
| 20.0 | 27                                     | 26   | 24   | 43.1 | 59              | 56 | 52 | 64 | 38                               | 36   | 33   | 36.4 | 83              | 78 | 72 | 70 | 60                               | 56   | 52   | 29.0 | 130             | 123 | 113 | 77 |
| 22.0 | 23                                     | 22   | 20   | 46.3 | 62              | 58 | 54 | 65 | 33                               | 31   | 29   | 39.1 | 87              | 82 | 76 | 70 | 52                               | 49   | 45   | 31.2 | 136             | 128 | 119 | 78 |
| 24.0 | 21                                     | 19   | 18   | 49.4 | 65              | 61 | 56 | 66 | 29                               | 27   | 25   | 41.8 | 91              | 85 | 79 | 71 | 45                               | 43   | 39   | 33.3 | 142             | 134 | 124 | 78 |
| 26.0 | 18                                     | 17   | 16   | 52.5 | 67              | 63 | 59 | 66 | 26                               | 24   | 22   | 44.4 | 94              | 89 | 82 | 72 | 40                               | 38   | 35   | 35.4 | 148             | 139 | 129 | 79 |
| 28.0 | 16                                     | 15   | 14   | 55.5 | 70              | 66 | 61 | 67 | 23                               | 22   | 20   | 46.9 | 98              | 92 | 85 | 72 | 36                               | 34   | 31   | 37.4 | 154             | 145 | 134 | 79 |
| 30.0 | 15                                     | 14   | 13   | 58.5 | 72              | 68 | 63 | 67 | 21                               | 19   | 18   | 49.4 | 101             | 95 | 88 | 73 | 32                               | 30   | 28   | 39.4 | 159             | 150 | 138 | 80 |

**Table D16:** Douglas-fir stocking levels for the PSME/VAME plant association (B-O province).

| QMD  | Climate Resilience; SDI 57; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 80; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 126; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 1853                                   | 1744 | 1613 | 5.2  | 10              | 10 | 9  | 37 | 2594                            | 2442 | 2258 | 4.4  | 14              | 13 | 12 | 42 | 4076                             | 3837 | 3548 | 3.5  | 22              | 21  | 19  | 49 |
| 1.5  | 1004                                   | 946  | 874  | 7.1  | 12              | 12 | 11 | 40 | 1406                            | 1324 | 1224 | 6.0  | 17              | 16 | 15 | 45 | 2210                             | 2080 | 1924 | 4.8  | 27              | 26  | 24  | 52 |
| 2.0  | 650                                    | 612  | 566  | 8.8  | 14              | 13 | 12 | 42 | 911                             | 857  | 793  | 7.4  | 20              | 19 | 17 | 47 | 1431                             | 1347 | 1246 | 5.9  | 31              | 29  | 27  | 54 |
| 2.5  | 464                                    | 437  | 404  | 10.4 | 16              | 15 | 14 | 44 | 650                             | 612  | 566  | 8.8  | 22              | 21 | 19 | 49 | 1022                             | 962  | 889  | 7.0  | 35              | 33  | 30  | 56 |
| 3.0  | 353                                    | 332  | 307  | 11.9 | 17              | 16 | 15 | 45 | 494                             | 465  | 430  | 10.1 | 24              | 23 | 21 | 50 | 776                              | 730  | 675  | 8.1  | 38              | 36  | 33  | 57 |
| 3.5  | 279                                    | 263  | 243  | 13.4 | 19              | 18 | 16 | 46 | 391                             | 368  | 341  | 11.3 | 26              | 25 | 23 | 51 | 615                              | 579  | 535  | 9.0  | 41              | 39  | 36  | 58 |
| 4.0  | 228                                    | 215  | 199  | 14.8 | 20              | 19 | 17 | 47 | 320                             | 301  | 278  | 12.5 | 28              | 26 | 24 | 52 | 502                              | 473  | 437  | 10.0 | 44              | 41  | 38  | 59 |
| 4.5  | 191                                    | 180  | 166  | 16.2 | 21              | 20 | 18 | 48 | 268                             | 252  | 233  | 13.7 | 30              | 28 | 26 | 53 | 421                              | 396  | 366  | 10.9 | 46              | 44  | 40  | 60 |
| 5.0  | 163                                    | 154  | 142  | 17.6 | 22              | 21 | 19 | 49 | 228                             | 215  | 199  | 14.8 | 31              | 29 | 27 | 54 | 359                              | 338  | 312  | 11.8 | 49              | 46  | 43  | 61 |
| 5.5  | 141                                    | 133  | 123  | 18.9 | 23              | 22 | 20 | 50 | 198                             | 186  | 172  | 16.0 | 33              | 31 | 28 | 55 | 311                              | 292  | 270  | 12.7 | 51              | 48  | 45  | 62 |
| 6.0  | 124                                    | 117  | 108  | 20.2 | 24              | 23 | 21 | 50 | 173                             | 163  | 151  | 17.0 | 34              | 32 | 30 | 55 | 272                              | 256  | 237  | 13.6 | 53              | 50  | 47  | 63 |
| 6.5  | 110                                    | 103  | 96   | 21.4 | 25              | 24 | 22 | 51 | 154                             | 145  | 134  | 18.1 | 35              | 33 | 31 | 56 | 241                              | 227  | 210  | 14.4 | 56              | 52  | 48  | 63 |
| 7.0  | 98                                     | 92   | 85   | 22.6 | 26              | 25 | 23 | 51 | 137                             | 129  | 120  | 19.1 | 37              | 35 | 32 | 57 | 216                              | 203  | 188  | 15.3 | 58              | 54  | 50  | 64 |
| 7.5  | 88                                     | 83   | 77   | 23.9 | 27              | 26 | 24 | 52 | 124                             | 117  | 108  | 20.2 | 38              | 36 | 33 | 57 | 194                              | 183  | 169  | 16.1 | 60              | 56  | 52  | 64 |
| 8.0  | 80                                     | 75   | 70   | 25.0 | 28              | 26 | 24 | 52 | 112                             | 106  | 98   | 21.2 | 39              | 37 | 34 | 58 | 176                              | 166  | 154  | 16.9 | 62              | 58  | 54  | 65 |
| 8.5  | 73                                     | 69   | 64   | 26.2 | 29              | 27 | 25 | 53 | 102                             | 96   | 89   | 22.2 | 40              | 38 | 35 | 58 | 161                              | 152  | 140  | 17.7 | 63              | 60  | 55  | 65 |
| 9.0  | 67                                     | 63   | 58   | 27.4 | 30              | 28 | 26 | 53 | 94                              | 88   | 82   | 23.1 | 42              | 39 | 36 | 59 | 148                              | 139  | 129  | 18.5 | 65              | 61  | 57  | 66 |
| 9.5  | 62                                     | 58   | 54   | 28.5 | 30              | 29 | 27 | 54 | 87                              | 82   | 75   | 24.1 | 43              | 40 | 37 | 59 | 136                              | 128  | 118  | 19.2 | 67              | 63  | 58  | 66 |
| 10.0 | 57                                     | 54   | 50   | 29.6 | 31              | 29 | 27 | 54 | 80                              | 75   | 70   | 25.1 | 44              | 41 | 38 | 59 | 126                              | 119  | 110  | 20.0 | 69              | 65  | 60  | 67 |
| 11.0 | 50                                     | 47   | 43   | 31.9 | 33              | 31 | 28 | 55 | 69                              | 65   | 60   | 26.9 | 46              | 43 | 40 | 60 | 109                              | 103  | 95   | 21.5 | 72              | 68  | 63  | 67 |
| 12.0 | 43                                     | 41   | 38   | 34.0 | 34              | 32 | 30 | 55 | 61                              | 57   | 53   | 28.7 | 48              | 45 | 42 | 61 | 96                               | 90   | 83   | 22.9 | 75              | 71  | 65  | 68 |
| 13.0 | 39                                     | 36   | 34   | 36.1 | 36              | 33 | 31 | 56 | 54                              | 51   | 47   | 30.5 | 50              | 47 | 43 | 61 | 85                               | 80   | 74   | 24.4 | 78              | 74  | 68  | 69 |
| 14.0 | 34                                     | 32   | 30   | 38.2 | 37              | 35 | 32 | 57 | 48                              | 45   | 42   | 32.3 | 52              | 49 | 45 | 62 | 76                               | 71   | 66   | 25.8 | 81              | 76  | 71  | 69 |
| 15.0 | 31                                     | 29   | 27   | 40.3 | 38              | 36 | 33 | 57 | 43                              | 41   | 38   | 34.0 | 53              | 50 | 46 | 63 | 68                               | 64   | 59   | 27.1 | 84              | 79  | 73  | 70 |
| 16.0 | 28                                     | 27   | 25   | 42.3 | 39              | 37 | 34 | 58 | 39                              | 37   | 34   | 35.7 | 55              | 52 | 48 | 63 | 62                               | 58   | 54   | 28.5 | 86              | 81  | 75  | 70 |
| 17.0 | 26                                     | 24   | 22   | 44.2 | 40              | 38 | 35 | 58 | 36                              | 34   | 31   | 37.4 | 57              | 53 | 49 | 64 | 57                               | 53   | 49   | 29.8 | 89              | 84  | 78  | 71 |
| 18.0 | 24                                     | 22   | 21   | 46.2 | 42              | 39 | 36 | 59 | 33                              | 31   | 29   | 39.0 | 58              | 55 | 51 | 64 | 52                               | 49   | 45   | 31.1 | 92              | 86  | 80  | 71 |
| 19.0 | 22                                     | 20   | 19   | 48.1 | 43              | 40 | 37 | 59 | 30                              | 29   | 26   | 40.7 | 60              | 56 | 52 | 64 | 48                               | 45   | 42   | 32.4 | 94              | 89  | 82  | 72 |
| 20.0 | 20                                     | 19   | 18   | 50.0 | 44              | 41 | 38 | 59 | 28                              | 26   | 25   | 42.3 | 61              | 58 | 53 | 65 | 44                               | 42   | 39   | 33.7 | 96              | 91  | 84  | 72 |
| 22.0 | 17                                     | 16   | 15   | 53.8 | 46              | 43 | 40 | 60 | 24                              | 23   | 21   | 45.4 | 64              | 61 | 56 | 66 | 38                               | 36   | 33   | 36.2 | 101             | 95  | 88  | 73 |
| 24.0 | 15                                     | 14   | 13   | 57.4 | 48              | 45 | 42 | 61 | 21                              | 20   | 19   | 48.5 | 67              | 63 | 58 | 66 | 34                               | 32   | 29   | 38.7 | 105             | 99  | 92  | 73 |
| 26.0 | 14                                     | 13   | 12   | 61.0 | 50              | 47 | 43 | 61 | 19                              | 18   | 16   | 51.5 | 70              | 66 | 61 | 67 | 30                               | 28   | 26   | 41.1 | 110             | 103 | 96  | 74 |
| 28.0 | 12                                     | 11   | 11   | 64.5 | 52              | 49 | 45 | 62 | 17                              | 16   | 15   | 54.5 | 72              | 68 | 63 | 67 | 27                               | 25   | 23   | 43.5 | 114             | 107 | 99  | 75 |
| 30.0 | 11                                     | 10   | 9    | 67.9 | 53              | 50 | 47 | 63 | 15                              | 14   | 13   | 57.4 | 75              | 71 | 65 | 68 | 24                               | 23   | 21   | 45.8 | 118             | 111 | 102 | 75 |

**Table W1:** Western larch stocking levels for the ABGR/ACGL and ABGR/POMU-ASCA3 plant associations (B-O province).

| QMD  | Climate Resilience; SDI 110; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 154; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 241; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5894                                    | 5549 | 5131 | 2.9  | 32              | 30 | 28 | 42 | 8251                             | 7769 | 7184 | 2.5  | 45              | 42  | 39 | 48 | 12967                            | 12208 | 11289 | 2.0  | 71              | 67  | 62  | 56 |
| 1.5  | 2923                                    | 2752 | 2544 | 4.1  | 36              | 34 | 31 | 44 | 4092                             | 3852 | 3562 | 3.5  | 50              | 47  | 44 | 50 | 6430                             | 6054  | 5598  | 2.8  | 79              | 74  | 69  | 58 |
| 2.0  | 1777                                    | 1673 | 1547 | 5.3  | 39              | 36 | 34 | 46 | 2487                             | 2342 | 2166 | 4.5  | 54              | 51  | 47 | 51 | 3909                             | 3680  | 3403  | 3.6  | 85              | 80  | 74  | 60 |
| 2.5  | 1208                                    | 1137 | 1051 | 6.5  | 41              | 39 | 36 | 47 | 1691                             | 1592 | 1472 | 5.5  | 58              | 54  | 50 | 53 | 2657                             | 2502  | 2313  | 4.4  | 91              | 85  | 79  | 61 |
| 3.0  | 881                                     | 829  | 767  | 7.6  | 43              | 41 | 38 | 47 | 1233                             | 1161 | 1074 | 6.4  | 61              | 57  | 53 | 53 | 1938                             | 1825  | 1687  | 5.1  | 95              | 90  | 83  | 62 |
| 3.5  | 675                                     | 635  | 587  | 8.6  | 45              | 42 | 39 | 48 | 945                              | 889  | 822  | 7.3  | 63              | 59  | 55 | 54 | 1485                             | 1398  | 1292  | 5.8  | 99              | 93  | 86  | 62 |
| 4.0  | 536                                     | 504  | 466  | 9.7  | 47              | 44 | 41 | 49 | 750                              | 706  | 653  | 8.2  | 65              | 62  | 57 | 55 | 1178                             | 1109  | 1026  | 6.5  | 103             | 97  | 90  | 63 |
| 4.5  | 437                                     | 411  | 380  | 10.7 | 48              | 45 | 42 | 49 | 612                              | 576  | 532  | 9.1  | 68              | 64  | 59 | 55 | 961                              | 905   | 837   | 7.2  | 106             | 100 | 92  | 63 |
| 5.0  | 364                                     | 343  | 317  | 11.8 | 50              | 47 | 43 | 50 | 510                              | 480  | 444  | 9.9  | 69              | 65  | 61 | 56 | 801                              | 754   | 697   | 7.9  | 109             | 103 | 95  | 64 |
| 5.5  | 309                                     | 291  | 269  | 12.8 | 51              | 48 | 44 | 50 | 432                              | 407  | 376  | 10.8 | 71              | 67  | 62 | 56 | 679                              | 639   | 591   | 8.6  | 112             | 106 | 98  | 64 |
| 6.0  | 266                                     | 250  | 231  | 13.8 | 52              | 49 | 45 | 51 | 372                              | 350  | 324  | 11.6 | 73              | 69  | 64 | 57 | 584                              | 550   | 509   | 9.3  | 115             | 108 | 100 | 65 |
| 6.5  | 231                                     | 218  | 201  | 14.7 | 53              | 50 | 46 | 51 | 324                              | 305  | 282  | 12.5 | 75              | 70  | 65 | 57 | 509                              | 479   | 443   | 9.9  | 117             | 110 | 102 | 65 |
| 7.0  | 203                                     | 192  | 177  | 15.7 | 54              | 51 | 47 | 52 | 285                              | 268  | 248  | 13.3 | 76              | 72  | 66 | 58 | 448                              | 421   | 390   | 10.6 | 120             | 113 | 104 | 66 |
| 7.5  | 181                                     | 170  | 157  | 16.7 | 55              | 52 | 48 | 52 | 253                              | 238  | 220  | 14.1 | 78              | 73  | 68 | 58 | 397                              | 374   | 346   | 11.3 | 122             | 115 | 106 | 66 |
| 8.0  | 161                                     | 152  | 141  | 17.7 | 56              | 53 | 49 | 52 | 226                              | 213  | 197  | 14.9 | 79              | 74  | 69 | 58 | 355                              | 334   | 309   | 11.9 | 124             | 117 | 108 | 66 |
| 8.5  | 145                                     | 137  | 127  | 18.6 | 57              | 54 | 50 | 52 | 204                              | 192  | 177  | 15.7 | 80              | 76  | 70 | 58 | 320                              | 301   | 278   | 12.5 | 126             | 119 | 110 | 67 |
| 9.0  | 132                                     | 124  | 115  | 19.5 | 58              | 55 | 51 | 53 | 184                              | 174  | 161  | 16.5 | 81              | 77  | 71 | 59 | 290                              | 273   | 252   | 13.2 | 128             | 121 | 111 | 67 |
| 9.5  | 120                                     | 113  | 104  | 20.5 | 59              | 56 | 51 | 53 | 168                              | 158  | 146  | 17.3 | 83              | 78  | 72 | 59 | 264                              | 248   | 230   | 13.8 | 130             | 122 | 113 | 67 |
| 10.0 | 110                                     | 103  | 96   | 21.4 | 60              | 56 | 52 | 53 | 154                              | 145  | 134  | 18.1 | 84              | 79  | 73 | 59 | 241                              | 227   | 210   | 14.4 | 132             | 124 | 115 | 67 |
| 11.0 | 93                                      | 88   | 81   | 23.2 | 61              | 58 | 53 | 54 | 130                              | 123  | 113  | 19.6 | 86              | 81  | 75 | 60 | 205                              | 193   | 178   | 15.7 | 135             | 127 | 118 | 68 |
| 12.0 | 80                                      | 75   | 70   | 25.1 | 63              | 59 | 55 | 54 | 112                              | 106  | 98   | 21.2 | 88              | 83  | 77 | 60 | 176                              | 166   | 153   | 16.9 | 138             | 130 | 120 | 68 |
| 13.0 | 70                                      | 66   | 61   | 26.9 | 64              | 60 | 56 | 54 | 98                               | 92   | 85   | 22.7 | 90              | 85  | 78 | 61 | 153                              | 144   | 134   | 18.1 | 141             | 133 | 123 | 69 |
| 14.0 | 61                                      | 58   | 53   | 28.6 | 66              | 62 | 57 | 55 | 86                               | 81   | 75   | 24.2 | 92              | 86  | 80 | 61 | 135                              | 127   | 117   | 19.3 | 144             | 136 | 126 | 69 |
| 15.0 | 54                                      | 51   | 47   | 30.4 | 67              | 63 | 58 | 55 | 76                               | 72   | 66   | 25.7 | 93              | 88  | 81 | 61 | 120                              | 113   | 104   | 20.5 | 147             | 138 | 128 | 69 |
| 16.0 | 49                                      | 46   | 42   | 32.1 | 68              | 64 | 59 | 55 | 68                               | 64   | 59   | 27.2 | 95              | 90  | 83 | 62 | 107                              | 101   | 93    | 21.7 | 150             | 141 | 130 | 70 |
| 17.0 | 44                                      | 41   | 38   | 33.9 | 69              | 65 | 60 | 56 | 61                               | 58   | 53   | 28.6 | 97              | 91  | 84 | 62 | 96                               | 91    | 84    | 22.8 | 152             | 143 | 132 | 70 |
| 18.0 | 40                                      | 37   | 35   | 35.6 | 70              | 66 | 61 | 56 | 56                               | 52   | 48   | 30.1 | 98              | 92  | 86 | 62 | 87                               | 82    | 76    | 24.0 | 154             | 145 | 134 | 70 |
| 19.0 | 36                                      | 34   | 31   | 37.3 | 71              | 67 | 62 | 56 | 51                               | 48   | 44   | 31.5 | 100             | 94  | 87 | 62 | 80                               | 75    | 69    | 25.1 | 157             | 147 | 136 | 70 |
| 20.0 | 33                                      | 31   | 29   | 39.0 | 72              | 68 | 63 | 57 | 46                               | 44   | 40   | 33.0 | 101             | 95  | 88 | 63 | 73                               | 69    | 63    | 26.3 | 159             | 150 | 138 | 71 |
| 22.0 | 28                                      | 26   | 24   | 42.3 | 74              | 70 | 64 | 57 | 39                               | 37   | 34   | 35.8 | 104             | 98  | 90 | 63 | 62                               | 58    | 54    | 28.5 | 163             | 153 | 142 | 71 |
| 24.0 | 24                                      | 23   | 21   | 45.7 | 76              | 71 | 66 | 57 | 34                               | 32   | 29   | 38.6 | 106             | 100 | 92 | 63 | 53                               | 50    | 46    | 30.8 | 167             | 157 | 145 | 72 |
| 26.0 | 21                                      | 20   | 18   | 48.9 | 77              | 73 | 67 | 58 | 29                               | 28   | 26   | 41.3 | 108             | 102 | 94 | 64 | 46                               | 44    | 40    | 33.0 | 170             | 160 | 148 | 72 |
| 28.0 | 18                                      | 17   | 16   | 52.2 | 79              | 74 | 69 | 58 | 26                               | 24   | 23   | 44.1 | 111             | 104 | 96 | 64 | 41                               | 38    | 35    | 35.2 | 174             | 164 | 151 | 72 |
| 30.0 | 16                                      | 15   | 14   | 55.4 | 81              | 76 | 70 | 59 | 23                               | 22   | 20   | 46.8 | 113             | 106 | 98 | 65 | 36                               | 34    | 31    | 37.3 | 177             | 167 | 154 | 73 |

**Table W2:** Western larch stocking levels for the ABGR/ACGL-PHMA plant association (W-S province).

| QMD  | Climate Resilience; SDI 111; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 155; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 244; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5961                                    | 5612 | 5190 | 2.9  | 33              | 31 | 28 | 42 | 8345                             | 7857 | 7266 | 2.5  | 46              | 43  | 40 | 48 | 13114                            | 12347 | 11417 | 2.0  | 72              | 67  | 62  | 56 |
| 1.5  | 2956                                    | 2783 | 2573 | 4.1  | 36              | 34 | 32 | 44 | 4138                             | 3896 | 3603 | 3.5  | 51              | 48  | 44 | 50 | 6503                             | 6122  | 5661  | 2.8  | 80              | 75  | 69  | 58 |
| 2.0  | 1797                                    | 1692 | 1564 | 5.3  | 39              | 37 | 34 | 46 | 2516                             | 2369 | 2190 | 4.5  | 55              | 52  | 48 | 52 | 3953                             | 3722  | 3442  | 3.6  | 86              | 81  | 75  | 60 |
| 2.5  | 1221                                    | 1150 | 1063 | 6.4  | 42              | 39 | 36 | 47 | 1710                             | 1610 | 1489 | 5.4  | 58              | 55  | 51 | 53 | 2687                             | 2530  | 2340  | 4.3  | 92              | 86  | 80  | 61 |
| 3.0  | 891                                     | 839  | 776  | 7.5  | 44              | 41 | 38 | 48 | 1247                             | 1174 | 1086 | 6.3  | 61              | 58  | 53 | 54 | 1960                             | 1846  | 1707  | 5.1  | 96              | 91  | 84  | 62 |
| 3.5  | 682                                     | 643  | 594  | 8.6  | 46              | 43 | 40 | 48 | 955                              | 900  | 832  | 7.3  | 64              | 60  | 56 | 54 | 1501                             | 1414  | 1307  | 5.8  | 100             | 94  | 87  | 62 |
| 4.0  | 542                                     | 510  | 472  | 9.6  | 47              | 45 | 41 | 49 | 758                              | 714  | 660  | 8.1  | 66              | 62  | 58 | 55 | 1192                             | 1122  | 1038  | 6.5  | 104             | 98  | 91  | 63 |
| 4.5  | 442                                     | 416  | 385  | 10.7 | 49              | 46 | 42 | 50 | 619                              | 582  | 539  | 9.0  | 68              | 64  | 59 | 56 | 972                              | 915   | 846   | 7.2  | 107             | 101 | 93  | 64 |
| 5.0  | 368                                     | 347  | 321  | 11.7 | 50              | 47 | 44 | 50 | 516                              | 485  | 449  | 9.9  | 70              | 66  | 61 | 56 | 810                              | 763   | 705   | 7.9  | 110             | 104 | 96  | 64 |
| 5.5  | 312                                     | 294  | 272  | 12.7 | 52              | 49 | 45 | 51 | 437                              | 412  | 381  | 10.7 | 72              | 68  | 63 | 57 | 687                              | 647   | 598   | 8.6  | 113             | 107 | 99  | 65 |
| 6.0  | 269                                     | 253  | 234  | 13.7 | 53              | 50 | 46 | 51 | 376                              | 354  | 327  | 11.6 | 74              | 70  | 64 | 57 | 591                              | 556   | 514   | 9.2  | 116             | 109 | 101 | 65 |
| 6.5  | 234                                     | 220  | 204  | 14.7 | 54              | 51 | 47 | 51 | 327                              | 308  | 285  | 12.4 | 75              | 71  | 66 | 57 | 515                              | 484   | 448   | 9.9  | 119             | 112 | 103 | 65 |
| 7.0  | 206                                     | 194  | 179  | 15.6 | 55              | 52 | 48 | 52 | 288                              | 271  | 251  | 13.2 | 77              | 72  | 67 | 58 | 453                              | 426   | 394   | 10.5 | 121             | 114 | 105 | 66 |
| 7.5  | 183                                     | 172  | 159  | 16.6 | 56              | 53 | 49 | 52 | 256                              | 241  | 223  | 14.0 | 78              | 74  | 68 | 58 | 402                              | 378   | 350   | 11.2 | 123             | 116 | 107 | 66 |
| 8.0  | 163                                     | 154  | 142  | 17.6 | 57              | 54 | 50 | 52 | 229                              | 215  | 199  | 14.8 | 80              | 75  | 69 | 58 | 359                              | 338   | 313   | 11.8 | 125             | 118 | 109 | 66 |
| 8.5  | 147                                     | 138  | 128  | 18.5 | 58              | 55 | 50 | 53 | 206                              | 194  | 179  | 15.6 | 81              | 76  | 71 | 59 | 323                              | 305   | 282   | 12.5 | 127             | 120 | 111 | 67 |
| 9.0  | 133                                     | 125  | 116  | 19.4 | 59              | 55 | 51 | 53 | 186                              | 176  | 162  | 16.4 | 82              | 78  | 72 | 59 | 293                              | 276   | 255   | 13.1 | 129             | 122 | 113 | 67 |
| 9.5  | 121                                     | 114  | 106  | 20.4 | 60              | 56 | 52 | 53 | 170                              | 160  | 148  | 17.2 | 84              | 79  | 73 | 59 | 267                              | 251   | 232   | 13.7 | 131             | 124 | 114 | 67 |
| 10.0 | 111                                     | 105  | 97   | 21.3 | 61              | 57 | 53 | 53 | 155                              | 146  | 135  | 18.0 | 85              | 80  | 74 | 59 | 244                              | 230   | 213   | 14.4 | 133             | 125 | 116 | 68 |
| 11.0 | 94                                      | 89   | 82   | 23.1 | 62              | 58 | 54 | 54 | 132                              | 124  | 115  | 19.5 | 87              | 82  | 76 | 60 | 207                              | 195   | 180   | 15.6 | 137             | 129 | 119 | 68 |
| 12.0 | 81                                      | 76   | 70   | 24.9 | 64              | 60 | 55 | 54 | 113                              | 107  | 99   | 21.1 | 89              | 84  | 78 | 60 | 178                              | 168   | 155   | 16.8 | 140             | 132 | 122 | 68 |
| 13.0 | 71                                      | 66   | 61   | 26.7 | 65              | 61 | 57 | 55 | 99                               | 93   | 86   | 22.6 | 91              | 86  | 79 | 61 | 155                              | 146   | 135   | 18.0 | 143             | 135 | 124 | 69 |
| 14.0 | 62                                      | 58   | 54   | 28.5 | 66              | 62 | 58 | 55 | 87                               | 82   | 76   | 24.1 | 93              | 87  | 81 | 61 | 136                              | 128   | 119   | 19.2 | 146             | 137 | 127 | 69 |
| 15.0 | 55                                      | 52   | 48   | 30.2 | 68              | 64 | 59 | 55 | 77                               | 73   | 67   | 25.5 | 95              | 89  | 82 | 61 | 121                              | 114   | 105   | 20.4 | 149             | 140 | 129 | 70 |
| 16.0 | 49                                      | 46   | 43   | 32.0 | 69              | 65 | 60 | 56 | 69                               | 65   | 60   | 27.0 | 96              | 91  | 84 | 62 | 108                              | 102   | 94    | 21.6 | 151             | 142 | 132 | 70 |
| 17.0 | 44                                      | 42   | 39   | 33.7 | 70              | 66 | 61 | 56 | 62                               | 58   | 54   | 28.5 | 98              | 92  | 85 | 62 | 98                               | 92    | 85    | 22.7 | 154             | 145 | 134 | 70 |
| 18.0 | 40                                      | 38   | 35   | 35.4 | 71              | 67 | 62 | 56 | 56                               | 53   | 49   | 29.9 | 99              | 94  | 86 | 62 | 88                               | 83    | 77    | 23.9 | 156             | 147 | 136 | 70 |
| 19.0 | 37                                      | 34   | 32   | 37.1 | 72              | 68 | 63 | 57 | 51                               | 48   | 45   | 31.3 | 101             | 95  | 88 | 63 | 80                               | 76    | 70    | 25.0 | 158             | 149 | 138 | 71 |
| 20.0 | 33                                      | 32   | 29   | 38.8 | 73              | 69 | 64 | 57 | 47                               | 44   | 41   | 32.8 | 102             | 96  | 89 | 63 | 74                               | 69    | 64    | 26.1 | 161             | 151 | 140 | 71 |
| 22.0 | 28                                      | 27   | 25   | 42.1 | 75              | 71 | 65 | 57 | 40                               | 37   | 35   | 35.6 | 105             | 99  | 91 | 63 | 62                               | 59    | 54    | 28.4 | 165             | 155 | 143 | 71 |
| 24.0 | 24                                      | 23   | 21   | 45.4 | 77              | 72 | 67 | 58 | 34                               | 32   | 30   | 38.4 | 107             | 101 | 93 | 64 | 54                               | 51    | 47    | 30.6 | 169             | 159 | 147 | 72 |
| 26.0 | 21                                      | 20   | 19   | 48.6 | 78              | 74 | 68 | 58 | 30                               | 28   | 26   | 41.1 | 110             | 103 | 96 | 64 | 47                               | 44    | 41    | 32.8 | 172             | 162 | 150 | 72 |
| 28.0 | 19                                      | 18   | 16   | 51.9 | 80              | 75 | 70 | 58 | 26                               | 25   | 23   | 43.8 | 112             | 105 | 97 | 64 | 41                               | 39    | 36    | 35.0 | 176             | 166 | 153 | 73 |
| 30.0 | 17                                      | 16   | 14   | 55.1 | 81              | 77 | 71 | 59 | 23                               | 22   | 20   | 46.5 | 114             | 107 | 99 | 65 | 37                               | 34    | 32    | 37.1 | 179             | 169 | 156 | 73 |

**Table W3:** Western larch stocking levels for the ABGR/CARU plant association (B-O province) and the ABGR/ARCO plant community type.

| QMD  | Climate Resilience; SDI 96; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 134; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 211; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5156                                   | 4854 | 4488 | 3.1  | 28              | 26 | 24 | 40 | 7218                             | 6795 | 6284 | 2.6  | 39              | 37 | 34 | 46 | 11342                            | 10679 | 9874 | 2.1  | 62              | 58  | 54  | 54 |
| 1.5  | 2556                                   | 2407 | 2226 | 4.4  | 31              | 30 | 27 | 42 | 3579                             | 3370 | 3116 | 3.7  | 44              | 41 | 38 | 48 | 5624                             | 5295  | 4896 | 3.0  | 69              | 65  | 60  | 56 |
| 2.0  | 1554                                   | 1463 | 1353 | 5.7  | 34              | 32 | 30 | 43 | 2176                             | 2049 | 1894 | 4.8  | 47              | 45 | 41 | 49 | 3419                             | 3219  | 2977 | 3.8  | 75              | 70  | 65  | 57 |
| 2.5  | 1056                                   | 995  | 920  | 6.9  | 36              | 34 | 31 | 44 | 1479                             | 1392 | 1288 | 5.8  | 50              | 47 | 44 | 50 | 2324                             | 2188  | 2023 | 4.7  | 79              | 75  | 69  | 58 |
| 3.0  | 771                                    | 726  | 671  | 8.1  | 38              | 36 | 33 | 45 | 1079                             | 1016 | 939  | 6.8  | 53              | 50 | 46 | 51 | 1695                             | 1596  | 1476 | 5.4  | 83              | 78  | 72  | 59 |
| 3.5  | 590                                    | 556  | 514  | 9.2  | 39              | 37 | 34 | 46 | 826                              | 778  | 719  | 7.8  | 55              | 52 | 48 | 52 | 1299                             | 1223  | 1131 | 6.2  | 87              | 82  | 76  | 60 |
| 4.0  | 468                                    | 441  | 408  | 10.4 | 41              | 38 | 36 | 46 | 656                              | 618  | 571  | 8.8  | 57              | 54 | 50 | 52 | 1031                             | 970   | 897  | 7.0  | 90              | 85  | 78  | 61 |
| 4.5  | 382                                    | 360  | 333  | 11.5 | 42              | 40 | 37 | 47 | 535                              | 504  | 466  | 9.7  | 59              | 56 | 51 | 53 | 841                              | 792   | 732  | 7.7  | 93              | 87  | 81  | 61 |
| 5.0  | 318                                    | 300  | 277  | 12.6 | 43              | 41 | 38 | 48 | 446                              | 420  | 388  | 10.6 | 61              | 57 | 53 | 53 | 701                              | 660   | 610  | 8.5  | 96              | 90  | 83  | 62 |
| 5.5  | 270                                    | 254  | 235  | 13.6 | 45              | 42 | 39 | 48 | 378                              | 356  | 329  | 11.5 | 62              | 59 | 54 | 54 | 594                              | 559   | 517  | 9.2  | 98              | 92  | 85  | 62 |
| 6.0  | 232                                    | 219  | 202  | 14.7 | 46              | 43 | 40 | 48 | 325                              | 306  | 283  | 12.4 | 64              | 60 | 56 | 54 | 511                              | 481   | 445  | 9.9  | 100             | 94  | 87  | 62 |
| 6.5  | 202                                    | 190  | 176  | 15.8 | 47              | 44 | 41 | 49 | 283                              | 267  | 247  | 13.3 | 65              | 61 | 57 | 55 | 445                              | 419   | 387  | 10.6 | 103             | 97  | 89  | 63 |
| 7.0  | 178                                    | 168  | 155  | 16.8 | 48              | 45 | 41 | 49 | 249                              | 235  | 217  | 14.2 | 67              | 63 | 58 | 55 | 391                              | 369   | 341  | 11.3 | 105             | 98  | 91  | 63 |
| 7.5  | 158                                    | 149  | 137  | 17.8 | 48              | 46 | 42 | 49 | 221                              | 208  | 192  | 15.1 | 68              | 64 | 59 | 55 | 347                              | 327   | 302  | 12.0 | 107             | 100 | 93  | 64 |
| 8.0  | 141                                    | 133  | 123  | 18.9 | 49              | 46 | 43 | 50 | 198                              | 186  | 172  | 15.9 | 69              | 65 | 60 | 56 | 311                              | 293   | 270  | 12.7 | 108             | 102 | 94  | 64 |
| 8.5  | 127                                    | 120  | 111  | 19.9 | 50              | 47 | 44 | 50 | 178                              | 168  | 155  | 16.8 | 70              | 66 | 61 | 56 | 280                              | 263   | 244  | 13.4 | 110             | 104 | 96  | 64 |
| 9.0  | 115                                    | 108  | 100  | 20.9 | 51              | 48 | 44 | 50 | 161                              | 152  | 140  | 17.7 | 71              | 67 | 62 | 56 | 253                              | 239   | 221  | 14.1 | 112             | 105 | 97  | 64 |
| 9.5  | 105                                    | 99   | 91   | 21.9 | 52              | 49 | 45 | 51 | 147                              | 138  | 128  | 18.5 | 72              | 68 | 63 | 57 | 231                              | 217   | 201  | 14.8 | 114             | 107 | 99  | 65 |
| 10.0 | 96                                     | 90   | 84   | 22.9 | 52              | 49 | 46 | 51 | 134                              | 127  | 117  | 19.3 | 73              | 69 | 64 | 57 | 211                              | 199   | 184  | 15.4 | 115             | 108 | 100 | 65 |
| 11.0 | 81                                     | 77   | 71   | 24.9 | 54              | 51 | 47 | 51 | 114                              | 107  | 99   | 21.0 | 75              | 71 | 65 | 57 | 179                              | 169   | 156  | 16.8 | 118             | 111 | 103 | 65 |
| 12.0 | 70                                     | 66   | 61   | 26.8 | 55              | 52 | 48 | 52 | 98                               | 92   | 85   | 22.7 | 77              | 72 | 67 | 58 | 154                              | 145   | 134  | 18.1 | 121             | 114 | 105 | 66 |
| 13.0 | 61                                     | 57   | 53   | 28.7 | 56              | 53 | 49 | 52 | 85                               | 80   | 74   | 24.3 | 79              | 74 | 69 | 58 | 134                              | 126   | 117  | 19.4 | 124             | 116 | 108 | 66 |
| 14.0 | 54                                     | 50   | 47   | 30.6 | 57              | 54 | 50 | 52 | 75                               | 71   | 65   | 25.9 | 80              | 76 | 70 | 58 | 118                              | 111   | 103  | 20.6 | 126             | 119 | 110 | 67 |
| 15.0 | 48                                     | 45   | 41   | 32.5 | 58              | 55 | 51 | 53 | 67                               | 63   | 58   | 27.5 | 82              | 77 | 71 | 59 | 105                              | 99    | 91   | 21.9 | 129             | 121 | 112 | 67 |
| 16.0 | 43                                     | 40   | 37   | 34.4 | 59              | 56 | 52 | 53 | 60                               | 56   | 52   | 29.1 | 83              | 78 | 72 | 59 | 94                               | 88    | 82   | 23.2 | 131             | 123 | 114 | 67 |
| 17.0 | 38                                     | 36   | 33   | 36.2 | 60              | 57 | 53 | 53 | 54                               | 51   | 47   | 30.6 | 85              | 80 | 74 | 59 | 84                               | 79    | 73   | 24.4 | 133             | 125 | 116 | 68 |
| 18.0 | 35                                     | 33   | 30   | 38.1 | 61              | 58 | 53 | 54 | 49                               | 46   | 42   | 32.2 | 86              | 81 | 75 | 60 | 76                               | 72    | 67   | 25.7 | 135             | 127 | 118 | 68 |
| 19.0 | 32                                     | 30   | 28   | 39.9 | 62              | 59 | 54 | 54 | 44                               | 42   | 39   | 33.7 | 87              | 82 | 76 | 60 | 70                               | 66    | 61   | 26.9 | 137             | 129 | 119 | 68 |
| 20.0 | 29                                     | 27   | 25   | 41.7 | 63              | 59 | 55 | 54 | 41                               | 38   | 35   | 35.2 | 88              | 83 | 77 | 60 | 64                               | 60    | 55   | 28.1 | 139             | 131 | 121 | 68 |
| 22.0 | 25                                     | 23   | 21   | 45.3 | 65              | 61 | 56 | 55 | 34                               | 32   | 30   | 38.3 | 91              | 85 | 79 | 61 | 54                               | 51    | 47   | 30.5 | 143             | 134 | 124 | 69 |
| 24.0 | 21                                     | 20   | 18   | 48.8 | 66              | 62 | 58 | 55 | 30                               | 28   | 26   | 41.3 | 93              | 87 | 81 | 61 | 46                               | 44    | 40   | 32.9 | 146             | 137 | 127 | 69 |
| 26.0 | 18                                     | 17   | 16   | 52.3 | 68              | 64 | 59 | 55 | 26                               | 24   | 22   | 44.2 | 95              | 89 | 83 | 61 | 40                               | 38    | 35   | 35.3 | 149             | 140 | 130 | 70 |
| 28.0 | 16                                     | 15   | 14   | 55.8 | 69              | 65 | 60 | 56 | 23                               | 21   | 20   | 47.1 | 97              | 91 | 84 | 62 | 36                               | 33    | 31   | 37.6 | 152             | 143 | 132 | 70 |
| 30.0 | 14                                     | 14   | 12   | 59.2 | 70              | 66 | 61 | 56 | 20                               | 19   | 17   | 50.0 | 99              | 93 | 86 | 62 | 32                               | 30    | 27   | 39.9 | 155             | 146 | 135 | 70 |

**Table W4:** Western larch stocking levels for the ABGR/BRVU, ABGR/CLUN, ABGR/VAME, ABLA2/CLUN, and ABLA2/LIBO2 (B-O province), and ABGR/LIBO2 and ABLA2/VASC/POPU (W-S province) plant associations; and the ABLA2/POPU, PICO(ABGR)/ALSI, PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, PICO(ABGR)/VAME/PTAQ, and PICO(ABLA2)/VASC/POPU plant community types.

| QMD  | Climate Resilience; SDI 128; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 179; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 282; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6887                                    | 6485 | 5996 | 2.7  | 38              | 35 | 33 | 45 | 9642                             | 9078 | 8395 | 2.3  | 53              | 50  | 46  | 51 | 15152                            | 14266 | 13192 | 1.8  | 83              | 78  | 72  | 59 |
| 1.5  | 3415                                    | 3215 | 2973 | 3.8  | 42              | 39 | 36 | 47 | 4781                             | 4502 | 4163 | 3.2  | 59              | 55  | 51  | 53 | 7513                             | 7074  | 6541  | 2.6  | 92              | 87  | 80  | 61 |
| 2.0  | 2076                                    | 1955 | 1808 | 4.9  | 45              | 43 | 39 | 48 | 2907                             | 2737 | 2531 | 4.2  | 63              | 60  | 55  | 54 | 4568                             | 4300  | 3977  | 3.3  | 100             | 94  | 87  | 62 |
| 2.5  | 1411                                    | 1329 | 1229 | 6.0  | 48              | 45 | 42 | 49 | 1976                             | 1860 | 1720 | 5.0  | 67              | 63  | 59  | 55 | 3105                             | 2923  | 2703  | 4.0  | 106             | 100 | 92  | 63 |
| 3.0  | 1030                                    | 969  | 896  | 7.0  | 51              | 48 | 44 | 50 | 1441                             | 1357 | 1255 | 5.9  | 71              | 67  | 62  | 56 | 2265                             | 2132  | 1972  | 4.7  | 111             | 105 | 97  | 64 |
| 3.5  | 789                                     | 742  | 686  | 8.0  | 53              | 50 | 46 | 51 | 1104                             | 1039 | 961  | 6.8  | 74              | 69  | 64  | 57 | 1735                             | 1633  | 1510  | 5.4  | 116             | 109 | 101 | 65 |
| 4.0  | 626                                     | 589  | 545  | 9.0  | 55              | 51 | 48 | 52 | 876                              | 825  | 763  | 7.6  | 76              | 72  | 67  | 58 | 1377                             | 1296  | 1199  | 6.0  | 120             | 113 | 105 | 66 |
| 4.5  | 511                                     | 481  | 444  | 9.9  | 56              | 53 | 49 | 52 | 715                              | 673  | 622  | 8.4  | 79              | 74  | 69  | 58 | 1123                             | 1057  | 978   | 6.7  | 124             | 117 | 108 | 66 |
| 5.0  | 425                                     | 401  | 370  | 10.9 | 58              | 55 | 51 | 53 | 596                              | 561  | 519  | 9.2  | 81              | 76  | 71  | 59 | 936                              | 881   | 815   | 7.3  | 128             | 120 | 111 | 67 |
| 5.5  | 361                                     | 340  | 314  | 11.8 | 60              | 56 | 52 | 53 | 505                              | 476  | 440  | 10.0 | 83              | 78  | 73  | 59 | 794                              | 747   | 691   | 8.0  | 131             | 123 | 114 | 67 |
| 6.0  | 310                                     | 292  | 270  | 12.7 | 61              | 57 | 53 | 54 | 434                              | 409  | 378  | 10.8 | 85              | 80  | 74  | 60 | 683                              | 643   | 594   | 8.6  | 134             | 126 | 117 | 68 |
| 6.5  | 270                                     | 254  | 235  | 13.6 | 62              | 59 | 54 | 54 | 378                              | 356  | 329  | 11.5 | 87              | 82  | 76  | 60 | 594                              | 560   | 518   | 9.2  | 137             | 129 | 119 | 68 |
| 7.0  | 238                                     | 224  | 207  | 14.5 | 64              | 60 | 55 | 54 | 333                              | 313  | 290  | 12.3 | 89              | 84  | 77  | 60 | 523                              | 492   | 455   | 9.8  | 140             | 132 | 122 | 68 |
| 7.5  | 211                                     | 199  | 184  | 15.4 | 65              | 61 | 56 | 55 | 295                              | 278  | 257  | 13.1 | 91              | 85  | 79  | 61 | 464                              | 437   | 404   | 10.4 | 142             | 134 | 124 | 69 |
| 8.0  | 189                                     | 178  | 164  | 16.3 | 66              | 62 | 57 | 55 | 264                              | 249  | 230  | 13.8 | 92              | 87  | 80  | 61 | 415                              | 391   | 361   | 11.0 | 145             | 136 | 126 | 69 |
| 8.5  | 170                                     | 160  | 148  | 17.2 | 67              | 63 | 58 | 55 | 238                              | 224  | 207  | 14.5 | 94              | 88  | 82  | 61 | 374                              | 352   | 325   | 11.6 | 147             | 139 | 128 | 69 |
| 9.0  | 154                                     | 145  | 134  | 18.1 | 68              | 64 | 59 | 55 | 215                              | 203  | 188  | 15.3 | 95              | 90  | 83  | 62 | 339                              | 319   | 295   | 12.2 | 150             | 141 | 130 | 70 |
| 9.5  | 140                                     | 132  | 122  | 18.9 | 69              | 65 | 60 | 56 | 196                              | 185  | 171  | 16.0 | 97              | 91  | 84  | 62 | 308                              | 290   | 268   | 12.8 | 152             | 143 | 132 | 70 |
| 10.0 | 128                                     | 121  | 112  | 19.8 | 70              | 66 | 61 | 56 | 180                              | 169  | 156  | 16.7 | 98              | 92  | 85  | 62 | 282                              | 266   | 246   | 13.4 | 154             | 145 | 134 | 70 |
| 11.0 | 109                                     | 102  | 95   | 21.5 | 72              | 68 | 62 | 56 | 152                              | 143  | 133  | 18.2 | 100             | 95  | 87  | 62 | 239                              | 225   | 208   | 14.5 | 158             | 149 | 137 | 71 |
| 12.0 | 94                                      | 88   | 81   | 23.2 | 73              | 69 | 64 | 57 | 131                              | 123  | 114  | 19.6 | 103             | 97  | 90  | 63 | 206                              | 194   | 179   | 15.6 | 162             | 152 | 141 | 71 |
| 13.0 | 81                                      | 77   | 71   | 24.8 | 75              | 71 | 65 | 57 | 114                              | 107  | 99   | 21.0 | 105             | 99  | 92  | 63 | 179                              | 169   | 156   | 16.8 | 165             | 156 | 144 | 71 |
| 14.0 | 72                                      | 67   | 62   | 26.5 | 77              | 72 | 67 | 58 | 100                              | 94   | 87   | 22.4 | 107             | 101 | 93  | 64 | 158                              | 148   | 137   | 17.9 | 169             | 159 | 147 | 72 |
| 15.0 | 64                                      | 60   | 55   | 28.1 | 78              | 73 | 68 | 58 | 89                               | 84   | 78   | 23.8 | 109             | 103 | 95  | 64 | 140                              | 132   | 122   | 19.0 | 172             | 162 | 149 | 72 |
| 16.0 | 57                                      | 54   | 50   | 29.7 | 79              | 75 | 69 | 58 | 80                               | 75   | 69   | 25.1 | 111             | 105 | 97  | 64 | 125                              | 118   | 109   | 20.0 | 175             | 164 | 152 | 72 |
| 17.0 | 51                                      | 48   | 45   | 31.3 | 81              | 76 | 70 | 59 | 72                               | 68   | 62   | 26.5 | 113             | 106 | 98  | 65 | 113                              | 106   | 98    | 21.1 | 178             | 167 | 155 | 73 |
| 18.0 | 46                                      | 44   | 40   | 32.9 | 82              | 77 | 71 | 59 | 65                               | 61   | 57   | 27.8 | 115             | 108 | 100 | 65 | 102                              | 96    | 89    | 22.2 | 180             | 170 | 157 | 73 |
| 19.0 | 42                                      | 40   | 37   | 34.5 | 83              | 78 | 72 | 59 | 59                               | 56   | 51   | 29.2 | 116             | 110 | 101 | 65 | 93                               | 88    | 81    | 23.3 | 183             | 172 | 159 | 73 |
| 20.0 | 39                                      | 36   | 34   | 36.1 | 84              | 79 | 73 | 59 | 54                               | 51   | 47   | 30.5 | 118             | 111 | 103 | 65 | 85                               | 80    | 74    | 24.3 | 186             | 175 | 162 | 74 |
| 22.0 | 33                                      | 31   | 29   | 39.2 | 87              | 81 | 75 | 60 | 46                               | 43   | 40   | 33.1 | 121             | 114 | 105 | 66 | 72                               | 68    | 63    | 26.4 | 190             | 179 | 166 | 74 |
| 24.0 | 28                                      | 27   | 25   | 42.2 | 89              | 83 | 77 | 60 | 39                               | 37   | 34   | 35.7 | 124             | 117 | 108 | 66 | 62                               | 58    | 54    | 28.5 | 195             | 184 | 170 | 74 |
| 26.0 | 25                                      | 23   | 21   | 45.3 | 91              | 85 | 79 | 61 | 34                               | 32   | 30   | 38.3 | 127             | 119 | 110 | 67 | 54                               | 51    | 47    | 30.5 | 199             | 188 | 173 | 75 |
| 28.0 | 22                                      | 20   | 19   | 48.3 | 92              | 87 | 80 | 61 | 30                               | 28   | 26   | 40.8 | 129             | 122 | 113 | 67 | 48                               | 45    | 41    | 32.5 | 203             | 191 | 177 | 75 |
| 30.0 | 19                                      | 18   | 17   | 51.2 | 94              | 89 | 82 | 61 | 27                               | 25   | 23   | 43.3 | 132             | 124 | 115 | 67 | 42                               | 40    | 37    | 34.5 | 207             | 195 | 180 | 76 |



**Table W5:** Western larch stocking levels for the ABGR/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 114; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 159; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 250; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6109                                    | 5751 | 5318 | 2.9  | 33              | 31 | 29 | 43 | 8552                             | 8052 | 7446 | 2.4  | 47              | 44  | 41  | 49 | 13439                            | 12653 | 11700 | 1.9  | 73              | 69  | 64  | 57 |
| 1.5  | 3029                                    | 2852 | 2637 | 4.1  | 37              | 35 | 32 | 45 | 4241                             | 3993 | 3692 | 3.4  | 52              | 49  | 45  | 51 | 6664                             | 6274  | 5802  | 2.7  | 82              | 77  | 71  | 59 |
| 2.0  | 1841                                    | 1734 | 1603 | 5.2  | 40              | 38 | 35 | 46 | 2578                             | 2427 | 2244 | 4.4  | 56              | 53  | 49  | 52 | 4051                             | 3814  | 3527  | 3.5  | 88              | 83  | 77  | 60 |
| 2.5  | 1252                                    | 1179 | 1090 | 6.3  | 43              | 40 | 37 | 47 | 1752                             | 1650 | 1526 | 5.4  | 60              | 56  | 52  | 53 | 2754                             | 2593  | 2397  | 4.3  | 94              | 88  | 82  | 61 |
| 3.0  | 913                                     | 860  | 795  | 7.4  | 45              | 42 | 39 | 48 | 1278                             | 1204 | 1113 | 6.3  | 63              | 59  | 55  | 54 | 2009                             | 1891  | 1749  | 5.0  | 99              | 93  | 86  | 62 |
| 3.5  | 699                                     | 658  | 609  | 8.5  | 47              | 44 | 41 | 49 | 979                              | 922  | 852  | 7.2  | 65              | 62  | 57  | 55 | 1539                             | 1449  | 1340  | 5.7  | 103             | 97  | 89  | 63 |
| 4.0  | 555                                     | 523  | 483  | 9.5  | 48              | 46 | 42 | 49 | 777                              | 732  | 677  | 8.0  | 68              | 64  | 59  | 55 | 1221                             | 1150  | 1063  | 6.4  | 107             | 100 | 93  | 64 |
| 4.5  | 453                                     | 426  | 394  | 10.5 | 50              | 47 | 44 | 50 | 634                              | 597  | 552  | 8.9  | 70              | 66  | 61  | 56 | 996                              | 938   | 867   | 7.1  | 110             | 104 | 96  | 64 |
| 5.0  | 377                                     | 355  | 329  | 11.5 | 51              | 48 | 45 | 51 | 528                              | 497  | 460  | 9.8  | 72              | 68  | 63  | 57 | 830                              | 782   | 723   | 7.8  | 113             | 107 | 99  | 65 |
| 5.5  | 320                                     | 301  | 279  | 12.5 | 53              | 50 | 46 | 51 | 448                              | 422  | 390  | 10.6 | 74              | 70  | 64  | 57 | 704                              | 663   | 613   | 8.5  | 116             | 109 | 101 | 65 |
| 6.0  | 275                                     | 259  | 240  | 13.5 | 54              | 51 | 47 | 51 | 385                              | 363  | 336  | 11.4 | 76              | 71  | 66  | 57 | 606                              | 570   | 527   | 9.1  | 119             | 112 | 104 | 66 |
| 6.5  | 240                                     | 226  | 209  | 14.5 | 55              | 52 | 48 | 52 | 336                              | 316  | 292  | 12.2 | 77              | 73  | 67  | 58 | 527                              | 496   | 459   | 9.8  | 122             | 114 | 106 | 66 |
| 7.0  | 211                                     | 198  | 184  | 15.4 | 56              | 53 | 49 | 52 | 295                              | 278  | 257  | 13.1 | 79              | 74  | 69  | 58 | 464                              | 437   | 404   | 10.4 | 124             | 117 | 108 | 66 |
| 7.5  | 187                                     | 176  | 163  | 16.4 | 57              | 54 | 50 | 52 | 262                              | 247  | 228  | 13.9 | 80              | 76  | 70  | 58 | 412                              | 388   | 358   | 11.1 | 126             | 119 | 110 | 67 |
| 8.0  | 167                                     | 158  | 146  | 17.3 | 58              | 55 | 51 | 53 | 234                              | 221  | 204  | 14.7 | 82              | 77  | 71  | 59 | 368                              | 347   | 321   | 11.7 | 129             | 121 | 112 | 67 |
| 8.5  | 151                                     | 142  | 131  | 18.3 | 59              | 56 | 52 | 53 | 211                              | 199  | 184  | 15.4 | 83              | 78  | 72  | 59 | 331                              | 312   | 289   | 12.3 | 131             | 123 | 114 | 67 |
| 9.0  | 136                                     | 129  | 119  | 19.2 | 60              | 57 | 52 | 53 | 191                              | 180  | 166  | 16.2 | 84              | 79  | 73  | 59 | 300                              | 283   | 261   | 12.9 | 133             | 125 | 115 | 67 |
| 9.5  | 124                                     | 117  | 108  | 20.1 | 61              | 58 | 53 | 54 | 174                              | 164  | 152  | 17.0 | 86              | 81  | 75  | 60 | 273                              | 257   | 238   | 13.6 | 135             | 127 | 117 | 68 |
| 10.0 | 114                                     | 107  | 99   | 21.0 | 62              | 58 | 54 | 54 | 159                              | 150  | 139  | 17.8 | 87              | 82  | 76  | 60 | 250                              | 236   | 218   | 14.2 | 136             | 129 | 119 | 68 |
| 11.0 | 96                                      | 91   | 84   | 22.8 | 64              | 60 | 55 | 54 | 135                              | 127  | 118  | 19.3 | 89              | 84  | 78  | 60 | 212                              | 200   | 185   | 15.4 | 140             | 132 | 122 | 68 |
| 12.0 | 83                                      | 78   | 72   | 24.6 | 65              | 61 | 57 | 55 | 116                              | 109  | 101  | 20.8 | 91              | 86  | 79  | 61 | 183                              | 172   | 159   | 16.6 | 143             | 135 | 125 | 69 |
| 13.0 | 72                                      | 68   | 63   | 26.4 | 67              | 63 | 58 | 55 | 101                              | 95   | 88   | 22.3 | 93              | 88  | 81  | 61 | 159                              | 150   | 138   | 17.8 | 147             | 138 | 128 | 69 |
| 14.0 | 64                                      | 60   | 55   | 28.1 | 68              | 64 | 59 | 55 | 89                               | 84   | 77   | 23.8 | 95              | 90  | 83  | 62 | 140                              | 132   | 122   | 19.0 | 149             | 141 | 130 | 70 |
| 15.0 | 56                                      | 53   | 49   | 29.9 | 69              | 65 | 60 | 56 | 79                               | 74   | 69   | 25.2 | 97              | 91  | 84  | 62 | 124                              | 117   | 108   | 20.1 | 152             | 143 | 133 | 70 |
| 16.0 | 50                                      | 47   | 44   | 31.6 | 70              | 66 | 61 | 56 | 71                               | 66   | 61   | 26.7 | 99              | 93  | 86  | 62 | 111                              | 104   | 97    | 21.3 | 155             | 146 | 135 | 70 |
| 17.0 | 45                                      | 43   | 40   | 33.3 | 72              | 67 | 62 | 56 | 64                               | 60   | 55   | 28.1 | 100             | 94  | 87  | 62 | 100                              | 94    | 87    | 22.4 | 158             | 148 | 137 | 71 |
| 18.0 | 41                                      | 39   | 36   | 35.0 | 73              | 68 | 63 | 57 | 58                               | 54   | 50   | 29.5 | 102             | 96  | 89  | 63 | 91                               | 85    | 79    | 23.6 | 160             | 151 | 139 | 71 |
| 19.0 | 37                                      | 35   | 33   | 36.6 | 74              | 69 | 64 | 57 | 52                               | 49   | 46   | 31.0 | 103             | 97  | 90  | 63 | 82                               | 78    | 72    | 24.7 | 162             | 153 | 141 | 71 |
| 20.0 | 34                                      | 32   | 30   | 38.3 | 75              | 70 | 65 | 57 | 48                               | 45   | 42   | 32.4 | 105             | 99  | 91  | 63 | 75                               | 71    | 66    | 25.8 | 165             | 155 | 143 | 71 |
| 22.0 | 29                                      | 27   | 25   | 41.6 | 77              | 72 | 67 | 58 | 41                               | 38   | 35   | 35.2 | 107             | 101 | 94  | 64 | 64                               | 60    | 56    | 28.0 | 169             | 159 | 147 | 72 |
| 24.0 | 25                                      | 24   | 22   | 44.8 | 79              | 74 | 68 | 58 | 35                               | 33   | 30   | 37.9 | 110             | 104 | 96  | 64 | 55                               | 52    | 48    | 30.2 | 173             | 163 | 151 | 72 |
| 26.0 | 22                                      | 21   | 19   | 48.1 | 80              | 76 | 70 | 58 | 30                               | 29   | 27   | 40.6 | 112             | 106 | 98  | 65 | 48                               | 45    | 42    | 32.4 | 177             | 166 | 154 | 73 |
| 28.0 | 19                                      | 18   | 17   | 51.2 | 82              | 77 | 71 | 59 | 27                               | 25   | 23   | 43.3 | 115             | 108 | 100 | 65 | 42                               | 40    | 37    | 34.5 | 180             | 170 | 157 | 73 |
| 30.0 | 17                                      | 16   | 15   | 54.4 | 83              | 79 | 73 | 59 | 24                               | 22   | 21   | 46.0 | 117             | 110 | 102 | 65 | 37                               | 35    | 33    | 36.7 | 184             | 173 | 160 | 73 |



**Table W6:** Western larch stocking levels for the ABGR/LIBO2 (B-O province) and ABGR/VAME and ABLA2/VAME (W-S province) plant associations, and the PICO(ABGR)/VAME-LIBO2 plant community type.

| QMD  | Climate Resilience; SDI 116; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 162; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 254; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6216                                    | 5852 | 5412 | 2.8  | 34              | 32 | 30 | 43 | 8703                             | 8193 | 7576 | 2.4  | 47              | 45  | 41  | 49 | 13676                            | 12875 | 11906 | 1.9  | 75              | 70  | 65  | 57 |
| 1.5  | 3082                                    | 2902 | 2684 | 4.0  | 38              | 36 | 33 | 45 | 4315                             | 4063 | 3757 | 3.4  | 53              | 50  | 46  | 51 | 6781                             | 6384  | 5904  | 2.7  | 83              | 78  | 72  | 59 |
| 2.0  | 1874                                    | 1764 | 1631 | 5.2  | 41              | 38 | 36 | 46 | 2623                             | 2470 | 2284 | 4.4  | 57              | 54  | 50  | 52 | 4123                             | 3881  | 3589  | 3.5  | 90              | 85  | 78  | 61 |
| 2.5  | 1274                                    | 1199 | 1109 | 6.3  | 43              | 41 | 38 | 48 | 1783                             | 1679 | 1552 | 5.3  | 61              | 57  | 53  | 53 | 2802                             | 2638  | 2440  | 4.2  | 96              | 90  | 83  | 62 |
| 3.0  | 929                                     | 875  | 809  | 7.4  | 46              | 43 | 40 | 48 | 1301                             | 1225 | 1133 | 6.2  | 64              | 60  | 56  | 54 | 2044                             | 1925  | 1780  | 5.0  | 100             | 94  | 87  | 62 |
| 3.5  | 712                                     | 670  | 620  | 8.4  | 48              | 45 | 41 | 49 | 996                              | 938  | 867  | 7.1  | 67              | 63  | 58  | 55 | 1566                             | 1474  | 1363  | 5.7  | 105             | 98  | 91  | 63 |
| 4.0  | 565                                     | 532  | 492  | 9.4  | 49              | 46 | 43 | 50 | 791                              | 745  | 688  | 8.0  | 69              | 65  | 60  | 56 | 1243                             | 1170  | 1082  | 6.4  | 108             | 102 | 94  | 64 |
| 4.5  | 461                                     | 434  | 401  | 10.4 | 51              | 48 | 44 | 50 | 645                              | 607  | 562  | 8.8  | 71              | 67  | 62  | 56 | 1014                             | 954   | 882   | 7.0  | 112             | 105 | 97  | 64 |
| 5.0  | 384                                     | 362  | 334  | 11.4 | 52              | 49 | 46 | 51 | 538                              | 506  | 468  | 9.7  | 73              | 69  | 64  | 57 | 845                              | 795   | 735   | 7.7  | 115             | 108 | 100 | 65 |
| 5.5  | 326                                     | 307  | 283  | 12.4 | 54              | 51 | 47 | 51 | 456                              | 429  | 397  | 10.5 | 75              | 71  | 65  | 57 | 716                              | 674   | 624   | 8.4  | 118             | 111 | 103 | 65 |
| 6.0  | 280                                     | 264  | 244  | 13.4 | 55              | 52 | 48 | 52 | 392                              | 369  | 341  | 11.3 | 77              | 72  | 67  | 58 | 616                              | 580   | 536   | 9.0  | 121             | 114 | 105 | 66 |
| 6.5  | 244                                     | 230  | 212  | 14.4 | 56              | 53 | 49 | 52 | 341                              | 321  | 297  | 12.1 | 79              | 74  | 68  | 58 | 537                              | 505   | 467   | 9.7  | 124             | 116 | 108 | 66 |
| 7.0  | 215                                     | 202  | 187  | 15.3 | 57              | 54 | 50 | 52 | 300                              | 283  | 261  | 12.9 | 80              | 76  | 70  | 58 | 472                              | 444   | 411   | 10.3 | 126             | 119 | 110 | 67 |
| 7.5  | 190                                     | 179  | 166  | 16.3 | 58              | 55 | 51 | 53 | 267                              | 251  | 232  | 13.7 | 82              | 77  | 71  | 59 | 419                              | 394   | 365   | 11.0 | 129             | 121 | 112 | 67 |
| 8.0  | 170                                     | 160  | 148  | 17.2 | 59              | 56 | 52 | 53 | 238                              | 224  | 208  | 14.5 | 83              | 78  | 72  | 59 | 375                              | 353   | 326   | 11.6 | 131             | 123 | 114 | 67 |
| 8.5  | 153                                     | 144  | 133  | 18.1 | 60              | 57 | 53 | 53 | 215                              | 202  | 187  | 15.3 | 85              | 80  | 74  | 59 | 337                              | 318   | 294   | 12.2 | 133             | 125 | 116 | 68 |
| 9.0  | 139                                     | 131  | 121  | 19.0 | 61              | 58 | 53 | 54 | 194                              | 183  | 169  | 16.1 | 86              | 81  | 75  | 60 | 306                              | 288   | 266   | 12.8 | 135             | 127 | 118 | 68 |
| 9.5  | 126                                     | 119  | 110  | 19.9 | 62              | 59 | 54 | 54 | 177                              | 167  | 154  | 16.9 | 87              | 82  | 76  | 60 | 278                              | 262   | 242   | 13.4 | 137             | 129 | 119 | 68 |
| 10.0 | 116                                     | 109  | 101  | 20.8 | 63              | 59 | 55 | 54 | 162                              | 153  | 141  | 17.6 | 88              | 83  | 77  | 60 | 255                              | 240   | 222   | 14.1 | 139             | 131 | 121 | 68 |
| 11.0 | 98                                      | 92   | 85   | 22.6 | 65              | 61 | 56 | 55 | 137                              | 129  | 120  | 19.1 | 91              | 85  | 79  | 61 | 216                              | 203   | 188   | 15.3 | 143             | 134 | 124 | 69 |
| 12.0 | 84                                      | 79   | 74   | 24.4 | 66              | 62 | 58 | 55 | 118                              | 111  | 103  | 20.6 | 93              | 87  | 81  | 61 | 186                              | 175   | 162   | 16.5 | 146             | 137 | 127 | 69 |
| 13.0 | 74                                      | 69   | 64   | 26.2 | 68              | 64 | 59 | 55 | 103                              | 97   | 90   | 22.1 | 95              | 89  | 83  | 61 | 162                              | 152   | 141   | 17.6 | 149             | 140 | 130 | 70 |
| 14.0 | 65                                      | 61   | 56   | 27.9 | 69              | 65 | 60 | 56 | 91                               | 85   | 79   | 23.6 | 97              | 91  | 84  | 62 | 142                              | 134   | 124   | 18.8 | 152             | 143 | 132 | 70 |
| 15.0 | 57                                      | 54   | 50   | 29.6 | 70              | 66 | 61 | 56 | 80                               | 76   | 70   | 25.0 | 99              | 93  | 86  | 62 | 126                              | 119   | 110   | 20.0 | 155             | 146 | 135 | 70 |
| 16.0 | 51                                      | 48   | 45   | 31.3 | 72              | 67 | 62 | 56 | 72                               | 68   | 63   | 26.5 | 100             | 94  | 87  | 62 | 113                              | 106   | 98    | 21.1 | 158             | 148 | 137 | 71 |
| 17.0 | 46                                      | 44   | 40   | 33.0 | 73              | 69 | 63 | 57 | 65                               | 61   | 56   | 27.9 | 102             | 96  | 89  | 63 | 102                              | 96    | 89    | 22.2 | 160             | 151 | 140 | 71 |
| 18.0 | 42                                      | 39   | 36   | 34.7 | 74              | 70 | 64 | 57 | 59                               | 55   | 51   | 29.3 | 104             | 98  | 90  | 63 | 92                               | 87    | 80    | 23.4 | 163             | 153 | 142 | 71 |
| 19.0 | 38                                      | 36   | 33   | 36.3 | 75              | 71 | 65 | 57 | 53                               | 50   | 46   | 30.7 | 105             | 99  | 92  | 63 | 84                               | 79    | 73    | 24.5 | 165             | 156 | 144 | 71 |
| 20.0 | 35                                      | 33   | 30   | 38.0 | 76              | 72 | 66 | 58 | 49                               | 46   | 43   | 32.1 | 107             | 100 | 93  | 64 | 77                               | 72    | 67    | 25.6 | 167             | 158 | 146 | 72 |
| 22.0 | 30                                      | 28   | 26   | 41.2 | 78              | 74 | 68 | 58 | 41                               | 39   | 36   | 34.8 | 109             | 103 | 95  | 64 | 65                               | 61    | 57    | 27.8 | 172             | 162 | 150 | 72 |
| 24.0 | 25                                      | 24   | 22   | 44.5 | 80              | 75 | 70 | 58 | 36                               | 34   | 31   | 37.6 | 112             | 105 | 97  | 64 | 56                               | 53    | 49    | 30.0 | 176             | 166 | 153 | 73 |
| 26.0 | 22                                      | 21   | 19   | 47.6 | 82              | 77 | 71 | 59 | 31                               | 29   | 27   | 40.3 | 114             | 108 | 100 | 65 | 49                               | 46    | 42    | 32.1 | 180             | 169 | 157 | 73 |
| 28.0 | 19                                      | 18   | 17   | 50.8 | 83              | 78 | 73 | 59 | 27                               | 26   | 24   | 42.9 | 117             | 110 | 102 | 65 | 43                               | 40    | 37    | 34.2 | 183             | 173 | 160 | 73 |
| 30.0 | 17                                      | 16   | 15   | 53.9 | 85              | 80 | 74 | 59 | 24                               | 23   | 21   | 45.6 | 119             | 112 | 104 | 66 | 38                               | 36    | 33    | 36.4 | 187             | 176 | 163 | 74 |

**Table W7:** Western larch stocking levels for the ABGR/TABR/LIBO2 and ABGR/VASC plant associations (B-O province), and the PICO(ABGR)/VASC/CARU plant community type.

| QMD  | Climate Resilience; SDI 94; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 132; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 208; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5075                                   | 4778 | 4418 | 3.1  | 28              | 26 | 24 | 40 | 7105                             | 6689 | 6186 | 2.7  | 39              | 36 | 34 | 45 | 11165                            | 10512 | 9720 | 2.1  | 61              | 57  | 53  | 54 |
| 1.5  | 2516                                   | 2369 | 2191 | 4.5  | 31              | 29 | 27 | 41 | 3523                             | 3317 | 3067 | 3.8  | 43              | 41 | 38 | 47 | 5536                             | 5212  | 4820 | 3.0  | 68              | 64  | 59  | 55 |
| 2.0  | 1530                                   | 1440 | 1332 | 5.7  | 33              | 31 | 29 | 43 | 2142                             | 2017 | 1865 | 4.8  | 47              | 44 | 41 | 49 | 3366                             | 3169  | 2930 | 3.9  | 73              | 69  | 64  | 57 |
| 2.5  | 1040                                   | 979  | 905  | 7.0  | 35              | 33 | 31 | 44 | 1456                             | 1371 | 1267 | 5.9  | 50              | 47 | 43 | 50 | 2288                             | 2154  | 1992 | 4.7  | 78              | 73  | 68  | 58 |
| 3.0  | 759                                    | 714  | 660  | 8.1  | 37              | 35 | 32 | 45 | 1062                             | 1000 | 925  | 6.9  | 52              | 49 | 45 | 51 | 1669                             | 1571  | 1453 | 5.5  | 82              | 77  | 71  | 59 |
| 3.5  | 581                                    | 547  | 506  | 9.3  | 39              | 37 | 34 | 46 | 813                              | 766  | 708  | 7.9  | 54              | 51 | 47 | 51 | 1278                             | 1203  | 1113 | 6.3  | 85              | 80  | 74  | 60 |
| 4.0  | 461                                    | 434  | 402  | 10.4 | 40              | 38 | 35 | 46 | 646                              | 608  | 562  | 8.8  | 56              | 53 | 49 | 52 | 1015                             | 955   | 883  | 7.0  | 89              | 83  | 77  | 60 |
| 4.5  | 376                                    | 354  | 327  | 11.6 | 42              | 39 | 36 | 47 | 527                              | 496  | 458  | 9.8  | 58              | 55 | 51 | 53 | 828                              | 779   | 720  | 7.8  | 91              | 86  | 80  | 61 |
| 5.0  | 313                                    | 295  | 273  | 12.7 | 43              | 40 | 37 | 47 | 439                              | 413  | 382  | 10.7 | 60              | 56 | 52 | 53 | 690                              | 649   | 600  | 8.5  | 94              | 89  | 82  | 61 |
| 5.5  | 266                                    | 250  | 231  | 13.8 | 44              | 41 | 38 | 48 | 372                              | 350  | 324  | 11.6 | 61              | 58 | 53 | 54 | 585                              | 551   | 509  | 9.3  | 96              | 91  | 84  | 62 |
| 6.0  | 229                                    | 215  | 199  | 14.8 | 45              | 42 | 39 | 48 | 320                              | 301  | 279  | 12.5 | 63              | 59 | 55 | 54 | 503                              | 474   | 438  | 10.0 | 99              | 93  | 86  | 62 |
| 6.5  | 199                                    | 187  | 173  | 15.9 | 46              | 43 | 40 | 48 | 279                              | 262  | 243  | 13.4 | 64              | 60 | 56 | 54 | 438                              | 412   | 381  | 10.7 | 101             | 95  | 88  | 63 |
| 7.0  | 175                                    | 165  | 152  | 16.9 | 47              | 44 | 41 | 49 | 245                              | 231  | 213  | 14.3 | 66              | 62 | 57 | 55 | 385                              | 363   | 335  | 11.4 | 103             | 97  | 90  | 63 |
| 7.5  | 155                                    | 146  | 135  | 18.0 | 48              | 45 | 42 | 49 | 218                              | 205  | 189  | 15.2 | 67              | 63 | 58 | 55 | 342                              | 322   | 298  | 12.1 | 105             | 99  | 91  | 63 |
| 8.0  | 139                                    | 131  | 121  | 19.0 | 49              | 46 | 42 | 49 | 195                              | 183  | 169  | 16.1 | 68              | 64 | 59 | 55 | 306                              | 288   | 266  | 12.8 | 107             | 101 | 93  | 64 |
| 8.5  | 125                                    | 118  | 109  | 20.0 | 49              | 46 | 43 | 50 | 175                              | 165  | 153  | 16.9 | 69              | 65 | 60 | 56 | 275                              | 259   | 240  | 13.5 | 109             | 102 | 94  | 64 |
| 9.0  | 113                                    | 107  | 99   | 21.1 | 50              | 47 | 44 | 50 | 159                              | 149  | 138  | 17.8 | 70              | 66 | 61 | 56 | 249                              | 235   | 217  | 14.2 | 110             | 104 | 96  | 64 |
| 9.5  | 103                                    | 97   | 90   | 22.1 | 51              | 48 | 44 | 50 | 145                              | 136  | 126  | 18.7 | 71              | 67 | 62 | 56 | 227                              | 214   | 198  | 14.9 | 112             | 105 | 97  | 64 |
| 10.0 | 95                                     | 89   | 82   | 23.1 | 52              | 49 | 45 | 51 | 132                              | 125  | 115  | 19.5 | 72              | 68 | 63 | 57 | 208                              | 196   | 181  | 15.6 | 113             | 107 | 99  | 65 |
| 11.0 | 80                                     | 75   | 70   | 25.1 | 53              | 50 | 46 | 51 | 112                              | 106  | 98   | 21.2 | 74              | 70 | 64 | 57 | 176                              | 166   | 153  | 16.9 | 116             | 110 | 101 | 65 |
| 12.0 | 69                                     | 65   | 60   | 27.0 | 54              | 51 | 47 | 51 | 97                               | 91   | 84   | 22.8 | 76              | 71 | 66 | 57 | 152                              | 143   | 132  | 18.2 | 119             | 112 | 104 | 66 |
| 13.0 | 60                                     | 57   | 52   | 28.9 | 55              | 52 | 48 | 52 | 84                               | 79   | 73   | 24.5 | 77              | 73 | 67 | 58 | 132                              | 124   | 115  | 19.5 | 122             | 115 | 106 | 66 |
| 14.0 | 53                                     | 50   | 46   | 30.9 | 56              | 53 | 49 | 52 | 74                               | 70   | 64   | 26.1 | 79              | 74 | 69 | 58 | 116                              | 109   | 101  | 20.8 | 124             | 117 | 108 | 66 |
| 15.0 | 47                                     | 44   | 41   | 32.8 | 58              | 54 | 50 | 53 | 66                               | 62   | 57   | 27.7 | 81              | 76 | 70 | 59 | 103                              | 97    | 90   | 22.1 | 127             | 119 | 110 | 67 |
| 16.0 | 42                                     | 39   | 36   | 34.6 | 59              | 55 | 51 | 53 | 59                               | 55   | 51   | 29.3 | 82              | 77 | 71 | 59 | 92                               | 87    | 80   | 23.4 | 129             | 121 | 112 | 67 |
| 17.0 | 38                                     | 36   | 33   | 36.5 | 59              | 56 | 52 | 53 | 53                               | 50   | 46   | 30.9 | 83              | 78 | 72 | 59 | 83                               | 78    | 72   | 24.6 | 131             | 123 | 114 | 67 |
| 18.0 | 34                                     | 32   | 30   | 38.4 | 60              | 57 | 53 | 53 | 48                               | 45   | 42   | 32.4 | 85              | 80 | 74 | 59 | 75                               | 71    | 65   | 25.9 | 133             | 125 | 116 | 68 |
| 19.0 | 31                                     | 29   | 27   | 40.2 | 61              | 58 | 53 | 54 | 44                               | 41   | 38   | 34.0 | 86              | 81 | 75 | 60 | 68                               | 64    | 60   | 27.1 | 135             | 127 | 117 | 68 |
| 20.0 | 28                                     | 27   | 25   | 42.0 | 62              | 59 | 54 | 54 | 40                               | 38   | 35   | 35.5 | 87              | 82 | 76 | 60 | 63                               | 59    | 55   | 28.3 | 137             | 129 | 119 | 68 |
| 22.0 | 24                                     | 23   | 21   | 45.6 | 64              | 60 | 56 | 54 | 34                               | 32   | 29   | 38.6 | 89              | 84 | 78 | 60 | 53                               | 50    | 46   | 30.8 | 140             | 132 | 122 | 68 |
| 24.0 | 21                                     | 20   | 18   | 49.2 | 65              | 61 | 57 | 55 | 29                               | 27   | 25   | 41.6 | 91              | 86 | 80 | 61 | 46                               | 43    | 40   | 33.2 | 144             | 135 | 125 | 69 |
| 26.0 | 18                                     | 17   | 16   | 52.7 | 67              | 63 | 58 | 55 | 25                               | 24   | 22   | 44.6 | 93              | 88 | 81 | 61 | 40                               | 37    | 35   | 35.5 | 147             | 138 | 128 | 69 |
| 28.0 | 16                                     | 15   | 14   | 56.2 | 68              | 64 | 59 | 56 | 22                               | 21   | 19   | 47.5 | 95              | 90 | 83 | 62 | 35                               | 33    | 30   | 37.9 | 150             | 141 | 130 | 70 |
| 30.0 | 14                                     | 13   | 12   | 59.7 | 69              | 65 | 60 | 56 | 20                               | 19   | 17   | 50.4 | 97              | 91 | 85 | 62 | 31                               | 29    | 27   | 40.2 | 153             | 144 | 133 | 70 |

**Table W8:** Western larch stocking levels for the ABGR/TRCA3 plant association (B-O province).

| QMD  | Climate Resilience; SDI 124; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 174; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 274; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6686                                    | 6295 | 5821 | 2.7  | 36              | 34 | 32 | 44 | 9360                             | 8813 | 8149 | 2.3  | 51              | 48  | 44  | 50 | 14709                            | 13849 | 12806 | 1.8  | 80              | 76  | 70  | 58 |
| 1.5  | 3315                                    | 3121 | 2886 | 3.9  | 41              | 38 | 35 | 46 | 4642                             | 4370 | 4041 | 3.3  | 57              | 54  | 50  | 52 | 7294                             | 6867  | 6350  | 2.6  | 90              | 84  | 78  | 60 |
| 2.0  | 2016                                    | 1898 | 1755 | 5.0  | 44              | 41 | 38 | 48 | 2822                             | 2657 | 2457 | 4.2  | 62              | 58  | 54  | 54 | 4434                             | 4175  | 3860  | 3.4  | 97              | 91  | 84  | 62 |
| 2.5  | 1370                                    | 1290 | 1193 | 6.1  | 47              | 44 | 41 | 49 | 1918                             | 1806 | 1670 | 5.1  | 65              | 62  | 57  | 55 | 3014                             | 2838  | 2624  | 4.1  | 103             | 97  | 89  | 63 |
| 3.0  | 999                                     | 941  | 870  | 7.1  | 49              | 46 | 43 | 50 | 1399                             | 1317 | 1218 | 6.0  | 69              | 65  | 60  | 56 | 2199                             | 2070  | 1914  | 4.8  | 108             | 102 | 94  | 64 |
| 3.5  | 765                                     | 721  | 666  | 8.1  | 51              | 48 | 45 | 50 | 1072                             | 1009 | 933  | 6.9  | 72              | 67  | 62  | 56 | 1684                             | 1586  | 1466  | 5.5  | 113             | 106 | 98  | 65 |
| 4.0  | 608                                     | 572  | 529  | 9.1  | 53              | 50 | 46 | 51 | 851                              | 801  | 741  | 7.7  | 74              | 70  | 65  | 57 | 1337                             | 1258  | 1164  | 6.1  | 117             | 110 | 102 | 65 |
| 4.5  | 496                                     | 467  | 431  | 10.1 | 55              | 52 | 48 | 52 | 694                              | 653  | 604  | 8.5  | 77              | 72  | 67  | 58 | 1090                             | 1026  | 949   | 6.8  | 120             | 113 | 105 | 66 |
| 5.0  | 413                                     | 389  | 360  | 11.0 | 56              | 53 | 49 | 52 | 578                              | 544  | 503  | 9.3  | 79              | 74  | 69  | 58 | 909                              | 855   | 791   | 7.4  | 124             | 117 | 108 | 66 |
| 5.5  | 350                                     | 330  | 305  | 12.0 | 58              | 54 | 50 | 53 | 490                              | 462  | 427  | 10.1 | 81              | 76  | 70  | 59 | 770                              | 725   | 671   | 8.1  | 127             | 120 | 111 | 67 |
| 6.0  | 301                                     | 284  | 262  | 12.9 | 59              | 56 | 52 | 53 | 422                              | 397  | 367  | 10.9 | 83              | 78  | 72  | 59 | 663                              | 624   | 577   | 8.7  | 130             | 123 | 113 | 67 |
| 6.5  | 262                                     | 247  | 228  | 13.8 | 60              | 57 | 53 | 53 | 367                              | 346  | 320  | 11.7 | 85              | 80  | 74  | 59 | 577                              | 543   | 502   | 9.3  | 133             | 125 | 116 | 68 |
| 7.0  | 231                                     | 217  | 201  | 14.8 | 62              | 58 | 54 | 54 | 323                              | 304  | 281  | 12.5 | 86              | 81  | 75  | 60 | 508                              | 478   | 442   | 10.0 | 136             | 128 | 118 | 68 |
| 7.5  | 205                                     | 193  | 178  | 15.7 | 63              | 59 | 55 | 54 | 287                              | 270  | 250  | 13.2 | 88              | 83  | 77  | 60 | 451                              | 424   | 392   | 10.6 | 138             | 130 | 120 | 68 |
| 8.0  | 183                                     | 172  | 159  | 16.6 | 64              | 60 | 56 | 54 | 256                              | 241  | 223  | 14.0 | 90              | 84  | 78  | 60 | 403                              | 379   | 351   | 11.2 | 141             | 132 | 122 | 69 |
| 8.5  | 165                                     | 155  | 144  | 17.5 | 65              | 61 | 57 | 55 | 231                              | 217  | 201  | 14.8 | 91              | 86  | 79  | 61 | 363                              | 342   | 316   | 11.8 | 143             | 135 | 124 | 69 |
| 9.0  | 149                                     | 141  | 130  | 18.3 | 66              | 62 | 57 | 55 | 209                              | 197  | 182  | 15.5 | 92              | 87  | 80  | 61 | 329                              | 309   | 286   | 12.4 | 145             | 137 | 126 | 69 |
| 9.5  | 136                                     | 128  | 118  | 19.2 | 67              | 63 | 58 | 55 | 190                              | 179  | 166  | 16.3 | 94              | 88  | 82  | 61 | 299                              | 282   | 261   | 13.0 | 147             | 139 | 128 | 69 |
| 10.0 | 125                                     | 117  | 108  | 20.1 | 68              | 64 | 59 | 55 | 174                              | 164  | 152  | 17.0 | 95              | 90  | 83  | 61 | 274                              | 258   | 238   | 13.6 | 149             | 141 | 130 | 70 |
| 11.0 | 106                                     | 99   | 92   | 21.8 | 70              | 66 | 61 | 56 | 148                              | 139  | 129  | 18.4 | 98              | 92  | 85  | 62 | 232                              | 219   | 202   | 14.7 | 153             | 144 | 133 | 70 |
| 12.0 | 91                                      | 86   | 79   | 23.5 | 71              | 67 | 62 | 56 | 127                              | 120  | 111  | 19.9 | 100             | 94  | 87  | 62 | 200                              | 188   | 174   | 15.9 | 157             | 148 | 137 | 71 |
| 13.0 | 79                                      | 74   | 69   | 25.2 | 73              | 69 | 63 | 57 | 111                              | 104  | 96   | 21.3 | 102             | 96  | 89  | 63 | 174                              | 164   | 151   | 17.0 | 160             | 151 | 140 | 71 |
| 14.0 | 70                                      | 65   | 61   | 26.9 | 74              | 70 | 65 | 57 | 97                               | 92   | 85   | 22.7 | 104             | 98  | 91  | 63 | 153                              | 144   | 133   | 18.1 | 164             | 154 | 142 | 71 |
| 15.0 | 62                                      | 58   | 54   | 28.5 | 76              | 71 | 66 | 57 | 86                               | 81   | 75   | 24.1 | 106             | 100 | 92  | 63 | 136                              | 128   | 118   | 19.2 | 167             | 157 | 145 | 72 |
| 16.0 | 55                                      | 52   | 48   | 30.2 | 77              | 73 | 67 | 58 | 77                               | 73   | 67   | 25.5 | 108             | 102 | 94  | 64 | 121                              | 114   | 106   | 20.3 | 170             | 160 | 148 | 72 |
| 17.0 | 50                                      | 47   | 43   | 31.8 | 78              | 74 | 68 | 58 | 70                               | 66   | 61   | 26.9 | 110             | 103 | 96  | 64 | 109                              | 103   | 95    | 21.4 | 172             | 162 | 150 | 72 |
| 18.0 | 45                                      | 42   | 39   | 33.4 | 80              | 75 | 69 | 58 | 63                               | 59   | 55   | 28.2 | 111             | 105 | 97  | 64 | 99                               | 93    | 86    | 22.5 | 175             | 165 | 152 | 72 |
| 19.0 | 41                                      | 39   | 36   | 35.0 | 81              | 76 | 70 | 59 | 57                               | 54   | 50   | 29.6 | 113             | 106 | 98  | 65 | 90                               | 85    | 79    | 23.6 | 178             | 167 | 155 | 73 |
| 20.0 | 38                                      | 35   | 33   | 36.6 | 82              | 77 | 71 | 59 | 53                               | 49   | 46   | 30.9 | 115             | 108 | 100 | 65 | 83                               | 78    | 72    | 24.7 | 180             | 170 | 157 | 73 |
| 22.0 | 32                                      | 30   | 28   | 39.8 | 84              | 79 | 73 | 59 | 45                               | 42   | 39   | 33.6 | 118             | 111 | 102 | 65 | 70                               | 66    | 61    | 26.8 | 185             | 174 | 161 | 73 |
| 24.0 | 27                                      | 26   | 24   | 42.9 | 86              | 81 | 75 | 60 | 38                               | 36   | 33   | 36.2 | 120             | 113 | 105 | 66 | 60                               | 57    | 52    | 28.9 | 189             | 178 | 165 | 74 |
| 26.0 | 24                                      | 22   | 21   | 45.9 | 88              | 83 | 77 | 60 | 33                               | 31   | 29   | 38.8 | 123             | 116 | 107 | 66 | 52                               | 49    | 46    | 31.0 | 193             | 182 | 168 | 74 |
| 28.0 | 21                                      | 20   | 18   | 49.0 | 90              | 84 | 78 | 60 | 29                               | 28   | 26   | 41.4 | 126             | 118 | 109 | 66 | 46                               | 43    | 40    | 33.0 | 197             | 186 | 172 | 75 |
| 30.0 | 19                                      | 18   | 16   | 52.0 | 91              | 86 | 80 | 61 | 26                               | 25   | 23   | 43.9 | 128             | 120 | 111 | 67 | 41                               | 39    | 36    | 35.1 | 201             | 189 | 175 | 75 |

**Table W9:** Western larch stocking levels for the ABGR/VASC-LIBO2 and PSME/PHMA plant associations (B-O province).

| QMD  | Climate Resilience; SDI 79; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 111; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 174; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4243                                   | 3994 | 3694 | 3.4  | 23              | 22 | 20 | 36 | 5940                             | 5592 | 5171 | 2.9  | 32              | 31 | 28 | 42 | 9334                             | 8788 | 8126 | 2.3  | 51              | 48  | 44  | 50 |
| 1.5  | 2104                                   | 1981 | 1832 | 4.9  | 26              | 24 | 22 | 38 | 2945                             | 2773 | 2564 | 4.1  | 36              | 34 | 31 | 44 | 4628                             | 4357 | 4029 | 3.3  | 57              | 53  | 49  | 52 |
| 2.0  | 1279                                   | 1204 | 1113 | 6.3  | 28              | 26 | 24 | 40 | 1790                             | 1686 | 1559 | 5.3  | 39              | 37 | 34 | 46 | 2814                             | 2649 | 2450 | 4.2  | 61              | 58  | 53  | 54 |
| 2.5  | 869                                    | 818  | 757  | 7.6  | 30              | 28 | 26 | 41 | 1217                             | 1146 | 1060 | 6.4  | 41              | 39 | 36 | 47 | 1913                             | 1801 | 1665 | 5.1  | 65              | 61  | 57  | 55 |
| 3.0  | 634                                    | 597  | 552  | 8.9  | 31              | 29 | 27 | 42 | 888                              | 836  | 773  | 7.5  | 44              | 41 | 38 | 48 | 1395                             | 1314 | 1215 | 6.0  | 68              | 64  | 60  | 56 |
| 3.5  | 486                                    | 457  | 423  | 10.2 | 32              | 31 | 28 | 42 | 680                              | 640  | 592  | 8.6  | 45              | 43 | 40 | 48 | 1069                             | 1006 | 930  | 6.9  | 71              | 67  | 62  | 56 |
| 4.0  | 386                                    | 363  | 336  | 11.4 | 34              | 32 | 29 | 43 | 540                              | 508  | 470  | 9.7  | 47              | 44 | 41 | 49 | 848                              | 799  | 738  | 7.7  | 74              | 70  | 64  | 57 |
| 4.5  | 314                                    | 296  | 274  | 12.6 | 35              | 33 | 30 | 44 | 440                              | 414  | 383  | 10.7 | 49              | 46 | 42 | 50 | 692                              | 651  | 602  | 8.5  | 76              | 72  | 67  | 58 |
| 5.0  | 262                                    | 247  | 228  | 13.9 | 36              | 34 | 31 | 44 | 367                              | 345  | 319  | 11.7 | 50              | 47 | 44 | 50 | 577                              | 543  | 502  | 9.3  | 79              | 74  | 68  | 58 |
| 5.5  | 222                                    | 209  | 193  | 15.0 | 37              | 35 | 32 | 45 | 311                              | 293  | 271  | 12.7 | 51              | 48 | 45 | 50 | 489                              | 460  | 426  | 10.1 | 81              | 76  | 70  | 59 |
| 6.0  | 191                                    | 180  | 166  | 16.2 | 38              | 35 | 33 | 45 | 268                              | 252  | 233  | 13.7 | 53              | 49 | 46 | 51 | 421                              | 396  | 366  | 10.9 | 83              | 78  | 72  | 59 |
| 6.5  | 166                                    | 157  | 145  | 17.4 | 38              | 36 | 33 | 45 | 233                              | 219  | 203  | 14.7 | 54              | 51 | 47 | 51 | 366                              | 345  | 319  | 11.7 | 84              | 79  | 73  | 59 |
| 7.0  | 146                                    | 138  | 127  | 18.5 | 39              | 37 | 34 | 46 | 205                              | 193  | 178  | 15.7 | 55              | 52 | 48 | 52 | 322                              | 303  | 280  | 12.5 | 86              | 81  | 75  | 60 |
| 7.5  | 130                                    | 122  | 113  | 19.7 | 40              | 38 | 35 | 46 | 182                              | 171  | 158  | 16.6 | 56              | 53 | 49 | 52 | 286                              | 269  | 249  | 13.3 | 88              | 83  | 76  | 60 |
| 8.0  | 116                                    | 109  | 101  | 20.8 | 41              | 38 | 35 | 46 | 163                              | 153  | 142  | 17.6 | 57              | 53 | 49 | 52 | 256                              | 241  | 223  | 14.0 | 89              | 84  | 78  | 60 |
| 8.5  | 105                                    | 99   | 91   | 21.9 | 41              | 39 | 36 | 47 | 147                              | 138  | 128  | 18.5 | 58              | 54 | 50 | 53 | 230                              | 217  | 200  | 14.8 | 91              | 85  | 79  | 61 |
| 9.0  | 95                                     | 89   | 83   | 23.0 | 42              | 39 | 36 | 47 | 133                              | 125  | 116  | 19.5 | 59              | 55 | 51 | 53 | 209                              | 196  | 182  | 15.5 | 92              | 87  | 80  | 61 |
| 9.5  | 86                                     | 81   | 75   | 24.1 | 42              | 40 | 37 | 47 | 121                              | 114  | 105  | 20.4 | 59              | 56 | 52 | 53 | 190                              | 179  | 165  | 16.3 | 93              | 88  | 81  | 61 |
| 10.0 | 79                                     | 74   | 69   | 25.2 | 43              | 41 | 38 | 47 | 111                              | 104  | 96   | 21.3 | 60              | 57 | 53 | 53 | 174                              | 164  | 151  | 17.0 | 95              | 89  | 83  | 61 |
| 11.0 | 67                                     | 63   | 58   | 27.4 | 44              | 42 | 38 | 48 | 94                               | 88   | 82   | 23.2 | 62              | 58 | 54 | 54 | 147                              | 139  | 128  | 18.5 | 97              | 92  | 85  | 62 |
| 12.0 | 58                                     | 54   | 50   | 29.5 | 45              | 43 | 39 | 48 | 81                               | 76   | 70   | 25.0 | 63              | 60 | 55 | 54 | 127                              | 119  | 110  | 19.9 | 100             | 94  | 87  | 62 |
| 13.0 | 50                                     | 47   | 44   | 31.7 | 46              | 44 | 40 | 49 | 70                               | 66   | 61   | 26.8 | 65              | 61 | 56 | 55 | 110                              | 104  | 96   | 21.3 | 102             | 96  | 89  | 63 |
| 14.0 | 44                                     | 42   | 38   | 33.8 | 47              | 44 | 41 | 49 | 62                               | 58   | 54   | 28.5 | 66              | 62 | 58 | 55 | 97                               | 91   | 85   | 22.8 | 104             | 98  | 90  | 63 |
| 15.0 | 39                                     | 37   | 34   | 35.8 | 48              | 45 | 42 | 49 | 55                               | 52   | 48   | 30.3 | 67              | 63 | 59 | 55 | 86                               | 81   | 75   | 24.2 | 106             | 100 | 92  | 63 |
| 16.0 | 35                                     | 33   | 31   | 37.9 | 49              | 46 | 43 | 50 | 49                               | 46   | 43   | 32.0 | 68              | 64 | 60 | 56 | 77                               | 73   | 67   | 25.5 | 108             | 101 | 94  | 64 |
| 17.0 | 32                                     | 30   | 27   | 39.9 | 50              | 47 | 43 | 50 | 44                               | 42   | 38   | 33.7 | 70              | 66 | 61 | 56 | 69                               | 65   | 60   | 26.9 | 109             | 103 | 95  | 64 |
| 18.0 | 29                                     | 27   | 25   | 42.0 | 50              | 48 | 44 | 50 | 40                               | 38   | 35   | 35.5 | 71              | 67 | 62 | 56 | 63                               | 59   | 55   | 28.3 | 111             | 105 | 97  | 64 |
| 19.0 | 26                                     | 25   | 23   | 44.0 | 51              | 48 | 45 | 50 | 36                               | 34   | 32   | 37.2 | 72              | 68 | 62 | 56 | 57                               | 54   | 50   | 29.6 | 113             | 106 | 98  | 65 |
| 20.0 | 24                                     | 22   | 21   | 46.0 | 52              | 49 | 45 | 51 | 33                               | 31   | 29   | 38.8 | 73              | 68 | 63 | 57 | 52                               | 49   | 46   | 31.0 | 114             | 108 | 100 | 65 |
| 22.0 | 20                                     | 19   | 18   | 49.9 | 53              | 50 | 46 | 51 | 28                               | 27   | 25   | 42.2 | 75              | 70 | 65 | 57 | 44                               | 42   | 39   | 33.6 | 117             | 110 | 102 | 65 |
| 24.0 | 17                                     | 16   | 15   | 53.8 | 55              | 51 | 48 | 52 | 24                               | 23   | 21   | 45.5 | 76              | 72 | 67 | 58 | 38                               | 36   | 33   | 36.3 | 120             | 113 | 105 | 66 |
| 26.0 | 15                                     | 14   | 13   | 57.7 | 56              | 53 | 49 | 52 | 21                               | 20   | 18   | 48.7 | 78              | 74 | 68 | 58 | 33                               | 31   | 29   | 38.9 | 123             | 116 | 107 | 66 |
| 28.0 | 13                                     | 13   | 12   | 61.5 | 57              | 54 | 50 | 52 | 19                               | 18   | 16   | 52.0 | 80              | 75 | 69 | 58 | 29                               | 28   | 25   | 41.5 | 125             | 118 | 109 | 66 |
| 30.0 | 12                                     | 11   | 10   | 65.3 | 58              | 55 | 50 | 53 | 17                               | 16   | 14   | 55.2 | 81              | 76 | 71 | 59 | 26                               | 24   | 23   | 44.0 | 128             | 120 | 111 | 67 |

**Table W10:** Western larch stocking levels for the ABLA2/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 103; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 145; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 228; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5558                                    | 5233 | 4839 | 3.0  | 30              | 29 | 26 | 41 | 7782                             | 7326 | 6775 | 2.5  | 42              | 40  | 37 | 47 | 12228                            | 11513 | 10646 | 2.0  | 67              | 63  | 58  | 55 |
| 1.5  | 2756                                    | 2595 | 2400 | 4.3  | 34              | 32 | 29 | 43 | 3859                             | 3633 | 3359 | 3.6  | 47              | 45  | 41 | 49 | 6064                             | 5709  | 5279  | 2.9  | 74              | 70  | 65  | 57 |
| 2.0  | 1676                                    | 1578 | 1459 | 5.5  | 37              | 34 | 32 | 44 | 2346                             | 2209 | 2042 | 4.6  | 51              | 48  | 45 | 50 | 3686                             | 3471  | 3209  | 3.7  | 80              | 76  | 70  | 58 |
| 2.5  | 1139                                    | 1072 | 992  | 6.6  | 39              | 37 | 34 | 46 | 1595                             | 1501 | 1388 | 5.6  | 54              | 51  | 47 | 52 | 2506                             | 2359  | 2181  | 4.5  | 85              | 80  | 74  | 60 |
| 3.0  | 831                                     | 782  | 723  | 7.8  | 41              | 38 | 36 | 46 | 1163                             | 1095 | 1013 | 6.6  | 57              | 54  | 50 | 52 | 1828                             | 1721  | 1591  | 5.2  | 90              | 84  | 78  | 60 |
| 3.5  | 636                                     | 599  | 554  | 8.9  | 43              | 40 | 37 | 47 | 891                              | 839  | 776  | 7.5  | 60              | 56  | 52 | 53 | 1400                             | 1318  | 1219  | 6.0  | 94              | 88  | 81  | 61 |
| 4.0  | 505                                     | 476  | 440  | 10.0 | 44              | 41 | 38 | 48 | 707                              | 666  | 616  | 8.4  | 62              | 58  | 54 | 54 | 1111                             | 1046  | 967   | 6.7  | 97              | 91  | 84  | 62 |
| 4.5  | 412                                     | 388  | 359  | 11.0 | 46              | 43 | 40 | 48 | 577                              | 543  | 502  | 9.3  | 64              | 60  | 55 | 54 | 906                              | 853   | 789   | 7.4  | 100             | 94  | 87  | 62 |
| 5.0  | 343                                     | 323  | 299  | 12.1 | 47              | 44 | 41 | 49 | 481                              | 453  | 418  | 10.2 | 66              | 62  | 57 | 55 | 755                              | 711   | 658   | 8.2  | 103             | 97  | 90  | 63 |
| 5.5  | 291                                     | 274  | 253  | 13.1 | 48              | 45 | 42 | 49 | 408                              | 384  | 355  | 11.1 | 67              | 63  | 59 | 55 | 641                              | 603   | 558   | 8.9  | 106             | 99  | 92  | 63 |
| 6.0  | 250                                     | 236  | 218  | 14.2 | 49              | 46 | 43 | 50 | 351                              | 330  | 305  | 12.0 | 69              | 65  | 60 | 56 | 551                              | 519   | 480   | 9.6  | 108             | 102 | 94  | 64 |
| 6.5  | 218                                     | 205  | 190  | 15.2 | 50              | 47 | 44 | 50 | 305                              | 287  | 266  | 12.8 | 70              | 66  | 61 | 56 | 480                              | 452   | 418   | 10.2 | 111             | 104 | 96  | 64 |
| 7.0  | 192                                     | 181  | 167  | 16.2 | 51              | 48 | 45 | 50 | 269                              | 253  | 234  | 13.7 | 72              | 68  | 62 | 56 | 422                              | 397   | 367   | 10.9 | 113             | 106 | 98  | 65 |
| 7.5  | 170                                     | 160  | 148  | 17.2 | 52              | 49 | 45 | 51 | 238                              | 224  | 208  | 14.5 | 73              | 69  | 64 | 57 | 375                              | 353   | 326   | 11.6 | 115             | 108 | 100 | 65 |
| 8.0  | 152                                     | 143  | 133  | 18.2 | 53              | 50 | 46 | 51 | 213                              | 201  | 186  | 15.4 | 74              | 70  | 65 | 57 | 335                              | 315   | 292   | 12.3 | 117             | 110 | 102 | 65 |
| 8.5  | 137                                     | 129  | 119  | 19.2 | 54              | 51 | 47 | 51 | 192                              | 181  | 167  | 16.2 | 76              | 71  | 66 | 57 | 302                              | 284   | 263   | 12.9 | 119             | 112 | 103 | 66 |
| 9.0  | 124                                     | 117  | 108  | 20.1 | 55              | 52 | 48 | 52 | 174                              | 164  | 151  | 17.0 | 77              | 72  | 67 | 58 | 273                              | 257   | 238   | 13.6 | 121             | 114 | 105 | 66 |
| 9.5  | 113                                     | 106  | 98   | 21.1 | 56              | 52 | 48 | 52 | 158                              | 149  | 138  | 17.8 | 78              | 73  | 68 | 58 | 249                              | 234   | 217   | 14.2 | 122             | 115 | 107 | 66 |
| 10.0 | 104                                     | 97   | 90   | 22.0 | 56              | 53 | 49 | 52 | 145                              | 136  | 126  | 18.6 | 79              | 74  | 69 | 58 | 228                              | 214   | 198   | 14.9 | 124             | 117 | 108 | 66 |
| 11.0 | 88                                      | 83   | 76   | 23.9 | 58              | 55 | 50 | 53 | 123                              | 116  | 107  | 20.2 | 81              | 76  | 71 | 59 | 193                              | 182   | 168   | 16.1 | 127             | 120 | 111 | 67 |
| 12.0 | 76                                      | 71   | 66   | 25.8 | 59              | 56 | 52 | 53 | 106                              | 100  | 92   | 21.8 | 83              | 78  | 72 | 59 | 166                              | 156   | 145   | 17.4 | 130             | 123 | 114 | 67 |
| 13.0 | 66                                      | 62   | 57   | 27.7 | 61              | 57 | 53 | 53 | 92                               | 87   | 80   | 23.4 | 85              | 80  | 74 | 59 | 145                              | 136   | 126   | 18.6 | 133             | 126 | 116 | 68 |
| 14.0 | 58                                      | 54   | 50   | 29.5 | 62              | 58 | 54 | 54 | 81                               | 76   | 70   | 24.9 | 87              | 81  | 75 | 60 | 127                              | 120   | 111   | 19.9 | 136             | 128 | 118 | 68 |
| 15.0 | 51                                      | 48   | 45   | 31.3 | 63              | 59 | 55 | 54 | 72                               | 68   | 63   | 26.5 | 88              | 83  | 77 | 60 | 113                              | 106   | 98    | 21.1 | 139             | 130 | 121 | 68 |
| 16.0 | 46                                      | 43   | 40   | 33.1 | 64              | 60 | 56 | 54 | 64                               | 61   | 56   | 28.0 | 90              | 84  | 78 | 60 | 101                              | 95    | 88    | 22.3 | 141             | 133 | 123 | 69 |
| 17.0 | 41                                      | 39   | 36   | 34.9 | 65              | 61 | 57 | 55 | 58                               | 54   | 50   | 29.5 | 91              | 86  | 79 | 61 | 91                               | 86    | 79    | 23.5 | 143             | 135 | 125 | 69 |
| 18.0 | 37                                      | 35   | 33   | 36.7 | 66              | 62 | 58 | 55 | 52                               | 49   | 46   | 31.0 | 93              | 87  | 81 | 61 | 82                               | 78    | 72    | 24.7 | 146             | 137 | 127 | 69 |
| 19.0 | 34                                      | 32   | 30   | 38.4 | 67              | 63 | 58 | 55 | 48                               | 45   | 42   | 32.5 | 94              | 88  | 82 | 61 | 75                               | 71    | 65    | 25.9 | 148             | 139 | 129 | 69 |
| 20.0 | 31                                      | 29   | 27   | 40.2 | 68              | 64 | 59 | 56 | 44                               | 41   | 38   | 33.9 | 95              | 90  | 83 | 62 | 69                               | 65    | 60    | 27.1 | 150             | 141 | 130 | 70 |
| 22.0 | 26                                      | 25   | 23   | 43.6 | 70              | 66 | 61 | 56 | 37                               | 35   | 32   | 36.9 | 98              | 92  | 85 | 62 | 58                               | 55    | 51    | 29.4 | 154             | 145 | 134 | 70 |
| 24.0 | 23                                      | 21   | 20   | 47.0 | 72              | 67 | 62 | 56 | 32                               | 30   | 28   | 39.7 | 100             | 94  | 87 | 62 | 50                               | 47    | 44    | 31.7 | 157             | 148 | 137 | 71 |
| 26.0 | 20                                      | 19   | 17   | 50.4 | 73              | 69 | 64 | 57 | 28                               | 26   | 24   | 42.6 | 102             | 96  | 89 | 63 | 44                               | 41    | 38    | 34.0 | 161             | 151 | 140 | 71 |
| 28.0 | 17                                      | 16   | 15   | 53.7 | 75              | 70 | 65 | 57 | 24                               | 23   | 21   | 45.4 | 104             | 98  | 91 | 63 | 38                               | 36    | 33    | 36.2 | 164             | 154 | 143 | 71 |
| 30.0 | 15                                      | 15   | 13   | 57.0 | 76              | 72 | 66 | 57 | 22                               | 20   | 19   | 48.2 | 106             | 100 | 93 | 64 | 34                               | 32    | 30    | 38.4 | 167             | 157 | 145 | 72 |

**Table W11:** Western larch stocking levels for the ABLA2/LIBO2 plant association (W-S province).

| QMD  | Climate Resilience; SDI 87; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 122; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 191; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4672                                   | 4399 | 4068 | 3.3  | 25              | 24 | 22 | 38 | 6541                             | 6158 | 5695 | 2.8  | 36              | 34 | 31 | 44 | 10279                            | 9677 | 8949 | 2.2  | 56              | 53  | 49  | 52 |
| 1.5  | 2317                                   | 2181 | 2017 | 4.7  | 28              | 27 | 25 | 40 | 3243                             | 3054 | 2824 | 3.9  | 40              | 37 | 35 | 46 | 5097                             | 4799 | 4437 | 3.1  | 63              | 59  | 54  | 54 |
| 2.0  | 1408                                   | 1326 | 1226 | 6.0  | 31              | 29 | 27 | 41 | 1972                             | 1856 | 1717 | 5.1  | 43              | 41 | 37 | 47 | 3099                             | 2917 | 2698 | 4.0  | 68              | 64  | 59  | 55 |
| 2.5  | 957                                    | 901  | 833  | 7.2  | 33              | 31 | 28 | 42 | 1340                             | 1262 | 1167 | 6.1  | 46              | 43 | 40 | 48 | 2106                             | 1983 | 1834 | 4.9  | 72              | 68  | 63  | 56 |
| 3.0  | 698                                    | 658  | 608  | 8.5  | 34              | 32 | 30 | 43 | 978                              | 921  | 851  | 7.2  | 48              | 45 | 42 | 49 | 1536                             | 1447 | 1338 | 5.7  | 75              | 71  | 66  | 57 |
| 3.5  | 535                                    | 504  | 466  | 9.7  | 36              | 34 | 31 | 44 | 749                              | 705  | 652  | 8.2  | 50              | 47 | 44 | 50 | 1177                             | 1108 | 1025 | 6.5  | 79              | 74  | 68  | 58 |
| 4.0  | 425                                    | 400  | 370  | 10.9 | 37              | 35 | 32 | 45 | 594                              | 560  | 517  | 9.2  | 52              | 49 | 45 | 51 | 934                              | 879  | 813  | 7.3  | 82              | 77  | 71  | 59 |
| 4.5  | 346                                    | 326  | 301  | 12.1 | 38              | 36 | 33 | 45 | 485                              | 456  | 422  | 10.2 | 54              | 50 | 47 | 51 | 762                              | 717  | 663  | 8.1  | 84              | 79  | 73  | 59 |
| 5.0  | 289                                    | 272  | 251  | 13.2 | 39              | 37 | 34 | 46 | 404                              | 380  | 352  | 11.2 | 55              | 52 | 48 | 52 | 635                              | 598  | 553  | 8.9  | 87              | 82  | 75  | 60 |
| 5.5  | 245                                    | 230  | 213  | 14.3 | 40              | 38 | 35 | 46 | 343                              | 323  | 298  | 12.1 | 57              | 53 | 49 | 52 | 538                              | 507  | 469  | 9.7  | 89              | 84  | 77  | 60 |
| 6.0  | 211                                    | 198  | 183  | 15.5 | 41              | 39 | 36 | 47 | 295                              | 278  | 257  | 13.1 | 58              | 54 | 50 | 53 | 463                              | 436  | 403  | 10.4 | 91              | 86  | 79  | 61 |
| 6.5  | 183                                    | 173  | 160  | 16.6 | 42              | 40 | 37 | 47 | 257                              | 242  | 223  | 14.0 | 59              | 56 | 51 | 53 | 403                              | 380  | 351  | 11.2 | 93              | 87  | 81  | 61 |
| 7.0  | 161                                    | 152  | 140  | 17.7 | 43              | 41 | 38 | 47 | 226                              | 213  | 197  | 14.9 | 60              | 57 | 53 | 53 | 355                              | 334  | 309  | 11.9 | 95              | 89  | 83  | 61 |
| 7.5  | 143                                    | 135  | 125  | 18.7 | 44              | 41 | 38 | 48 | 200                              | 189  | 174  | 15.8 | 61              | 58 | 54 | 54 | 315                              | 296  | 274  | 12.6 | 97              | 91  | 84  | 62 |
| 8.0  | 128                                    | 121  | 111  | 19.8 | 45              | 42 | 39 | 48 | 179                              | 169  | 156  | 16.8 | 63              | 59 | 54 | 54 | 282                              | 265  | 245  | 13.4 | 98              | 93  | 86  | 62 |
| 8.5  | 115                                    | 109  | 100  | 20.9 | 45              | 43 | 40 | 48 | 161                              | 152  | 140  | 17.7 | 64              | 60 | 55 | 54 | 254                              | 239  | 221  | 14.1 | 100             | 94  | 87  | 62 |
| 9.0  | 104                                    | 98   | 91   | 22.0 | 46              | 43 | 40 | 49 | 146                              | 138  | 127  | 18.6 | 65              | 61 | 56 | 55 | 230                              | 216  | 200  | 14.8 | 101             | 96  | 88  | 63 |
| 9.5  | 95                                     | 90   | 83   | 23.0 | 47              | 44 | 41 | 49 | 133                              | 125  | 116  | 19.4 | 66              | 62 | 57 | 55 | 209                              | 197  | 182  | 15.5 | 103             | 97  | 90  | 63 |
| 10.0 | 87                                     | 82   | 76   | 24.0 | 47              | 45 | 41 | 49 | 122                              | 115  | 106  | 20.3 | 66              | 63 | 58 | 55 | 191                              | 180  | 167  | 16.2 | 104             | 98  | 91  | 63 |
| 11.0 | 74                                     | 69   | 64   | 26.1 | 49              | 46 | 42 | 50 | 103                              | 97   | 90   | 22.1 | 68              | 64 | 59 | 56 | 162                              | 153  | 141  | 17.6 | 107             | 101 | 93  | 64 |
| 12.0 | 63                                     | 60   | 55   | 28.2 | 50              | 47 | 43 | 50 | 89                               | 84   | 77   | 23.8 | 70              | 66 | 61 | 56 | 140                              | 131  | 122  | 19.0 | 110             | 103 | 95  | 64 |
| 13.0 | 55                                     | 52   | 48   | 30.2 | 51              | 48 | 44 | 50 | 77                               | 73   | 67   | 25.5 | 71              | 67 | 62 | 56 | 122                              | 114  | 106  | 20.3 | 112             | 106 | 98  | 64 |
| 14.0 | 49                                     | 46   | 42   | 32.2 | 52              | 49 | 45 | 51 | 68                               | 64   | 59   | 27.2 | 73              | 68 | 63 | 57 | 107                              | 101  | 93   | 21.7 | 114             | 108 | 100 | 65 |
| 15.0 | 43                                     | 41   | 38   | 34.1 | 53              | 50 | 46 | 51 | 60                               | 57   | 53   | 28.9 | 74              | 70 | 65 | 57 | 95                               | 89   | 83   | 23.0 | 116             | 110 | 101 | 65 |
| 16.0 | 39                                     | 36   | 34   | 36.1 | 54              | 51 | 47 | 51 | 54                               | 51   | 47   | 30.5 | 75              | 71 | 66 | 57 | 85                               | 80   | 74   | 24.3 | 119             | 112 | 103 | 65 |
| 17.0 | 35                                     | 33   | 30   | 38.1 | 55              | 52 | 48 | 52 | 49                               | 46   | 42   | 32.2 | 77              | 72 | 67 | 58 | 76                               | 72   | 67   | 25.7 | 120             | 113 | 105 | 66 |
| 18.0 | 31                                     | 30   | 27   | 40.0 | 56              | 52 | 48 | 52 | 44                               | 41   | 38   | 33.8 | 78              | 73 | 68 | 58 | 69                               | 65   | 60   | 27.0 | 122             | 115 | 107 | 66 |
| 19.0 | 29                                     | 27   | 25   | 41.9 | 56              | 53 | 49 | 52 | 40                               | 38   | 35   | 35.4 | 79              | 74 | 69 | 58 | 63                               | 59   | 55   | 28.2 | 124             | 117 | 108 | 66 |
| 20.0 | 26                                     | 25   | 23   | 43.8 | 57              | 54 | 50 | 52 | 37                               | 35   | 32   | 37.0 | 80              | 75 | 70 | 58 | 58                               | 54   | 50   | 29.5 | 126             | 119 | 110 | 67 |
| 22.0 | 22                                     | 21   | 19   | 47.6 | 59              | 55 | 51 | 53 | 31                               | 29   | 27   | 40.2 | 82              | 77 | 72 | 59 | 49                               | 46   | 43   | 32.1 | 129             | 122 | 112 | 67 |
| 24.0 | 19                                     | 18   | 17   | 51.3 | 60              | 57 | 52 | 53 | 27                               | 25   | 23   | 43.3 | 84              | 79 | 73 | 59 | 42                               | 40   | 37   | 34.6 | 132             | 124 | 115 | 67 |
| 26.0 | 17                                     | 16   | 15   | 55.0 | 61              | 58 | 53 | 54 | 23                               | 22   | 20   | 46.4 | 86              | 81 | 75 | 60 | 37                               | 35   | 32   | 37.0 | 135             | 127 | 118 | 68 |
| 28.0 | 15                                     | 14   | 13   | 58.6 | 63              | 59 | 55 | 54 | 21                               | 19   | 18   | 49.5 | 88              | 83 | 76 | 60 | 32                               | 30   | 28   | 39.5 | 138             | 130 | 120 | 68 |
| 30.0 | 13                                     | 12   | 11   | 62.2 | 64              | 60 | 56 | 54 | 18                               | 17   | 16   | 52.6 | 89              | 84 | 78 | 60 | 29                               | 27   | 25   | 41.9 | 140             | 132 | 122 | 69 |

**Table W12:** Western larch stocking levels for the ABLA2/VAME and ABLA2/VASC plant associations (B-O province), and the PICO(ABLA2)/VAME and PICO(ABLA2)/VASC plant community types.

| QMD  | Climate Resilience; SDI 119; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 166; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 261; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6377                                    | 6004 | 5552 | 2.8  | 35              | 33 | 30 | 44 | 8928                             | 8406 | 7773 | 2.4  | 49              | 46  | 42  | 50 | 14030                            | 13209 | 12214 | 1.9  | 77              | 72  | 67  | 58 |
| 1.5  | 3162                                    | 2977 | 2753 | 4.0  | 39              | 37 | 34 | 46 | 4427                             | 4168 | 3854 | 3.4  | 54              | 51  | 47  | 51 | 6957                             | 6550  | 6057  | 2.7  | 85              | 80  | 74  | 60 |
| 2.0  | 1922                                    | 1810 | 1674 | 5.1  | 42              | 39 | 37 | 47 | 2691                             | 2534 | 2343 | 4.3  | 59              | 55  | 51  | 53 | 4229                             | 3982  | 3682  | 3.4  | 92              | 87  | 80  | 61 |
| 2.5  | 1307                                    | 1230 | 1138 | 6.2  | 45              | 42 | 39 | 48 | 1829                             | 1722 | 1593 | 5.2  | 62              | 59  | 54  | 54 | 2875                             | 2707  | 2503  | 4.2  | 98              | 92  | 85  | 62 |
| 3.0  | 953                                     | 897  | 830  | 7.3  | 47              | 44 | 41 | 49 | 1335                             | 1256 | 1162 | 6.1  | 66              | 62  | 57  | 55 | 2097                             | 1974  | 1826  | 4.9  | 103             | 97  | 90  | 63 |
| 3.5  | 730                                     | 687  | 636  | 8.3  | 49              | 46 | 42 | 50 | 1022                             | 962  | 890  | 7.0  | 68              | 64  | 59  | 56 | 1606                             | 1512  | 1398  | 5.6  | 107             | 101 | 93  | 64 |
| 4.0  | 580                                     | 546  | 505  | 9.3  | 51              | 48 | 44 | 50 | 811                              | 764  | 706  | 7.9  | 71              | 67  | 62  | 56 | 1275                             | 1200  | 1110  | 6.3  | 111             | 105 | 97  | 64 |
| 4.5  | 473                                     | 445  | 412  | 10.3 | 52              | 49 | 45 | 51 | 662                              | 623  | 576  | 8.7  | 73              | 69  | 64  | 57 | 1040                             | 979   | 905   | 7.0  | 115             | 108 | 100 | 65 |
| 5.0  | 394                                     | 371  | 343  | 11.3 | 54              | 51 | 47 | 51 | 551                              | 519  | 480  | 9.6  | 75              | 71  | 65  | 57 | 867                              | 816   | 754   | 7.6  | 118             | 111 | 103 | 65 |
| 5.5  | 334                                     | 315  | 291  | 12.3 | 55              | 52 | 48 | 52 | 468                              | 440  | 407  | 10.4 | 77              | 73  | 67  | 58 | 735                              | 692   | 640   | 8.3  | 121             | 114 | 106 | 66 |
| 6.0  | 287                                     | 271  | 250  | 13.2 | 56              | 53 | 49 | 52 | 402                              | 379  | 350  | 11.2 | 79              | 74  | 69  | 58 | 632                              | 595   | 550   | 8.9  | 124             | 117 | 108 | 66 |
| 6.5  | 250                                     | 236  | 218  | 14.2 | 58              | 54 | 50 | 53 | 350                              | 330  | 305  | 12.0 | 81              | 76  | 70  | 59 | 550                              | 518   | 479   | 9.6  | 127             | 119 | 110 | 67 |
| 7.0  | 220                                     | 207  | 192  | 15.1 | 59              | 55 | 51 | 53 | 308                              | 290  | 268  | 12.8 | 82              | 78  | 72  | 59 | 484                              | 456   | 422   | 10.2 | 129             | 122 | 113 | 67 |
| 7.5  | 195                                     | 184  | 170  | 16.0 | 60              | 56 | 52 | 53 | 273                              | 257  | 238  | 13.6 | 84              | 79  | 73  | 59 | 430                              | 405   | 374   | 10.8 | 132             | 124 | 115 | 67 |
| 8.0  | 175                                     | 164  | 152  | 17.0 | 61              | 57 | 53 | 54 | 245                              | 230  | 213  | 14.3 | 85              | 80  | 74  | 60 | 384                              | 362   | 335   | 11.4 | 134             | 126 | 117 | 68 |
| 8.5  | 157                                     | 148  | 137  | 17.9 | 62              | 58 | 54 | 54 | 220                              | 207  | 192  | 15.1 | 87              | 82  | 76  | 60 | 346                              | 326   | 301   | 12.1 | 136             | 128 | 119 | 68 |
| 9.0  | 142                                     | 134  | 124  | 18.8 | 63              | 59 | 55 | 54 | 199                              | 188  | 174  | 15.9 | 88              | 83  | 77  | 60 | 313                              | 295   | 273   | 12.7 | 138             | 130 | 121 | 68 |
| 9.5  | 130                                     | 122  | 113  | 19.7 | 64              | 60 | 56 | 54 | 182                              | 171  | 158  | 16.6 | 89              | 84  | 78  | 60 | 285                              | 269   | 249   | 13.3 | 141             | 132 | 122 | 69 |
| 10.0 | 119                                     | 112  | 103  | 20.6 | 65              | 61 | 56 | 55 | 166                              | 157  | 145  | 17.4 | 91              | 85  | 79  | 61 | 261                              | 246   | 227   | 13.9 | 142             | 134 | 124 | 69 |
| 11.0 | 101                                     | 95   | 88   | 22.3 | 66              | 63 | 58 | 55 | 141                              | 133  | 123  | 18.9 | 93              | 88  | 81  | 61 | 222                              | 209   | 193   | 15.1 | 146             | 138 | 127 | 69 |
| 12.0 | 87                                      | 82   | 75   | 24.1 | 68              | 64 | 59 | 56 | 121                              | 114  | 106  | 20.4 | 95              | 90  | 83  | 62 | 191                              | 179   | 166   | 16.2 | 150             | 141 | 130 | 70 |
| 13.0 | 75                                      | 71   | 66   | 25.8 | 70              | 65 | 61 | 56 | 106                              | 99   | 92   | 21.8 | 97              | 92  | 85  | 62 | 166                              | 156   | 144   | 17.4 | 153             | 144 | 133 | 70 |
| 14.0 | 66                                      | 62   | 58   | 27.5 | 71              | 67 | 62 | 56 | 93                               | 87   | 81   | 23.3 | 99              | 93  | 86  | 62 | 146                              | 137   | 127   | 18.6 | 156             | 147 | 136 | 70 |
| 15.0 | 59                                      | 55   | 51   | 29.2 | 72              | 68 | 63 | 57 | 82                               | 78   | 72   | 24.7 | 101             | 95  | 88  | 63 | 130                              | 122   | 113   | 19.7 | 159             | 150 | 138 | 71 |
| 16.0 | 53                                      | 50   | 46   | 30.9 | 74              | 69 | 64 | 57 | 74                               | 69   | 64   | 26.1 | 103             | 97  | 90  | 63 | 116                              | 109   | 101   | 20.8 | 162             | 152 | 141 | 71 |
| 17.0 | 47                                      | 45   | 41   | 32.6 | 75              | 70 | 65 | 57 | 66                               | 63   | 58   | 27.5 | 105             | 99  | 91  | 63 | 104                              | 98    | 91    | 22.0 | 164             | 155 | 143 | 71 |
| 18.0 | 43                                      | 40   | 37   | 34.2 | 76              | 71 | 66 | 57 | 60                               | 57   | 52   | 28.9 | 106             | 100 | 93  | 64 | 95                               | 89    | 82    | 23.1 | 167             | 157 | 145 | 72 |
| 19.0 | 39                                      | 37   | 34   | 35.9 | 77              | 73 | 67 | 58 | 55                               | 52   | 48   | 30.3 | 108             | 102 | 94  | 64 | 86                               | 81    | 75    | 24.2 | 169             | 160 | 148 | 72 |
| 20.0 | 36                                      | 34   | 31   | 37.5 | 78              | 74 | 68 | 58 | 50                               | 47   | 44   | 31.7 | 109             | 103 | 95  | 64 | 79                               | 74    | 69    | 25.3 | 172             | 162 | 150 | 72 |
| 22.0 | 30                                      | 29   | 26   | 40.7 | 80              | 75 | 70 | 58 | 42                               | 40   | 37   | 34.4 | 112             | 106 | 98  | 64 | 67                               | 63    | 58    | 27.4 | 176             | 166 | 153 | 73 |
| 24.0 | 26                                      | 25   | 23   | 43.9 | 82              | 77 | 71 | 59 | 37                               | 34   | 32   | 37.1 | 115             | 108 | 100 | 65 | 57                               | 54    | 50    | 29.6 | 180             | 170 | 157 | 73 |
| 26.0 | 23                                      | 21   | 20   | 47.0 | 84              | 79 | 73 | 59 | 32                               | 30   | 28   | 39.8 | 117             | 110 | 102 | 65 | 50                               | 47    | 44    | 31.7 | 184             | 174 | 161 | 73 |
| 28.0 | 20                                      | 19   | 17   | 50.1 | 86              | 81 | 74 | 60 | 28                               | 26   | 24   | 42.4 | 120             | 113 | 104 | 66 | 44                               | 41    | 38    | 33.8 | 188             | 177 | 164 | 74 |
| 30.0 | 18                                      | 17   | 15   | 53.2 | 87              | 82 | 76 | 60 | 25                               | 23   | 22   | 45.0 | 122             | 115 | 106 | 66 | 39                               | 37    | 34    | 35.9 | 192             | 180 | 167 | 74 |



**Table W13:** Western larch stocking levels for the PSME/SYAL plant association (B-O province).

| QMD  | Climate Resilience; SDI 64; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 90; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 141; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3437                                   | 3236 | 2992 | 3.8  | 19              | 18 | 16 | 33 | 4812                            | 4530 | 4189 | 3.2  | 26              | 25 | 23 | 39 | 7561                             | 7119 | 6583 | 2.6  | 41              | 39 | 36 | 47 |
| 1.5  | 1704                                   | 1605 | 1484 | 5.4  | 21              | 20 | 18 | 35 | 2386                            | 2246 | 2077 | 4.6  | 29              | 28 | 25 | 41 | 3749                             | 3530 | 3264 | 3.7  | 46              | 43 | 40 | 49 |
| 2.0  | 1036                                   | 975  | 902  | 7.0  | 23              | 21 | 20 | 36 | 1451                            | 1366 | 1263 | 5.9  | 32              | 30 | 28 | 42 | 2279                             | 2146 | 1984 | 4.7  | 50              | 47 | 43 | 50 |
| 2.5  | 704                                    | 663  | 613  | 8.5  | 24              | 23 | 21 | 37 | 986                             | 928  | 858  | 7.1  | 34              | 32 | 29 | 43 | 1549                             | 1459 | 1349 | 5.7  | 53              | 50 | 46 | 51 |
| 3.0  | 514                                    | 484  | 447  | 9.9  | 25              | 24 | 22 | 38 | 719                             | 677  | 626  | 8.4  | 35              | 33 | 31 | 44 | 1130                             | 1064 | 984  | 6.7  | 55              | 52 | 48 | 52 |
| 3.5  | 393                                    | 370  | 343  | 11.3 | 26              | 25 | 23 | 39 | 551                             | 519  | 480  | 9.6  | 37              | 35 | 32 | 45 | 866                              | 815  | 754  | 7.6  | 58              | 54 | 50 | 53 |
| 4.0  | 312                                    | 294  | 272  | 12.7 | 27              | 26 | 24 | 39 | 437                             | 412  | 381  | 10.7 | 38              | 36 | 33 | 45 | 687                              | 647  | 598  | 8.6  | 60              | 56 | 52 | 53 |
| 4.5  | 255                                    | 240  | 222  | 14.1 | 28              | 26 | 24 | 40 | 357                             | 336  | 311  | 11.9 | 39              | 37 | 34 | 46 | 560                              | 528  | 488  | 9.5  | 62              | 58 | 54 | 54 |
| 5.0  | 212                                    | 200  | 185  | 15.4 | 29              | 27 | 25 | 40 | 297                             | 280  | 259  | 13.0 | 41              | 38 | 35 | 46 | 467                              | 440  | 407  | 10.4 | 64              | 60 | 55 | 54 |
| 5.5  | 180                                    | 170  | 157  | 16.7 | 30              | 28 | 26 | 41 | 252                             | 237  | 219  | 14.1 | 42              | 39 | 36 | 47 | 396                              | 373  | 345  | 11.3 | 65              | 62 | 57 | 55 |
| 6.0  | 155                                    | 146  | 135  | 18.0 | 30              | 29 | 26 | 41 | 217                             | 204  | 189  | 15.2 | 43              | 40 | 37 | 47 | 341                              | 321  | 297  | 12.2 | 67              | 63 | 58 | 55 |
| 6.5  | 135                                    | 127  | 117  | 19.3 | 31              | 29 | 27 | 42 | 189                             | 178  | 164  | 16.3 | 44              | 41 | 38 | 48 | 297                              | 279  | 258  | 13.0 | 68              | 64 | 60 | 56 |
| 7.0  | 119                                    | 112  | 103  | 20.6 | 32              | 30 | 28 | 42 | 166                             | 156  | 145  | 17.4 | 44              | 42 | 39 | 48 | 261                              | 246  | 227  | 13.9 | 70              | 66 | 61 | 56 |
| 7.5  | 105                                    | 99   | 92   | 21.9 | 32              | 30 | 28 | 42 | 147                             | 139  | 128  | 18.5 | 45              | 43 | 39 | 48 | 232                              | 218  | 202  | 14.7 | 71              | 67 | 62 | 56 |
| 8.0  | 94                                     | 89   | 82   | 23.1 | 33              | 31 | 29 | 43 | 132                             | 124  | 115  | 19.5 | 46              | 43 | 40 | 49 | 207                              | 195  | 180  | 15.6 | 72              | 68 | 63 | 57 |
| 8.5  | 85                                     | 80   | 74   | 24.4 | 33              | 31 | 29 | 43 | 119                             | 112  | 103  | 20.6 | 47              | 44 | 41 | 49 | 187                              | 176  | 162  | 16.4 | 73              | 69 | 64 | 57 |
| 9.0  | 77                                     | 72   | 67   | 25.6 | 34              | 32 | 30 | 43 | 108                             | 101  | 94   | 21.6 | 47              | 45 | 41 | 49 | 169                              | 159  | 147  | 17.3 | 75              | 70 | 65 | 57 |
| 9.5  | 70                                     | 66   | 61   | 26.8 | 34              | 32 | 30 | 43 | 98                              | 92   | 85   | 22.7 | 48              | 45 | 42 | 49 | 154                              | 145  | 134  | 18.1 | 76              | 71 | 66 | 57 |
| 10.0 | 64                                     | 60   | 56   | 28.0 | 35              | 33 | 30 | 44 | 90                              | 84   | 78   | 23.7 | 49              | 46 | 43 | 50 | 141                              | 133  | 123  | 18.9 | 77              | 72 | 67 | 58 |
| 11.0 | 54                                     | 51   | 47   | 30.4 | 36              | 34 | 31 | 44 | 76                              | 72   | 66   | 25.7 | 50              | 47 | 44 | 50 | 119                              | 112  | 104  | 20.5 | 79              | 74 | 69 | 58 |
| 12.0 | 47                                     | 44   | 41   | 32.8 | 37              | 35 | 32 | 45 | 65                              | 62   | 57   | 27.7 | 51              | 48 | 45 | 50 | 103                              | 97   | 89   | 22.1 | 81              | 76 | 70 | 59 |
| 13.0 | 41                                     | 38   | 35   | 35.2 | 37              | 35 | 33 | 45 | 57                              | 54   | 50   | 29.7 | 52              | 49 | 46 | 51 | 89                               | 84   | 78   | 23.7 | 82              | 78 | 72 | 59 |
| 14.0 | 36                                     | 34   | 31   | 37.5 | 38              | 36 | 33 | 45 | 50                              | 47   | 44   | 31.7 | 54              | 50 | 47 | 51 | 79                               | 74   | 68   | 25.3 | 84              | 79 | 73 | 59 |
| 15.0 | 32                                     | 30   | 28   | 39.8 | 39              | 37 | 34 | 46 | 44                              | 42   | 39   | 33.6 | 55              | 51 | 47 | 52 | 70                               | 66   | 61   | 26.8 | 86              | 81 | 75 | 60 |
| 16.0 | 28                                     | 27   | 25   | 42.1 | 40              | 37 | 35 | 46 | 40                              | 37   | 35   | 35.6 | 55              | 52 | 48 | 52 | 62                               | 59   | 54   | 28.4 | 87              | 82 | 76 | 60 |
| 17.0 | 26                                     | 24   | 22   | 44.4 | 40              | 38 | 35 | 46 | 36                              | 34   | 31   | 37.5 | 56              | 53 | 49 | 52 | 56                               | 53   | 49   | 29.9 | 89              | 83 | 77 | 60 |
| 18.0 | 23                                     | 22   | 20   | 46.6 | 41              | 39 | 36 | 46 | 32                              | 31   | 28   | 39.4 | 57              | 54 | 50 | 52 | 51                               | 48   | 44   | 31.4 | 90              | 85 | 78 | 61 |
| 19.0 | 21                                     | 20   | 18   | 48.8 | 42              | 39 | 36 | 47 | 30                              | 28   | 26   | 41.3 | 58              | 55 | 51 | 53 | 46                               | 44   | 40   | 32.9 | 91              | 86 | 80 | 61 |
| 20.0 | 19                                     | 18   | 17   | 51.1 | 42              | 40 | 37 | 47 | 27                              | 25   | 24   | 43.2 | 59              | 55 | 51 | 53 | 42                               | 40   | 37   | 34.4 | 93              | 87 | 81 | 61 |
| 22.0 | 16                                     | 15   | 14   | 55.4 | 43              | 41 | 38 | 47 | 23                              | 22   | 20   | 46.9 | 60              | 57 | 53 | 53 | 36                               | 34   | 31   | 37.4 | 95              | 89 | 83 | 61 |
| 24.0 | 14                                     | 13   | 12   | 59.8 | 44              | 42 | 38 | 48 | 20                              | 19   | 17   | 50.5 | 62              | 58 | 54 | 54 | 31                               | 29   | 27   | 40.3 | 97              | 92 | 85 | 62 |
| 26.0 | 12                                     | 12   | 11   | 64.1 | 45              | 43 | 39 | 48 | 17                              | 16   | 15   | 54.1 | 63              | 60 | 55 | 54 | 27                               | 25   | 23   | 43.2 | 99              | 94 | 87 | 62 |
| 28.0 | 11                                     | 10   | 9    | 68.3 | 46              | 43 | 40 | 49 | 15                              | 14   | 13   | 57.7 | 65              | 61 | 56 | 55 | 24                               | 22   | 21   | 46.1 | 101             | 95 | 88 | 63 |
| 30.0 | 10                                     | 9    | 8    | 72.5 | 47              | 44 | 41 | 49 | 13                              | 13   | 12   | 61.3 | 66              | 62 | 57 | 55 | 21                               | 20   | 18   | 48.9 | 103             | 97 | 90 | 63 |



**Table L1:** Lodgepole pine stocking levels for the ABGR/LIBO2 and ABLA2/VAME (W-S province), and ABGR/CARU (B-O province) plant associations, and the ABGR/ARCO plant community type.

| QMD  | Climate Resilience; SDI 95; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 133; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 209; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5221                                   | 4915 | 4545 | 3.1  | 28              | 27 | 25 | 41 | 7309                             | 6881 | 6363 | 2.6  | 40              | 38 | 35 | 47 | 11485                            | 10814 | 9999 | 2.1  | 63              | 59  | 55  | 55 |
| 1.5  | 2578                                   | 2427 | 2245 | 4.4  | 32              | 30 | 28 | 43 | 3610                             | 3398 | 3142 | 3.7  | 44              | 42 | 39 | 49 | 5672                             | 5340  | 4938 | 3.0  | 70              | 66  | 61  | 57 |
| 2.0  | 1563                                   | 1471 | 1361 | 5.7  | 34              | 32 | 30 | 44 | 2188                             | 2060 | 1905 | 4.8  | 48              | 45 | 42 | 50 | 3438                             | 3237  | 2993 | 3.8  | 75              | 71  | 65  | 58 |
| 2.5  | 1060                                   | 998  | 923  | 6.9  | 36              | 34 | 31 | 45 | 1484                             | 1397 | 1292 | 5.8  | 51              | 48 | 44 | 51 | 2332                             | 2196  | 2030 | 4.6  | 79              | 75  | 69  | 59 |
| 3.0  | 772                                    | 727  | 672  | 8.1  | 38              | 36 | 33 | 46 | 1081                             | 1017 | 941  | 6.8  | 53              | 50 | 46 | 52 | 1698                             | 1599  | 1478 | 5.4  | 83              | 78  | 73  | 60 |
| 3.5  | 590                                    | 556  | 514  | 9.2  | 39              | 37 | 34 | 47 | 826                              | 778  | 719  | 7.8  | 55              | 52 | 48 | 53 | 1299                             | 1223  | 1131 | 6.2  | 87              | 82  | 76  | 61 |
| 4.0  | 468                                    | 441  | 407  | 10.4 | 41              | 38 | 36 | 47 | 655                              | 617  | 570  | 8.8  | 57              | 54 | 50 | 53 | 1029                             | 969   | 896  | 7.0  | 90              | 85  | 78  | 62 |
| 4.5  | 381                                    | 359  | 332  | 11.5 | 42              | 40 | 37 | 48 | 534                              | 502  | 465  | 9.7  | 59              | 55 | 51 | 54 | 839                              | 790   | 730  | 7.7  | 93              | 87  | 81  | 62 |
| 5.0  | 317                                    | 299  | 276  | 12.6 | 43              | 41 | 38 | 49 | 444                              | 418  | 387  | 10.6 | 61              | 57 | 53 | 55 | 698                              | 657   | 608  | 8.5  | 95              | 90  | 83  | 63 |
| 5.5  | 269                                    | 253  | 234  | 13.7 | 44              | 42 | 39 | 49 | 376                              | 354  | 328  | 11.6 | 62              | 58 | 54 | 55 | 591                              | 557   | 515  | 9.2  | 98              | 92  | 85  | 63 |
| 6.0  | 231                                    | 218  | 201  | 14.8 | 45              | 43 | 39 | 49 | 323                              | 305  | 282  | 12.5 | 64              | 60 | 55 | 55 | 508                              | 479   | 443  | 9.9  | 100             | 94  | 87  | 63 |
| 6.5  | 201                                    | 189  | 175  | 15.8 | 46              | 44 | 40 | 50 | 281                              | 265  | 245  | 13.4 | 65              | 61 | 56 | 56 | 442                              | 416   | 385  | 10.7 | 102             | 96  | 89  | 64 |
| 7.0  | 177                                    | 166  | 154  | 16.9 | 47              | 44 | 41 | 50 | 247                              | 233  | 215  | 14.3 | 66              | 62 | 58 | 56 | 389                              | 366   | 338  | 11.4 | 104             | 98  | 90  | 64 |
| 7.5  | 157                                    | 148  | 136  | 17.9 | 48              | 45 | 42 | 50 | 219                              | 207  | 191  | 15.1 | 67              | 63 | 59 | 56 | 345                              | 325   | 300  | 12.1 | 106             | 100 | 92  | 65 |
| 8.0  | 140                                    | 132  | 122  | 19.0 | 49              | 46 | 43 | 51 | 196                              | 185  | 171  | 16.0 | 68              | 64 | 60 | 57 | 308                              | 290   | 268  | 12.8 | 108             | 101 | 94  | 65 |
| 8.5  | 126                                    | 119  | 110  | 20.0 | 50              | 47 | 43 | 51 | 176                              | 166  | 154  | 16.9 | 70              | 65 | 61 | 57 | 277                              | 261   | 241  | 13.5 | 109             | 103 | 95  | 65 |
| 9.0  | 114                                    | 107  | 99   | 21.0 | 50              | 47 | 44 | 51 | 160                              | 150  | 139  | 17.7 | 71              | 66 | 61 | 57 | 251                              | 236   | 219  | 14.2 | 111             | 104 | 97  | 65 |
| 9.5  | 104                                    | 98   | 90   | 22.0 | 51              | 48 | 45 | 51 | 145                              | 137  | 127  | 18.6 | 72              | 67 | 62 | 57 | 229                              | 215   | 199  | 14.8 | 112             | 106 | 98  | 66 |
| 10.0 | 95                                     | 89   | 83   | 23.0 | 52              | 49 | 45 | 52 | 133                              | 125  | 116  | 19.4 | 73              | 68 | 63 | 58 | 209                              | 197   | 182  | 15.5 | 114             | 107 | 99  | 66 |
| 11.0 | 80                                     | 76   | 70   | 25.0 | 53              | 50 | 46 | 52 | 113                              | 106  | 98   | 21.1 | 74              | 70 | 65 | 58 | 177                              | 167   | 154  | 16.9 | 117             | 110 | 102 | 66 |
| 12.0 | 69                                     | 65   | 60   | 27.0 | 54              | 51 | 47 | 53 | 97                               | 91   | 84   | 22.8 | 76              | 72 | 66 | 59 | 152                              | 143   | 132  | 18.2 | 120             | 113 | 104 | 67 |
| 13.0 | 60                                     | 57   | 52   | 28.9 | 55              | 52 | 48 | 53 | 84                               | 79   | 73   | 24.4 | 78              | 73 | 68 | 59 | 132                              | 125   | 115  | 19.5 | 122             | 115 | 106 | 67 |
| 14.0 | 53                                     | 50   | 46   | 30.8 | 57              | 53 | 49 | 53 | 74                               | 70   | 64   | 26.1 | 79              | 75 | 69 | 59 | 116                              | 110   | 101  | 20.8 | 124             | 117 | 108 | 67 |
| 15.0 | 47                                     | 44   | 41   | 32.7 | 58              | 54 | 50 | 54 | 66                               | 62   | 57   | 27.7 | 81              | 76 | 70 | 60 | 103                              | 97    | 90   | 22.1 | 127             | 119 | 110 | 68 |
| 16.0 | 42                                     | 39   | 37   | 34.6 | 59              | 55 | 51 | 54 | 59                               | 55   | 51   | 29.3 | 82              | 77 | 71 | 60 | 92                               | 87    | 80   | 23.4 | 129             | 121 | 112 | 68 |
| 17.0 | 38                                     | 36   | 33   | 36.5 | 59              | 56 | 52 | 54 | 53                               | 50   | 46   | 30.9 | 83              | 78 | 72 | 60 | 83                               | 78    | 72   | 24.6 | 131             | 123 | 114 | 68 |
| 18.0 | 34                                     | 32   | 30   | 38.4 | 60              | 57 | 53 | 54 | 48                               | 45   | 42   | 32.4 | 85              | 80 | 74 | 60 | 75                               | 71    | 65   | 25.9 | 133             | 125 | 116 | 69 |
| 19.0 | 31                                     | 29   | 27   | 40.2 | 61              | 58 | 53 | 55 | 44                               | 41   | 38   | 34.0 | 86              | 81 | 75 | 61 | 68                               | 64    | 60   | 27.1 | 135             | 127 | 117 | 69 |
| 20.0 | 28                                     | 27   | 25   | 42.1 | 62              | 58 | 54 | 55 | 40                               | 37   | 35   | 35.5 | 87              | 82 | 76 | 61 | 63                               | 59    | 54   | 28.4 | 137             | 129 | 119 | 69 |
| 22.0 | 24                                     | 23   | 21   | 45.7 | 64              | 60 | 55 | 55 | 34                               | 32   | 29   | 38.6 | 89              | 84 | 78 | 61 | 53                               | 50    | 46   | 30.8 | 140             | 132 | 122 | 70 |
| 24.0 | 21                                     | 19   | 18   | 49.3 | 65              | 61 | 57 | 56 | 29                               | 27   | 25   | 41.7 | 91              | 86 | 79 | 62 | 46                               | 43    | 40   | 33.2 | 143             | 135 | 125 | 70 |
| 26.0 | 18                                     | 17   | 16   | 52.8 | 66              | 63 | 58 | 56 | 25                               | 24   | 22   | 44.7 | 93              | 88 | 81 | 62 | 40                               | 37    | 35   | 35.6 | 146             | 138 | 127 | 70 |
| 28.0 | 16                                     | 15   | 14   | 56.4 | 68              | 64 | 59 | 56 | 22                               | 21   | 19   | 47.6 | 95              | 89 | 83 | 63 | 35                               | 33    | 30   | 38.0 | 149             | 140 | 130 | 71 |
| 30.0 | 14                                     | 13   | 12   | 59.8 | 69              | 65 | 60 | 57 | 20                               | 19   | 17   | 50.6 | 97              | 91 | 84 | 63 | 31                               | 29    | 27   | 40.3 | 152             | 143 | 132 | 71 |

**Table L2:** Lodgepole pine stocking levels for the ABGR/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 107; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 150; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 235; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5880                                    | 5536 | 5119 | 2.9  | 32              | 30 | 28 | 43 | 8232                             | 7751 | 7167 | 2.5  | 45              | 42  | 39 | 49 | 12936                            | 12179 | 11262 | 2.0  | 71              | 66  | 61  | 57 |
| 1.5  | 2904                                    | 2734 | 2528 | 4.2  | 36              | 34 | 31 | 45 | 4065                             | 3828 | 3539 | 3.5  | 50              | 47  | 43 | 51 | 6389                             | 6015  | 5562  | 2.8  | 78              | 74  | 68  | 59 |
| 2.0  | 1760                                    | 1657 | 1533 | 5.3  | 38              | 36 | 33 | 46 | 2464                             | 2320 | 2146 | 4.5  | 54              | 51  | 47 | 52 | 3873                             | 3646  | 3372  | 3.6  | 84              | 80  | 74  | 60 |
| 2.5  | 1194                                    | 1124 | 1039 | 6.5  | 41              | 38 | 35 | 47 | 1671                             | 1574 | 1455 | 5.5  | 57              | 54  | 50 | 53 | 2627                             | 2473  | 2287  | 4.4  | 90              | 84  | 78  | 62 |
| 3.0  | 869                                     | 818  | 757  | 7.6  | 43              | 40 | 37 | 48 | 1217                             | 1146 | 1060 | 6.4  | 60              | 56  | 52 | 54 | 1913                             | 1801  | 1665  | 5.1  | 94              | 88  | 82  | 62 |
| 3.5  | 665                                     | 626  | 579  | 8.7  | 44              | 42 | 39 | 49 | 931                              | 876  | 810  | 7.4  | 62              | 59  | 54 | 55 | 1463                             | 1377  | 1273  | 5.9  | 98              | 92  | 85  | 63 |
| 4.0  | 527                                     | 496  | 459  | 9.8  | 46              | 43 | 40 | 50 | 738                              | 695  | 642  | 8.3  | 64              | 61  | 56 | 56 | 1159                             | 1092  | 1009  | 6.6  | 101             | 95  | 88  | 64 |
| 4.5  | 429                                     | 404  | 374  | 10.8 | 47              | 45 | 41 | 50 | 601                              | 566  | 523  | 9.1  | 66              | 63  | 58 | 56 | 945                              | 889   | 822   | 7.3  | 104             | 98  | 91  | 64 |
| 5.0  | 357                                     | 337  | 311  | 11.9 | 49              | 46 | 42 | 51 | 500                              | 471  | 436  | 10.0 | 68              | 64  | 59 | 57 | 786                              | 740   | 685   | 8.0  | 107             | 101 | 93  | 65 |
| 5.5  | 303                                     | 285  | 264  | 12.9 | 50              | 47 | 43 | 51 | 424                              | 399  | 369  | 10.9 | 70              | 66  | 61 | 57 | 666                              | 627   | 580   | 8.7  | 110             | 103 | 96  | 65 |
| 6.0  | 260                                     | 245  | 227  | 13.9 | 51              | 48 | 44 | 51 | 364                              | 343  | 317  | 11.7 | 72              | 67  | 62 | 57 | 573                              | 539   | 498   | 9.4  | 112             | 106 | 98  | 66 |
| 6.5  | 226                                     | 213  | 197  | 14.9 | 52              | 49 | 45 | 52 | 317                              | 298  | 276  | 12.6 | 73              | 69  | 64 | 58 | 498                              | 469   | 434   | 10.0 | 115             | 108 | 100 | 66 |
| 7.0  | 199                                     | 187  | 173  | 15.9 | 53              | 50 | 46 | 52 | 279                              | 262  | 243  | 13.4 | 74              | 70  | 65 | 58 | 438                              | 412   | 381   | 10.7 | 117             | 110 | 102 | 66 |
| 7.5  | 177                                     | 166  | 154  | 16.9 | 54              | 51 | 47 | 53 | 247                              | 233  | 215  | 14.3 | 76              | 71  | 66 | 59 | 388                              | 366   | 338   | 11.4 | 119             | 112 | 104 | 67 |
| 8.0  | 158                                     | 149  | 137  | 17.9 | 55              | 52 | 48 | 53 | 221                              | 208  | 192  | 15.1 | 77              | 73  | 67 | 59 | 347                              | 327   | 302   | 12.0 | 121             | 114 | 105 | 67 |
| 8.5  | 142                                     | 134  | 124  | 18.8 | 56              | 53 | 49 | 53 | 199                              | 187  | 173  | 15.9 | 78              | 74  | 68 | 59 | 312                              | 294   | 272   | 12.7 | 123             | 116 | 107 | 67 |
| 9.0  | 129                                     | 121  | 112  | 19.8 | 57              | 53 | 49 | 53 | 180                              | 169  | 157  | 16.7 | 79              | 75  | 69 | 59 | 283                              | 266   | 246   | 13.3 | 125             | 118 | 109 | 67 |
| 9.5  | 117                                     | 110  | 102  | 20.7 | 58              | 54 | 50 | 54 | 164                              | 154  | 143  | 17.5 | 81              | 76  | 70 | 60 | 257                              | 242   | 224   | 14.0 | 127             | 119 | 110 | 68 |
| 10.0 | 107                                     | 101  | 93   | 21.7 | 58              | 55 | 51 | 54 | 150                              | 141  | 130  | 18.3 | 82              | 77  | 71 | 60 | 235                              | 222   | 205   | 14.6 | 128             | 121 | 112 | 68 |
| 11.0 | 91                                      | 85   | 79   | 23.6 | 60              | 56 | 52 | 54 | 127                              | 119  | 110  | 19.9 | 84              | 79  | 73 | 60 | 199                              | 188   | 174   | 15.9 | 132             | 124 | 115 | 68 |
| 12.0 | 78                                      | 73   | 68   | 25.4 | 61              | 58 | 53 | 55 | 109                              | 103  | 95   | 21.5 | 86              | 81  | 75 | 61 | 171                              | 161   | 149   | 17.1 | 135             | 127 | 117 | 69 |
| 13.0 | 68                                      | 64   | 59   | 27.2 | 62              | 59 | 54 | 55 | 95                               | 89   | 83   | 23.0 | 87              | 82  | 76 | 61 | 149                              | 140   | 130   | 18.4 | 137             | 129 | 120 | 69 |
| 14.0 | 60                                      | 56   | 52   | 29.1 | 64              | 60 | 55 | 55 | 83                               | 79   | 73   | 24.6 | 89              | 84  | 78 | 61 | 131                              | 123   | 114   | 19.6 | 140             | 132 | 122 | 70 |
| 15.0 | 53                                      | 50   | 46   | 30.9 | 65              | 61 | 56 | 56 | 74                               | 70   | 64   | 26.1 | 91              | 85  | 79 | 62 | 116                              | 109   | 101   | 20.8 | 143             | 134 | 124 | 70 |
| 16.0 | 47                                      | 44   | 41   | 32.6 | 66              | 62 | 57 | 56 | 66                               | 62   | 58   | 27.6 | 92              | 87  | 80 | 62 | 104                              | 98    | 90    | 22.0 | 145             | 137 | 126 | 70 |
| 17.0 | 43                                      | 40   | 37   | 34.4 | 67              | 63 | 58 | 56 | 60                               | 56   | 52   | 29.1 | 94              | 88  | 82 | 62 | 94                               | 88    | 81    | 23.2 | 147             | 139 | 128 | 70 |
| 18.0 | 38                                      | 36   | 33   | 36.2 | 68              | 64 | 59 | 57 | 54                               | 51   | 47   | 30.6 | 95              | 90  | 83 | 63 | 85                               | 80    | 74    | 24.4 | 150             | 141 | 130 | 71 |
| 19.0 | 35                                      | 33   | 30   | 37.9 | 69              | 65 | 60 | 57 | 49                               | 46   | 43   | 32.0 | 97              | 91  | 84 | 63 | 77                               | 73    | 67    | 25.6 | 152             | 143 | 132 | 71 |
| 20.0 | 32                                      | 30   | 28   | 39.6 | 70              | 66 | 61 | 57 | 45                               | 42   | 39   | 33.5 | 98              | 92  | 85 | 63 | 70                               | 66    | 61    | 26.7 | 154             | 145 | 134 | 71 |
| 22.0 | 27                                      | 26   | 24   | 43.1 | 72              | 67 | 62 | 58 | 38                               | 36   | 33   | 36.4 | 100             | 94  | 87 | 64 | 60                               | 56    | 52    | 29.0 | 158             | 148 | 137 | 72 |
| 24.0 | 23                                      | 22   | 20   | 46.4 | 73              | 69 | 64 | 58 | 33                               | 31   | 28   | 39.2 | 103             | 97  | 89 | 64 | 51                               | 48    | 45    | 31.3 | 161             | 152 | 140 | 72 |
| 26.0 | 20                                      | 19   | 18   | 49.8 | 75              | 70 | 65 | 58 | 28                               | 27   | 25   | 42.1 | 105             | 99  | 91 | 64 | 45                               | 42    | 39    | 33.6 | 165             | 155 | 143 | 72 |
| 28.0 | 18                                      | 17   | 16   | 53.1 | 76              | 72 | 66 | 59 | 25                               | 24   | 22   | 44.9 | 107             | 101 | 93 | 65 | 39                               | 37    | 34    | 35.8 | 168             | 158 | 146 | 73 |
| 30.0 | 16                                      | 15   | 14   | 56.4 | 78              | 73 | 68 | 59 | 22                               | 21   | 19   | 47.7 | 109             | 102 | 95 | 65 | 35                               | 33    | 30    | 38.0 | 171             | 161 | 149 | 73 |

**Table L3:** Lodgepole pine stocking levels for the ABGR/LIBO2 plant association (B-O province) and the PICO(ABGR)/VAME-LIBO2 plant community type.

| QMD  | Climate Resilience; SDI 136; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 190; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 298; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7460                                    | 7024 | 6495 | 2.6  | 41              | 38 | 35 | 47 | 10444                            | 9833 | 9093 | 2.2  | 57              | 54  | 50  | 53 | 16412                            | 15452 | 14288 | 1.8  | 90              | 84  | 78  | 62 |
| 1.5  | 3684                                    | 3469 | 3207 | 3.7  | 45              | 43 | 39 | 49 | 5158                             | 4856 | 4490 | 3.1  | 63              | 60  | 55  | 55 | 8105                             | 7631  | 7056  | 2.5  | 99              | 94  | 87  | 63 |
| 2.0  | 2233                                    | 2103 | 1944 | 4.7  | 49              | 46 | 42 | 51 | 3127                             | 2944 | 2722 | 4.0  | 68              | 64  | 59  | 57 | 4913                             | 4626  | 4277  | 3.2  | 107             | 101 | 93  | 65 |
| 2.5  | 1515                                    | 1426 | 1319 | 5.8  | 52              | 49 | 45 | 52 | 2121                             | 1997 | 1846 | 4.9  | 72              | 68  | 63  | 58 | 3332                             | 3137  | 2901  | 3.9  | 114             | 107 | 99  | 66 |
| 3.0  | 1103                                    | 1038 | 960  | 6.8  | 54              | 51 | 47 | 53 | 1544                             | 1454 | 1344 | 5.7  | 76              | 71  | 66  | 59 | 2426                             | 2285  | 2112  | 4.6  | 119             | 112 | 104 | 67 |
| 3.5  | 843                                     | 794  | 734  | 7.7  | 56              | 53 | 49 | 53 | 1181                             | 1112 | 1028 | 6.5  | 79              | 74  | 69  | 59 | 1856                             | 1747  | 1615  | 5.2  | 124             | 117 | 108 | 67 |
| 4.0  | 669                                     | 629  | 582  | 8.7  | 58              | 55 | 51 | 54 | 936                              | 881  | 815  | 7.3  | 82              | 77  | 71  | 60 | 1471                             | 1385  | 1281  | 5.8  | 128             | 121 | 112 | 68 |
| 4.5  | 545                                     | 513  | 474  | 9.6  | 60              | 57 | 52 | 54 | 763                              | 718  | 664  | 8.1  | 84              | 79  | 73  | 60 | 1198                             | 1128  | 1043  | 6.5  | 132             | 125 | 115 | 69 |
| 5.0  | 453                                     | 427  | 395  | 10.5 | 62              | 58 | 54 | 55 | 635                              | 598  | 553  | 8.9  | 87              | 81  | 75  | 61 | 998                              | 939   | 869   | 7.1  | 136             | 128 | 118 | 69 |
| 5.5  | 384                                     | 362  | 334  | 11.4 | 63              | 60 | 55 | 55 | 538                              | 506  | 468  | 9.7  | 89              | 84  | 77  | 61 | 845                              | 796   | 736   | 7.7  | 139             | 131 | 121 | 69 |
| 6.0  | 330                                     | 311  | 287  | 12.3 | 65              | 61 | 56 | 56 | 462                              | 435  | 402  | 10.4 | 91              | 85  | 79  | 62 | 726                              | 684   | 632   | 8.3  | 143             | 134 | 124 | 70 |
| 6.5  | 287                                     | 270  | 250  | 13.2 | 66              | 62 | 58 | 56 | 402                              | 379  | 350  | 11.2 | 93              | 87  | 81  | 62 | 632                              | 595   | 550   | 8.9  | 146             | 137 | 127 | 70 |
| 7.0  | 253                                     | 238  | 220  | 14.1 | 67              | 64 | 59 | 56 | 354                              | 333  | 308  | 11.9 | 94              | 89  | 82  | 62 | 556                              | 523   | 484   | 9.5  | 148             | 140 | 129 | 71 |
| 7.5  | 224                                     | 211  | 195  | 15.0 | 69              | 65 | 60 | 57 | 314                              | 295  | 273  | 12.7 | 96              | 91  | 84  | 63 | 493                              | 464   | 429   | 10.1 | 151             | 142 | 132 | 71 |
| 8.0  | 200                                     | 188  | 174  | 15.9 | 70              | 66 | 61 | 57 | 280                              | 264  | 244  | 13.4 | 98              | 92  | 85  | 63 | 440                              | 415   | 383   | 10.7 | 154             | 145 | 134 | 71 |
| 8.5  | 180                                     | 170  | 157  | 16.7 | 71              | 67 | 62 | 57 | 252                              | 237  | 220  | 14.1 | 99              | 94  | 87  | 63 | 396                              | 373   | 345   | 11.3 | 156             | 147 | 136 | 72 |
| 9.0  | 163                                     | 154  | 142  | 17.6 | 72              | 68 | 63 | 58 | 228                              | 215  | 199  | 14.8 | 101             | 95  | 88  | 64 | 359                              | 338   | 312   | 11.8 | 158             | 149 | 138 | 72 |
| 9.5  | 148                                     | 140  | 129  | 18.4 | 73              | 69 | 64 | 58 | 208                              | 196  | 181  | 15.6 | 102             | 96  | 89  | 64 | 327                              | 307   | 284   | 12.4 | 161             | 151 | 140 | 72 |
| 10.0 | 136                                     | 128  | 118  | 19.2 | 74              | 70 | 64 | 58 | 190                              | 179  | 165  | 16.3 | 104             | 98  | 90  | 64 | 299                              | 281   | 260   | 13.0 | 163             | 153 | 142 | 72 |
| 11.0 | 115                                     | 108  | 100  | 20.9 | 76              | 71 | 66 | 59 | 161                              | 152  | 140  | 17.7 | 106             | 100 | 93  | 65 | 253                              | 238   | 220   | 14.1 | 167             | 157 | 145 | 73 |
| 12.0 | 99                                      | 93   | 86   | 22.6 | 78              | 73 | 68 | 59 | 138                              | 130  | 120  | 19.1 | 109             | 102 | 95  | 65 | 217                              | 205   | 189   | 15.2 | 171             | 161 | 149 | 73 |
| 13.0 | 86                                      | 81   | 75   | 24.2 | 79              | 75 | 69 | 59 | 120                              | 113  | 105  | 20.4 | 111             | 104 | 97  | 65 | 189                              | 178   | 165   | 16.3 | 174             | 164 | 152 | 74 |
| 14.0 | 76                                      | 71   | 66   | 25.8 | 81              | 76 | 70 | 60 | 106                              | 100  | 92   | 21.8 | 113             | 107 | 98  | 66 | 166                              | 157   | 145   | 17.4 | 178             | 167 | 155 | 74 |
| 15.0 | 67                                      | 63   | 58   | 27.4 | 82              | 77 | 72 | 60 | 94                               | 88   | 82   | 23.1 | 115             | 108 | 100 | 66 | 147                              | 139   | 128   | 18.5 | 181             | 170 | 158 | 74 |
| 16.0 | 60                                      | 56   | 52   | 29.0 | 84              | 79 | 73 | 60 | 84                               | 79   | 73   | 24.5 | 117             | 110 | 102 | 66 | 132                              | 124   | 115   | 19.5 | 184             | 173 | 160 | 74 |
| 17.0 | 54                                      | 51   | 47   | 30.5 | 85              | 80 | 74 | 61 | 75                               | 71   | 66   | 25.8 | 119             | 112 | 104 | 67 | 119                              | 112   | 103   | 20.6 | 187             | 176 | 163 | 75 |
| 18.0 | 49                                      | 46   | 42   | 32.1 | 86              | 81 | 75 | 61 | 68                               | 64   | 59   | 27.1 | 121             | 114 | 105 | 67 | 107                              | 101   | 93    | 21.6 | 190             | 179 | 165 | 75 |
| 19.0 | 44                                      | 42   | 39   | 33.6 | 87              | 82 | 76 | 61 | 62                               | 59   | 54   | 28.4 | 122             | 115 | 107 | 67 | 98                               | 92    | 85    | 22.7 | 192             | 181 | 168 | 75 |
| 20.0 | 41                                      | 38   | 35   | 35.2 | 89              | 83 | 77 | 61 | 57                               | 54   | 50   | 29.7 | 124             | 117 | 108 | 67 | 89                               | 84    | 78    | 23.7 | 195             | 184 | 170 | 76 |
| 22.0 | 34                                      | 32   | 30   | 38.2 | 91              | 86 | 79 | 62 | 48                               | 45   | 42   | 32.3 | 127             | 120 | 111 | 68 | 76                               | 71    | 66    | 25.8 | 200             | 188 | 174 | 76 |
| 24.0 | 30                                      | 28   | 26   | 41.2 | 93              | 88 | 81 | 62 | 41                               | 39   | 36   | 34.8 | 130             | 123 | 113 | 68 | 65                               | 61    | 57    | 27.8 | 205             | 193 | 178 | 76 |
| 26.0 | 26                                      | 24   | 22   | 44.2 | 95              | 89 | 83 | 63 | 36                               | 34   | 31   | 37.4 | 133             | 125 | 116 | 69 | 57                               | 53    | 49    | 29.8 | 209             | 197 | 182 | 77 |
| 28.0 | 23                                      | 21   | 20   | 47.1 | 97              | 91 | 84 | 63 | 32                               | 30   | 28   | 39.8 | 135             | 128 | 118 | 69 | 50                               | 47    | 43    | 31.8 | 213             | 200 | 185 | 77 |
| 30.0 | 20                                      | 19   | 17   | 50.1 | 99              | 93 | 86 | 63 | 28                               | 26   | 24   | 42.3 | 138             | 130 | 120 | 69 | 44                               | 42    | 38    | 33.8 | 217             | 204 | 189 | 77 |

**Table L4:** Lodgepole pine stocking levels for the ABGR/VAME plant association (B-O province), and the PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, and PICO(ABGR)/VAME/PTAQ plant community types.

| QMD  | Climate Resilience; SDI 74; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 104; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 164; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4094                                   | 3855 | 3564 | 3.5  | 22              | 21 | 19 | 37 | 5732                             | 5396 | 4990 | 3.0  | 31              | 29 | 27 | 43 | 9007                             | 8480 | 7841 | 2.4  | 49              | 46  | 43  | 51 |
| 1.5  | 2022                                   | 1904 | 1760 | 5.0  | 25              | 23 | 22 | 39 | 2831                             | 2665 | 2464 | 4.2  | 35              | 33 | 30 | 45 | 4448                             | 4188 | 3873 | 3.4  | 55              | 51  | 48  | 53 |
| 2.0  | 1226                                   | 1154 | 1067 | 6.4  | 27              | 25 | 23 | 40 | 1716                             | 1616 | 1494 | 5.4  | 37              | 35 | 33 | 46 | 2696                             | 2539 | 2347 | 4.3  | 59              | 55  | 51  | 54 |
| 2.5  | 831                                    | 783  | 724  | 7.8  | 28              | 27 | 25 | 41 | 1164                             | 1096 | 1013 | 6.6  | 40              | 37 | 35 | 47 | 1829                             | 1722 | 1592 | 5.2  | 62              | 59  | 54  | 55 |
| 3.0  | 605                                    | 570  | 527  | 9.1  | 30              | 28 | 26 | 42 | 847                              | 798  | 738  | 7.7  | 42              | 39 | 36 | 48 | 1332                             | 1254 | 1159 | 6.1  | 65              | 62  | 57  | 56 |
| 3.5  | 463                                    | 436  | 403  | 10.4 | 31              | 29 | 27 | 43 | 648                              | 610  | 564  | 8.8  | 43              | 41 | 38 | 49 | 1018                             | 959  | 887  | 7.0  | 68              | 64  | 59  | 57 |
| 4.0  | 367                                    | 345  | 319  | 11.7 | 32              | 30 | 28 | 43 | 514                              | 484  | 447  | 9.9  | 45              | 42 | 39 | 49 | 807                              | 760  | 703  | 7.9  | 70              | 66  | 61  | 57 |
| 4.5  | 299                                    | 281  | 260  | 13.0 | 33              | 31 | 29 | 44 | 418                              | 394  | 364  | 11.0 | 46              | 44 | 40 | 50 | 658                              | 619  | 573  | 8.7  | 73              | 68  | 63  | 58 |
| 5.0  | 249                                    | 234  | 217  | 14.2 | 34              | 32 | 30 | 44 | 348                              | 328  | 303  | 12.0 | 48              | 45 | 41 | 50 | 547                              | 515  | 477  | 9.6  | 75              | 70  | 65  | 58 |
| 5.5  | 211                                    | 198  | 184  | 15.4 | 35              | 33 | 30 | 45 | 295                              | 278  | 257  | 13.1 | 49              | 46 | 42 | 51 | 464                              | 437  | 404  | 10.4 | 77              | 72  | 67  | 59 |
| 6.0  | 181                                    | 171  | 158  | 16.7 | 36              | 33 | 31 | 45 | 254                              | 239  | 221  | 14.1 | 50              | 47 | 43 | 51 | 399                              | 375  | 347  | 11.2 | 78              | 74  | 68  | 59 |
| 6.5  | 158                                    | 148  | 137  | 17.9 | 36              | 34 | 32 | 45 | 221                              | 208  | 192  | 15.1 | 51              | 48 | 44 | 51 | 347                              | 327  | 302  | 12.0 | 80              | 75  | 70  | 59 |
| 7.0  | 139                                    | 130  | 121  | 19.1 | 37              | 35 | 32 | 46 | 194                              | 183  | 169  | 16.1 | 52              | 49 | 45 | 52 | 305                              | 287  | 265  | 12.8 | 81              | 77  | 71  | 60 |
| 7.5  | 123                                    | 116  | 107  | 20.2 | 38              | 35 | 33 | 46 | 172                              | 162  | 150  | 17.1 | 53              | 50 | 46 | 52 | 270                              | 255  | 235  | 13.6 | 83              | 78  | 72  | 60 |
| 8.0  | 110                                    | 103  | 96   | 21.4 | 38              | 36 | 33 | 46 | 154                              | 145  | 134  | 18.1 | 54              | 51 | 47 | 52 | 242                              | 228  | 210  | 14.4 | 84              | 79  | 73  | 60 |
| 8.5  | 99                                     | 93   | 86   | 22.6 | 39              | 37 | 34 | 47 | 138                              | 130  | 120  | 19.1 | 55              | 51 | 47 | 53 | 217                              | 205  | 189  | 15.2 | 86              | 81  | 75  | 61 |
| 9.0  | 89                                     | 84   | 78   | 23.7 | 40              | 37 | 34 | 47 | 125                              | 118  | 109  | 20.0 | 55              | 52 | 48 | 53 | 197                              | 185  | 171  | 16.0 | 87              | 82  | 76  | 61 |
| 9.5  | 81                                     | 77   | 71   | 24.8 | 40              | 38 | 35 | 47 | 114                              | 107  | 99   | 21.0 | 56              | 53 | 49 | 53 | 179                              | 169  | 156  | 16.8 | 88              | 83  | 77  | 61 |
| 10.0 | 75                                     | 70   | 65   | 26.0 | 41              | 38 | 35 | 47 | 104                              | 98   | 91   | 22.0 | 57              | 54 | 50 | 53 | 164                              | 154  | 143  | 17.5 | 89              | 84  | 78  | 61 |
| 11.0 | 63                                     | 59   | 55   | 28.2 | 42              | 39 | 36 | 48 | 88                               | 83   | 77   | 23.9 | 58              | 55 | 51 | 54 | 139                              | 131  | 121  | 19.0 | 92              | 86  | 80  | 62 |
| 12.0 | 54                                     | 51   | 47   | 30.5 | 43              | 40 | 37 | 48 | 76                               | 72   | 66   | 25.7 | 60              | 56 | 52 | 54 | 119                              | 112  | 104  | 20.5 | 94              | 88  | 82  | 62 |
| 13.0 | 47                                     | 44   | 41   | 32.6 | 44              | 41 | 38 | 49 | 66                               | 62   | 58   | 27.6 | 61              | 57 | 53 | 55 | 104                              | 98   | 90   | 22.0 | 96              | 90  | 83  | 63 |
| 14.0 | 41                                     | 39   | 36   | 34.8 | 44              | 42 | 39 | 49 | 58                               | 55   | 51   | 29.4 | 62              | 58 | 54 | 55 | 91                               | 86   | 79   | 23.5 | 98              | 92  | 85  | 63 |
| 15.0 | 37                                     | 35   | 32   | 37.0 | 45              | 43 | 39 | 49 | 52                               | 48   | 45   | 31.2 | 63              | 60 | 55 | 55 | 81                               | 76   | 70   | 24.9 | 99              | 94  | 86  | 63 |
| 16.0 | 33                                     | 31   | 29   | 39.1 | 46              | 43 | 40 | 50 | 46                               | 43   | 40   | 33.1 | 64              | 61 | 56 | 56 | 72                               | 68   | 63   | 26.4 | 101             | 95  | 88  | 64 |
| 17.0 | 30                                     | 28   | 26   | 41.2 | 47              | 44 | 41 | 50 | 41                               | 39   | 36   | 34.8 | 65              | 61 | 57 | 56 | 65                               | 61   | 57   | 27.8 | 103             | 97  | 89  | 64 |
| 18.0 | 27                                     | 25   | 23   | 43.3 | 47              | 45 | 41 | 50 | 38                               | 35   | 33   | 36.6 | 66              | 62 | 58 | 56 | 59                               | 55   | 51   | 29.2 | 104             | 98  | 91  | 64 |
| 19.0 | 24                                     | 23   | 21   | 45.4 | 48              | 45 | 42 | 50 | 34                               | 32   | 30   | 38.4 | 67              | 63 | 59 | 56 | 54                               | 51   | 47   | 30.6 | 106             | 99  | 92  | 64 |
| 20.0 | 22                                     | 21   | 19   | 47.5 | 49              | 46 | 42 | 51 | 31                               | 29   | 27   | 40.1 | 68              | 64 | 59 | 57 | 49                               | 46   | 43   | 32.0 | 107             | 101 | 93  | 65 |
| 22.0 | 19                                     | 18   | 16   | 51.6 | 50              | 47 | 43 | 51 | 26                               | 25   | 23   | 43.6 | 70              | 66 | 61 | 57 | 42                               | 39   | 36   | 34.8 | 110             | 103 | 96  | 65 |
| 24.0 | 16                                     | 15   | 14   | 55.7 | 51              | 48 | 44 | 51 | 23                               | 21   | 20   | 47.0 | 71              | 67 | 62 | 57 | 36                               | 34   | 31   | 37.5 | 112             | 106 | 98  | 66 |
| 26.0 | 14                                     | 13   | 12   | 59.7 | 52              | 49 | 45 | 52 | 20                               | 19   | 17   | 50.4 | 73              | 69 | 63 | 58 | 31                               | 29   | 27   | 40.2 | 115             | 108 | 100 | 66 |
| 28.0 | 12                                     | 12   | 11   | 63.6 | 53              | 50 | 46 | 52 | 17                               | 16   | 15   | 53.8 | 74              | 70 | 65 | 58 | 27                               | 26   | 24   | 42.9 | 117             | 110 | 102 | 66 |
| 30.0 | 11                                     | 10   | 10   | 67.6 | 54              | 51 | 47 | 52 | 15                               | 15   | 13   | 57.1 | 76              | 71 | 66 | 58 | 24                               | 23   | 21   | 45.6 | 119             | 112 | 104 | 67 |

**Table L5:** Lodgepole pine stocking levels for the ABGR/VAME and ABLA2/LIBO2 plant associations (W-S province).

| QMD  | Climate Resilience; SDI 83; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 116; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 182; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4547                                   | 4281 | 3959 | 3.3  | 25              | 23 | 22 | 39 | 6366                             | 5994 | 5543 | 2.8  | 35              | 33 | 30 | 45 | 10004                            | 9419 | 8710 | 2.2  | 55              | 51  | 48  | 53 |
| 1.5  | 2246                                   | 2114 | 1955 | 4.7  | 28              | 26 | 24 | 41 | 3144                             | 2960 | 2737 | 4.0  | 39              | 36 | 34 | 46 | 4941                             | 4652 | 4301 | 3.2  | 61              | 57  | 53  | 55 |
| 2.0  | 1361                                   | 1282 | 1185 | 6.1  | 30              | 28 | 26 | 42 | 1906                             | 1794 | 1659 | 5.1  | 42              | 39 | 36 | 48 | 2995                             | 2820 | 2607 | 4.1  | 65              | 62  | 57  | 56 |
| 2.5  | 923                                    | 869  | 804  | 7.4  | 31              | 30 | 27 | 43 | 1293                             | 1217 | 1125 | 6.2  | 44              | 41 | 38 | 49 | 2031                             | 1912 | 1768 | 5.0  | 69              | 65  | 60  | 57 |
| 3.0  | 672                                    | 633  | 585  | 8.6  | 33              | 31 | 29 | 44 | 941                              | 886  | 819  | 7.3  | 46              | 44 | 40 | 50 | 1479                             | 1393 | 1288 | 5.8  | 73              | 68  | 63  | 58 |
| 3.5  | 514                                    | 484  | 448  | 9.9  | 34              | 32 | 30 | 44 | 720                              | 678  | 627  | 8.4  | 48              | 45 | 42 | 50 | 1131                             | 1065 | 985  | 6.7  | 76              | 71  | 66  | 58 |
| 4.0  | 408                                    | 384  | 355  | 11.1 | 36              | 33 | 31 | 45 | 571                              | 537  | 497  | 9.4  | 50              | 47 | 43 | 51 | 897                              | 844  | 781  | 7.5  | 78              | 74  | 68  | 59 |
| 4.5  | 332                                    | 313  | 289  | 12.3 | 37              | 35 | 32 | 46 | 465                              | 438  | 405  | 10.4 | 51              | 48 | 45 | 52 | 730                              | 688  | 636  | 8.3  | 81              | 76  | 70  | 60 |
| 5.0  | 276                                    | 260  | 241  | 13.5 | 38              | 35 | 33 | 46 | 387                              | 364  | 337  | 11.4 | 53              | 50 | 46 | 52 | 608                              | 573  | 529  | 9.1  | 83              | 78  | 72  | 60 |
| 5.5  | 234                                    | 220  | 204  | 14.7 | 39              | 36 | 34 | 47 | 328                              | 309  | 285  | 12.4 | 54              | 51 | 47 | 52 | 515                              | 485  | 449  | 9.9  | 85              | 80  | 74  | 61 |
| 6.0  | 201                                    | 189  | 175  | 15.8 | 40              | 37 | 34 | 47 | 282                              | 265  | 245  | 13.4 | 55              | 52 | 48 | 53 | 443                              | 417  | 386  | 10.7 | 87              | 82  | 76  | 61 |
| 6.5  | 175                                    | 165  | 152  | 16.9 | 40              | 38 | 35 | 47 | 245                              | 231  | 213  | 14.3 | 56              | 53 | 49 | 53 | 385                              | 363  | 335  | 11.4 | 89              | 84  | 77  | 61 |
| 7.0  | 154                                    | 145  | 134  | 18.1 | 41              | 39 | 36 | 48 | 215                              | 203  | 188  | 15.3 | 58              | 54 | 50 | 54 | 339                              | 319  | 295  | 12.2 | 90              | 85  | 79  | 62 |
| 7.5  | 137                                    | 129  | 119  | 19.2 | 42              | 39 | 36 | 48 | 191                              | 180  | 166  | 16.2 | 59              | 55 | 51 | 54 | 300                              | 283  | 261  | 12.9 | 92              | 87  | 80  | 62 |
| 8.0  | 122                                    | 115  | 106  | 20.3 | 43              | 40 | 37 | 48 | 171                              | 161  | 149  | 17.2 | 60              | 56 | 52 | 54 | 268                              | 253  | 234  | 13.7 | 94              | 88  | 82  | 62 |
| 8.5  | 110                                    | 103  | 96   | 21.4 | 43              | 41 | 38 | 49 | 154                              | 145  | 134  | 18.1 | 61              | 57 | 53 | 55 | 242                              | 227  | 210  | 14.4 | 95              | 90  | 83  | 63 |
| 9.0  | 99                                     | 94   | 87   | 22.5 | 44              | 41 | 38 | 49 | 139                              | 131  | 121  | 19.0 | 61              | 58 | 54 | 55 | 219                              | 206  | 190  | 15.2 | 97              | 91  | 84  | 63 |
| 9.5  | 90                                     | 85   | 79   | 23.6 | 45              | 42 | 39 | 49 | 127                              | 119  | 110  | 19.9 | 62              | 59 | 54 | 55 | 199                              | 187  | 173  | 15.9 | 98              | 92  | 85  | 63 |
| 10.0 | 83                                     | 78   | 72   | 24.7 | 45              | 42 | 39 | 49 | 116                              | 109  | 101  | 20.8 | 63              | 59 | 55 | 55 | 182                              | 171  | 158  | 16.6 | 99              | 93  | 86  | 63 |
| 11.0 | 70                                     | 66   | 61   | 26.8 | 46              | 44 | 40 | 50 | 98                               | 92   | 85   | 22.6 | 65              | 61 | 56 | 56 | 154                              | 145  | 134  | 18.1 | 102             | 96  | 89  | 64 |
| 12.0 | 60                                     | 57   | 52   | 28.9 | 47              | 45 | 41 | 50 | 84                               | 79   | 73   | 24.4 | 66              | 62 | 58 | 56 | 133                              | 125  | 115  | 19.5 | 104             | 98  | 91  | 64 |
| 13.0 | 52                                     | 49   | 46   | 31.0 | 48              | 45 | 42 | 50 | 73                               | 69   | 64   | 26.2 | 68              | 64 | 59 | 56 | 115                              | 109  | 100  | 20.9 | 106             | 100 | 93  | 65 |
| 14.0 | 46                                     | 43   | 40   | 33.0 | 49              | 46 | 43 | 51 | 65                               | 61   | 56   | 27.9 | 69              | 65 | 60 | 57 | 101                              | 95   | 88   | 22.3 | 108             | 102 | 94  | 65 |
| 15.0 | 41                                     | 38   | 36   | 35.1 | 50              | 47 | 44 | 51 | 57                               | 54   | 50   | 29.7 | 70              | 66 | 61 | 57 | 90                               | 85   | 78   | 23.7 | 110             | 104 | 96  | 65 |
| 16.0 | 37                                     | 34   | 32   | 37.1 | 51              | 48 | 44 | 51 | 51                               | 48   | 45   | 31.4 | 71              | 67 | 62 | 57 | 80                               | 76   | 70   | 25.0 | 112             | 106 | 98  | 66 |
| 17.0 | 33                                     | 31   | 29   | 39.1 | 52              | 49 | 45 | 52 | 46                               | 43   | 40   | 33.1 | 73              | 68 | 63 | 58 | 72                               | 68   | 63   | 26.4 | 114             | 107 | 99  | 66 |
| 18.0 | 30                                     | 28   | 26   | 41.1 | 53              | 50 | 46 | 52 | 42                               | 39   | 36   | 34.7 | 74              | 69 | 64 | 58 | 65                               | 62   | 57   | 27.7 | 116             | 109 | 101 | 66 |
| 19.0 | 27                                     | 26   | 24   | 43.1 | 53              | 50 | 46 | 52 | 38                               | 36   | 33   | 36.4 | 75              | 70 | 65 | 58 | 60                               | 56   | 52   | 29.1 | 117             | 110 | 102 | 66 |
| 20.0 | 25                                     | 23   | 22   | 45.1 | 54              | 51 | 47 | 52 | 35                               | 33   | 30   | 38.1 | 76              | 71 | 66 | 58 | 55                               | 51   | 47   | 30.4 | 119             | 112 | 104 | 67 |
| 22.0 | 21                                     | 20   | 18   | 49.0 | 55              | 52 | 48 | 53 | 29                               | 28   | 26   | 41.4 | 78              | 73 | 68 | 59 | 46                               | 43   | 40   | 33.0 | 122             | 115 | 106 | 67 |
| 24.0 | 18                                     | 17   | 16   | 52.8 | 57              | 53 | 49 | 53 | 25                               | 24   | 22   | 44.6 | 79              | 75 | 69 | 59 | 40                               | 37   | 35   | 35.6 | 125             | 117 | 109 | 67 |
| 26.0 | 16                                     | 15   | 14   | 56.6 | 58              | 54 | 50 | 54 | 22                               | 21   | 19   | 47.8 | 81              | 76 | 71 | 60 | 35                               | 33   | 30   | 38.2 | 127             | 120 | 111 | 68 |
| 28.0 | 14                                     | 13   | 12   | 60.4 | 59              | 56 | 51 | 54 | 19                               | 18   | 17   | 51.0 | 83              | 78 | 72 | 60 | 30                               | 29   | 26   | 40.7 | 130             | 122 | 113 | 68 |
| 30.0 | 12                                     | 12   | 11   | 64.1 | 60              | 57 | 52 | 54 | 17                               | 16   | 15   | 54.2 | 84              | 79 | 73 | 60 | 27                               | 25   | 23   | 43.2 | 132             | 124 | 115 | 69 |

**Table L6:** Lodgepole pine stocking levels for the ABGR/VASC plant association (B-O province) and the PICO(ABGR)/VASC/CARU plant community type.

| QMD  | Climate Resilience; SDI 93; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 130; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 204; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5083                                   | 4786 | 4425 | 3.1  | 28              | 26 | 24 | 41 | 7117                             | 6700 | 6196 | 2.7  | 39              | 37 | 34 | 47 | 11183                            | 10529 | 9736 | 2.1  | 61              | 57  | 53  | 55 |
| 1.5  | 2510                                   | 2364 | 2186 | 4.5  | 31              | 29 | 27 | 43 | 3515                             | 3309 | 3060 | 3.8  | 43              | 41 | 38 | 48 | 5523                             | 5200  | 4808 | 3.0  | 68              | 64  | 59  | 57 |
| 2.0  | 1522                                   | 1433 | 1325 | 5.7  | 33              | 31 | 29 | 44 | 2130                             | 2006 | 1855 | 4.9  | 46              | 44 | 40 | 50 | 3348                             | 3152  | 2915 | 3.9  | 73              | 69  | 64  | 58 |
| 2.5  | 1032                                   | 972  | 899  | 7.0  | 35              | 33 | 31 | 45 | 1445                             | 1360 | 1258 | 5.9  | 49              | 46 | 43 | 51 | 2271                             | 2138  | 1977 | 4.7  | 77              | 73  | 67  | 59 |
| 3.0  | 752                                    | 708  | 654  | 8.2  | 37              | 35 | 32 | 46 | 1052                             | 991  | 916  | 6.9  | 52              | 49 | 45 | 52 | 1653                             | 1557  | 1439 | 5.5  | 81              | 76  | 71  | 60 |
| 3.5  | 575                                    | 541  | 500  | 9.4  | 38              | 36 | 33 | 46 | 805                              | 758  | 701  | 7.9  | 54              | 51 | 47 | 52 | 1264                             | 1190  | 1101 | 6.3  | 84              | 80  | 74  | 60 |
| 4.0  | 456                                    | 429  | 397  | 10.5 | 40              | 37 | 35 | 47 | 638                              | 600  | 555  | 8.9  | 56              | 52 | 48 | 53 | 1002                             | 944   | 873  | 7.1  | 87              | 82  | 76  | 61 |
| 4.5  | 371                                    | 349  | 323  | 11.6 | 41              | 39 | 36 | 48 | 520                              | 489  | 452  | 9.8  | 57              | 54 | 50 | 54 | 817                              | 769   | 711  | 7.8  | 90              | 85  | 79  | 62 |
| 5.0  | 309                                    | 291  | 269  | 12.8 | 42              | 40 | 37 | 48 | 433                              | 407  | 377  | 10.8 | 59              | 56 | 51 | 54 | 680                              | 640   | 592  | 8.6  | 93              | 87  | 81  | 62 |
| 5.5  | 262                                    | 246  | 228  | 13.9 | 43              | 41 | 38 | 48 | 366                              | 345  | 319  | 11.7 | 60              | 57 | 53 | 54 | 576                              | 542   | 501  | 9.3  | 95              | 89  | 83  | 63 |
| 6.0  | 225                                    | 212  | 196  | 15.0 | 44              | 42 | 38 | 49 | 315                              | 297  | 274  | 12.6 | 62              | 58 | 54 | 55 | 495                              | 466   | 431  | 10.1 | 97              | 92  | 85  | 63 |
| 6.5  | 196                                    | 184  | 170  | 16.0 | 45              | 42 | 39 | 49 | 274                              | 258  | 239  | 13.5 | 63              | 59 | 55 | 55 | 431                              | 405   | 375  | 10.8 | 99              | 93  | 86  | 63 |
| 7.0  | 172                                    | 162  | 150  | 17.1 | 46              | 43 | 40 | 50 | 241                              | 227  | 210  | 14.5 | 64              | 61 | 56 | 56 | 379                              | 356   | 330  | 11.5 | 101             | 95  | 88  | 64 |
| 7.5  | 153                                    | 144  | 133  | 18.2 | 47              | 44 | 41 | 50 | 214                              | 201  | 186  | 15.3 | 66              | 62 | 57 | 56 | 336                              | 316   | 292  | 12.2 | 103             | 97  | 90  | 64 |
| 8.0  | 136                                    | 128  | 119  | 19.2 | 48              | 45 | 41 | 50 | 191                              | 180  | 166  | 16.2 | 67              | 63 | 58 | 56 | 300                              | 282   | 261  | 12.9 | 105             | 99  | 91  | 64 |
| 8.5  | 123                                    | 116  | 107  | 20.2 | 48              | 46 | 42 | 50 | 172                              | 162  | 150  | 17.1 | 68              | 64 | 59 | 56 | 270                              | 254   | 235  | 13.6 | 106             | 100 | 93  | 65 |
| 9.0  | 111                                    | 105  | 97   | 21.3 | 49              | 46 | 43 | 51 | 156                              | 146  | 135  | 18.0 | 69              | 65 | 60 | 57 | 244                              | 230   | 213  | 14.3 | 108             | 102 | 94  | 65 |
| 9.5  | 101                                    | 95   | 88   | 22.3 | 50              | 47 | 43 | 51 | 142                              | 133  | 123  | 18.8 | 70              | 66 | 61 | 57 | 222                              | 209   | 194  | 15.0 | 110             | 103 | 95  | 65 |
| 10.0 | 93                                     | 87   | 81   | 23.3 | 50              | 47 | 44 | 51 | 130                              | 122  | 113  | 19.7 | 71              | 66 | 61 | 57 | 204                              | 192   | 177  | 15.7 | 111             | 104 | 97  | 65 |
| 11.0 | 78                                     | 74   | 68   | 25.3 | 52              | 49 | 45 | 52 | 110                              | 103  | 96   | 21.4 | 72              | 68 | 63 | 58 | 172                              | 162   | 150  | 17.1 | 114             | 107 | 99  | 66 |
| 12.0 | 67                                     | 63   | 59   | 27.3 | 53              | 50 | 46 | 52 | 94                               | 89   | 82   | 23.1 | 74              | 70 | 64 | 58 | 148                              | 140   | 129  | 18.4 | 116             | 110 | 101 | 66 |
| 13.0 | 59                                     | 55   | 51   | 29.3 | 54              | 51 | 47 | 52 | 82                               | 77   | 71   | 24.8 | 76              | 71 | 66 | 58 | 129                              | 121   | 112  | 19.8 | 119             | 112 | 103 | 67 |
| 14.0 | 52                                     | 48   | 45   | 31.2 | 55              | 52 | 48 | 53 | 72                               | 68   | 63   | 26.4 | 77              | 73 | 67 | 59 | 113                              | 107   | 99   | 21.1 | 121             | 114 | 105 | 67 |
| 15.0 | 46                                     | 43   | 40   | 33.2 | 56              | 53 | 49 | 53 | 64                               | 60   | 56   | 28.0 | 78              | 74 | 68 | 59 | 100                              | 95    | 87   | 22.4 | 123             | 116 | 107 | 67 |
| 16.0 | 41                                     | 38   | 36   | 35.1 | 57              | 54 | 50 | 53 | 57                               | 54   | 50   | 29.7 | 80              | 75 | 69 | 59 | 90                               | 85    | 78   | 23.7 | 125             | 118 | 109 | 68 |
| 17.0 | 37                                     | 35   | 32   | 37.0 | 58              | 55 | 50 | 54 | 51                               | 48   | 45   | 31.3 | 81              | 76 | 71 | 60 | 81                               | 76    | 70   | 24.9 | 127             | 120 | 111 | 68 |
| 18.0 | 33                                     | 31   | 29   | 38.9 | 59              | 55 | 51 | 54 | 47                               | 44   | 41   | 32.9 | 82              | 77 | 72 | 60 | 73                               | 69    | 64   | 26.2 | 129             | 122 | 113 | 68 |
| 19.0 | 30                                     | 29   | 26   | 40.8 | 60              | 56 | 52 | 54 | 42                               | 40   | 37   | 34.4 | 83              | 79 | 73 | 60 | 67                               | 63    | 58   | 27.5 | 131             | 123 | 114 | 68 |
| 20.0 | 28                                     | 26   | 24   | 42.6 | 60              | 57 | 53 | 54 | 39                               | 37   | 34   | 36.0 | 85              | 80 | 74 | 60 | 61                               | 57    | 53   | 28.7 | 133             | 125 | 116 | 69 |
| 22.0 | 23                                     | 22   | 20   | 46.3 | 62              | 58 | 54 | 55 | 33                               | 31   | 29   | 39.1 | 87              | 82 | 75 | 61 | 52                               | 49    | 45   | 31.2 | 136             | 128 | 119 | 69 |
| 24.0 | 20                                     | 19   | 18   | 49.9 | 63              | 60 | 55 | 55 | 28                               | 27   | 25   | 42.2 | 89              | 83 | 77 | 61 | 44                               | 42    | 39   | 33.7 | 139             | 131 | 121 | 69 |
| 26.0 | 18                                     | 17   | 15   | 53.5 | 65              | 61 | 56 | 56 | 25                               | 23   | 21   | 45.3 | 91              | 85 | 79 | 62 | 39                               | 36    | 34   | 36.1 | 142             | 134 | 124 | 70 |
| 28.0 | 15                                     | 15   | 13   | 57.1 | 66              | 62 | 57 | 56 | 22                               | 20   | 19   | 48.3 | 92              | 87 | 80 | 62 | 34                               | 32    | 30   | 38.5 | 145             | 137 | 126 | 70 |
| 30.0 | 14                                     | 13   | 12   | 60.6 | 67              | 63 | 58 | 56 | 19                               | 18   | 17   | 51.3 | 94              | 88 | 82 | 62 | 30                               | 28    | 26   | 40.9 | 148             | 139 | 129 | 71 |

**Table L7:** Lodgepole pine stocking levels for the ABGR/VASC-LIBO2 plant association (B-O province).

| QMD  | Climate Resilience; SDI 103; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 144; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 227; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5674                                    | 5342 | 4940 | 3.0  | 31              | 29 | 27 | 43 | 7944                             | 7479 | 6916 | 2.5  | 43              | 41 | 38 | 49 | 12483                            | 11753 | 10868 | 2.0  | 68              | 64  | 59  | 57 |
| 1.5  | 2802                                    | 2638 | 2440 | 4.2  | 34              | 32 | 30 | 44 | 3923                             | 3694 | 3415 | 3.6  | 48              | 45 | 42 | 50 | 6165                             | 5804  | 5367  | 2.9  | 76              | 71  | 66  | 58 |
| 2.0  | 1699                                    | 1599 | 1479 | 5.4  | 37              | 35 | 32 | 46 | 2378                             | 2239 | 2070 | 4.6  | 52              | 49 | 45 | 52 | 3737                             | 3518  | 3253  | 3.7  | 82              | 77  | 71  | 60 |
| 2.5  | 1152                                    | 1085 | 1003 | 6.6  | 39              | 37 | 34 | 47 | 1613                             | 1519 | 1404 | 5.6  | 55              | 52 | 48 | 53 | 2535                             | 2386  | 2207  | 4.5  | 86              | 81  | 75  | 61 |
| 3.0  | 839                                     | 790  | 730  | 7.7  | 41              | 39 | 36 | 48 | 1174                             | 1106 | 1022 | 6.5  | 58              | 54 | 50 | 54 | 1846                             | 1738  | 1607  | 5.2  | 91              | 85  | 79  | 62 |
| 3.5  | 642                                     | 604  | 559  | 8.9  | 43              | 40 | 37 | 48 | 898                              | 846  | 782  | 7.5  | 60              | 56 | 52 | 54 | 1411                             | 1329  | 1229  | 6.0  | 94              | 89  | 82  | 62 |
| 4.0  | 509                                     | 479  | 443  | 9.9  | 44              | 42 | 39 | 49 | 712                              | 670  | 620  | 8.4  | 62              | 58 | 54 | 55 | 1119                             | 1053  | 974   | 6.7  | 98              | 92  | 85  | 63 |
| 4.5  | 414                                     | 390  | 361  | 11.0 | 46              | 43 | 40 | 50 | 580                              | 546  | 505  | 9.3  | 64              | 60 | 56 | 56 | 911                              | 858   | 793   | 7.4  | 101             | 95  | 88  | 64 |
| 5.0  | 345                                     | 325  | 300  | 12.1 | 47              | 44 | 41 | 50 | 483                              | 455  | 420  | 10.2 | 66              | 62 | 57 | 56 | 759                              | 714   | 661   | 8.1  | 103             | 97  | 90  | 64 |
| 5.5  | 292                                     | 275  | 254  | 13.1 | 48              | 45 | 42 | 50 | 409                              | 385  | 356  | 11.1 | 67              | 64 | 59 | 56 | 643                              | 605   | 560   | 8.8  | 106             | 100 | 92  | 65 |
| 6.0  | 251                                     | 236  | 219  | 14.2 | 49              | 46 | 43 | 51 | 352                              | 331  | 306  | 12.0 | 69              | 65 | 60 | 57 | 552                              | 520   | 481   | 9.5  | 108             | 102 | 94  | 65 |
| 6.5  | 218                                     | 206  | 190  | 15.2 | 50              | 47 | 44 | 51 | 306                              | 288  | 266  | 12.8 | 70              | 66 | 61 | 57 | 481                              | 453   | 418   | 10.2 | 111             | 104 | 96  | 65 |
| 7.0  | 192                                     | 181  | 167  | 16.2 | 51              | 48 | 45 | 52 | 269                              | 253  | 234  | 13.7 | 72              | 68 | 63 | 58 | 423                              | 398   | 368   | 10.9 | 113             | 106 | 98  | 66 |
| 7.5  | 170                                     | 160  | 148  | 17.2 | 52              | 49 | 45 | 52 | 238                              | 225  | 208  | 14.5 | 73              | 69 | 64 | 58 | 375                              | 353   | 326   | 11.6 | 115             | 108 | 100 | 66 |
| 8.0  | 152                                     | 143  | 133  | 18.2 | 53              | 50 | 46 | 52 | 213                              | 201  | 186  | 15.4 | 74              | 70 | 65 | 58 | 335                              | 315   | 292   | 12.3 | 117             | 110 | 102 | 66 |
| 8.5  | 137                                     | 129  | 119  | 19.2 | 54              | 51 | 47 | 52 | 192                              | 181  | 167  | 16.2 | 76              | 71 | 66 | 58 | 301                              | 284   | 262   | 12.9 | 119             | 112 | 103 | 67 |
| 9.0  | 124                                     | 117  | 108  | 20.1 | 55              | 52 | 48 | 53 | 174                              | 163  | 151  | 17.0 | 77              | 72 | 67 | 59 | 273                              | 257   | 238   | 13.6 | 121             | 113 | 105 | 67 |
| 9.5  | 113                                     | 106  | 98   | 21.1 | 56              | 52 | 48 | 53 | 158                              | 149  | 138  | 17.8 | 78              | 73 | 68 | 59 | 248                              | 234   | 216   | 14.2 | 122             | 115 | 106 | 67 |
| 10.0 | 103                                     | 97   | 90   | 22.1 | 56              | 53 | 49 | 53 | 145                              | 136  | 126  | 18.7 | 79              | 74 | 69 | 59 | 227                              | 214   | 198   | 14.9 | 124             | 117 | 108 | 67 |
| 11.0 | 87                                      | 82   | 76   | 24.0 | 58              | 54 | 50 | 54 | 122                              | 115  | 107  | 20.3 | 81              | 76 | 70 | 60 | 192                              | 181   | 168   | 16.2 | 127             | 120 | 111 | 68 |
| 12.0 | 75                                      | 71   | 65   | 25.9 | 59              | 56 | 51 | 54 | 105                              | 99   | 92   | 21.9 | 83              | 78 | 72 | 60 | 165                              | 156   | 144   | 17.4 | 130             | 122 | 113 | 68 |
| 13.0 | 65                                      | 62   | 57   | 27.7 | 60              | 57 | 52 | 54 | 92                               | 86   | 80   | 23.4 | 84              | 79 | 73 | 60 | 144                              | 135   | 125   | 18.7 | 133             | 125 | 115 | 69 |
| 14.0 | 57                                      | 54   | 50   | 29.6 | 61              | 58 | 54 | 55 | 80                               | 76   | 70   | 25.0 | 86              | 81 | 75 | 61 | 126                              | 119   | 110   | 19.9 | 135             | 127 | 118 | 69 |
| 15.0 | 51                                      | 48   | 44   | 31.4 | 63              | 59 | 54 | 55 | 71                               | 67   | 62   | 26.5 | 88              | 82 | 76 | 61 | 112                              | 106   | 98    | 21.2 | 138             | 130 | 120 | 69 |
| 16.0 | 46                                      | 43   | 40   | 33.2 | 64              | 60 | 55 | 55 | 64                               | 60   | 56   | 28.1 | 89              | 84 | 78 | 61 | 100                              | 94    | 87    | 22.4 | 140             | 132 | 122 | 70 |
| 17.0 | 41                                      | 39   | 36   | 35.0 | 65              | 61 | 56 | 56 | 57                               | 54   | 50   | 29.6 | 91              | 85 | 79 | 62 | 90                               | 85    | 79    | 23.6 | 142             | 134 | 124 | 70 |
| 18.0 | 37                                      | 35   | 32   | 36.8 | 66              | 62 | 57 | 56 | 52                               | 49   | 45   | 31.1 | 92              | 86 | 80 | 62 | 82                               | 77    | 71    | 24.8 | 144             | 136 | 126 | 70 |
| 19.0 | 34                                      | 32   | 29   | 38.6 | 67              | 63 | 58 | 56 | 47                               | 45   | 41   | 32.6 | 93              | 88 | 81 | 62 | 74                               | 70    | 65    | 26.0 | 146             | 138 | 127 | 70 |
| 20.0 | 31                                      | 29   | 27   | 40.3 | 67              | 63 | 59 | 56 | 43                               | 41   | 38   | 34.1 | 94              | 89 | 82 | 62 | 68                               | 64    | 59    | 27.2 | 148             | 140 | 129 | 71 |
| 22.0 | 26                                      | 25   | 23   | 43.8 | 69              | 65 | 60 | 57 | 37                               | 35   | 32   | 37.0 | 97              | 91 | 84 | 63 | 58                               | 54    | 50    | 29.5 | 152             | 143 | 132 | 71 |
| 24.0 | 23                                      | 21   | 20   | 47.3 | 71              | 67 | 62 | 57 | 32                               | 30   | 27   | 40.0 | 99              | 93 | 86 | 63 | 50                               | 47    | 43    | 31.9 | 156             | 146 | 135 | 71 |
| 26.0 | 20                                      | 18   | 17   | 50.7 | 72              | 68 | 63 | 58 | 27                               | 26   | 24   | 42.8 | 101             | 95 | 88 | 64 | 43                               | 41    | 38    | 34.2 | 159             | 150 | 138 | 72 |
| 28.0 | 17                                      | 16   | 15   | 54.1 | 74              | 69 | 64 | 58 | 24                               | 23   | 21   | 45.7 | 103             | 97 | 90 | 64 | 38                               | 36    | 33    | 36.4 | 162             | 152 | 141 | 72 |
| 30.0 | 15                                      | 14   | 13   | 57.4 | 75              | 71 | 65 | 58 | 21                               | 20   | 19   | 48.5 | 105             | 99 | 91 | 64 | 34                               | 32    | 29    | 38.7 | 165             | 155 | 144 | 72 |



**Table L8:** Lodgepole pine stocking levels for the ABLA2/TRCA3 plant association (B-O province) and the ABLA2/ARCO plant community type.

| QMD  | Climate Resilience; SDI 139; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 195; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 306; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7639                                    | 7192 | 6650 | 2.6  | 42              | 39 | 36 | 48 | 10694                            | 10068 | 9310 | 2.2  | 58              | 55  | 51  | 54 | 16805                            | 15822 | 14630 | 1.7  | 92              | 86  | 80  | 62 |
| 1.5  | 3772                                    | 3552 | 3284 | 3.7  | 46              | 44 | 40 | 50 | 5281                             | 4972  | 4598 | 3.1  | 65              | 61  | 56  | 56 | 8299                             | 7814  | 7225  | 2.5  | 102             | 96  | 89  | 64 |
| 2.0  | 2287                                    | 2153 | 1991 | 4.7  | 50              | 47 | 43 | 51 | 3201                             | 3014  | 2787 | 4.0  | 70              | 66  | 61  | 57 | 5031                             | 4737  | 4380  | 3.2  | 110             | 103 | 96  | 65 |
| 2.5  | 1551                                    | 1460 | 1350 | 5.7  | 53              | 50 | 46 | 52 | 2171                             | 2044  | 1890 | 4.8  | 74              | 70  | 64  | 58 | 3412                             | 3212  | 2971  | 3.8  | 116             | 110 | 101 | 66 |
| 3.0  | 1129                                    | 1063 | 983  | 6.7  | 55              | 52 | 48 | 53 | 1581                             | 1489  | 1376 | 5.6  | 78              | 73  | 68  | 59 | 2485                             | 2339  | 2163  | 4.5  | 122             | 115 | 106 | 67 |
| 3.5  | 864                                     | 813  | 752  | 7.6  | 58              | 54 | 50 | 54 | 1209                             | 1138  | 1053 | 6.4  | 81              | 76  | 70  | 60 | 1900                             | 1789  | 1654  | 5.1  | 127             | 120 | 111 | 68 |
| 4.0  | 685                                     | 645  | 596  | 8.6  | 60              | 56 | 52 | 54 | 958                              | 902   | 834  | 7.2  | 84              | 79  | 73  | 60 | 1506                             | 1418  | 1311  | 5.8  | 131             | 124 | 114 | 68 |
| 4.5  | 558                                     | 525  | 486  | 9.5  | 62              | 58 | 54 | 55 | 781                              | 735   | 680  | 8.0  | 86              | 81  | 75  | 61 | 1227                             | 1155  | 1068  | 6.4  | 136             | 128 | 118 | 69 |
| 5.0  | 464                                     | 437  | 404  | 10.4 | 63              | 60 | 55 | 55 | 650                              | 612   | 566  | 8.8  | 89              | 83  | 77  | 61 | 1021                             | 962   | 889   | 7.0  | 139             | 131 | 121 | 69 |
| 5.5  | 393                                     | 370  | 342  | 11.3 | 65              | 61 | 57 | 56 | 551                              | 518   | 479  | 9.6  | 91              | 86  | 79  | 62 | 865                              | 815   | 753   | 7.6  | 143             | 134 | 124 | 70 |
| 6.0  | 338                                     | 318  | 294  | 12.2 | 66              | 63 | 58 | 56 | 473                              | 446   | 412  | 10.3 | 93              | 88  | 81  | 62 | 744                              | 700   | 648   | 8.2  | 146             | 138 | 127 | 70 |
| 6.5  | 294                                     | 277  | 256  | 13.1 | 68              | 64 | 59 | 57 | 412                              | 388   | 359  | 11.1 | 95              | 89  | 83  | 63 | 647                              | 609   | 563   | 8.8  | 149             | 140 | 130 | 71 |
| 7.0  | 259                                     | 243  | 225  | 13.9 | 69              | 65 | 60 | 57 | 362                              | 341   | 315  | 11.8 | 97              | 91  | 84  | 63 | 569                              | 536   | 495   | 9.4  | 152             | 143 | 132 | 71 |
| 7.5  | 229                                     | 216  | 200  | 14.8 | 70              | 66 | 61 | 57 | 321                              | 302   | 279  | 12.5 | 98              | 93  | 86  | 63 | 504                              | 475   | 439   | 10.0 | 155             | 146 | 135 | 71 |
| 8.0  | 205                                     | 193  | 178  | 15.7 | 72              | 67 | 62 | 57 | 287                              | 270   | 250  | 13.2 | 100             | 94  | 87  | 64 | 451                              | 425   | 393   | 10.6 | 157             | 148 | 137 | 72 |
| 8.5  | 184                                     | 174  | 161  | 16.5 | 73              | 68 | 63 | 58 | 258                              | 243   | 225  | 14.0 | 102             | 96  | 89  | 64 | 406                              | 382   | 353   | 11.1 | 160             | 151 | 139 | 72 |
| 9.0  | 167                                     | 157  | 145  | 17.4 | 74              | 69 | 64 | 58 | 234                              | 220   | 204  | 14.7 | 103             | 97  | 90  | 64 | 367                              | 346   | 320   | 11.7 | 162             | 153 | 141 | 72 |
| 9.5  | 152                                     | 143  | 132  | 18.2 | 75              | 70 | 65 | 58 | 213                              | 200   | 185  | 15.4 | 105             | 99  | 91  | 64 | 334                              | 315   | 291   | 12.3 | 165             | 155 | 143 | 72 |
| 10.0 | 139                                     | 131  | 121  | 19.0 | 76              | 71 | 66 | 59 | 195                              | 183   | 169  | 16.1 | 106             | 100 | 92  | 65 | 306                              | 288   | 266   | 12.8 | 167             | 157 | 145 | 73 |
| 11.0 | 118                                     | 111  | 103  | 20.7 | 78              | 73 | 68 | 59 | 165                              | 155   | 144  | 17.5 | 109             | 102 | 95  | 65 | 259                              | 244   | 226   | 13.9 | 171             | 161 | 149 | 73 |
| 12.0 | 101                                     | 95   | 88   | 22.3 | 79              | 75 | 69 | 59 | 142                              | 133   | 123  | 18.8 | 111             | 105 | 97  | 65 | 223                              | 210   | 194   | 15.0 | 175             | 165 | 152 | 74 |
| 13.0 | 88                                      | 83   | 77   | 23.9 | 81              | 76 | 71 | 60 | 123                              | 116   | 107  | 20.2 | 114             | 107 | 99  | 66 | 194                              | 182   | 169   | 16.1 | 179             | 168 | 155 | 74 |
| 14.0 | 77                                      | 73   | 67   | 25.5 | 83              | 78 | 72 | 60 | 108                              | 102   | 94   | 21.5 | 116             | 109 | 101 | 66 | 170                              | 160   | 148   | 17.2 | 182             | 171 | 158 | 74 |
| 15.0 | 69                                      | 65   | 60   | 27.1 | 84              | 79 | 73 | 60 | 96                               | 90    | 84   | 22.9 | 118             | 111 | 103 | 66 | 151                              | 142   | 131   | 18.3 | 185             | 174 | 161 | 75 |
| 16.0 | 61                                      | 58   | 53   | 28.6 | 86              | 81 | 75 | 61 | 86                               | 81    | 75   | 24.2 | 120             | 113 | 104 | 67 | 135                              | 127   | 118   | 19.3 | 188             | 177 | 164 | 75 |
| 17.0 | 55                                      | 52   | 48   | 30.2 | 87              | 82 | 76 | 61 | 77                               | 73    | 67   | 25.5 | 122             | 115 | 106 | 67 | 121                              | 114   | 106   | 20.3 | 191             | 180 | 167 | 75 |
| 18.0 | 50                                      | 47   | 44   | 31.7 | 88              | 83 | 77 | 61 | 70                               | 66    | 61   | 26.8 | 124             | 116 | 108 | 67 | 110                              | 104   | 96    | 21.4 | 194             | 183 | 169 | 75 |
| 19.0 | 45                                      | 43   | 40   | 33.3 | 90              | 84 | 78 | 62 | 64                               | 60    | 55   | 28.1 | 125             | 118 | 109 | 68 | 100                              | 94    | 87    | 22.4 | 197             | 186 | 172 | 76 |
| 20.0 | 42                                      | 39   | 36   | 34.8 | 91              | 85 | 79 | 62 | 58                               | 55    | 51   | 29.4 | 127             | 120 | 111 | 68 | 92                               | 86    | 80    | 23.4 | 200             | 188 | 174 | 76 |
| 22.0 | 35                                      | 33   | 31   | 37.8 | 93              | 88 | 81 | 62 | 49                               | 46    | 43   | 31.9 | 130             | 123 | 113 | 68 | 78                               | 73    | 68    | 25.5 | 205             | 193 | 178 | 76 |
| 24.0 | 30                                      | 29   | 26   | 40.7 | 95              | 90 | 83 | 63 | 42                               | 40    | 37   | 34.4 | 133             | 125 | 116 | 69 | 67                               | 63    | 58    | 27.5 | 209             | 197 | 182 | 77 |
| 26.0 | 26                                      | 25   | 23   | 43.7 | 97              | 92 | 85 | 63 | 37                               | 35    | 32   | 36.9 | 136             | 128 | 118 | 69 | 58                               | 55    | 50    | 29.5 | 214             | 201 | 186 | 77 |
| 28.0 | 23                                      | 22   | 20   | 46.6 | 99              | 93 | 86 | 63 | 32                               | 31    | 28   | 39.4 | 139             | 131 | 121 | 69 | 51                               | 48    | 44    | 31.4 | 218             | 205 | 190 | 78 |
| 30.0 | 21                                      | 19   | 18   | 49.5 | 101             | 95 | 88 | 64 | 29                               | 27    | 25   | 41.8 | 141             | 133 | 123 | 70 | 45                               | 43    | 39    | 33.4 | 222             | 209 | 193 | 78 |



**Table L9:** Lodgepole pine stocking levels for the ABLA2/CAGE plant association (B-O province), and the ABLA2/STOC and PICO(ABLA2)/STOC plant community types.

| QMD  | Climate Resilience; SDI 123; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 172; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 270; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6732                                    | 6338 | 5861 | 2.7  | 37              | 35 | 32 | 46 | 9425                             | 8873 | 8205 | 2.3  | 51              | 48  | 45  | 52 | 14810                            | 13944 | 12894 | 1.8  | 81              | 76  | 70  | 60 |
| 1.5  | 3325                                    | 3130 | 2894 | 3.9  | 41              | 38 | 36 | 47 | 4654                             | 4382 | 4052 | 3.3  | 57              | 54  | 50  | 53 | 7314                             | 6886  | 6368  | 2.6  | 90              | 85  | 78  | 62 |
| 2.0  | 2015                                    | 1897 | 1755 | 5.0  | 44              | 41 | 38 | 49 | 2821                             | 2656 | 2456 | 4.2  | 62              | 58  | 54  | 55 | 4434                             | 4174  | 3860  | 3.4  | 97              | 91  | 84  | 63 |
| 2.5  | 1367                                    | 1287 | 1190 | 6.1  | 47              | 44 | 41 | 50 | 1914                             | 1802 | 1666 | 5.1  | 65              | 61  | 57  | 56 | 3007                             | 2831  | 2618  | 4.1  | 103             | 97  | 89  | 64 |
| 3.0  | 995                                     | 937  | 866  | 7.1  | 49              | 46 | 43 | 51 | 1393                             | 1312 | 1213 | 6.0  | 68              | 64  | 60  | 57 | 2190                             | 2062  | 1906  | 4.8  | 107             | 101 | 94  | 65 |
| 3.5  | 761                                     | 717  | 663  | 8.1  | 51              | 48 | 44 | 51 | 1066                             | 1003 | 928  | 6.9  | 71              | 67  | 62  | 57 | 1674                             | 1577  | 1458  | 5.5  | 112             | 105 | 97  | 66 |
| 4.0  | 603                                     | 568  | 525  | 9.1  | 53              | 50 | 46 | 52 | 845                              | 795  | 735  | 7.7  | 74              | 69  | 64  | 58 | 1327                             | 1250  | 1156  | 6.2  | 116             | 109 | 101 | 66 |
| 4.5  | 492                                     | 463  | 428  | 10.1 | 54              | 51 | 47 | 53 | 688                              | 648  | 599  | 8.5  | 76              | 72  | 66  | 59 | 1081                             | 1018  | 941   | 6.8  | 119             | 112 | 104 | 67 |
| 5.0  | 409                                     | 385  | 356  | 11.1 | 56              | 53 | 49 | 53 | 573                              | 539  | 499  | 9.4  | 78              | 74  | 68  | 59 | 900                              | 848   | 784   | 7.5  | 123             | 116 | 107 | 67 |
| 5.5  | 347                                     | 326  | 302  | 12.0 | 57              | 54 | 50 | 53 | 485                              | 457  | 423  | 10.2 | 80              | 75  | 70  | 60 | 763                              | 718   | 664   | 8.1  | 126             | 118 | 110 | 68 |
| 6.0  | 298                                     | 281  | 259  | 13.0 | 59              | 55 | 51 | 54 | 417                              | 393  | 363  | 11.0 | 82              | 77  | 71  | 60 | 656                              | 617   | 571   | 8.8  | 129             | 121 | 112 | 68 |
| 6.5  | 259                                     | 244  | 226  | 13.9 | 60              | 56 | 52 | 54 | 363                              | 342  | 316  | 11.8 | 84              | 79  | 73  | 60 | 570                              | 537   | 496   | 9.4  | 131             | 124 | 114 | 68 |
| 7.0  | 228                                     | 215  | 198  | 14.9 | 61              | 57 | 53 | 55 | 319                              | 300  | 278  | 12.6 | 85              | 80  | 74  | 61 | 501                              | 472   | 436   | 10.0 | 134             | 126 | 117 | 69 |
| 7.5  | 202                                     | 190  | 176  | 15.8 | 62              | 58 | 54 | 55 | 283                              | 266  | 246  | 13.3 | 87              | 82  | 76  | 61 | 445                              | 419   | 387   | 10.6 | 136             | 128 | 119 | 69 |
| 8.0  | 181                                     | 170  | 157  | 16.7 | 63              | 59 | 55 | 55 | 253                              | 238  | 220  | 14.1 | 88              | 83  | 77  | 61 | 397                              | 374   | 346   | 11.3 | 139             | 131 | 121 | 69 |
| 8.5  | 163                                     | 153  | 142  | 17.6 | 64              | 60 | 56 | 56 | 228                              | 214  | 198  | 14.9 | 90              | 84  | 78  | 62 | 358                              | 337   | 311   | 11.9 | 141             | 133 | 123 | 70 |
| 9.0  | 147                                     | 139  | 128  | 18.5 | 65              | 61 | 57 | 56 | 206                              | 194  | 179  | 15.6 | 91              | 86  | 79  | 62 | 324                              | 305   | 282   | 12.5 | 143             | 135 | 125 | 70 |
| 9.5  | 134                                     | 126  | 117  | 19.4 | 66              | 62 | 57 | 56 | 188                              | 177  | 163  | 16.4 | 92              | 87  | 80  | 62 | 295                              | 277   | 257   | 13.1 | 145             | 137 | 126 | 70 |
| 10.0 | 123                                     | 115  | 107  | 20.3 | 67              | 63 | 58 | 56 | 172                              | 161  | 149  | 17.1 | 94              | 88  | 81  | 62 | 270                              | 254   | 235   | 13.7 | 147             | 138 | 128 | 70 |
| 11.0 | 104                                     | 98   | 90   | 22.0 | 68              | 64 | 60 | 57 | 145                              | 137  | 126  | 18.6 | 96              | 90  | 83  | 63 | 228                              | 215   | 199   | 14.8 | 151             | 142 | 131 | 71 |
| 12.0 | 89                                      | 84   | 78   | 23.7 | 70              | 66 | 61 | 57 | 125                              | 118  | 109  | 20.1 | 98              | 92  | 85  | 63 | 196                              | 185   | 171   | 16.0 | 154             | 145 | 134 | 71 |
| 13.0 | 78                                      | 73   | 68   | 25.5 | 72              | 67 | 62 | 57 | 109                              | 102  | 95   | 21.5 | 100             | 94  | 87  | 64 | 171                              | 161   | 149   | 17.2 | 157             | 148 | 137 | 72 |
| 14.0 | 68                                      | 64   | 59   | 27.2 | 73              | 69 | 63 | 58 | 95                               | 90   | 83   | 23.0 | 102             | 96  | 89  | 64 | 150                              | 141   | 131   | 18.3 | 160             | 151 | 140 | 72 |
| 15.0 | 60                                      | 57   | 53   | 28.8 | 74              | 70 | 65 | 58 | 85                               | 80   | 74   | 24.4 | 104             | 98  | 90  | 64 | 133                              | 125   | 116   | 19.4 | 163             | 154 | 142 | 72 |
| 16.0 | 54                                      | 51   | 47   | 30.5 | 75              | 71 | 66 | 58 | 76                               | 71   | 66   | 25.8 | 106             | 100 | 92  | 64 | 119                              | 112   | 104   | 20.6 | 166             | 156 | 145 | 73 |
| 17.0 | 49                                      | 46   | 42   | 32.2 | 77              | 72 | 67 | 59 | 68                               | 64   | 59   | 27.2 | 107             | 101 | 93  | 65 | 107                              | 101   | 93    | 21.7 | 169             | 159 | 147 | 73 |
| 18.0 | 44                                      | 41   | 38   | 33.8 | 78              | 73 | 68 | 59 | 62                               | 58   | 54   | 28.6 | 109             | 103 | 95  | 65 | 97                               | 91    | 84    | 22.8 | 171             | 161 | 149 | 73 |
| 19.0 | 40                                      | 38   | 35   | 35.4 | 79              | 74 | 69 | 59 | 56                               | 53   | 49   | 29.9 | 111             | 104 | 96  | 65 | 88                               | 83    | 77    | 23.9 | 174             | 164 | 151 | 73 |
| 20.0 | 37                                      | 35   | 32   | 37.0 | 80              | 75 | 70 | 59 | 51                               | 48   | 45   | 31.3 | 112             | 105 | 98  | 66 | 81                               | 76    | 70    | 25.0 | 176             | 166 | 153 | 74 |
| 22.0 | 31                                      | 29   | 27   | 40.2 | 82              | 77 | 71 | 60 | 43                               | 41   | 38   | 34.0 | 115             | 108 | 100 | 66 | 68                               | 64    | 60    | 27.1 | 180             | 170 | 157 | 74 |
| 24.0 | 27                                      | 25   | 23   | 43.4 | 84              | 79 | 73 | 60 | 37                               | 35   | 33   | 36.7 | 117             | 111 | 102 | 66 | 59                               | 55    | 51    | 29.3 | 185             | 174 | 161 | 75 |
| 26.0 | 23                                      | 22   | 20   | 46.5 | 86              | 81 | 75 | 61 | 33                               | 31   | 28   | 39.3 | 120             | 113 | 104 | 67 | 51                               | 48    | 44    | 31.4 | 188             | 177 | 164 | 75 |
| 28.0 | 20                                      | 19   | 18   | 49.6 | 87              | 82 | 76 | 61 | 29                               | 27   | 25   | 41.9 | 122             | 115 | 106 | 67 | 45                               | 42    | 39    | 33.5 | 192             | 181 | 167 | 75 |
| 30.0 | 18                                      | 17   | 16   | 52.7 | 89              | 84 | 77 | 61 | 25                               | 24   | 22   | 44.5 | 124             | 117 | 108 | 67 | 40                               | 38    | 35    | 35.5 | 196             | 184 | 170 | 76 |

**Table L10:** Lodgepole pine stocking levels for the ABLA2/MEFE and ABLA2/STAM plant associations (W-S province).

| QMD  | Climate Resilience; SDI 90; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 126; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 198; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4946                                   | 4657 | 4306 | 3.2  | 27              | 25 | 23 | 40 | 6924                             | 6519 | 6028 | 2.7  | 38              | 36 | 33 | 46 | 10881                            | 10244 | 9473 | 2.2  | 59              | 56  | 52  | 54 |
| 1.5  | 2443                                   | 2300 | 2126 | 4.5  | 30              | 28 | 26 | 42 | 3420                             | 3220 | 2977 | 3.8  | 42              | 40 | 37 | 48 | 5374                             | 5059  | 4678 | 3.1  | 66              | 62  | 57  | 56 |
| 2.0  | 1481                                   | 1394 | 1289 | 5.8  | 32              | 30 | 28 | 43 | 2073                             | 1952 | 1805 | 4.9  | 45              | 43 | 39 | 49 | 3257                             | 3067  | 2836 | 3.9  | 71              | 67  | 62  | 57 |
| 2.5  | 1004                                   | 945  | 874  | 7.1  | 34              | 32 | 30 | 44 | 1406                             | 1324 | 1224 | 6.0  | 48              | 45 | 42 | 50 | 2209                             | 2080  | 1923 | 4.8  | 75              | 71  | 66  | 58 |
| 3.0  | 731                                    | 688  | 637  | 8.3  | 36              | 34 | 31 | 45 | 1024                             | 964  | 891  | 7.0  | 50              | 47 | 44 | 51 | 1609                             | 1515  | 1401 | 5.6  | 79              | 74  | 69  | 59 |
| 3.5  | 559                                    | 526  | 487  | 9.5  | 37              | 35 | 33 | 46 | 783                              | 737  | 682  | 8.0  | 52              | 49 | 46 | 52 | 1230                             | 1158  | 1071 | 6.4  | 82              | 77  | 72  | 60 |
| 4.0  | 443                                    | 417  | 386  | 10.7 | 39              | 36 | 34 | 47 | 621                              | 584  | 540  | 9.0  | 54              | 51 | 47 | 53 | 975                              | 918   | 849  | 7.2  | 85              | 80  | 74  | 61 |
| 4.5  | 361                                    | 340  | 314  | 11.8 | 40              | 38 | 35 | 47 | 506                              | 476  | 440  | 10.0 | 56              | 53 | 49 | 53 | 794                              | 748   | 692  | 8.0  | 88              | 83  | 76  | 61 |
| 5.0  | 301                                    | 283  | 262  | 12.9 | 41              | 39 | 36 | 48 | 421                              | 396  | 366  | 10.9 | 57              | 54 | 50 | 54 | 661                              | 623   | 576  | 8.7  | 90              | 85  | 79  | 62 |
| 5.5  | 255                                    | 240  | 222  | 14.1 | 42              | 40 | 37 | 48 | 357                              | 336  | 310  | 11.9 | 59              | 55 | 51 | 54 | 560                              | 528   | 488  | 9.5  | 92              | 87  | 80  | 62 |
| 6.0  | 219                                    | 206  | 191  | 15.2 | 43              | 40 | 37 | 48 | 306                              | 289  | 267  | 12.8 | 60              | 57 | 52 | 54 | 482                              | 453   | 419  | 10.2 | 95              | 89  | 82  | 62 |
| 6.5  | 190                                    | 179  | 166  | 16.3 | 44              | 41 | 38 | 49 | 267                              | 251  | 232  | 13.7 | 61              | 58 | 53 | 55 | 419                              | 394   | 365  | 11.0 | 97              | 91  | 84  | 63 |
| 7.0  | 167                                    | 158  | 146  | 17.3 | 45              | 42 | 39 | 49 | 234                              | 221  | 204  | 14.6 | 63              | 59 | 55 | 55 | 368                              | 347   | 321  | 11.7 | 98              | 93  | 86  | 63 |
| 7.5  | 148                                    | 140  | 129  | 18.4 | 46              | 43 | 40 | 49 | 208                              | 196  | 181  | 15.6 | 64              | 60 | 56 | 55 | 327                              | 308   | 284  | 12.4 | 100             | 94  | 87  | 64 |
| 8.0  | 133                                    | 125  | 116  | 19.5 | 46              | 44 | 40 | 50 | 186                              | 175  | 162  | 16.5 | 65              | 61 | 56 | 56 | 292                              | 275   | 254  | 13.1 | 102             | 96  | 89  | 64 |
| 8.5  | 119                                    | 112  | 104  | 20.5 | 47              | 44 | 41 | 50 | 167                              | 157  | 146  | 17.3 | 66              | 62 | 57 | 56 | 263                              | 247   | 229  | 13.8 | 104             | 97  | 90  | 64 |
| 9.0  | 108                                    | 102  | 94   | 21.6 | 48              | 45 | 42 | 50 | 151                              | 142  | 132  | 18.2 | 67              | 63 | 58 | 56 | 238                              | 224   | 207  | 14.5 | 105             | 99  | 91  | 64 |
| 9.5  | 98                                     | 93   | 86   | 22.6 | 48              | 46 | 42 | 51 | 138                              | 130  | 120  | 19.1 | 68              | 64 | 59 | 57 | 216                              | 204   | 188  | 15.2 | 107             | 100 | 93  | 65 |
| 10.0 | 90                                     | 85   | 78   | 23.6 | 49              | 46 | 43 | 51 | 126                              | 119  | 110  | 20.0 | 69              | 65 | 60 | 57 | 198                              | 186   | 172  | 15.9 | 108             | 102 | 94  | 65 |
| 11.0 | 76                                     | 72   | 66   | 25.7 | 50              | 47 | 44 | 51 | 107                              | 101  | 93   | 21.7 | 70              | 66 | 61 | 57 | 168                              | 158   | 146  | 17.3 | 111             | 104 | 96  | 65 |
| 12.0 | 66                                     | 62   | 57   | 27.7 | 51              | 48 | 45 | 52 | 92                               | 86   | 80   | 23.4 | 72              | 68 | 63 | 58 | 144                              | 136   | 126  | 18.7 | 113             | 107 | 99  | 66 |
| 13.0 | 57                                     | 54   | 50   | 29.7 | 53              | 49 | 46 | 52 | 80                               | 75   | 69   | 25.1 | 74              | 69 | 64 | 58 | 125                              | 118   | 109  | 20.0 | 116             | 109 | 101 | 66 |
| 14.0 | 50                                     | 47   | 44   | 31.7 | 54              | 50 | 47 | 52 | 70                               | 66   | 61   | 26.8 | 75              | 71 | 65 | 58 | 110                              | 104   | 96   | 21.4 | 118             | 111 | 103 | 66 |
| 15.0 | 44                                     | 42   | 39   | 33.6 | 55              | 51 | 47 | 53 | 62                               | 59   | 54   | 28.4 | 76              | 72 | 66 | 59 | 98                               | 92    | 85   | 22.7 | 120             | 113 | 104 | 67 |
| 16.0 | 40                                     | 37   | 35   | 35.6 | 55              | 52 | 48 | 53 | 56                               | 52   | 48   | 30.1 | 78              | 73 | 68 | 59 | 87                               | 82    | 76   | 24.0 | 122             | 115 | 106 | 67 |
| 17.0 | 36                                     | 34   | 31   | 37.5 | 56              | 53 | 49 | 53 | 50                               | 47   | 44   | 31.7 | 79              | 74 | 69 | 59 | 79                               | 74    | 68   | 25.3 | 124             | 117 | 108 | 67 |
| 18.0 | 32                                     | 30   | 28   | 39.4 | 57              | 54 | 50 | 53 | 45                               | 43   | 39   | 33.3 | 80              | 75 | 70 | 60 | 71                               | 67    | 62   | 26.6 | 126             | 118 | 110 | 68 |
| 19.0 | 29                                     | 28   | 26   | 41.3 | 58              | 55 | 50 | 54 | 41                               | 39   | 36   | 34.9 | 81              | 76 | 71 | 60 | 65                               | 61    | 56   | 27.9 | 128             | 120 | 111 | 68 |
| 20.0 | 27                                     | 25   | 23   | 43.2 | 59              | 55 | 51 | 54 | 38                               | 36   | 33   | 36.5 | 82              | 77 | 72 | 60 | 59                               | 56    | 52   | 29.1 | 129             | 122 | 113 | 68 |
| 22.0 | 23                                     | 21   | 20   | 46.9 | 60              | 57 | 52 | 54 | 32                               | 30   | 28   | 39.7 | 84              | 79 | 73 | 60 | 50                               | 47    | 44   | 31.6 | 133             | 125 | 115 | 69 |
| 24.0 | 20                                     | 18   | 17   | 50.6 | 62              | 58 | 54 | 55 | 27                               | 26   | 24   | 42.8 | 86              | 81 | 75 | 61 | 43                               | 41    | 38   | 34.1 | 136             | 128 | 118 | 69 |
| 26.0 | 17                                     | 16   | 15   | 54.3 | 63              | 59 | 55 | 55 | 24                               | 22   | 21   | 45.9 | 88              | 83 | 77 | 61 | 38                               | 35    | 33   | 36.6 | 138             | 130 | 121 | 69 |
| 28.0 | 15                                     | 14   | 13   | 57.9 | 64              | 60 | 56 | 56 | 21                               | 20   | 18   | 48.9 | 90              | 85 | 78 | 62 | 33                               | 31    | 29   | 39.0 | 141             | 133 | 123 | 70 |
| 30.0 | 13                                     | 13   | 12   | 61.5 | 65              | 61 | 57 | 56 | 19                               | 18   | 16   | 52.0 | 91              | 86 | 80 | 62 | 29                               | 28    | 25   | 41.5 | 144             | 135 | 125 | 70 |

**Table L11:** Lodgepole pine stocking levels for the ABLA2/VASC/POPU plant association (W-S province), and the ABLA2/POPU and PICO(ABLA2)/VASC/POPU plant community types.

| QMD  | Climate Resilience; SDI 101; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 142; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 223; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5564                                    | 5239 | 4844 | 3.0  | 30              | 29 | 26 | 42 | 7790                             | 7334 | 6782 | 2.5  | 42              | 40 | 37 | 48 | 12241                            | 11525 | 10657 | 2.0  | 67              | 63  | 58  | 56 |
| 1.5  | 2748                                    | 2587 | 2392 | 4.3  | 34              | 32 | 29 | 44 | 3847                             | 3622 | 3349 | 3.6  | 47              | 44 | 41 | 50 | 6045                             | 5692  | 5263  | 2.9  | 74              | 70  | 65  | 58 |
| 2.0  | 1666                                    | 1568 | 1450 | 5.5  | 36              | 34 | 32 | 45 | 2332                             | 2196 | 2030 | 4.6  | 51              | 48 | 44 | 51 | 3665                             | 3450  | 3190  | 3.7  | 80              | 75  | 70  | 59 |
| 2.5  | 1130                                    | 1064 | 984  | 6.7  | 39              | 36 | 34 | 46 | 1582                             | 1489 | 1377 | 5.6  | 54              | 51 | 47 | 52 | 2485                             | 2340  | 2164  | 4.5  | 85              | 80  | 74  | 61 |
| 3.0  | 823                                     | 775  | 716  | 7.8  | 40              | 38 | 35 | 47 | 1152                             | 1084 | 1003 | 6.6  | 57              | 53 | 49 | 53 | 1810                             | 1704  | 1576  | 5.3  | 89              | 84  | 77  | 61 |
| 3.5  | 629                                     | 592  | 548  | 8.9  | 42              | 40 | 37 | 48 | 881                              | 829  | 767  | 7.6  | 59              | 55 | 51 | 54 | 1384                             | 1303  | 1205  | 6.0  | 92              | 87  | 81  | 62 |
| 4.0  | 499                                     | 469  | 434  | 10.0 | 44              | 41 | 38 | 49 | 698                              | 657  | 608  | 8.5  | 61              | 57 | 53 | 55 | 1097                             | 1033  | 955   | 6.8  | 96              | 90  | 83  | 63 |
| 4.5  | 406                                     | 382  | 354  | 11.1 | 45              | 42 | 39 | 49 | 569                              | 535  | 495  | 9.4  | 63              | 59 | 55 | 55 | 894                              | 841   | 778   | 7.5  | 99              | 93  | 86  | 63 |
| 5.0  | 338                                     | 318  | 294  | 12.2 | 46              | 43 | 40 | 50 | 473                              | 446  | 412  | 10.3 | 65              | 61 | 56 | 56 | 744                              | 701   | 648   | 8.2  | 101             | 96  | 88  | 64 |
| 5.5  | 287                                     | 270  | 249  | 13.2 | 47              | 45 | 41 | 50 | 401                              | 378  | 349  | 11.2 | 66              | 62 | 58 | 56 | 630                              | 593   | 549   | 8.9  | 104             | 98  | 91  | 64 |
| 6.0  | 246                                     | 232  | 214  | 14.3 | 48              | 46 | 42 | 50 | 345                              | 325  | 300  | 12.1 | 68              | 64 | 59 | 56 | 542                              | 510   | 472   | 9.6  | 106             | 100 | 93  | 65 |
| 6.5  | 214                                     | 202  | 187  | 15.3 | 49              | 46 | 43 | 51 | 300                              | 282  | 261  | 12.9 | 69              | 65 | 60 | 57 | 471                              | 444   | 410   | 10.3 | 109             | 102 | 95  | 65 |
| 7.0  | 188                                     | 177  | 164  | 16.3 | 50              | 47 | 44 | 51 | 264                              | 248  | 230  | 13.8 | 70              | 66 | 61 | 57 | 414                              | 390   | 361   | 11.0 | 111             | 104 | 96  | 65 |
| 7.5  | 167                                     | 157  | 145  | 17.4 | 51              | 48 | 45 | 52 | 234                              | 220  | 204  | 14.7 | 72              | 68 | 62 | 58 | 367                              | 346   | 320   | 11.7 | 113             | 106 | 98  | 66 |
| 8.0  | 149                                     | 141  | 130  | 18.4 | 52              | 49 | 45 | 52 | 209                              | 197  | 182  | 15.5 | 73              | 69 | 64 | 58 | 328                              | 309   | 286   | 12.4 | 115             | 108 | 100 | 66 |
| 8.5  | 134                                     | 126  | 117  | 19.4 | 53              | 50 | 46 | 52 | 188                              | 177  | 164  | 16.4 | 74              | 70 | 65 | 58 | 296                              | 278   | 257   | 13.0 | 116             | 110 | 101 | 66 |
| 9.0  | 122                                     | 115  | 106  | 20.3 | 54              | 51 | 47 | 52 | 170                              | 160  | 148  | 17.2 | 75              | 71 | 65 | 58 | 268                              | 252   | 233   | 13.7 | 118             | 111 | 103 | 66 |
| 9.5  | 111                                     | 104  | 96   | 21.3 | 54              | 51 | 47 | 53 | 155                              | 146  | 135  | 18.0 | 76              | 72 | 66 | 59 | 244                              | 229   | 212   | 14.4 | 120             | 113 | 104 | 67 |
| 10.0 | 101                                     | 95   | 88   | 22.3 | 55              | 52 | 48 | 53 | 142                              | 133  | 123  | 18.8 | 77              | 73 | 67 | 59 | 223                              | 210   | 194   | 15.0 | 121             | 114 | 106 | 67 |
| 11.0 | 86                                      | 81   | 75   | 24.2 | 57              | 53 | 49 | 53 | 120                              | 113  | 105  | 20.5 | 79              | 75 | 69 | 59 | 189                              | 178   | 164   | 16.3 | 125             | 117 | 108 | 67 |
| 12.0 | 74                                      | 69   | 64   | 26.1 | 58              | 55 | 50 | 54 | 103                              | 97   | 90   | 22.1 | 81              | 76 | 71 | 60 | 162                              | 153   | 141   | 17.6 | 127             | 120 | 111 | 68 |
| 13.0 | 64                                      | 60   | 56   | 28.0 | 59              | 56 | 51 | 54 | 90                               | 85   | 78   | 23.7 | 83              | 78 | 72 | 60 | 141                              | 133   | 123   | 18.9 | 130             | 122 | 113 | 68 |
| 14.0 | 56                                      | 53   | 49   | 29.9 | 60              | 57 | 52 | 54 | 79                               | 74   | 69   | 25.2 | 84              | 79 | 73 | 60 | 124                              | 117   | 108   | 20.1 | 133             | 125 | 115 | 69 |
| 15.0 | 50                                      | 47   | 44   | 31.7 | 61              | 58 | 53 | 55 | 70                               | 66   | 61   | 26.8 | 86              | 81 | 75 | 61 | 110                              | 104   | 96    | 21.4 | 135             | 127 | 118 | 69 |
| 16.0 | 45                                      | 42   | 39   | 33.5 | 62              | 59 | 54 | 55 | 63                               | 59   | 54   | 28.4 | 87              | 82 | 76 | 61 | 98                               | 93    | 86    | 22.6 | 137             | 129 | 120 | 69 |
| 17.0 | 40                                      | 38   | 35   | 35.4 | 63              | 60 | 55 | 55 | 56                               | 53   | 49   | 29.9 | 89              | 84 | 77 | 61 | 88                               | 83    | 77    | 23.8 | 139             | 131 | 121 | 69 |
| 18.0 | 36                                      | 34   | 32   | 37.2 | 64              | 61 | 56 | 56 | 51                               | 48   | 44   | 31.4 | 90              | 85 | 78 | 62 | 80                               | 75    | 70    | 25.1 | 142             | 133 | 123 | 70 |
| 19.0 | 33                                      | 31   | 29   | 39.0 | 65              | 61 | 57 | 56 | 46                               | 44   | 40   | 32.9 | 91              | 86 | 80 | 62 | 73                               | 69    | 63    | 26.3 | 144             | 135 | 125 | 70 |
| 20.0 | 30                                      | 29   | 26   | 40.7 | 66              | 62 | 58 | 56 | 42                               | 40   | 37   | 34.4 | 93              | 87 | 81 | 62 | 67                               | 63    | 58    | 27.5 | 145             | 137 | 127 | 70 |
| 22.0 | 26                                      | 24   | 22   | 44.3 | 68              | 64 | 59 | 57 | 36                               | 34   | 31   | 37.4 | 95              | 89 | 83 | 63 | 56                               | 53    | 49    | 29.8 | 149             | 140 | 130 | 71 |
| 24.0 | 22                                      | 21   | 19   | 47.7 | 69              | 65 | 60 | 57 | 31                               | 29   | 27   | 40.3 | 97              | 91 | 85 | 63 | 49                               | 46    | 42    | 32.2 | 153             | 144 | 133 | 71 |
| 26.0 | 19                                      | 18   | 17   | 51.2 | 71              | 67 | 62 | 57 | 27                               | 25   | 23   | 43.3 | 99              | 93 | 86 | 63 | 42                               | 40    | 37    | 34.5 | 156             | 147 | 136 | 71 |
| 28.0 | 17                                      | 16   | 15   | 54.6 | 72              | 68 | 63 | 58 | 24                               | 22   | 21   | 46.1 | 101             | 95 | 88 | 64 | 37                               | 35    | 32    | 36.8 | 159             | 149 | 138 | 72 |
| 30.0 | 15                                      | 14   | 13   | 58.0 | 73              | 69 | 64 | 58 | 21                               | 20   | 18   | 49.0 | 103             | 97 | 90 | 64 | 33                               | 31    | 29    | 39.1 | 162             | 152 | 141 | 72 |

**Table L12:** Lodgepole pine stocking levels for the ABLA2/VAME plant association (B-O province) and the PICO(ABLA2)/VAME plant community type.

| QMD  | Climate Resilience; SDI 80; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 112; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 175; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4383                                   | 4126 | 3815 | 3.4  | 24              | 23 | 21 | 38 | 6136                             | 5777 | 5342 | 2.9  | 33              | 32 | 29 | 44 | 9642                             | 9078 | 8394 | 2.3  | 53              | 50  | 46  | 52 |
| 1.5  | 2164                                   | 2038 | 1884 | 4.8  | 27              | 25 | 23 | 40 | 3030                             | 2853 | 2638 | 4.1  | 37              | 35 | 32 | 46 | 4762                             | 4483 | 4145 | 3.3  | 58              | 55  | 51  | 54 |
| 2.0  | 1312                                   | 1235 | 1142 | 6.2  | 29              | 27 | 25 | 41 | 1837                             | 1729 | 1599 | 5.2  | 40              | 38 | 35 | 47 | 2886                             | 2718 | 2513 | 4.2  | 63              | 59  | 55  | 55 |
| 2.5  | 890                                    | 838  | 775  | 7.5  | 30              | 29 | 26 | 42 | 1246                             | 1173 | 1085 | 6.4  | 42              | 40 | 37 | 48 | 1958                             | 1843 | 1704 | 5.1  | 67              | 63  | 58  | 56 |
| 3.0  | 648                                    | 610  | 564  | 8.8  | 32              | 30 | 28 | 43 | 907                              | 854  | 790  | 7.4  | 45              | 42 | 39 | 49 | 1425                             | 1342 | 1241 | 5.9  | 70              | 66  | 61  | 57 |
| 3.5  | 496                                    | 467  | 431  | 10.1 | 33              | 31 | 29 | 44 | 694                              | 653  | 604  | 8.5  | 46              | 44 | 40 | 50 | 1090                             | 1026 | 949  | 6.8  | 73              | 69  | 63  | 58 |
| 4.0  | 393                                    | 370  | 342  | 11.3 | 34              | 32 | 30 | 44 | 550                              | 518  | 479  | 9.6  | 48              | 45 | 42 | 50 | 864                              | 814  | 752  | 7.6  | 75              | 71  | 66  | 58 |
| 4.5  | 320                                    | 301  | 279  | 12.5 | 35              | 33 | 31 | 45 | 448                              | 422  | 390  | 10.6 | 49              | 47 | 43 | 51 | 704                              | 663  | 613  | 8.5  | 78              | 73  | 68  | 59 |
| 5.0  | 266                                    | 251  | 232  | 13.7 | 36              | 34 | 32 | 45 | 373                              | 351  | 325  | 11.6 | 51              | 48 | 44 | 51 | 586                              | 552  | 510  | 9.3  | 80              | 75  | 70  | 59 |
| 5.5  | 226                                    | 212  | 196  | 14.9 | 37              | 35 | 32 | 46 | 316                              | 297  | 275  | 12.6 | 52              | 49 | 45 | 52 | 497                              | 467  | 432  | 10.1 | 82              | 77  | 71  | 60 |
| 6.0  | 194                                    | 183  | 169  | 16.1 | 38              | 36 | 33 | 46 | 272                              | 256  | 236  | 13.6 | 53              | 50 | 46 | 52 | 427                              | 402  | 372  | 10.9 | 84              | 79  | 73  | 60 |
| 6.5  | 169                                    | 159  | 147  | 17.3 | 39              | 37 | 34 | 47 | 236                              | 222  | 206  | 14.6 | 54              | 51 | 47 | 53 | 371                              | 350  | 323  | 11.6 | 86              | 81  | 74  | 61 |
| 7.0  | 148                                    | 140  | 129  | 18.4 | 40              | 37 | 35 | 47 | 208                              | 196  | 181  | 15.6 | 56              | 52 | 48 | 53 | 326                              | 307  | 284  | 12.4 | 87              | 82  | 76  | 61 |
| 7.5  | 132                                    | 124  | 115  | 19.6 | 40              | 38 | 35 | 47 | 184                              | 173  | 160  | 16.5 | 57              | 53 | 49 | 53 | 289                              | 273  | 252  | 13.2 | 89              | 84  | 77  | 61 |
| 8.0  | 118                                    | 111  | 102  | 20.7 | 41              | 39 | 36 | 48 | 165                              | 155  | 143  | 17.5 | 57              | 54 | 50 | 54 | 259                              | 244  | 225  | 13.9 | 90              | 85  | 79  | 62 |
| 8.5  | 106                                    | 100  | 92   | 21.8 | 42              | 39 | 36 | 48 | 148                              | 139  | 129  | 18.4 | 58              | 55 | 51 | 54 | 233                              | 219  | 203  | 14.7 | 92              | 86  | 80  | 62 |
| 9.0  | 96                                     | 90   | 83   | 22.9 | 42              | 40 | 37 | 48 | 134                              | 126  | 117  | 19.4 | 59              | 56 | 52 | 54 | 211                              | 198  | 183  | 15.4 | 93              | 88  | 81  | 62 |
| 9.5  | 87                                     | 82   | 76   | 24.0 | 43              | 40 | 37 | 48 | 122                              | 115  | 106  | 20.3 | 60              | 57 | 52 | 54 | 192                              | 181  | 167  | 16.2 | 94              | 89  | 82  | 62 |
| 10.0 | 80                                     | 75   | 69   | 25.1 | 43              | 41 | 38 | 49 | 112                              | 105  | 97   | 21.2 | 61              | 57 | 53 | 55 | 175                              | 165  | 153  | 16.9 | 96              | 90  | 83  | 63 |
| 11.0 | 68                                     | 64   | 59   | 27.3 | 45              | 42 | 39 | 49 | 95                               | 89   | 82   | 23.1 | 62              | 59 | 54 | 55 | 149                              | 140  | 129  | 18.4 | 98              | 92  | 85  | 63 |
| 12.0 | 58                                     | 55   | 51   | 29.4 | 46              | 43 | 40 | 49 | 81                               | 77   | 71   | 24.9 | 64              | 60 | 56 | 55 | 128                              | 120  | 111  | 19.8 | 100             | 94  | 87  | 64 |
| 13.0 | 51                                     | 48   | 44   | 31.6 | 47              | 44 | 41 | 50 | 71                               | 67   | 62   | 26.7 | 65              | 61 | 57 | 56 | 111                              | 105  | 97   | 21.3 | 102             | 96  | 89  | 64 |
| 14.0 | 44                                     | 42   | 39   | 33.7 | 47              | 45 | 41 | 50 | 62                               | 59   | 54   | 28.4 | 66              | 63 | 58 | 56 | 98                               | 92   | 85   | 22.7 | 104             | 98  | 91  | 64 |
| 15.0 | 39                                     | 37   | 34   | 35.7 | 48              | 46 | 42 | 50 | 55                               | 52   | 48   | 30.2 | 68              | 64 | 59 | 56 | 87                               | 82   | 75   | 24.1 | 106             | 100 | 93  | 65 |
| 16.0 | 35                                     | 33   | 31   | 37.8 | 49              | 46 | 43 | 51 | 49                               | 46   | 43   | 31.9 | 69              | 65 | 60 | 57 | 77                               | 73   | 67   | 25.5 | 108             | 102 | 94  | 65 |
| 17.0 | 32                                     | 30   | 28   | 39.8 | 50              | 47 | 43 | 51 | 44                               | 42   | 39   | 33.7 | 70              | 66 | 61 | 57 | 70                               | 66   | 61   | 26.9 | 110             | 103 | 96  | 65 |
| 18.0 | 29                                     | 27   | 25   | 41.9 | 51              | 48 | 44 | 51 | 40                               | 38   | 35   | 35.4 | 71              | 67 | 62 | 57 | 63                               | 59   | 55   | 28.2 | 111             | 105 | 97  | 65 |
| 19.0 | 26                                     | 25   | 23   | 43.9 | 51              | 48 | 45 | 52 | 37                               | 34   | 32   | 37.1 | 72              | 68 | 63 | 58 | 57                               | 54   | 50   | 29.6 | 113             | 106 | 98  | 66 |
| 20.0 | 24                                     | 22   | 21   | 45.9 | 52              | 49 | 45 | 52 | 33                               | 31   | 29   | 38.8 | 73              | 69 | 63 | 58 | 53                               | 49   | 46   | 30.9 | 115             | 108 | 100 | 66 |
| 22.0 | 20                                     | 19   | 18   | 49.9 | 53              | 50 | 46 | 52 | 28                               | 27   | 25   | 42.1 | 75              | 70 | 65 | 58 | 44                               | 42   | 39   | 33.6 | 117             | 111 | 102 | 66 |
| 24.0 | 17                                     | 16   | 15   | 53.8 | 55              | 51 | 48 | 53 | 24                               | 23   | 21   | 45.5 | 76              | 72 | 67 | 59 | 38                               | 36   | 33   | 36.3 | 120             | 113 | 105 | 67 |
| 26.0 | 15                                     | 14   | 13   | 57.7 | 56              | 53 | 49 | 53 | 21                               | 20   | 18   | 48.7 | 78              | 74 | 68 | 59 | 33                               | 31   | 29   | 38.9 | 123             | 116 | 107 | 67 |
| 28.0 | 13                                     | 13   | 12   | 61.5 | 57              | 54 | 49 | 53 | 19                               | 18   | 16   | 52.0 | 80              | 75 | 69 | 59 | 29                               | 28   | 25   | 41.5 | 125             | 118 | 109 | 68 |
| 30.0 | 12                                     | 11   | 10   | 65.3 | 58              | 54 | 50 | 54 | 17                               | 16   | 14   | 55.2 | 81              | 76 | 71 | 60 | 26                               | 24   | 23   | 44.0 | 127             | 120 | 111 | 68 |

**Table L13:** Lodgepole pine stocking levels for the ABLA2/VASC plant association (B-O province) and the PICO(ABLA2)/VASC plant community type.

| QMD  | Climate Resilience; SDI 99; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 139; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 218; 55% of Max |       |       |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5440                                   | 5122 | 4736 | 3.0  | 30              | 28 | 26 | 42 | 7617                             | 7171 | 6631 | 2.6  | 42              | 39 | 36 | 48 | 11969                            | 11269 | 10420 | 2.1  | 65              | 61  | 57  | 56 |
| 1.5  | 2687                                   | 2530 | 2339 | 4.3  | 33              | 31 | 29 | 44 | 3762                             | 3541 | 3275 | 3.7  | 46              | 43 | 40 | 50 | 5911                             | 5565  | 5146  | 2.9  | 73              | 68  | 63  | 58 |
| 2.0  | 1629                                   | 1533 | 1418 | 5.6  | 36              | 33 | 31 | 45 | 2280                             | 2147 | 1985 | 4.7  | 50              | 47 | 43 | 51 | 3583                             | 3374  | 3119  | 3.7  | 78              | 74  | 68  | 59 |
| 2.5  | 1105                                   | 1040 | 962  | 6.7  | 38              | 35 | 33 | 46 | 1546                             | 1456 | 1346 | 5.7  | 53              | 50 | 46 | 52 | 2430                             | 2288  | 2116  | 4.5  | 83              | 78  | 72  | 60 |
| 3.0  | 804                                    | 757  | 700  | 7.9  | 39              | 37 | 34 | 47 | 1126                             | 1060 | 980  | 6.7  | 55              | 52 | 48 | 53 | 1770                             | 1666  | 1541  | 5.3  | 87              | 82  | 76  | 61 |
| 3.5  | 615                                    | 579  | 536  | 9.0  | 41              | 39 | 36 | 48 | 861                              | 811  | 750  | 7.6  | 58              | 54 | 50 | 54 | 1353                             | 1274  | 1178  | 6.1  | 90              | 85  | 79  | 62 |
| 4.0  | 488                                    | 459  | 424  | 10.2 | 43              | 40 | 37 | 48 | 683                              | 643  | 594  | 8.6  | 60              | 56 | 52 | 54 | 1073                             | 1010  | 934   | 6.8  | 94              | 88  | 81  | 62 |
| 4.5  | 397                                    | 374  | 346  | 11.3 | 44              | 41 | 38 | 49 | 556                              | 524  | 484  | 9.5  | 61              | 58 | 53 | 55 | 874                              | 823   | 761   | 7.6  | 97              | 91  | 84  | 63 |
| 5.0  | 331                                    | 311  | 288  | 12.3 | 45              | 42 | 39 | 49 | 463                              | 436  | 403  | 10.4 | 63              | 59 | 55 | 55 | 728                              | 685   | 633   | 8.3  | 99              | 93  | 86  | 63 |
| 5.5  | 280                                    | 264  | 244  | 13.4 | 46              | 44 | 40 | 50 | 392                              | 369  | 341  | 11.3 | 65              | 61 | 56 | 56 | 616                              | 580   | 537   | 9.0  | 102             | 96  | 89  | 64 |
| 6.0  | 241                                    | 227  | 210  | 14.5 | 47              | 45 | 41 | 50 | 337                              | 317  | 293  | 12.2 | 66              | 62 | 58 | 56 | 530                              | 499   | 461   | 9.7  | 104             | 98  | 91  | 64 |
| 6.5  | 209                                    | 197  | 182  | 15.5 | 48              | 45 | 42 | 50 | 293                              | 276  | 255  | 13.1 | 68              | 64 | 59 | 56 | 461                              | 434   | 401   | 10.4 | 106             | 100 | 92  | 65 |
| 7.0  | 184                                    | 173  | 160  | 16.5 | 49              | 46 | 43 | 51 | 258                              | 243  | 224  | 14.0 | 69              | 65 | 60 | 57 | 405                              | 381   | 353   | 11.1 | 108             | 102 | 94  | 65 |
| 7.5  | 163                                    | 154  | 142  | 17.5 | 50              | 47 | 44 | 51 | 229                              | 215  | 199  | 14.8 | 70              | 66 | 61 | 57 | 359                              | 338   | 313   | 11.8 | 110             | 104 | 96  | 65 |
| 8.0  | 146                                    | 137  | 127  | 18.6 | 51              | 48 | 44 | 51 | 204                              | 192  | 178  | 15.7 | 71              | 67 | 62 | 57 | 321                              | 302   | 280   | 12.5 | 112             | 106 | 98  | 66 |
| 8.5  | 131                                    | 124  | 114  | 19.6 | 52              | 49 | 45 | 52 | 184                              | 173  | 160  | 16.5 | 72              | 68 | 63 | 58 | 289                              | 272   | 252   | 13.2 | 114             | 107 | 99  | 66 |
| 9.0  | 119                                    | 112  | 104  | 20.6 | 53              | 49 | 46 | 52 | 166                              | 157  | 145  | 17.4 | 74              | 69 | 64 | 58 | 262                              | 246   | 228   | 13.9 | 116             | 109 | 101 | 66 |
| 9.5  | 108                                    | 102  | 94   | 21.6 | 53              | 50 | 46 | 52 | 152                              | 143  | 132  | 18.2 | 75              | 70 | 65 | 58 | 238                              | 224   | 207   | 14.5 | 117             | 110 | 102 | 66 |
| 10.0 | 99                                     | 93   | 86   | 22.5 | 54              | 51 | 47 | 52 | 139                              | 130  | 121  | 19.1 | 76              | 71 | 66 | 58 | 218                              | 205   | 190   | 15.2 | 119             | 112 | 103 | 67 |
| 11.0 | 84                                     | 79   | 73   | 24.5 | 55              | 52 | 48 | 53 | 117                              | 111  | 102  | 20.7 | 77              | 73 | 67 | 59 | 185                              | 174   | 161   | 16.5 | 122             | 115 | 106 | 67 |
| 12.0 | 72                                     | 68   | 63   | 26.4 | 57              | 53 | 49 | 53 | 101                              | 95   | 88   | 22.3 | 79              | 75 | 69 | 59 | 159                              | 149   | 138   | 17.8 | 125             | 117 | 108 | 67 |
| 13.0 | 63                                     | 59   | 55   | 28.3 | 58              | 54 | 50 | 54 | 88                               | 83   | 76   | 23.9 | 81              | 76 | 70 | 60 | 138                              | 130   | 120   | 19.1 | 127             | 120 | 111 | 68 |
| 14.0 | 55                                     | 52   | 48   | 30.2 | 59              | 55 | 51 | 54 | 77                               | 73   | 67   | 25.5 | 83              | 78 | 72 | 60 | 121                              | 114   | 106   | 20.4 | 130             | 122 | 113 | 68 |
| 15.0 | 49                                     | 46   | 43   | 32.1 | 60              | 56 | 52 | 54 | 68                               | 64   | 60   | 27.1 | 84              | 79 | 73 | 60 | 108                              | 101   | 94    | 21.6 | 132             | 124 | 115 | 68 |
| 16.0 | 44                                     | 41   | 38   | 33.9 | 61              | 57 | 53 | 55 | 61                               | 58   | 53   | 28.7 | 85              | 80 | 74 | 61 | 96                               | 91    | 84    | 22.9 | 134             | 126 | 117 | 69 |
| 17.0 | 39                                     | 37   | 34   | 35.8 | 62              | 58 | 54 | 55 | 55                               | 52   | 48   | 30.2 | 87              | 82 | 76 | 61 | 87                               | 81    | 75    | 24.1 | 136             | 128 | 119 | 69 |
| 18.0 | 36                                     | 34   | 31   | 37.6 | 63              | 59 | 55 | 55 | 50                               | 47   | 43   | 31.8 | 88              | 83 | 77 | 61 | 78                               | 74    | 68    | 25.3 | 138             | 130 | 120 | 69 |
| 19.0 | 32                                     | 31   | 28   | 39.4 | 64              | 60 | 56 | 55 | 45                               | 43   | 39   | 33.3 | 89              | 84 | 78 | 61 | 71                               | 67    | 62    | 26.6 | 140             | 132 | 122 | 70 |
| 20.0 | 30                                     | 28   | 26   | 41.2 | 65              | 61 | 56 | 56 | 41                               | 39   | 36   | 34.8 | 91              | 85 | 79 | 62 | 65                               | 61    | 57    | 27.8 | 142             | 134 | 124 | 70 |
| 22.0 | 25                                     | 24   | 22   | 44.8 | 66              | 62 | 58 | 56 | 35                               | 33   | 31   | 37.8 | 93              | 87 | 81 | 62 | 55                               | 52    | 48    | 30.2 | 146             | 137 | 127 | 70 |
| 24.0 | 22                                     | 20   | 19   | 48.3 | 68              | 64 | 59 | 57 | 30                               | 28   | 26   | 40.8 | 95              | 89 | 83 | 63 | 47                               | 45    | 41    | 32.5 | 149             | 140 | 130 | 71 |
| 26.0 | 19                                     | 18   | 16   | 51.8 | 69              | 65 | 60 | 57 | 26                               | 25   | 23   | 43.7 | 97              | 91 | 84 | 63 | 41                               | 39    | 36    | 34.9 | 152             | 143 | 133 | 71 |
| 28.0 | 17                                     | 16   | 14   | 55.2 | 71              | 66 | 61 | 57 | 23                               | 22   | 20   | 46.7 | 99              | 93 | 86 | 63 | 36                               | 34    | 32    | 37.2 | 155             | 146 | 135 | 71 |
| 30.0 | 15                                     | 14   | 13   | 58.6 | 72              | 68 | 63 | 58 | 20                               | 19   | 18   | 49.5 | 101             | 95 | 88 | 64 | 32                               | 30    | 28    | 39.5 | 158             | 149 | 138 | 72 |

**Table L14:** Lodgepole pine stocking levels for the PICO/CARU (B-O province) and TSME/VASC+VAME (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 70; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 98; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 153; 55% of Max |      |      |      |                 |     |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC |
| 1.0  | 3833                                   | 3609 | 3337 | 3.6  | 21              | 20 | 18 | 36 | 5366                            | 5052 | 4672 | 3.1  | 29              | 28 | 25 | 42 | 8433                             | 7939 | 7342 | 2.4  | 46              | 43  | 40 | 50 |
| 1.5  | 1893                                   | 1782 | 1648 | 5.2  | 23              | 22 | 20 | 38 | 2650                            | 2495 | 2307 | 4.4  | 33              | 31 | 28 | 43 | 4165                             | 3921 | 3626 | 3.5  | 51              | 48  | 44 | 51 |
| 2.0  | 1147                                   | 1080 | 999  | 6.6  | 25              | 24 | 22 | 39 | 1606                            | 1513 | 1399 | 5.6  | 35              | 33 | 31 | 45 | 2524                             | 2377 | 2198 | 4.5  | 55              | 52  | 48 | 53 |
| 2.5  | 778                                    | 733  | 678  | 8.0  | 27              | 25 | 23 | 40 | 1090                            | 1026 | 949  | 6.8  | 37              | 35 | 32 | 46 | 1712                             | 1612 | 1491 | 5.4  | 58              | 55  | 51 | 54 |
| 3.0  | 567                                    | 534  | 493  | 9.4  | 28              | 26 | 24 | 41 | 793                             | 747  | 691  | 8.0  | 39              | 37 | 34 | 47 | 1247                             | 1174 | 1085 | 6.4  | 61              | 58  | 53 | 55 |
| 3.5  | 433                                    | 408  | 377  | 10.8 | 29              | 27 | 25 | 41 | 607                             | 571  | 528  | 9.1  | 41              | 38 | 35 | 47 | 953                              | 898  | 830  | 7.3  | 64              | 60  | 55 | 55 |
| 4.0  | 344                                    | 323  | 299  | 12.1 | 30              | 28 | 26 | 42 | 481                             | 453  | 419  | 10.2 | 42              | 40 | 37 | 48 | 756                              | 712  | 658  | 8.2  | 66              | 62  | 57 | 56 |
| 4.5  | 280                                    | 263  | 244  | 13.4 | 31              | 29 | 27 | 43 | 392                             | 369  | 341  | 11.3 | 43              | 41 | 38 | 49 | 616                              | 580  | 536  | 9.0  | 68              | 64  | 59 | 57 |
| 5.0  | 233                                    | 219  | 203  | 14.7 | 32              | 30 | 28 | 43 | 326                             | 307  | 284  | 12.4 | 44              | 42 | 39 | 49 | 513                              | 483  | 446  | 9.9  | 70              | 66  | 61 | 57 |
| 5.5  | 197                                    | 186  | 172  | 16.0 | 33              | 31 | 28 | 43 | 276                             | 260  | 241  | 13.5 | 46              | 43 | 40 | 49 | 434                              | 409  | 378  | 10.8 | 72              | 67  | 62 | 58 |
| 6.0  | 170                                    | 160  | 148  | 17.2 | 33              | 31 | 29 | 44 | 238                             | 224  | 207  | 14.6 | 47              | 44 | 41 | 50 | 373                              | 351  | 325  | 11.6 | 73              | 69  | 64 | 58 |
| 6.5  | 148                                    | 139  | 128  | 18.5 | 34              | 32 | 30 | 44 | 207                             | 195  | 180  | 15.6 | 48              | 45 | 41 | 50 | 325                              | 306  | 283  | 12.4 | 75              | 70  | 65 | 58 |
| 7.0  | 130                                    | 122  | 113  | 19.7 | 35              | 33 | 30 | 45 | 182                             | 171  | 158  | 16.6 | 49              | 46 | 42 | 51 | 285                              | 269  | 248  | 13.3 | 76              | 72  | 66 | 59 |
| 7.5  | 115                                    | 108  | 100  | 20.9 | 35              | 33 | 31 | 45 | 161                             | 152  | 140  | 17.7 | 49              | 47 | 43 | 51 | 253                              | 238  | 220  | 14.1 | 78              | 73  | 68 | 59 |
| 8.0  | 103                                    | 97   | 90   | 22.1 | 36              | 34 | 31 | 45 | 144                             | 136  | 125  | 18.7 | 50              | 47 | 44 | 51 | 226                              | 213  | 197  | 14.9 | 79              | 74  | 69 | 59 |
| 8.5  | 93                                     | 87   | 81   | 23.3 | 36              | 34 | 32 | 45 | 130                             | 122  | 113  | 19.7 | 51              | 48 | 44 | 51 | 204                              | 192  | 177  | 15.7 | 80              | 76  | 70 | 60 |
| 9.0  | 84                                     | 79   | 73   | 24.5 | 37              | 35 | 32 | 46 | 117                             | 110  | 102  | 20.7 | 52              | 49 | 45 | 52 | 184                              | 174  | 160  | 16.5 | 81              | 77  | 71 | 60 |
| 9.5  | 76                                     | 72   | 66   | 25.7 | 38              | 35 | 33 | 46 | 107                             | 101  | 93   | 21.7 | 53              | 49 | 46 | 52 | 168                              | 158  | 146  | 17.3 | 83              | 78  | 72 | 60 |
| 10.0 | 70                                     | 66   | 61   | 26.9 | 38              | 36 | 33 | 46 | 98                              | 92   | 85   | 22.7 | 53              | 50 | 46 | 52 | 153                              | 144  | 134  | 18.1 | 84              | 79  | 73 | 60 |
| 11.0 | 59                                     | 56   | 51   | 29.2 | 39              | 37 | 34 | 47 | 83                              | 78   | 72   | 24.7 | 55              | 51 | 48 | 53 | 130                              | 122  | 113  | 19.7 | 86              | 81  | 75 | 61 |
| 12.0 | 51                                     | 48   | 44   | 31.5 | 40              | 38 | 35 | 47 | 71                              | 67   | 62   | 26.6 | 56              | 53 | 49 | 53 | 112                              | 105  | 97   | 21.2 | 88              | 83  | 76 | 61 |
| 13.0 | 44                                     | 42   | 38   | 33.7 | 41              | 38 | 35 | 47 | 62                              | 58   | 54   | 28.5 | 57              | 54 | 50 | 53 | 97                               | 92   | 85   | 22.7 | 90              | 84  | 78 | 62 |
| 14.0 | 39                                     | 37   | 34   | 36.0 | 42              | 39 | 36 | 48 | 54                              | 51   | 47   | 30.4 | 58              | 55 | 51 | 54 | 85                               | 80   | 74   | 24.3 | 91              | 86  | 80 | 62 |
| 15.0 | 34                                     | 32   | 30   | 38.2 | 42              | 40 | 37 | 48 | 48                              | 45   | 42   | 32.3 | 59              | 56 | 52 | 54 | 76                               | 71   | 66   | 25.8 | 93              | 88  | 81 | 62 |
| 16.0 | 31                                     | 29   | 27   | 40.4 | 43              | 40 | 37 | 48 | 43                              | 41   | 38   | 34.2 | 60              | 57 | 52 | 54 | 68                               | 64   | 59   | 27.3 | 95              | 89  | 82 | 62 |
| 17.0 | 28                                     | 26   | 24   | 42.6 | 44              | 41 | 38 | 49 | 39                              | 37   | 34   | 36.0 | 61              | 58 | 53 | 55 | 61                               | 57   | 53   | 28.7 | 96              | 90  | 84 | 63 |
| 18.0 | 25                                     | 24   | 22   | 44.8 | 44              | 42 | 39 | 49 | 35                              | 33   | 31   | 37.8 | 62              | 58 | 54 | 55 | 55                               | 52   | 48   | 30.2 | 98              | 92  | 85 | 63 |
| 19.0 | 23                                     | 21   | 20   | 46.9 | 45              | 42 | 39 | 49 | 32                              | 30   | 28   | 39.7 | 63              | 59 | 55 | 55 | 50                               | 47   | 44   | 31.6 | 99              | 93  | 86 | 63 |
| 20.0 | 21                                     | 20   | 18   | 49.1 | 46              | 43 | 40 | 49 | 29                              | 28   | 25   | 41.5 | 64              | 60 | 56 | 55 | 46                               | 43   | 40   | 33.1 | 100             | 94  | 87 | 64 |
| 22.0 | 18                                     | 17   | 15   | 53.3 | 47              | 44 | 41 | 50 | 25                              | 23   | 22   | 45.1 | 65              | 62 | 57 | 56 | 39                               | 37   | 34   | 36.0 | 103             | 97  | 89 | 64 |
| 24.0 | 15                                     | 14   | 13   | 57.5 | 48              | 45 | 42 | 50 | 21                              | 20   | 19   | 48.6 | 67              | 63 | 58 | 56 | 33                               | 31   | 29   | 38.8 | 105             | 99  | 91 | 64 |
| 26.0 | 13                                     | 12   | 12   | 61.7 | 49              | 46 | 42 | 51 | 19                              | 17   | 16   | 52.1 | 68              | 64 | 59 | 57 | 29                               | 27   | 25   | 41.6 | 107             | 101 | 93 | 65 |
| 28.0 | 12                                     | 11   | 10   | 65.8 | 50              | 47 | 43 | 51 | 16                              | 15   | 14   | 55.6 | 70              | 66 | 61 | 57 | 26                               | 24   | 22   | 44.3 | 109             | 103 | 95 | 65 |
| 30.0 | 10                                     | 10   | 9    | 69.8 | 51              | 48 | 44 | 51 | 14                              | 14   | 13   | 59.0 | 71              | 67 | 62 | 57 | 23                               | 21   | 20   | 47.1 | 111             | 105 | 97 | 65 |

**Table E1:** Engelmann spruce stocking levels for the ABGR/ACGL plant association (B-O province).

| QMD  | Climate Resilience; SDI 101; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 142; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 223; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5437                                    | 5119 | 4734 | 3.0  | 30              | 28 | 26 | 54 | 7612                             | 7167 | 6627 | 2.6  | 42              | 39 | 36 | 60 | 11962                            | 11263 | 10414 | 2.1  | 65              | 61  | 57  | 68 |
| 1.5  | 2696                                    | 2539 | 2347 | 4.3  | 33              | 31 | 29 | 56 | 3775                             | 3554 | 3286 | 3.7  | 46              | 44 | 40 | 62 | 5932                             | 5585  | 5164  | 2.9  | 73              | 69  | 63  | 70 |
| 2.0  | 1639                                    | 1543 | 1427 | 5.5  | 36              | 34 | 31 | 57 | 2295                             | 2161 | 1998 | 4.7  | 50              | 47 | 44 | 63 | 3606                             | 3395  | 3139  | 3.7  | 79              | 74  | 68  | 71 |
| 2.5  | 1114                                    | 1049 | 970  | 6.7  | 38              | 36 | 33 | 58 | 1560                             | 1469 | 1358 | 5.7  | 53              | 50 | 46 | 64 | 2451                             | 2308  | 2134  | 4.5  | 84              | 79  | 73  | 72 |
| 3.0  | 813                                     | 765  | 708  | 7.9  | 40              | 38 | 35 | 59 | 1138                             | 1071 | 991  | 6.6  | 56              | 53 | 49 | 65 | 1788                             | 1684  | 1557  | 5.3  | 88              | 83  | 76  | 73 |
| 3.5  | 623                                     | 586  | 542  | 9.0  | 42              | 39 | 36 | 60 | 872                              | 821  | 759  | 7.6  | 58              | 55 | 51 | 66 | 1370                             | 1289  | 1192  | 6.1  | 92              | 86  | 80  | 73 |
| 4.0  | 494                                     | 465  | 430  | 10.1 | 43              | 41 | 38 | 60 | 692                              | 651  | 602  | 8.5  | 60              | 57 | 53 | 66 | 1087                             | 1023  | 946   | 6.8  | 95              | 89  | 83  | 74 |
| 4.5  | 403                                     | 379  | 351  | 11.2 | 45              | 42 | 39 | 61 | 564                              | 531  | 491  | 9.4  | 62              | 59 | 54 | 67 | 887                              | 835   | 772   | 7.5  | 98              | 92  | 85  | 75 |
| 5.0  | 336                                     | 316  | 292  | 12.2 | 46              | 43 | 40 | 62 | 470                              | 443  | 409  | 10.3 | 64              | 60 | 56 | 67 | 739                              | 696   | 643   | 8.3  | 101             | 95  | 88  | 75 |
| 5.5  | 285                                     | 268  | 248  | 13.3 | 47              | 44 | 41 | 62 | 399                              | 375  | 347  | 11.2 | 66              | 62 | 57 | 68 | 627                              | 590   | 546   | 9.0  | 103             | 97  | 90  | 76 |
| 6.0  | 245                                     | 231  | 213  | 14.3 | 48              | 45 | 42 | 62 | 343                              | 323  | 299  | 12.1 | 67              | 63 | 59 | 68 | 539                              | 508   | 469   | 9.7  | 106             | 100 | 92  | 76 |
| 6.5  | 213                                     | 201  | 186  | 15.4 | 49              | 46 | 43 | 63 | 299                              | 281  | 260  | 13.0 | 69              | 65 | 60 | 69 | 469                              | 442   | 409   | 10.4 | 108             | 102 | 94  | 76 |
| 7.0  | 188                                     | 177  | 163  | 16.4 | 50              | 47 | 44 | 63 | 263                              | 247  | 229  | 13.8 | 70              | 66 | 61 | 69 | 413                              | 389   | 359   | 11.0 | 110             | 104 | 96  | 77 |
| 7.5  | 167                                     | 157  | 145  | 17.4 | 51              | 48 | 44 | 63 | 233                              | 220  | 203  | 14.7 | 72              | 67 | 62 | 69 | 366                              | 345   | 319   | 11.7 | 112             | 106 | 98  | 77 |
| 8.0  | 149                                     | 140  | 130  | 18.4 | 52              | 49 | 45 | 64 | 209                              | 196  | 182  | 15.5 | 73              | 69 | 63 | 70 | 328                              | 309   | 285   | 12.4 | 114             | 108 | 100 | 77 |
| 8.5  | 134                                     | 126  | 117  | 19.4 | 53              | 50 | 46 | 64 | 188                              | 177  | 163  | 16.4 | 74              | 70 | 64 | 70 | 295                              | 278   | 257   | 13.1 | 116             | 109 | 101 | 78 |
| 9.0  | 121                                     | 114  | 106  | 20.3 | 54              | 51 | 47 | 64 | 170                              | 160  | 148  | 17.2 | 75              | 71 | 65 | 70 | 267                              | 252   | 233   | 13.7 | 118             | 111 | 103 | 78 |
| 9.5  | 111                                     | 104  | 96   | 21.3 | 54              | 51 | 47 | 65 | 155                              | 146  | 135  | 18.0 | 76              | 72 | 66 | 70 | 243                              | 229   | 212   | 14.4 | 120             | 113 | 104 | 78 |
| 10.0 | 101                                     | 95   | 88   | 22.3 | 55              | 52 | 48 | 65 | 142                              | 133  | 123  | 18.8 | 77              | 73 | 67 | 71 | 223                              | 210   | 194   | 15.0 | 121             | 114 | 106 | 78 |
| 11.0 | 86                                      | 81   | 75   | 24.2 | 57              | 53 | 49 | 65 | 120                              | 113  | 105  | 20.5 | 79              | 75 | 69 | 71 | 189                              | 178   | 164   | 16.3 | 125             | 117 | 109 | 79 |
| 12.0 | 74                                      | 70   | 64   | 26.1 | 58              | 55 | 51 | 66 | 103                              | 97   | 90   | 22.1 | 81              | 76 | 71 | 71 | 162                              | 153   | 141   | 17.6 | 128             | 120 | 111 | 79 |
| 13.0 | 64                                      | 61   | 56   | 28.0 | 59              | 56 | 52 | 66 | 90                               | 85   | 78   | 23.6 | 83              | 78 | 72 | 72 | 141                              | 133   | 123   | 18.9 | 130             | 123 | 114 | 80 |
| 14.0 | 57                                      | 53   | 49   | 29.8 | 60              | 57 | 53 | 66 | 79                               | 75   | 69   | 25.2 | 85              | 80 | 74 | 72 | 124                              | 117   | 108   | 20.1 | 133             | 125 | 116 | 80 |
| 15.0 | 50                                      | 47   | 44   | 31.7 | 62              | 58 | 54 | 67 | 70                               | 66   | 61   | 26.8 | 86              | 81 | 75 | 72 | 110                              | 104   | 96    | 21.3 | 136             | 128 | 118 | 80 |
| 16.0 | 45                                      | 42   | 39   | 33.5 | 63              | 59 | 55 | 67 | 63                               | 59   | 55   | 28.3 | 88              | 83 | 76 | 73 | 99                               | 93    | 86    | 22.6 | 138             | 130 | 120 | 81 |
| 17.0 | 40                                      | 38   | 35   | 35.3 | 64              | 60 | 55 | 67 | 57                               | 53   | 49   | 29.8 | 89              | 84 | 78 | 73 | 89                               | 84    | 77    | 23.8 | 140             | 132 | 122 | 81 |
| 18.0 | 37                                      | 34   | 32   | 37.1 | 65              | 61 | 56 | 67 | 51                               | 48   | 45   | 31.3 | 91              | 85 | 79 | 73 | 81                               | 76    | 70    | 25.0 | 142             | 134 | 124 | 81 |
| 19.0 | 33                                      | 31   | 29   | 38.8 | 66              | 62 | 57 | 68 | 47                               | 44   | 41   | 32.8 | 92              | 87 | 80 | 74 | 73                               | 69    | 64    | 26.2 | 144             | 136 | 126 | 81 |
| 20.0 | 31                                      | 29   | 27   | 40.6 | 67              | 63 | 58 | 68 | 43                               | 40   | 37   | 34.3 | 93              | 88 | 81 | 74 | 67                               | 63    | 58    | 27.4 | 146             | 138 | 128 | 82 |
| 22.0 | 26                                      | 24   | 23   | 44.1 | 68              | 64 | 59 | 68 | 36                               | 34   | 32   | 37.3 | 96              | 90 | 83 | 74 | 57                               | 54    | 50    | 29.7 | 150             | 142 | 131 | 82 |
| 24.0 | 22                                      | 21   | 19   | 47.5 | 70              | 66 | 61 | 69 | 31                               | 29   | 27   | 40.2 | 98              | 92 | 85 | 75 | 49                               | 46    | 43    | 32.0 | 154             | 145 | 134 | 83 |
| 26.0 | 19                                      | 18   | 17   | 50.9 | 71              | 67 | 62 | 69 | 27                               | 26   | 24   | 43.1 | 100             | 94 | 87 | 75 | 43                               | 40    | 37    | 34.3 | 157             | 148 | 137 | 83 |
| 28.0 | 17                                      | 16   | 15   | 54.3 | 73              | 69 | 63 | 70 | 24                               | 22   | 21   | 45.9 | 102             | 96 | 89 | 75 | 38                               | 35    | 33    | 36.6 | 160             | 151 | 140 | 83 |
| 30.0 | 15                                      | 14   | 13   | 57.6 | 74              | 70 | 65 | 70 | 21                               | 20   | 18   | 48.7 | 104             | 98 | 91 | 76 | 33                               | 31    | 29    | 38.9 | 163             | 154 | 142 | 84 |



**Table E2:** Engelmann spruce stocking levels for the ABGR/BRVU, ABGR/CLUN, ABGR/POMU-ASCA3, and ABLA2/CLUN (B-O province), and ABGR/CLUN, ABGR/VAME, ABLA2/CLUN, and ABLA2/STAM (W-S province) plant associations, and the PICO(ABGR)/ALSI plant community type.

| QMD  | Climate Resilience; SDI 147; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 205; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 322; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7868                                    | 7407 | 6849 | 2.5  | 43              | 40  | 37 | 60 | 11015                            | 10370 | 9589 | 2.1  | 60              | 57  | 52  | 66 | 17309                            | 16296 | 15069 | 1.7  | 94              | 89  | 82  | 74 |
| 1.5  | 3901                                    | 3673 | 3396 | 3.6  | 48              | 45  | 42 | 62 | 5462                             | 5142  | 4755 | 3.0  | 67              | 63  | 58  | 68 | 8583                             | 8081  | 7472  | 2.4  | 105             | 99  | 92  | 76 |
| 2.0  | 2372                                    | 2233 | 2065 | 4.6  | 52              | 49  | 45 | 64 | 3320                             | 3126  | 2891 | 3.9  | 72              | 68  | 63  | 69 | 5218                             | 4912  | 4543  | 3.1  | 114             | 107 | 99  | 77 |
| 2.5  | 1612                                    | 1518 | 1404 | 5.6  | 55              | 52  | 48 | 65 | 2257                             | 2125  | 1965 | 4.7  | 77              | 72  | 67  | 70 | 3547                             | 3339  | 3088  | 3.8  | 121             | 114 | 105 | 78 |
| 3.0  | 1176                                    | 1107 | 1024 | 6.5  | 58              | 54  | 50 | 66 | 1646                             | 1550  | 1433 | 5.5  | 81              | 76  | 70  | 71 | 2587                             | 2436  | 2252  | 4.4  | 127             | 120 | 111 | 79 |
| 3.5  | 901                                     | 848  | 784  | 7.5  | 60              | 57  | 52 | 66 | 1261                             | 1187  | 1098 | 6.3  | 84              | 79  | 73  | 72 | 1982                             | 1866  | 1725  | 5.0  | 132             | 125 | 115 | 80 |
| 4.0  | 715                                     | 673  | 622  | 8.4  | 62              | 59  | 54 | 67 | 1001                             | 942   | 871  | 7.1  | 87              | 82  | 76  | 73 | 1573                             | 1481  | 1369  | 5.7  | 137             | 129 | 119 | 81 |
| 4.5  | 583                                     | 549  | 508  | 9.3  | 64              | 61  | 56 | 67 | 816                              | 769   | 711  | 7.8  | 90              | 85  | 79  | 73 | 1283                             | 1208  | 1117  | 6.3  | 142             | 133 | 123 | 81 |
| 5.0  | 486                                     | 458  | 423  | 10.2 | 66              | 62  | 58 | 68 | 680                              | 641   | 592  | 8.6  | 93              | 87  | 81  | 74 | 1069                             | 1007  | 931   | 6.9  | 146             | 137 | 127 | 82 |
| 5.5  | 412                                     | 388  | 359  | 11.0 | 68              | 64  | 59 | 68 | 577                              | 543   | 502  | 9.3  | 95              | 90  | 83  | 74 | 907                              | 854   | 789   | 7.4  | 150             | 141 | 130 | 82 |
| 6.0  | 355                                     | 334  | 309  | 11.9 | 70              | 66  | 61 | 69 | 496                              | 467   | 432  | 10.1 | 97              | 92  | 85  | 75 | 780                              | 734   | 679   | 8.0  | 153             | 144 | 133 | 82 |
| 6.5  | 309                                     | 291  | 269  | 12.8 | 71              | 67  | 62 | 69 | 432                              | 407   | 376  | 10.8 | 100             | 94  | 87  | 75 | 679                              | 639   | 591   | 8.6  | 156             | 147 | 136 | 83 |
| 7.0  | 272                                     | 256  | 236  | 13.6 | 73              | 68  | 63 | 69 | 380                              | 358   | 331  | 11.5 | 102             | 96  | 88  | 75 | 597                              | 562   | 520   | 9.2  | 160             | 150 | 139 | 83 |
| 7.5  | 241                                     | 227  | 210  | 14.4 | 74              | 70  | 64 | 70 | 337                              | 318   | 294  | 12.2 | 104             | 97  | 90  | 76 | 530                              | 499   | 462   | 9.7  | 163             | 153 | 142 | 84 |
| 8.0  | 216                                     | 203  | 188  | 15.3 | 75              | 71  | 65 | 70 | 302                              | 284   | 263  | 12.9 | 105             | 99  | 92  | 76 | 474                              | 446   | 413   | 10.3 | 166             | 156 | 144 | 84 |
| 8.5  | 194                                     | 183  | 169  | 16.1 | 76              | 72  | 67 | 70 | 272                              | 256   | 237  | 13.6 | 107             | 101 | 93  | 76 | 427                              | 402   | 372   | 10.9 | 168             | 158 | 146 | 84 |
| 9.0  | 176                                     | 166  | 153  | 16.9 | 78              | 73  | 68 | 71 | 246                              | 232   | 214  | 14.3 | 109             | 102 | 95  | 76 | 387                              | 364   | 337   | 11.4 | 171             | 161 | 149 | 84 |
| 9.5  | 160                                     | 151  | 139  | 17.7 | 79              | 74  | 69 | 71 | 224                              | 211   | 195  | 15.0 | 110             | 104 | 96  | 77 | 352                              | 332   | 307   | 12.0 | 173             | 163 | 151 | 85 |
| 10.0 | 147                                     | 138  | 128  | 18.5 | 80              | 75  | 70 | 71 | 205                              | 193   | 179  | 15.7 | 112             | 105 | 97  | 77 | 322                              | 303   | 281   | 12.5 | 176             | 166 | 153 | 85 |
| 11.0 | 124                                     | 117  | 108  | 20.1 | 82              | 77  | 71 | 72 | 174                              | 164   | 151  | 17.0 | 115             | 108 | 100 | 77 | 273                              | 257   | 238   | 13.6 | 180             | 170 | 157 | 85 |
| 12.0 | 107                                     | 101  | 93   | 21.7 | 84              | 79  | 73 | 72 | 150                              | 141   | 130  | 18.3 | 118             | 111 | 102 | 78 | 235                              | 221   | 205   | 14.6 | 185             | 174 | 161 | 86 |
| 13.0 | 93                                      | 88   | 81   | 23.3 | 86              | 81  | 75 | 72 | 130                              | 123   | 113  | 19.7 | 120             | 113 | 105 | 78 | 205                              | 193   | 178   | 15.7 | 189             | 178 | 164 | 86 |
| 14.0 | 82                                      | 77   | 71   | 24.8 | 88              | 82  | 76 | 73 | 115                              | 108   | 100  | 21.0 | 123             | 115 | 107 | 79 | 180                              | 170   | 157   | 16.7 | 193             | 181 | 168 | 86 |
| 15.0 | 73                                      | 68   | 63   | 26.3 | 89              | 84  | 78 | 73 | 102                              | 96    | 89   | 22.2 | 125             | 118 | 109 | 79 | 160                              | 150   | 139   | 17.7 | 196             | 185 | 171 | 87 |
| 16.0 | 65                                      | 61   | 57   | 27.8 | 91              | 85  | 79 | 73 | 91                               | 86    | 79   | 23.5 | 127             | 120 | 111 | 79 | 143                              | 135   | 124   | 18.8 | 200             | 188 | 174 | 87 |
| 17.0 | 59                                      | 55   | 51   | 29.3 | 92              | 87  | 80 | 74 | 82                               | 77    | 71   | 24.8 | 129             | 122 | 112 | 79 | 129                              | 121   | 112   | 19.8 | 203             | 191 | 177 | 87 |
| 18.0 | 53                                      | 50   | 46   | 30.8 | 94              | 88  | 82 | 74 | 74                               | 70    | 65   | 26.0 | 131             | 123 | 114 | 80 | 117                              | 110   | 101   | 20.8 | 206             | 194 | 179 | 88 |
| 19.0 | 48                                      | 45   | 42   | 32.3 | 95              | 89  | 83 | 74 | 68                               | 64    | 59   | 27.3 | 133             | 125 | 116 | 80 | 106                              | 100   | 92    | 21.8 | 209             | 197 | 182 | 88 |
| 20.0 | 44                                      | 42   | 38   | 33.7 | 96              | 91  | 84 | 74 | 62                               | 58    | 54   | 28.5 | 135             | 127 | 117 | 80 | 97                               | 91    | 85    | 22.8 | 212             | 200 | 185 | 88 |
| 22.0 | 37                                      | 35   | 33   | 36.6 | 99              | 93  | 86 | 75 | 52                               | 49    | 46   | 31.0 | 138             | 130 | 120 | 81 | 82                               | 78    | 72    | 24.7 | 217             | 205 | 189 | 89 |
| 24.0 | 32                                      | 30   | 28   | 39.5 | 101             | 95  | 88 | 75 | 45                               | 42    | 39   | 33.4 | 142             | 133 | 123 | 81 | 71                               | 67    | 62    | 26.6 | 223             | 210 | 194 | 89 |
| 26.0 | 28                                      | 26   | 24   | 42.3 | 103             | 97  | 90 | 76 | 39                               | 37    | 34   | 35.8 | 145             | 136 | 126 | 81 | 62                               | 58    | 54    | 28.6 | 228             | 214 | 198 | 89 |
| 28.0 | 25                                      | 23   | 21   | 45.2 | 106             | 99  | 92 | 76 | 35                               | 33    | 30   | 38.2 | 148             | 139 | 129 | 82 | 54                               | 51    | 47    | 30.4 | 232             | 219 | 202 | 90 |
| 30.0 | 22                                      | 21   | 19   | 47.9 | 107             | 101 | 94 | 76 | 31                               | 29    | 27   | 40.5 | 150             | 142 | 131 | 82 | 48                               | 45    | 42    | 32.3 | 236             | 223 | 206 | 90 |



**Table E3:** Engelmann spruce stocking levels for the ABGR/LIBO2 plant association (B-O province) and the PICO(ABGR)/VAME-LIBO2 plant community type.

| QMD  | Climate Resilience; SDI 125; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 175; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 274; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6699                                    | 6308 | 5833 | 2.7  | 37              | 34 | 32 | 58 | 9379                             | 8831 | 8166 | 2.3  | 51              | 48  | 45  | 63 | 14739                            | 13877 | 12832 | 1.8  | 80              | 76  | 70  | 71 |
| 1.5  | 3322                                    | 3128 | 2892 | 3.9  | 41              | 38 | 35 | 60 | 4651                             | 4379 | 4049 | 3.3  | 57              | 54  | 50  | 65 | 7308                             | 6881  | 6363  | 2.6  | 90              | 84  | 78  | 73 |
| 2.0  | 2020                                    | 1901 | 1758 | 5.0  | 44              | 41 | 38 | 61 | 2827                             | 2662 | 2462 | 4.2  | 62              | 58  | 54  | 67 | 4443                             | 4183  | 3868  | 3.4  | 97              | 91  | 84  | 74 |
| 2.5  | 1373                                    | 1292 | 1195 | 6.1  | 47              | 44 | 41 | 62 | 1922                             | 1809 | 1673 | 5.1  | 66              | 62  | 57  | 68 | 3020                             | 2843  | 2629  | 4.1  | 103             | 97  | 90  | 76 |
| 3.0  | 1001                                    | 943  | 872  | 7.1  | 49              | 46 | 43 | 63 | 1402                             | 1320 | 1221 | 6.0  | 69              | 65  | 60  | 69 | 2203                             | 2074  | 1918  | 4.8  | 108             | 102 | 94  | 76 |
| 3.5  | 767                                     | 722  | 668  | 8.1  | 51              | 48 | 45 | 63 | 1074                             | 1011 | 935  | 6.8  | 72              | 68  | 62  | 69 | 1687                             | 1589  | 1469  | 5.5  | 113             | 106 | 98  | 77 |
| 4.0  | 609                                     | 573  | 530  | 9.1  | 53              | 50 | 46 | 64 | 852                              | 802  | 742  | 7.7  | 74              | 70  | 65  | 70 | 1339                             | 1261  | 1166  | 6.1  | 117             | 110 | 102 | 78 |
| 4.5  | 497                                     | 468  | 432  | 10.1 | 55              | 52 | 48 | 65 | 695                              | 655  | 605  | 8.5  | 77              | 72  | 67  | 70 | 1092                             | 1029  | 951   | 6.8  | 121             | 114 | 105 | 78 |
| 5.0  | 414                                     | 390  | 360  | 11.0 | 56              | 53 | 49 | 65 | 579                              | 545  | 504  | 9.3  | 79              | 74  | 69  | 71 | 910                              | 857   | 793   | 7.4  | 124             | 117 | 108 | 79 |
| 5.5  | 351                                     | 330  | 306  | 12.0 | 58              | 55 | 50 | 66 | 491                              | 463  | 428  | 10.1 | 81              | 76  | 71  | 71 | 772                              | 727   | 672   | 8.1  | 127             | 120 | 111 | 79 |
| 6.0  | 302                                     | 284  | 263  | 12.9 | 59              | 56 | 52 | 66 | 423                              | 398  | 368  | 10.9 | 83              | 78  | 72  | 72 | 664                              | 625   | 578   | 8.7  | 130             | 123 | 114 | 80 |
| 6.5  | 263                                     | 247  | 229  | 13.8 | 61              | 57 | 53 | 66 | 368                              | 346  | 320  | 11.7 | 85              | 80  | 74  | 72 | 578                              | 544   | 503   | 9.3  | 133             | 125 | 116 | 80 |
| 7.0  | 231                                     | 218  | 201  | 14.7 | 62              | 58 | 54 | 67 | 324                              | 305  | 282  | 12.5 | 87              | 81  | 75  | 73 | 509                              | 479   | 443   | 9.9  | 136             | 128 | 118 | 80 |
| 7.5  | 205                                     | 193  | 179  | 15.7 | 63              | 59 | 55 | 67 | 287                              | 270  | 250  | 13.2 | 88              | 83  | 77  | 73 | 451                              | 425   | 393   | 10.6 | 139             | 130 | 121 | 81 |
| 8.0  | 184                                     | 173  | 160  | 16.6 | 64              | 60 | 56 | 67 | 257                              | 242  | 224  | 14.0 | 90              | 84  | 78  | 73 | 404                              | 380   | 352   | 11.2 | 141             | 133 | 123 | 81 |
| 8.5  | 165                                     | 156  | 144  | 17.4 | 65              | 61 | 57 | 68 | 231                              | 218  | 201  | 14.7 | 91              | 86  | 79  | 73 | 364                              | 342   | 317   | 11.8 | 143             | 135 | 125 | 81 |
| 9.0  | 150                                     | 141  | 130  | 18.3 | 66              | 62 | 58 | 68 | 210                              | 197  | 182  | 15.5 | 93              | 87  | 81  | 74 | 329                              | 310   | 287   | 12.4 | 145             | 137 | 127 | 82 |
| 9.5  | 136                                     | 128  | 119  | 19.2 | 67              | 63 | 58 | 68 | 191                              | 180  | 166  | 16.2 | 94              | 88  | 82  | 74 | 300                              | 282   | 261   | 13.0 | 148             | 139 | 129 | 82 |
| 10.0 | 125                                     | 117  | 109  | 20.1 | 68              | 64 | 59 | 68 | 175                              | 164  | 152  | 17.0 | 95              | 90  | 83  | 74 | 274                              | 258   | 239   | 13.5 | 150             | 141 | 130 | 82 |
| 11.0 | 106                                     | 100  | 92   | 21.8 | 70              | 66 | 61 | 69 | 148                              | 139  | 129  | 18.4 | 98              | 92  | 85  | 75 | 233                              | 219   | 203   | 14.7 | 154             | 145 | 134 | 83 |
| 12.0 | 91                                      | 86   | 79   | 23.5 | 71              | 67 | 62 | 69 | 127                              | 120  | 111  | 19.9 | 100             | 94  | 87  | 75 | 200                              | 188   | 174   | 15.9 | 157             | 148 | 137 | 83 |
| 13.0 | 79                                      | 75   | 69   | 25.2 | 73              | 69 | 64 | 70 | 111                              | 104  | 97   | 21.3 | 102             | 96  | 89  | 75 | 174                              | 164   | 152   | 17.0 | 161             | 151 | 140 | 83 |
| 14.0 | 70                                      | 66   | 61   | 26.9 | 75              | 70 | 65 | 70 | 98                               | 92   | 85   | 22.7 | 104             | 98  | 91  | 76 | 153                              | 144   | 133   | 18.1 | 164             | 154 | 143 | 84 |
| 15.0 | 62                                      | 58   | 54   | 28.5 | 76              | 71 | 66 | 70 | 87                               | 82   | 75   | 24.1 | 106             | 100 | 93  | 76 | 136                              | 128   | 118   | 19.2 | 167             | 157 | 145 | 84 |
| 16.0 | 55                                      | 52   | 48   | 30.2 | 77              | 73 | 67 | 71 | 77                               | 73   | 67   | 25.5 | 108             | 102 | 94  | 76 | 122                              | 115   | 106   | 20.3 | 170             | 160 | 148 | 84 |
| 17.0 | 50                                      | 47   | 43   | 31.8 | 79              | 74 | 68 | 71 | 70                               | 66   | 61   | 26.9 | 110             | 103 | 96  | 77 | 110                              | 103   | 95    | 21.4 | 173             | 163 | 150 | 85 |
| 18.0 | 45                                      | 42   | 39   | 33.4 | 80              | 75 | 69 | 71 | 63                               | 59   | 55   | 28.2 | 112             | 105 | 97  | 77 | 99                               | 93    | 86    | 22.5 | 175             | 165 | 153 | 85 |
| 19.0 | 41                                      | 39   | 36   | 35.0 | 81              | 76 | 70 | 71 | 58                               | 54   | 50   | 29.6 | 113             | 107 | 99  | 77 | 90                               | 85    | 79    | 23.6 | 178             | 168 | 155 | 85 |
| 20.0 | 38                                      | 35   | 33   | 36.6 | 82              | 77 | 71 | 72 | 53                               | 50   | 46   | 30.9 | 115             | 108 | 100 | 77 | 83                               | 78    | 72    | 24.7 | 180             | 170 | 157 | 85 |
| 22.0 | 32                                      | 30   | 28   | 39.7 | 84              | 79 | 73 | 72 | 45                               | 42   | 39   | 33.6 | 118             | 111 | 103 | 78 | 70                               | 66    | 61    | 26.8 | 185             | 174 | 161 | 86 |
| 24.0 | 27                                      | 26   | 24   | 42.8 | 86              | 81 | 75 | 72 | 38                               | 36   | 33   | 36.2 | 121             | 114 | 105 | 78 | 60                               | 57    | 53    | 28.9 | 190             | 179 | 165 | 86 |
| 26.0 | 24                                      | 22   | 21   | 45.9 | 88              | 83 | 77 | 73 | 33                               | 31   | 29   | 38.8 | 123             | 116 | 107 | 79 | 53                               | 49    | 46    | 30.9 | 194             | 182 | 169 | 87 |
| 28.0 | 21                                      | 20   | 18   | 48.9 | 90              | 85 | 78 | 73 | 29                               | 28   | 26   | 41.4 | 126             | 118 | 110 | 79 | 46                               | 44    | 40    | 33.0 | 198             | 186 | 172 | 87 |
| 30.0 | 19                                      | 18   | 16   | 51.9 | 92              | 86 | 80 | 73 | 26                               | 25   | 23   | 43.9 | 128             | 121 | 112 | 79 | 41                               | 39    | 36    | 35.0 | 201             | 190 | 175 | 87 |

**Table E4:** Engelmann spruce stocking levels for the ABGR/TABR/CLUN plant association (B-O province).

| QMD  | Climate Resilience; SDI 133; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 186; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 293; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7156                                    | 6737 | 6230 | 2.7  | 39              | 37 | 34 | 59 | 10018                            | 9432 | 8722 | 2.2  | 55              | 51  | 48  | 65 | 15743                            | 14822 | 13706 | 1.8  | 86              | 81  | 75  | 72 |
| 1.5  | 3548                                    | 3341 | 3089 | 3.8  | 44              | 41 | 38 | 61 | 4968                             | 4677 | 4325 | 3.2  | 61              | 57  | 53  | 66 | 7806                             | 7350  | 6796  | 2.5  | 96              | 90  | 83  | 74 |
| 2.0  | 2157                                    | 2031 | 1878 | 4.8  | 47              | 44 | 41 | 62 | 3020                             | 2843 | 2629 | 4.1  | 66              | 62  | 57  | 68 | 4746                             | 4468  | 4132  | 3.3  | 104             | 97  | 90  | 76 |
| 2.5  | 1466                                    | 1381 | 1277 | 5.9  | 50              | 47 | 44 | 63 | 2053                             | 1933 | 1787 | 5.0  | 70              | 66  | 61  | 69 | 3226                             | 3037  | 2808  | 3.9  | 110             | 104 | 96  | 77 |
| 3.0  | 1070                                    | 1007 | 931  | 6.9  | 53              | 49 | 46 | 64 | 1498                             | 1410 | 1304 | 5.8  | 74              | 69  | 64  | 70 | 2353                             | 2216  | 2049  | 4.6  | 116             | 109 | 101 | 78 |
| 3.5  | 819                                     | 771  | 713  | 7.8  | 55              | 52 | 48 | 65 | 1147                             | 1080 | 999  | 6.6  | 77              | 72  | 67  | 70 | 1802                             | 1697  | 1569  | 5.3  | 120             | 113 | 105 | 78 |
| 4.0  | 650                                     | 612  | 566  | 8.8  | 57              | 53 | 49 | 65 | 910                              | 857  | 793  | 7.4  | 79              | 75  | 69  | 71 | 1431                             | 1347  | 1246  | 5.9  | 125             | 118 | 109 | 79 |
| 4.5  | 530                                     | 499  | 462  | 9.7  | 59              | 55 | 51 | 66 | 743                              | 699  | 646  | 8.2  | 82              | 77  | 71  | 72 | 1167                             | 1099  | 1016  | 6.6  | 129             | 121 | 112 | 79 |
| 5.0  | 442                                     | 416  | 385  | 10.7 | 60              | 57 | 52 | 66 | 619                              | 583  | 539  | 9.0  | 84              | 79  | 73  | 72 | 972                              | 916   | 847   | 7.2  | 133             | 125 | 115 | 80 |
| 5.5  | 375                                     | 353  | 326  | 11.6 | 62              | 58 | 54 | 67 | 525                              | 494  | 457  | 9.8  | 87              | 82  | 75  | 73 | 825                              | 776   | 718   | 7.8  | 136             | 128 | 118 | 80 |
| 6.0  | 322                                     | 304  | 281  | 12.5 | 63              | 60 | 55 | 67 | 451                              | 425  | 393  | 10.6 | 89              | 83  | 77  | 73 | 709                              | 668   | 618   | 8.4  | 139             | 131 | 121 | 81 |
| 6.5  | 281                                     | 264  | 244  | 13.4 | 65              | 61 | 56 | 67 | 393                              | 370  | 342  | 11.3 | 91              | 85  | 79  | 73 | 618                              | 582   | 538   | 9.0  | 142             | 134 | 124 | 81 |
| 7.0  | 247                                     | 233  | 215  | 14.3 | 66              | 62 | 57 | 68 | 346                              | 326  | 301  | 12.1 | 92              | 87  | 80  | 74 | 543                              | 512   | 473   | 9.6  | 145             | 137 | 126 | 82 |
| 7.5  | 219                                     | 206  | 191  | 15.1 | 67              | 63 | 59 | 68 | 307                              | 289  | 267  | 12.8 | 94              | 89  | 82  | 74 | 482                              | 454   | 420   | 10.2 | 148             | 139 | 129 | 82 |
| 8.0  | 196                                     | 185  | 171  | 16.0 | 68              | 64 | 60 | 68 | 274                              | 258  | 239  | 13.5 | 96              | 90  | 83  | 74 | 431                              | 406   | 375   | 10.8 | 151             | 142 | 131 | 82 |
| 8.5  | 177                                     | 166  | 154  | 16.9 | 70              | 65 | 61 | 69 | 247                              | 233  | 215  | 14.3 | 97              | 92  | 85  | 75 | 388                              | 366   | 338   | 11.4 | 153             | 144 | 133 | 82 |
| 9.0  | 160                                     | 151  | 139  | 17.7 | 71              | 67 | 61 | 69 | 224                              | 211  | 195  | 15.0 | 99              | 93  | 86  | 75 | 352                              | 331   | 306   | 12.0 | 155             | 146 | 135 | 83 |
| 9.5  | 146                                     | 137  | 127  | 18.6 | 72              | 67 | 62 | 69 | 204                              | 192  | 177  | 15.7 | 100             | 94  | 87  | 75 | 320                              | 302   | 279   | 12.5 | 158             | 148 | 137 | 83 |
| 10.0 | 133                                     | 125  | 116  | 19.4 | 73              | 68 | 63 | 69 | 187                              | 176  | 162  | 16.4 | 102             | 96  | 89  | 75 | 293                              | 276   | 255   | 13.1 | 160             | 151 | 139 | 83 |
| 11.0 | 113                                     | 106  | 98   | 21.1 | 75              | 70 | 65 | 70 | 158                              | 149  | 138  | 17.8 | 104             | 98  | 91  | 76 | 249                              | 234   | 216   | 14.2 | 164             | 154 | 143 | 84 |
| 12.0 | 97                                      | 92   | 85   | 22.7 | 76              | 72 | 66 | 70 | 136                              | 128  | 118  | 19.2 | 107             | 101 | 93  | 76 | 214                              | 201   | 186   | 15.3 | 168             | 158 | 146 | 84 |
| 13.0 | 85                                      | 80   | 74   | 24.4 | 78              | 73 | 68 | 71 | 118                              | 112  | 103  | 20.6 | 109             | 103 | 95  | 77 | 186                              | 175   | 162   | 16.4 | 172             | 162 | 149 | 84 |
| 14.0 | 74                                      | 70   | 65   | 26.0 | 80              | 75 | 69 | 71 | 104                              | 98   | 91   | 22.0 | 111             | 105 | 97  | 77 | 164                              | 154   | 143   | 17.5 | 175             | 165 | 152 | 85 |
| 15.0 | 66                                      | 62   | 58   | 27.6 | 81              | 76 | 71 | 71 | 93                               | 87   | 81   | 23.3 | 114             | 107 | 99  | 77 | 145                              | 137   | 127   | 18.6 | 178             | 168 | 155 | 85 |
| 16.0 | 59                                      | 56   | 51   | 29.2 | 83              | 78 | 72 | 72 | 83                               | 78   | 72   | 24.7 | 116             | 109 | 101 | 78 | 130                              | 122   | 113   | 19.7 | 182             | 171 | 158 | 85 |
| 17.0 | 53                                      | 50   | 46   | 30.7 | 84              | 79 | 73 | 72 | 74                               | 70   | 65   | 26.0 | 117             | 111 | 102 | 78 | 117                              | 110   | 102   | 20.7 | 185             | 174 | 161 | 86 |
| 18.0 | 48                                      | 45   | 42   | 32.3 | 85              | 80 | 74 | 72 | 67                               | 64   | 59   | 27.3 | 119             | 112 | 104 | 78 | 106                              | 100   | 92    | 21.8 | 187             | 176 | 163 | 86 |
| 19.0 | 44                                      | 41   | 38   | 33.9 | 86              | 81 | 75 | 73 | 61                               | 58   | 54   | 28.6 | 121             | 114 | 105 | 78 | 97                               | 91    | 84    | 22.8 | 190             | 179 | 166 | 86 |
| 20.0 | 40                                      | 38   | 35   | 35.4 | 88              | 83 | 76 | 73 | 56                               | 53   | 49   | 29.9 | 123             | 116 | 107 | 79 | 88                               | 83    | 77    | 23.9 | 193             | 182 | 168 | 86 |
| 22.0 | 34                                      | 32   | 30   | 38.4 | 90              | 85 | 78 | 73 | 48                               | 45   | 42   | 32.5 | 126             | 119 | 110 | 79 | 75                               | 71    | 65    | 25.9 | 198             | 186 | 172 | 87 |
| 24.0 | 29                                      | 28   | 26   | 41.4 | 92              | 87 | 80 | 74 | 41                               | 39   | 36   | 35.0 | 129             | 121 | 112 | 79 | 64                               | 61    | 56    | 27.9 | 203             | 191 | 176 | 87 |
| 26.0 | 26                                      | 24   | 22   | 44.4 | 94              | 89 | 82 | 74 | 36                               | 34   | 31   | 37.5 | 132             | 124 | 115 | 80 | 56                               | 53    | 49    | 29.9 | 207             | 195 | 180 | 88 |
| 28.0 | 22                                      | 21   | 20   | 47.3 | 96              | 90 | 84 | 74 | 31                               | 30   | 27   | 40.0 | 134             | 126 | 117 | 80 | 49                               | 46    | 43    | 31.9 | 211             | 199 | 184 | 88 |
| 30.0 | 20                                      | 19   | 17   | 50.3 | 98              | 92 | 85 | 75 | 28                               | 26   | 24   | 42.5 | 137             | 129 | 119 | 81 | 44                               | 41    | 38    | 33.9 | 215             | 203 | 187 | 88 |

**Table E5:** Engelmann spruce stocking levels for the ABGR/TABR/LIBO2 (B-O province) and TSME/VASC+VAME (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 93; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 130; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 204; 55% of Max |       |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4981                                   | 4690 | 4336 | 3.2  | 27              | 26 | 24 | 53 | 6973                             | 6565 | 6071 | 2.7  | 38              | 36 | 33 | 58 | 10958                            | 10317 | 9540 | 2.1  | 60              | 56  | 52  | 66 |
| 1.5  | 2470                                   | 2325 | 2150 | 4.5  | 30              | 29 | 26 | 54 | 3458                             | 3256 | 3010 | 3.8  | 42              | 40 | 37 | 60 | 5434                             | 5116  | 4731 | 3.0  | 67              | 63  | 58  | 68 |
| 2.0  | 1502                                   | 1414 | 1307 | 5.8  | 33              | 31 | 29 | 56 | 2102                             | 1979 | 1830 | 4.9  | 46              | 43 | 40 | 62 | 3303                             | 3110  | 2876 | 3.9  | 72              | 68  | 63  | 69 |
| 2.5  | 1021                                   | 961  | 889  | 7.0  | 35              | 33 | 30 | 57 | 1429                             | 1345 | 1244 | 5.9  | 49              | 46 | 42 | 63 | 2245                             | 2114  | 1955 | 4.7  | 77              | 72  | 67  | 70 |
| 3.0  | 745                                    | 701  | 648  | 8.2  | 37              | 34 | 32 | 58 | 1042                             | 981  | 907  | 6.9  | 51              | 48 | 45 | 63 | 1638                             | 1542  | 1426 | 5.5  | 80              | 76  | 70  | 71 |
| 3.5  | 570                                    | 537  | 496  | 9.4  | 38              | 36 | 33 | 58 | 798                              | 752  | 695  | 7.9  | 53              | 50 | 46 | 64 | 1255                             | 1181  | 1092 | 6.3  | 84              | 79  | 73  | 72 |
| 4.0  | 453                                    | 426  | 394  | 10.5 | 40              | 37 | 34 | 59 | 634                              | 597  | 552  | 8.9  | 55              | 52 | 48 | 65 | 996                              | 938   | 867  | 7.1  | 87              | 82  | 76  | 73 |
| 4.5  | 369                                    | 348  | 321  | 11.7 | 41              | 38 | 35 | 60 | 517                              | 487  | 450  | 9.9  | 57              | 54 | 50 | 65 | 812                              | 765   | 707  | 7.9  | 90              | 84  | 78  | 73 |
| 5.0  | 308                                    | 290  | 268  | 12.8 | 42              | 39 | 37 | 60 | 431                              | 406  | 375  | 10.8 | 59              | 55 | 51 | 66 | 677                              | 637   | 589  | 8.6  | 92              | 87  | 80  | 74 |
| 5.5  | 261                                    | 246  | 227  | 13.9 | 43              | 41 | 37 | 60 | 365                              | 344  | 318  | 11.7 | 60              | 57 | 52 | 66 | 574                              | 540   | 500  | 9.4  | 95              | 89  | 82  | 74 |
| 6.0  | 224                                    | 211  | 195  | 15.0 | 44              | 41 | 38 | 61 | 314                              | 296  | 274  | 12.7 | 62              | 58 | 54 | 67 | 494                              | 465   | 430  | 10.1 | 97              | 91  | 84  | 74 |
| 6.5  | 195                                    | 184  | 170  | 16.0 | 45              | 42 | 39 | 61 | 274                              | 258  | 238  | 13.6 | 63              | 59 | 55 | 67 | 430                              | 405   | 374  | 10.8 | 99              | 93  | 86  | 75 |
| 7.0  | 172                                    | 162  | 150  | 17.1 | 46              | 43 | 40 | 62 | 241                              | 227  | 210  | 14.5 | 64              | 61 | 56 | 67 | 378                              | 356   | 329  | 11.5 | 101             | 95  | 88  | 75 |
| 7.5  | 153                                    | 144  | 133  | 18.2 | 47              | 44 | 41 | 62 | 214                              | 201  | 186  | 15.3 | 66              | 62 | 57 | 68 | 336                              | 316   | 292  | 12.2 | 103             | 97  | 90  | 76 |
| 8.0  | 136                                    | 128  | 119  | 19.2 | 48              | 45 | 41 | 62 | 191                              | 180  | 166  | 16.2 | 67              | 63 | 58 | 68 | 300                              | 283   | 261  | 12.9 | 105             | 99  | 91  | 76 |
| 8.5  | 123                                    | 116  | 107  | 20.2 | 48              | 46 | 42 | 62 | 172                              | 162  | 150  | 17.1 | 68              | 64 | 59 | 68 | 270                              | 254   | 235  | 13.6 | 107             | 100 | 93  | 76 |
| 9.0  | 111                                    | 105  | 97   | 21.3 | 49              | 46 | 43 | 63 | 156                              | 147  | 136  | 18.0 | 69              | 65 | 60 | 69 | 245                              | 231   | 213  | 14.3 | 108             | 102 | 94  | 76 |
| 9.5  | 101                                    | 95   | 88   | 22.3 | 50              | 47 | 43 | 63 | 142                              | 134  | 124  | 18.8 | 70              | 66 | 61 | 69 | 223                              | 210   | 194  | 15.0 | 110             | 103 | 96  | 77 |
| 10.0 | 93                                     | 87   | 81   | 23.3 | 51              | 48 | 44 | 63 | 130                              | 122  | 113  | 19.7 | 71              | 67 | 62 | 69 | 204                              | 192   | 178  | 15.7 | 111             | 105 | 97  | 77 |
| 11.0 | 79                                     | 74   | 68   | 25.3 | 52              | 49 | 45 | 64 | 110                              | 104  | 96   | 21.4 | 73              | 68 | 63 | 69 | 173                              | 163   | 151  | 17.0 | 114             | 108 | 99  | 77 |
| 12.0 | 68                                     | 64   | 59   | 27.3 | 53              | 50 | 46 | 64 | 95                               | 89   | 82   | 23.0 | 74              | 70 | 65 | 70 | 149                              | 140   | 130  | 18.4 | 117             | 110 | 102 | 78 |
| 13.0 | 59                                     | 55   | 51   | 29.2 | 54              | 51 | 47 | 64 | 82                               | 78   | 72   | 24.7 | 76              | 72 | 66 | 70 | 130                              | 122   | 113  | 19.7 | 119             | 112 | 104 | 78 |
| 14.0 | 52                                     | 49   | 45   | 31.2 | 55              | 52 | 48 | 65 | 73                               | 68   | 63   | 26.3 | 78              | 73 | 68 | 71 | 114                              | 107   | 99   | 21.0 | 122             | 115 | 106 | 78 |
| 15.0 | 46                                     | 43   | 40   | 33.1 | 56              | 53 | 49 | 65 | 64                               | 61   | 56   | 28.0 | 79              | 74 | 69 | 71 | 101                              | 95    | 88   | 22.3 | 124             | 117 | 108 | 79 |
| 16.0 | 41                                     | 39   | 36   | 35.0 | 57              | 54 | 50 | 65 | 58                               | 54   | 50   | 29.6 | 80              | 76 | 70 | 71 | 90                               | 85    | 79   | 23.6 | 126             | 119 | 110 | 79 |
| 17.0 | 37                                     | 35   | 32   | 36.9 | 58              | 55 | 51 | 66 | 52                               | 49   | 45   | 31.1 | 82              | 77 | 71 | 72 | 81                               | 77    | 71   | 24.8 | 128             | 121 | 112 | 79 |
| 18.0 | 34                                     | 32   | 29   | 38.7 | 59              | 56 | 52 | 66 | 47                               | 44   | 41   | 32.7 | 83              | 78 | 72 | 72 | 74                               | 69    | 64   | 26.1 | 130             | 123 | 114 | 80 |
| 19.0 | 31                                     | 29   | 27   | 40.6 | 60              | 57 | 52 | 66 | 43                               | 40   | 37   | 34.3 | 84              | 79 | 73 | 72 | 67                               | 63    | 59   | 27.4 | 132             | 125 | 115 | 80 |
| 20.0 | 28                                     | 26   | 24   | 42.4 | 61              | 57 | 53 | 66 | 39                               | 37   | 34   | 35.8 | 85              | 80 | 74 | 72 | 62                               | 58    | 54   | 28.6 | 134             | 126 | 117 | 80 |
| 22.0 | 24                                     | 22   | 21   | 46.1 | 63              | 59 | 54 | 67 | 33                               | 31   | 29   | 38.9 | 88              | 82 | 76 | 73 | 52                               | 49    | 45   | 31.1 | 138             | 130 | 120 | 81 |
| 24.0 | 20                                     | 19   | 18   | 49.7 | 64              | 60 | 56 | 67 | 29                               | 27   | 25   | 42.0 | 90              | 84 | 78 | 73 | 45                               | 42    | 39   | 33.5 | 141             | 133 | 123 | 81 |
| 26.0 | 18                                     | 17   | 15   | 53.2 | 65              | 62 | 57 | 68 | 25                               | 23   | 22   | 45.0 | 92              | 86 | 80 | 74 | 39                               | 37    | 34   | 35.9 | 144             | 136 | 125 | 81 |
| 28.0 | 16                                     | 15   | 14   | 56.7 | 67              | 63 | 58 | 68 | 22                               | 21   | 19   | 48.0 | 94              | 88 | 81 | 74 | 34                               | 32    | 30   | 38.3 | 147             | 138 | 128 | 82 |
| 30.0 | 14                                     | 13   | 12   | 60.2 | 68              | 64 | 59 | 68 | 19                               | 18   | 17   | 50.9 | 95              | 90 | 83 | 74 | 31                               | 29    | 27   | 40.6 | 150             | 141 | 130 | 82 |

**Table E6:** Engelmann spruce stocking levels for the ABGR/TRCA3 plant association (B-O province).

| QMD  | Climate Resilience; SDI 121; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 170; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 267; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6512                                    | 6131 | 5669 | 2.8  | 36              | 33 | 31 | 57 | 9116                             | 8583 | 7936 | 2.3  | 50              | 47  | 43  | 63 | 14325                            | 13487 | 12472 | 1.9  | 78              | 74  | 68  | 71 |
| 1.5  | 3229                                    | 3040 | 2811 | 3.9  | 40              | 37 | 34 | 59 | 4520                             | 4256 | 3935 | 3.3  | 55              | 52  | 48  | 65 | 7103                             | 6688  | 6184  | 2.7  | 87              | 82  | 76  | 73 |
| 2.0  | 1963                                    | 1848 | 1709 | 5.1  | 43              | 40 | 37 | 60 | 2748                             | 2587 | 2392 | 4.3  | 60              | 56  | 52  | 66 | 4318                             | 4066  | 3760  | 3.4  | 94              | 89  | 82  | 74 |
| 2.5  | 1334                                    | 1256 | 1162 | 6.1  | 45              | 43 | 40 | 61 | 1868                             | 1759 | 1626 | 5.2  | 64              | 60  | 55  | 67 | 2935                             | 2764  | 2556  | 4.1  | 100             | 94  | 87  | 75 |
| 3.0  | 973                                     | 916  | 847  | 7.2  | 48              | 45 | 42 | 62 | 1363                             | 1283 | 1186 | 6.1  | 67              | 63  | 58  | 68 | 2141                             | 2016  | 1864  | 4.8  | 105             | 99  | 92  | 76 |
| 3.5  | 745                                     | 702  | 649  | 8.2  | 50              | 47 | 43 | 63 | 1044                             | 983  | 909  | 6.9  | 70              | 66  | 61  | 69 | 1640                             | 1544  | 1428  | 5.5  | 110             | 103 | 95  | 77 |
| 4.0  | 592                                     | 557  | 515  | 9.2  | 52              | 49 | 45 | 64 | 828                              | 780  | 721  | 7.8  | 72              | 68  | 63  | 69 | 1302                             | 1226  | 1133  | 6.2  | 114             | 107 | 99  | 77 |
| 4.5  | 483                                     | 454  | 420  | 10.2 | 53              | 50 | 46 | 64 | 676                              | 636  | 588  | 8.6  | 75              | 70  | 65  | 70 | 1062                             | 1000  | 924   | 6.9  | 117             | 110 | 102 | 78 |
| 5.0  | 402                                     | 379  | 350  | 11.2 | 55              | 52 | 48 | 65 | 563                              | 530  | 490  | 9.5  | 77              | 72  | 67  | 70 | 885                              | 833   | 770   | 7.5  | 121             | 114 | 105 | 78 |
| 5.5  | 341                                     | 321  | 297  | 12.1 | 56              | 53 | 49 | 65 | 478                              | 450  | 416  | 10.3 | 79              | 74  | 69  | 71 | 750                              | 706   | 653   | 8.2  | 124             | 117 | 108 | 79 |
| 6.0  | 293                                     | 276  | 255  | 13.1 | 58              | 54 | 50 | 65 | 411                              | 387  | 358  | 11.1 | 81              | 76  | 70  | 71 | 646                              | 608   | 562   | 8.8  | 127             | 119 | 110 | 79 |
| 6.5  | 255                                     | 241  | 222  | 14.0 | 59              | 55 | 51 | 66 | 358                              | 337  | 311  | 11.9 | 82              | 78  | 72  | 72 | 562                              | 529   | 489   | 9.5  | 130             | 122 | 113 | 80 |
| 7.0  | 225                                     | 212  | 196  | 15.0 | 60              | 57 | 52 | 66 | 315                              | 296  | 274  | 12.6 | 84              | 79  | 73  | 72 | 494                              | 465   | 430   | 10.1 | 132             | 124 | 115 | 80 |
| 7.5  | 199                                     | 188  | 174  | 15.9 | 61              | 58 | 53 | 67 | 279                              | 263  | 243  | 13.4 | 86              | 81  | 75  | 72 | 439                              | 413   | 382   | 10.7 | 135             | 127 | 117 | 80 |
| 8.0  | 178                                     | 168  | 155  | 16.8 | 62              | 59 | 54 | 67 | 250                              | 235  | 217  | 14.2 | 87              | 82  | 76  | 73 | 392                              | 369   | 342   | 11.3 | 137             | 129 | 119 | 81 |
| 8.5  | 161                                     | 151  | 140  | 17.7 | 63              | 60 | 55 | 67 | 225                              | 212  | 196  | 15.0 | 89              | 83  | 77  | 73 | 353                              | 333   | 308   | 11.9 | 139             | 131 | 121 | 81 |
| 9.0  | 145                                     | 137  | 127  | 18.6 | 64              | 61 | 56 | 67 | 204                              | 192  | 177  | 15.7 | 90              | 85  | 78  | 73 | 320                              | 301   | 279   | 12.5 | 141             | 133 | 123 | 81 |
| 9.5  | 133                                     | 125  | 115  | 19.5 | 65              | 61 | 57 | 68 | 186                              | 175  | 161  | 16.5 | 91              | 86  | 79  | 73 | 292                              | 274   | 254   | 13.1 | 143             | 135 | 125 | 81 |
| 10.0 | 121                                     | 114  | 106  | 20.4 | 66              | 62 | 58 | 68 | 170                              | 160  | 148  | 17.2 | 93              | 87  | 81  | 74 | 267                              | 251   | 232   | 13.7 | 145             | 137 | 127 | 82 |
| 11.0 | 103                                     | 97   | 90   | 22.1 | 68              | 64 | 59 | 68 | 144                              | 136  | 125  | 18.7 | 95              | 89  | 83  | 74 | 226                              | 213   | 197   | 14.9 | 149             | 141 | 130 | 82 |
| 12.0 | 88                                      | 83   | 77   | 23.8 | 69              | 65 | 60 | 69 | 124                              | 117  | 108  | 20.2 | 97              | 92  | 85  | 75 | 195                              | 183   | 169   | 16.1 | 153             | 144 | 133 | 82 |
| 13.0 | 77                                      | 73   | 67   | 25.6 | 71              | 67 | 62 | 69 | 108                              | 102  | 94   | 21.6 | 99              | 94  | 87  | 75 | 169                              | 160   | 148   | 17.2 | 156             | 147 | 136 | 83 |
| 14.0 | 68                                      | 64   | 59   | 27.2 | 72              | 68 | 63 | 69 | 95                               | 89   | 83   | 23.0 | 101             | 95  | 88  | 75 | 149                              | 140   | 130   | 18.4 | 159             | 150 | 139 | 83 |
| 15.0 | 60                                      | 57   | 52   | 28.9 | 74              | 69 | 64 | 70 | 84                               | 79   | 73   | 24.4 | 103             | 97  | 90  | 76 | 132                              | 125   | 115   | 19.5 | 162             | 153 | 141 | 83 |
| 16.0 | 54                                      | 51   | 47   | 30.6 | 75              | 71 | 65 | 70 | 75                               | 71   | 66   | 25.8 | 105             | 99  | 92  | 76 | 118                              | 111   | 103   | 20.6 | 165             | 156 | 144 | 84 |
| 17.0 | 48                                      | 46   | 42   | 32.2 | 76              | 72 | 66 | 70 | 68                               | 64   | 59   | 27.2 | 107             | 101 | 93  | 76 | 107                              | 100   | 93    | 21.7 | 168             | 158 | 146 | 84 |
| 18.0 | 44                                      | 41   | 38   | 33.9 | 78              | 73 | 67 | 71 | 61                               | 58   | 53   | 28.6 | 109             | 102 | 94  | 76 | 96                               | 91    | 84    | 22.8 | 171             | 161 | 148 | 84 |
| 19.0 | 40                                      | 38   | 35   | 35.5 | 79              | 74 | 68 | 71 | 56                               | 53   | 49   | 30.0 | 110             | 104 | 96  | 77 | 88                               | 83    | 77    | 23.9 | 173             | 163 | 151 | 85 |
| 20.0 | 37                                      | 34   | 32   | 37.1 | 80              | 75 | 69 | 71 | 51                               | 48   | 45   | 31.4 | 112             | 105 | 97  | 77 | 80                               | 76    | 70    | 25.0 | 175             | 165 | 153 | 85 |
| 22.0 | 31                                      | 29   | 27   | 40.3 | 82              | 77 | 71 | 72 | 43                               | 41   | 38   | 34.0 | 115             | 108 | 100 | 77 | 68                               | 64    | 59    | 27.2 | 180             | 169 | 157 | 85 |
| 24.0 | 27                                      | 25   | 23   | 43.4 | 84              | 79 | 73 | 72 | 37                               | 35   | 32   | 36.7 | 117             | 110 | 102 | 78 | 59                               | 55    | 51    | 29.3 | 184             | 174 | 160 | 86 |
| 26.0 | 23                                      | 22   | 20   | 46.5 | 86              | 81 | 75 | 72 | 33                               | 31   | 28   | 39.3 | 120             | 113 | 104 | 78 | 51                               | 48    | 44    | 31.4 | 188             | 177 | 164 | 86 |
| 28.0 | 20                                      | 19   | 18   | 49.6 | 87              | 82 | 76 | 73 | 29                               | 27   | 25   | 41.9 | 122             | 115 | 106 | 79 | 45                               | 42    | 39    | 33.5 | 192             | 181 | 167 | 86 |
| 30.0 | 18                                      | 17   | 16   | 52.7 | 89              | 84 | 77 | 73 | 25                               | 24   | 22   | 44.5 | 125             | 117 | 108 | 79 | 40                               | 38    | 35    | 35.5 | 196             | 184 | 170 | 87 |

**Table E7:** Engelmann spruce stocking levels for the ABGR/VAME and ABLA2/TRCA3 plant associations (B-O province), and the ABLA2/ARCO, PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, and PICO(ABGR)/VAME/PTAQ plant community types.

| QMD  | Climate Resilience; SDI 107; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 149; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 234; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5719                                    | 5385 | 4979 | 3.0  | 31              | 29 | 27 | 55 | 8007                             | 7539 | 6971 | 2.5  | 44              | 41  | 38 | 61 | 12583                            | 11847 | 10954 | 2.0  | 69              | 65  | 60  | 69 |
| 1.5  | 2836                                    | 2670 | 2469 | 4.2  | 35              | 33 | 30 | 57 | 3970                             | 3738 | 3457 | 3.6  | 49              | 46  | 42 | 63 | 6239                             | 5874  | 5432  | 2.8  | 77              | 72  | 67  | 70 |
| 2.0  | 1724                                    | 1623 | 1501 | 5.4  | 38              | 35 | 33 | 58 | 2414                             | 2273 | 2101 | 4.6  | 53              | 50  | 46 | 64 | 3793                             | 3571  | 3302  | 3.6  | 83              | 78  | 72  | 72 |
| 2.5  | 1172                                    | 1103 | 1020 | 6.6  | 40              | 38 | 35 | 59 | 1641                             | 1545 | 1428 | 5.5  | 56              | 53  | 49 | 65 | 2578                             | 2427  | 2245  | 4.4  | 88              | 83  | 77  | 73 |
| 3.0  | 855                                     | 805  | 744  | 7.7  | 42              | 40 | 37 | 60 | 1197                             | 1127 | 1042 | 6.5  | 59              | 55  | 51 | 66 | 1881                             | 1771  | 1637  | 5.2  | 92              | 87  | 80  | 74 |
| 3.5  | 655                                     | 616  | 570  | 8.8  | 44              | 41 | 38 | 61 | 917                              | 863  | 798  | 7.4  | 61              | 58  | 53 | 67 | 1441                             | 1356  | 1254  | 5.9  | 96              | 91  | 84  | 74 |
| 4.0  | 520                                     | 489  | 452  | 9.8  | 45              | 43 | 39 | 61 | 728                              | 685  | 633  | 8.3  | 63              | 60  | 55 | 67 | 1143                             | 1077  | 995   | 6.6  | 100             | 94  | 87  | 75 |
| 4.5  | 424                                     | 399  | 369  | 10.9 | 47              | 44 | 41 | 62 | 593                              | 559  | 517  | 9.2  | 66              | 62  | 57 | 68 | 933                              | 878   | 812   | 7.3  | 103             | 97  | 90  | 76 |
| 5.0  | 353                                     | 333  | 308  | 11.9 | 48              | 45 | 42 | 62 | 495                              | 466  | 431  | 10.1 | 67              | 63  | 59 | 68 | 777                              | 732   | 677   | 8.0  | 106             | 100 | 92  | 76 |
| 5.5  | 300                                     | 282  | 261  | 13.0 | 49              | 47 | 43 | 63 | 419                              | 395  | 365  | 11.0 | 69              | 65  | 60 | 69 | 659                              | 621   | 574   | 8.7  | 109             | 102 | 95  | 76 |
| 6.0  | 258                                     | 243  | 224  | 14.0 | 51              | 48 | 44 | 63 | 361                              | 340  | 314  | 11.8 | 71              | 67  | 62 | 69 | 567                              | 534   | 494   | 9.4  | 111             | 105 | 97  | 77 |
| 6.5  | 224                                     | 211  | 195  | 15.0 | 52              | 49 | 45 | 64 | 314                              | 296  | 273  | 12.7 | 72              | 68  | 63 | 69 | 494                              | 465   | 430   | 10.1 | 114             | 107 | 99  | 77 |
| 7.0  | 197                                     | 186  | 172  | 16.0 | 53              | 50 | 46 | 64 | 276                              | 260  | 241  | 13.5 | 74              | 70  | 64 | 70 | 434                              | 409   | 378   | 10.8 | 116             | 109 | 101 | 78 |
| 7.5  | 175                                     | 165  | 153  | 16.9 | 54              | 51 | 47 | 64 | 245                              | 231  | 214  | 14.3 | 75              | 71  | 66 | 70 | 385                              | 363   | 336   | 11.4 | 118             | 111 | 103 | 78 |
| 8.0  | 157                                     | 148  | 136  | 17.9 | 55              | 51 | 48 | 65 | 219                              | 207  | 191  | 15.1 | 77              | 72  | 67 | 70 | 345                              | 325   | 300   | 12.1 | 120             | 113 | 105 | 78 |
| 8.5  | 141                                     | 133  | 123  | 18.9 | 56              | 52 | 48 | 65 | 198                              | 186  | 172  | 16.0 | 78              | 73  | 68 | 71 | 310                              | 292   | 270   | 12.7 | 122             | 115 | 106 | 79 |
| 9.0  | 128                                     | 120  | 111  | 19.8 | 56              | 53 | 49 | 65 | 179                              | 168  | 156  | 16.8 | 79              | 74  | 69 | 71 | 281                              | 265   | 245   | 13.4 | 124             | 117 | 108 | 79 |
| 9.5  | 116                                     | 110  | 101  | 20.8 | 57              | 54 | 50 | 65 | 163                              | 153  | 142  | 17.6 | 80              | 76  | 70 | 71 | 256                              | 241   | 223   | 14.0 | 126             | 119 | 110 | 79 |
| 10.0 | 107                                     | 100  | 93   | 21.7 | 58              | 55 | 51 | 66 | 149                              | 140  | 130  | 18.4 | 81              | 77  | 71 | 71 | 234                              | 221   | 204   | 14.7 | 128             | 120 | 111 | 79 |
| 11.0 | 90                                      | 85   | 79   | 23.6 | 60              | 56 | 52 | 66 | 126                              | 119  | 110  | 19.9 | 83              | 79  | 73 | 72 | 199                              | 187   | 173   | 15.9 | 131             | 123 | 114 | 80 |
| 12.0 | 78                                      | 73   | 68   | 25.4 | 61              | 57 | 53 | 66 | 109                              | 102  | 95   | 21.5 | 85              | 80  | 74 | 72 | 171                              | 161   | 149   | 17.2 | 134             | 126 | 117 | 80 |
| 13.0 | 68                                      | 64   | 59   | 27.3 | 62              | 59 | 54 | 67 | 95                               | 89   | 82   | 23.0 | 87              | 82  | 76 | 73 | 149                              | 140   | 130   | 18.4 | 137             | 129 | 119 | 81 |
| 14.0 | 60                                      | 56   | 52   | 29.1 | 64              | 60 | 55 | 67 | 83                               | 78   | 73   | 24.6 | 89              | 84  | 78 | 73 | 131                              | 123   | 114   | 19.6 | 140             | 132 | 122 | 81 |
| 15.0 | 53                                      | 50   | 46   | 30.9 | 65              | 61 | 56 | 68 | 74                               | 70   | 64   | 26.1 | 91              | 85  | 79 | 73 | 116                              | 109   | 101   | 20.8 | 143             | 134 | 124 | 81 |
| 16.0 | 47                                      | 44   | 41   | 32.6 | 66              | 62 | 57 | 68 | 66                               | 62   | 58   | 27.6 | 92              | 87  | 80 | 74 | 104                              | 98    | 90    | 22.0 | 145             | 137 | 126 | 82 |
| 17.0 | 43                                      | 40   | 37   | 34.4 | 67              | 63 | 58 | 68 | 60                               | 56   | 52   | 29.1 | 94              | 88  | 82 | 74 | 94                               | 88    | 81    | 23.2 | 147             | 139 | 128 | 82 |
| 18.0 | 39                                      | 36   | 34   | 36.1 | 68              | 64 | 59 | 68 | 54                               | 51   | 47   | 30.5 | 95              | 90  | 83 | 74 | 85                               | 80    | 74    | 24.4 | 150             | 141 | 130 | 82 |
| 19.0 | 35                                      | 33   | 31   | 37.9 | 69              | 65 | 60 | 69 | 49                               | 46   | 43   | 32.0 | 97              | 91  | 84 | 74 | 77                               | 73    | 67    | 25.5 | 152             | 143 | 132 | 82 |
| 20.0 | 32                                      | 30   | 28   | 39.6 | 70              | 66 | 61 | 69 | 45                               | 42   | 39   | 33.5 | 98              | 92  | 85 | 75 | 71                               | 66    | 61    | 26.7 | 154             | 145 | 134 | 83 |
| 22.0 | 27                                      | 26   | 24   | 43.0 | 72              | 68 | 63 | 69 | 38                               | 36   | 33   | 36.3 | 101             | 95  | 88 | 75 | 60                               | 56    | 52    | 29.0 | 158             | 149 | 138 | 83 |
| 24.0 | 23                                      | 22   | 20   | 46.3 | 74              | 69 | 64 | 70 | 33                               | 31   | 29   | 39.2 | 103             | 97  | 90 | 76 | 52                               | 49    | 45    | 31.2 | 162             | 152 | 141 | 83 |
| 26.0 | 20                                      | 19   | 18   | 49.7 | 75              | 71 | 65 | 70 | 29                               | 27   | 25   | 42.0 | 105             | 99  | 92 | 76 | 45                               | 42    | 39    | 33.5 | 165             | 156 | 144 | 84 |
| 28.0 | 18                                      | 17   | 16   | 53.0 | 77              | 72 | 67 | 70 | 25                               | 24   | 22   | 44.8 | 107             | 101 | 93 | 76 | 39                               | 37    | 34    | 35.7 | 169             | 159 | 147 | 84 |
| 30.0 | 16                                      | 15   | 14   | 56.2 | 78              | 74 | 68 | 71 | 22                               | 21   | 19   | 47.5 | 109             | 103 | 95 | 77 | 35                               | 33    | 30    | 37.9 | 172             | 162 | 150 | 84 |

**Table E8:** Engelmann spruce stocking levels for the ABGR/VASC-LIBO2 plant association (B-O province).

| QMD  | Climate Resilience; SDI 109; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 153; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 240; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5854                                    | 5511 | 5096 | 2.9  | 32              | 30 | 28 | 55 | 8195                             | 7716 | 7135 | 2.5  | 45              | 42  | 39 | 61 | 12878                            | 12125 | 11212 | 2.0  | 70              | 66  | 61  | 69 |
| 1.5  | 2903                                    | 2733 | 2527 | 4.2  | 36              | 34 | 31 | 57 | 4064                             | 3826 | 3538 | 3.5  | 50              | 47  | 43 | 63 | 6386                             | 6012  | 5559  | 2.8  | 78              | 74  | 68  | 71 |
| 2.0  | 1765                                    | 1661 | 1536 | 5.3  | 38              | 36 | 34 | 59 | 2470                             | 2326 | 2151 | 4.5  | 54              | 51  | 47 | 64 | 3882                             | 3655  | 3380  | 3.6  | 85              | 80  | 74  | 72 |
| 2.5  | 1199                                    | 1129 | 1044 | 6.5  | 41              | 38 | 36 | 60 | 1679                             | 1581 | 1462 | 5.5  | 57              | 54  | 50 | 65 | 2639                             | 2484  | 2297  | 4.4  | 90              | 85  | 78  | 73 |
| 3.0  | 875                                     | 824  | 762  | 7.6  | 43              | 40 | 37 | 60 | 1225                             | 1153 | 1066 | 6.4  | 60              | 57  | 52 | 66 | 1925                             | 1812  | 1676  | 5.1  | 94              | 89  | 82  | 74 |
| 3.5  | 670                                     | 631  | 583  | 8.7  | 45              | 42 | 39 | 61 | 938                              | 883  | 817  | 7.3  | 63              | 59  | 55 | 67 | 1474                             | 1388  | 1284  | 5.8  | 99              | 93  | 86  | 75 |
| 4.0  | 532                                     | 501  | 463  | 9.7  | 46              | 44 | 40 | 62 | 745                              | 701  | 648  | 8.2  | 65              | 61  | 57 | 68 | 1170                             | 1102  | 1019  | 6.6  | 102             | 96  | 89  | 75 |
| 4.5  | 434                                     | 408  | 378  | 10.8 | 48              | 45 | 42 | 62 | 607                              | 572  | 529  | 9.1  | 67              | 63  | 58 | 68 | 955                              | 899   | 831   | 7.3  | 105             | 99  | 92  | 76 |
| 5.0  | 362                                     | 340  | 315  | 11.8 | 49              | 46 | 43 | 63 | 506                              | 477  | 441  | 10.0 | 69              | 65  | 60 | 69 | 795                              | 749   | 693   | 8.0  | 108             | 102 | 94  | 76 |
| 5.5  | 307                                     | 289  | 267  | 12.8 | 51              | 48 | 44 | 63 | 429                              | 404  | 374  | 10.8 | 71              | 67  | 62 | 69 | 675                              | 635   | 587   | 8.6  | 111             | 105 | 97  | 77 |
| 6.0  | 264                                     | 248  | 230  | 13.8 | 52              | 49 | 45 | 64 | 369                              | 348  | 321  | 11.7 | 73              | 68  | 63 | 69 | 580                              | 546   | 505   | 9.3  | 114             | 107 | 99  | 77 |
| 6.5  | 230                                     | 216  | 200  | 14.8 | 53              | 50 | 46 | 64 | 322                              | 303  | 280  | 12.5 | 74              | 70  | 65 | 70 | 505                              | 476   | 440   | 10.0 | 116             | 110 | 101 | 78 |
| 7.0  | 202                                     | 190  | 176  | 15.8 | 54              | 51 | 47 | 64 | 283                              | 266  | 246  | 13.3 | 76              | 71  | 66 | 70 | 444                              | 418   | 387   | 10.6 | 119             | 112 | 103 | 78 |
| 7.5  | 179                                     | 169  | 156  | 16.7 | 55              | 52 | 48 | 65 | 251                              | 236  | 219  | 14.2 | 77              | 73  | 67 | 71 | 394                              | 371   | 343   | 11.3 | 121             | 114 | 105 | 78 |
| 8.0  | 160                                     | 151  | 140  | 17.7 | 56              | 53 | 49 | 65 | 224                              | 211  | 195  | 15.0 | 78              | 74  | 68 | 71 | 353                              | 332   | 307   | 11.9 | 123             | 116 | 107 | 79 |
| 8.5  | 144                                     | 136  | 126  | 18.7 | 57              | 54 | 50 | 65 | 202                              | 190  | 176  | 15.8 | 80              | 75  | 69 | 71 | 318                              | 299   | 277   | 12.6 | 125             | 118 | 109 | 79 |
| 9.0  | 131                                     | 123  | 114  | 19.6 | 58              | 54 | 50 | 66 | 183                              | 172  | 159  | 16.6 | 81              | 76  | 70 | 71 | 288                              | 271   | 251   | 13.2 | 127             | 120 | 111 | 79 |
| 9.5  | 119                                     | 112  | 104  | 20.5 | 59              | 55 | 51 | 66 | 167                              | 157  | 145  | 17.4 | 82              | 77  | 71 | 72 | 262                              | 247   | 228   | 13.9 | 129             | 121 | 112 | 79 |
| 10.0 | 109                                     | 103  | 95   | 21.5 | 59              | 56 | 52 | 66 | 153                              | 144  | 133  | 18.2 | 83              | 78  | 72 | 72 | 240                              | 226   | 209   | 14.5 | 131             | 123 | 114 | 80 |
| 11.0 | 92                                      | 87   | 80   | 23.3 | 61              | 57 | 53 | 66 | 129                              | 122  | 113  | 19.7 | 85              | 80  | 74 | 72 | 203                              | 191   | 177   | 15.7 | 134             | 126 | 117 | 80 |
| 12.0 | 80                                      | 75   | 69   | 25.2 | 62              | 59 | 54 | 67 | 111                              | 105  | 97   | 21.3 | 87              | 82  | 76 | 73 | 175                              | 165   | 152   | 17.0 | 137             | 129 | 120 | 81 |
| 13.0 | 69                                      | 65   | 60   | 27.0 | 64              | 60 | 56 | 67 | 97                               | 91   | 84   | 22.8 | 89              | 84  | 78 | 73 | 152                              | 143   | 133   | 18.2 | 140             | 132 | 122 | 81 |
| 14.0 | 61                                      | 57   | 53   | 28.7 | 65              | 61 | 57 | 68 | 85                               | 80   | 74   | 24.3 | 91              | 86  | 79 | 73 | 134                              | 126   | 117   | 19.4 | 143             | 135 | 125 | 81 |
| 15.0 | 54                                      | 51   | 47   | 30.5 | 66              | 62 | 58 | 68 | 76                               | 71   | 66   | 25.8 | 93              | 87  | 81 | 74 | 119                              | 112   | 104   | 20.6 | 146             | 137 | 127 | 82 |
| 16.0 | 48                                      | 46   | 42   | 32.3 | 67              | 64 | 59 | 68 | 68                               | 64   | 59   | 27.3 | 94              | 89  | 82 | 74 | 106                              | 100   | 93    | 21.7 | 148             | 140 | 129 | 82 |
| 17.0 | 44                                      | 41   | 38   | 34.0 | 69              | 65 | 60 | 69 | 61                               | 57   | 53   | 28.7 | 96              | 90  | 84 | 74 | 96                               | 90    | 83    | 22.9 | 151             | 142 | 131 | 82 |
| 18.0 | 39                                      | 37   | 34   | 35.7 | 70              | 66 | 61 | 69 | 55                               | 52   | 48   | 30.2 | 98              | 92  | 85 | 75 | 87                               | 82    | 76    | 24.1 | 153             | 144 | 133 | 82 |
| 19.0 | 36                                      | 34   | 31   | 37.4 | 71              | 67 | 62 | 69 | 50                               | 47   | 44   | 31.6 | 99              | 93  | 86 | 75 | 79                               | 74    | 69    | 25.2 | 156             | 146 | 135 | 83 |
| 20.0 | 33                                      | 31   | 29   | 39.1 | 72              | 67 | 62 | 69 | 46                               | 43   | 40   | 33.1 | 100             | 94  | 87 | 75 | 72                               | 68    | 63    | 26.4 | 158             | 148 | 137 | 83 |
| 22.0 | 28                                      | 26   | 24   | 42.5 | 74              | 69 | 64 | 70 | 39                               | 37   | 34   | 35.9 | 103             | 97  | 90 | 76 | 61                               | 58    | 53    | 28.6 | 162             | 152 | 141 | 83 |
| 24.0 | 24                                      | 23   | 21   | 45.8 | 75              | 71 | 66 | 70 | 34                               | 32   | 29   | 38.7 | 105             | 99  | 92 | 76 | 53                               | 50    | 46    | 30.9 | 166             | 156 | 144 | 84 |
| 26.0 | 21                                      | 20   | 18   | 49.1 | 77              | 72 | 67 | 70 | 29                               | 28   | 25   | 41.5 | 108             | 101 | 94 | 76 | 46                               | 43    | 40    | 33.1 | 169             | 159 | 147 | 84 |
| 28.0 | 18                                      | 17   | 16   | 52.3 | 79              | 74 | 68 | 71 | 26                               | 24   | 22   | 44.2 | 110             | 103 | 96 | 77 | 40                               | 38    | 35    | 35.3 | 173             | 163 | 150 | 85 |
| 30.0 | 16                                      | 15   | 14   | 55.6 | 80              | 75 | 70 | 71 | 23                               | 21   | 20   | 47.0 | 112             | 105 | 97 | 77 | 36                               | 34    | 31    | 37.5 | 176             | 166 | 153 | 85 |

**Table E9:** Engelmann spruce stocking levels for the ABLA2/VAME and ABLA2/LIBO2 plant associations (B-O province), and the PICO(ABLA2)/VAME plant community type.

| QMD  | Climate Resilience; SDI 119; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 167; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 263; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6418                                    | 6042 | 5587 | 2.8  | 35              | 33 | 30 | 57 | 8985                             | 8459 | 7822 | 2.4  | 49              | 46  | 43  | 63 | 14119                            | 13293 | 12292 | 1.9  | 77              | 73  | 67  | 70 |
| 1.5  | 3182                                    | 2996 | 2770 | 4.0  | 39              | 37 | 34 | 59 | 4455                             | 4194 | 3879 | 3.4  | 55              | 51  | 48  | 65 | 7001                             | 6591  | 6095  | 2.7  | 86              | 81  | 75  | 72 |
| 2.0  | 1935                                    | 1821 | 1684 | 5.1  | 42              | 40 | 37 | 60 | 2708                             | 2550 | 2358 | 4.3  | 59              | 56  | 51  | 66 | 4256                             | 4007  | 3705  | 3.4  | 93              | 87  | 81  | 74 |
| 2.5  | 1315                                    | 1238 | 1145 | 6.2  | 45              | 42 | 39 | 61 | 1841                             | 1733 | 1603 | 5.2  | 63              | 59  | 55  | 67 | 2893                             | 2724  | 2519  | 4.2  | 99              | 93  | 86  | 75 |
| 3.0  | 959                                     | 903  | 835  | 7.2  | 47              | 44 | 41 | 62 | 1343                             | 1264 | 1169 | 6.1  | 66              | 62  | 57  | 68 | 2110                             | 1987  | 1837  | 4.9  | 104             | 98  | 90  | 76 |
| 3.5  | 735                                     | 692  | 640  | 8.3  | 49              | 46 | 43 | 63 | 1029                             | 968  | 896  | 7.0  | 69              | 65  | 60  | 69 | 1616                             | 1522  | 1407  | 5.6  | 108             | 102 | 94  | 76 |
| 4.0  | 583                                     | 549  | 508  | 9.3  | 51              | 48 | 44 | 63 | 816                              | 769  | 711  | 7.8  | 71              | 67  | 62  | 69 | 1283                             | 1208  | 1117  | 6.3  | 112             | 105 | 97  | 77 |
| 4.5  | 476                                     | 448  | 414  | 10.3 | 53              | 49 | 46 | 64 | 666                              | 627  | 580  | 8.7  | 74              | 69  | 64  | 70 | 1046                             | 985   | 911   | 6.9  | 116             | 109 | 101 | 78 |
| 5.0  | 396                                     | 373  | 345  | 11.3 | 54              | 51 | 47 | 64 | 555                              | 523  | 483  | 9.5  | 76              | 71  | 66  | 70 | 872                              | 821   | 759   | 7.6  | 119             | 112 | 104 | 78 |
| 5.5  | 336                                     | 316  | 293  | 12.2 | 55              | 52 | 48 | 65 | 471                              | 443  | 410  | 10.3 | 78              | 73  | 68  | 71 | 740                              | 696   | 644   | 8.2  | 122             | 115 | 106 | 78 |
| 6.0  | 289                                     | 272  | 252  | 13.2 | 57              | 53 | 49 | 65 | 405                              | 381  | 352  | 11.1 | 79              | 75  | 69  | 71 | 636                              | 599   | 554   | 8.9  | 125             | 118 | 109 | 79 |
| 6.5  | 252                                     | 237  | 219  | 14.1 | 58              | 55 | 51 | 66 | 352                              | 332  | 307  | 11.9 | 81              | 76  | 71  | 71 | 554                              | 522   | 482   | 9.5  | 128             | 120 | 111 | 79 |
| 7.0  | 221                                     | 209  | 193  | 15.1 | 59              | 56 | 52 | 66 | 310                              | 292  | 270  | 12.7 | 83              | 78  | 72  | 72 | 487                              | 459   | 424   | 10.2 | 130             | 123 | 113 | 80 |
| 7.5  | 197                                     | 185  | 171  | 16.0 | 60              | 57 | 53 | 66 | 275                              | 259  | 240  | 13.5 | 84              | 79  | 74  | 72 | 432                              | 407   | 376   | 10.8 | 133             | 125 | 116 | 80 |
| 8.0  | 176                                     | 166  | 153  | 16.9 | 61              | 58 | 53 | 67 | 246                              | 232  | 214  | 14.3 | 86              | 81  | 75  | 72 | 387                              | 364   | 337   | 11.4 | 135             | 127 | 118 | 80 |
| 8.5  | 158                                     | 149  | 138  | 17.8 | 62              | 59 | 54 | 67 | 222                              | 209  | 193  | 15.1 | 87              | 82  | 76  | 73 | 348                              | 328   | 303   | 12.0 | 137             | 129 | 119 | 81 |
| 9.0  | 143                                     | 135  | 125  | 18.7 | 63              | 60 | 55 | 67 | 201                              | 189  | 175  | 15.8 | 89              | 84  | 77  | 73 | 315                              | 297   | 275   | 12.6 | 139             | 131 | 121 | 81 |
| 9.5  | 131                                     | 123  | 114  | 19.6 | 64              | 61 | 56 | 67 | 183                              | 172  | 159  | 16.6 | 90              | 85  | 78  | 73 | 287                              | 270   | 250   | 13.2 | 141             | 133 | 123 | 81 |
| 10.0 | 120                                     | 113  | 104  | 20.5 | 65              | 61 | 57 | 68 | 167                              | 158  | 146  | 17.3 | 91              | 86  | 79  | 73 | 263                              | 248   | 229   | 13.8 | 143             | 135 | 125 | 81 |
| 11.0 | 101                                     | 95   | 88   | 22.3 | 67              | 63 | 58 | 68 | 142                              | 134  | 124  | 18.8 | 94              | 88  | 82  | 74 | 223                              | 210   | 194   | 15.0 | 147             | 139 | 128 | 82 |
| 12.0 | 87                                      | 82   | 76   | 24.0 | 68              | 64 | 60 | 68 | 122                              | 115  | 106  | 20.3 | 96              | 90  | 83  | 74 | 192                              | 181   | 167   | 16.2 | 151             | 142 | 131 | 82 |
| 13.0 | 76                                      | 71   | 66   | 25.7 | 70              | 66 | 61 | 69 | 106                              | 100  | 93   | 21.8 | 98              | 92  | 85  | 75 | 167                              | 157   | 145   | 17.4 | 154             | 145 | 134 | 83 |
| 14.0 | 67                                      | 63   | 58   | 27.4 | 71              | 67 | 62 | 69 | 93                               | 88   | 81   | 23.2 | 100             | 94  | 87  | 75 | 147                              | 138   | 128   | 18.5 | 157             | 148 | 137 | 83 |
| 15.0 | 59                                      | 56   | 52   | 29.1 | 73              | 68 | 63 | 70 | 83                               | 78   | 72   | 24.6 | 102             | 96  | 89  | 75 | 130                              | 123   | 113   | 19.6 | 160             | 151 | 139 | 83 |
| 16.0 | 53                                      | 50   | 46   | 30.8 | 74              | 70 | 64 | 70 | 74                               | 70   | 65   | 26.0 | 104             | 98  | 90  | 76 | 117                              | 110   | 102   | 20.8 | 163             | 153 | 142 | 84 |
| 17.0 | 48                                      | 45   | 42   | 32.5 | 75              | 71 | 65 | 70 | 67                               | 63   | 58   | 27.4 | 105             | 99  | 92  | 76 | 105                              | 99    | 91    | 21.9 | 165             | 156 | 144 | 84 |
| 18.0 | 43                                      | 41   | 38   | 34.1 | 76              | 72 | 67 | 70 | 61                               | 57   | 53   | 28.8 | 107             | 101 | 93  | 76 | 95                               | 90    | 83    | 23.0 | 168             | 158 | 146 | 84 |
| 19.0 | 39                                      | 37   | 34   | 35.7 | 78              | 73 | 67 | 71 | 55                               | 52   | 48   | 30.2 | 109             | 102 | 94  | 76 | 87                               | 82    | 75    | 24.1 | 171             | 161 | 148 | 84 |
| 20.0 | 36                                      | 34   | 31   | 37.4 | 79              | 74 | 68 | 71 | 50                               | 47   | 44   | 31.6 | 110             | 104 | 96  | 77 | 79                               | 75    | 69    | 25.2 | 173             | 163 | 151 | 85 |
| 22.0 | 31                                      | 29   | 27   | 40.6 | 81              | 76 | 70 | 71 | 43                               | 40   | 37   | 34.3 | 113             | 106 | 98  | 77 | 67                               | 63    | 59    | 27.4 | 177             | 167 | 154 | 85 |
| 24.0 | 26                                      | 25   | 23   | 43.8 | 83              | 78 | 72 | 72 | 37                               | 35   | 32   | 37.0 | 116             | 109 | 101 | 78 | 58                               | 54    | 50    | 29.5 | 182             | 171 | 158 | 85 |
| 26.0 | 23                                      | 22   | 20   | 46.9 | 84              | 79 | 73 | 72 | 32                               | 30   | 28   | 39.6 | 118             | 111 | 103 | 78 | 50                               | 47    | 44    | 31.6 | 186             | 175 | 162 | 86 |
| 28.0 | 20                                      | 19   | 18   | 50.0 | 86              | 81 | 75 | 72 | 28                               | 27   | 25   | 42.3 | 120             | 113 | 105 | 78 | 44                               | 42    | 39    | 33.7 | 189             | 178 | 165 | 86 |
| 30.0 | 18                                      | 17   | 16   | 53.1 | 88              | 83 | 76 | 73 | 25                               | 24   | 22   | 44.8 | 123             | 116 | 107 | 79 | 39                               | 37    | 34    | 35.8 | 193             | 182 | 168 | 86 |



**Table E10:** Engelmann spruce stocking levels for the ABLA2/LIBO2 plant association (W-S province).

| QMD  | Climate Resilience; SDI 134; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 188; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 296; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7223                                    | 6801 | 6288 | 2.6  | 39              | 37 | 34 | 59 | 10112                            | 9521 | 8804 | 2.2  | 55              | 52  | 48  | 65 | 15891                            | 14961 | 13835 | 1.8  | 87              | 82  | 75  | 73 |
| 1.5  | 3582                                    | 3372 | 3118 | 3.7  | 44              | 41 | 38 | 61 | 5014                             | 4721 | 4365 | 3.2  | 62              | 58  | 54  | 67 | 7880                             | 7419  | 6860  | 2.5  | 97              | 91  | 84  | 74 |
| 2.0  | 2177                                    | 2050 | 1896 | 4.8  | 48              | 45 | 41 | 62 | 3048                             | 2870 | 2654 | 4.1  | 67              | 63  | 58  | 68 | 4790                             | 4510  | 4170  | 3.2  | 105             | 98  | 91  | 76 |
| 2.5  | 1480                                    | 1393 | 1289 | 5.8  | 50              | 48 | 44 | 63 | 2072                             | 1951 | 1804 | 4.9  | 71              | 67  | 61  | 69 | 3256                             | 3066  | 2835  | 3.9  | 111             | 105 | 97  | 77 |
| 3.0  | 1080                                    | 1017 | 940  | 6.8  | 53              | 50 | 46 | 64 | 1512                             | 1423 | 1316 | 5.8  | 74              | 70  | 65  | 70 | 2375                             | 2236  | 2068  | 4.6  | 117             | 110 | 102 | 78 |
| 3.5  | 827                                     | 779  | 720  | 7.8  | 55              | 52 | 48 | 65 | 1158                             | 1090 | 1008 | 6.6  | 77              | 73  | 67  | 71 | 1819                             | 1713  | 1584  | 5.3  | 122             | 114 | 106 | 78 |
| 4.0  | 656                                     | 618  | 571  | 8.8  | 57              | 54 | 50 | 65 | 919                              | 865  | 800  | 7.4  | 80              | 76  | 70  | 71 | 1444                             | 1360  | 1257  | 5.9  | 126             | 119 | 110 | 79 |
| 4.5  | 535                                     | 504  | 466  | 9.7  | 59              | 56 | 51 | 66 | 750                              | 706  | 653  | 8.2  | 83              | 78  | 72  | 72 | 1178                             | 1109  | 1025  | 6.5  | 130             | 122 | 113 | 80 |
| 5.0  | 446                                     | 420  | 388  | 10.6 | 61              | 57 | 53 | 66 | 625                              | 588  | 544  | 9.0  | 85              | 80  | 74  | 72 | 982                              | 924   | 855   | 7.2  | 134             | 126 | 117 | 80 |
| 5.5  | 378                                     | 356  | 329  | 11.5 | 62              | 59 | 54 | 67 | 530                              | 499  | 461  | 9.7  | 87              | 82  | 76  | 73 | 832                              | 784   | 725   | 7.8  | 137             | 129 | 120 | 81 |
| 6.0  | 325                                     | 306  | 283  | 12.4 | 64              | 60 | 56 | 67 | 456                              | 429  | 397  | 10.5 | 89              | 84  | 78  | 73 | 716                              | 674   | 623   | 8.4  | 141             | 132 | 122 | 81 |
| 6.5  | 283                                     | 267  | 247  | 13.3 | 65              | 61 | 57 | 68 | 397                              | 374  | 345  | 11.3 | 91              | 86  | 80  | 73 | 623                              | 587   | 543   | 9.0  | 144             | 135 | 125 | 81 |
| 7.0  | 249                                     | 235  | 217  | 14.2 | 67              | 63 | 58 | 68 | 349                              | 329  | 304  | 12.0 | 93              | 88  | 81  | 74 | 548                              | 516   | 477   | 9.6  | 147             | 138 | 128 | 82 |
| 7.5  | 221                                     | 208  | 193  | 15.1 | 68              | 64 | 59 | 68 | 310                              | 292  | 270  | 12.7 | 95              | 89  | 83  | 74 | 487                              | 458   | 424   | 10.2 | 149             | 141 | 130 | 82 |
| 8.0  | 198                                     | 186  | 172  | 15.9 | 69              | 65 | 60 | 69 | 277                              | 261  | 241  | 13.5 | 97              | 91  | 84  | 74 | 435                              | 410   | 379   | 10.7 | 152             | 143 | 132 | 82 |
| 8.5  | 178                                     | 168  | 155  | 16.8 | 70              | 66 | 61 | 69 | 249                              | 235  | 217  | 14.2 | 98              | 93  | 86  | 75 | 392                              | 369   | 341   | 11.3 | 154             | 145 | 134 | 83 |
| 9.0  | 161                                     | 152  | 141  | 17.7 | 71              | 67 | 62 | 69 | 226                              | 213  | 197  | 14.9 | 100             | 94  | 87  | 75 | 355                              | 334   | 309   | 11.9 | 157             | 148 | 137 | 83 |
| 9.5  | 147                                     | 138  | 128  | 18.5 | 72              | 68 | 63 | 69 | 206                              | 194  | 179  | 15.6 | 101             | 95  | 88  | 75 | 323                              | 304   | 282   | 12.5 | 159             | 150 | 139 | 83 |
| 10.0 | 135                                     | 127  | 117  | 19.3 | 73              | 69 | 64 | 70 | 188                              | 177  | 164  | 16.3 | 103             | 97  | 89  | 75 | 296                              | 279   | 258   | 13.0 | 161             | 152 | 141 | 83 |
| 11.0 | 114                                     | 107  | 99   | 21.0 | 75              | 71 | 66 | 70 | 160                              | 150  | 139  | 17.7 | 105             | 99  | 92  | 76 | 251                              | 236   | 218   | 14.2 | 166             | 156 | 144 | 84 |
| 12.0 | 98                                      | 92   | 85   | 22.6 | 77              | 73 | 67 | 71 | 137                              | 129  | 120  | 19.1 | 108             | 102 | 94  | 76 | 216                              | 203   | 188   | 15.3 | 170             | 160 | 148 | 84 |
| 13.0 | 85                                      | 80   | 74   | 24.3 | 79              | 74 | 69 | 71 | 120                              | 113  | 104  | 20.5 | 110             | 104 | 96  | 77 | 188                              | 177   | 164   | 16.4 | 173             | 163 | 151 | 85 |
| 14.0 | 75                                      | 71   | 65   | 25.9 | 80              | 76 | 70 | 71 | 105                              | 99   | 92   | 21.9 | 112             | 106 | 98  | 77 | 165                              | 156   | 144   | 17.4 | 177             | 166 | 154 | 85 |
| 15.0 | 67                                      | 63   | 58   | 27.5 | 82              | 77 | 71 | 72 | 93                               | 88   | 81   | 23.2 | 115             | 108 | 100 | 77 | 147                              | 138   | 128   | 18.5 | 180             | 170 | 157 | 85 |
| 16.0 | 60                                      | 56   | 52   | 29.0 | 83              | 78 | 73 | 72 | 84                               | 79   | 73   | 24.5 | 117             | 110 | 102 | 78 | 131                              | 124   | 114   | 19.6 | 183             | 173 | 160 | 86 |
| 17.0 | 54                                      | 51   | 47   | 30.6 | 85              | 80 | 74 | 72 | 75                               | 71   | 65   | 25.9 | 119             | 112 | 103 | 78 | 118                              | 111   | 103   | 20.6 | 186             | 175 | 162 | 86 |
| 18.0 | 49                                      | 46   | 42   | 32.2 | 86              | 81 | 75 | 72 | 68                               | 64   | 59   | 27.2 | 120             | 113 | 105 | 78 | 107                              | 101   | 93    | 21.7 | 189             | 178 | 165 | 86 |
| 19.0 | 44                                      | 42   | 39   | 33.7 | 87              | 82 | 76 | 73 | 62                               | 58   | 54   | 28.5 | 122             | 115 | 106 | 79 | 97                               | 92    | 85    | 22.7 | 192             | 181 | 167 | 86 |
| 20.0 | 41                                      | 38   | 35   | 35.2 | 88              | 83 | 77 | 73 | 57                               | 53   | 49   | 29.8 | 124             | 117 | 108 | 79 | 89                               | 84    | 78    | 23.7 | 195             | 183 | 169 | 87 |
| 22.0 | 34                                      | 32   | 30   | 38.2 | 91              | 85 | 79 | 73 | 48                               | 45   | 42   | 32.3 | 127             | 120 | 111 | 79 | 76                               | 71    | 66    | 25.8 | 200             | 188 | 174 | 87 |
| 24.0 | 30                                      | 28   | 26   | 41.2 | 93              | 87 | 81 | 74 | 41                               | 39   | 36   | 34.9 | 130             | 122 | 113 | 80 | 65                               | 61    | 57    | 27.8 | 204             | 192 | 178 | 88 |
| 26.0 | 26                                      | 24   | 22   | 44.2 | 95              | 89 | 83 | 74 | 36                               | 34   | 31   | 37.4 | 133             | 125 | 116 | 80 | 57                               | 53    | 49    | 29.8 | 209             | 197 | 182 | 88 |
| 28.0 | 23                                      | 21   | 20   | 47.1 | 97              | 91 | 84 | 74 | 32                               | 30   | 28   | 39.8 | 136             | 128 | 118 | 80 | 50                               | 47    | 43    | 31.8 | 213             | 201 | 186 | 88 |
| 30.0 | 20                                      | 19   | 18   | 50.0 | 99              | 93 | 86 | 75 | 28                               | 27   | 25   | 42.3 | 138             | 130 | 120 | 81 | 44                               | 42    | 39    | 33.7 | 217             | 204 | 189 | 89 |



**Table E11:** Engelmann spruce stocking levels for the ABLA2/MEFE (W-S province) and ABLA2/VASC (B-O province) plant associations, and the PICO(ABLA2)/VASC plant community type.

| QMD  | Climate Resilience; SDI 114; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 160; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 252; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6149                                    | 5789 | 5353 | 2.9  | 34              | 32 | 29 | 56 | 8609                             | 8105 | 7495 | 2.4  | 47              | 44  | 41  | 62 | 13528                            | 12736 | 11777 | 1.9  | 74              | 69  | 64  | 70 |
| 1.5  | 3049                                    | 2871 | 2655 | 4.1  | 37              | 35 | 33 | 58 | 4269                             | 4019 | 3716 | 3.4  | 52              | 49  | 46  | 64 | 6708                             | 6316  | 5840  | 2.7  | 82              | 78  | 72  | 72 |
| 2.0  | 1854                                    | 1745 | 1614 | 5.2  | 40              | 38 | 35 | 59 | 2595                             | 2443 | 2259 | 4.4  | 57              | 53  | 49  | 65 | 4078                             | 3839  | 3550  | 3.5  | 89              | 84  | 77  | 73 |
| 2.5  | 1260                                    | 1186 | 1097 | 6.3  | 43              | 40 | 37 | 60 | 1764                             | 1661 | 1536 | 5.3  | 60              | 57  | 52  | 66 | 2772                             | 2610  | 2413  | 4.3  | 94              | 89  | 82  | 74 |
| 3.0  | 919                                     | 865  | 800  | 7.4  | 45              | 42 | 39 | 61 | 1287                             | 1212 | 1120 | 6.3  | 63              | 59  | 55  | 67 | 2022                             | 1904  | 1760  | 5.0  | 99              | 93  | 86  | 75 |
| 3.5  | 704                                     | 663  | 613  | 8.5  | 47              | 44 | 41 | 62 | 986                              | 928  | 858  | 7.1  | 66              | 62  | 57  | 68 | 1549                             | 1458  | 1348  | 5.7  | 103             | 97  | 90  | 76 |
| 4.0  | 559                                     | 526  | 486  | 9.5  | 49              | 46 | 42 | 63 | 782                              | 737  | 681  | 8.0  | 68              | 64  | 59  | 68 | 1229                             | 1157  | 1070  | 6.4  | 107             | 101 | 93  | 76 |
| 4.5  | 456                                     | 429  | 397  | 10.5 | 50              | 47 | 44 | 63 | 638                              | 601  | 556  | 8.9  | 70              | 66  | 61  | 69 | 1003                             | 944   | 873   | 7.1  | 111             | 104 | 96  | 77 |
| 5.0  | 380                                     | 358  | 331  | 11.5 | 52              | 49 | 45 | 64 | 532                              | 501  | 463  | 9.7  | 73              | 68  | 63  | 69 | 836                              | 787   | 727   | 7.8  | 114             | 107 | 99  | 77 |
| 5.5  | 322                                     | 303  | 280  | 12.5 | 53              | 50 | 46 | 64 | 451                              | 425  | 393  | 10.6 | 74              | 70  | 65  | 70 | 709                              | 667   | 617   | 8.4  | 117             | 110 | 102 | 78 |
| 6.0  | 277                                     | 261  | 241  | 13.5 | 54              | 51 | 47 | 64 | 388                              | 365  | 338  | 11.4 | 76              | 72  | 66  | 70 | 610                              | 574   | 531   | 9.1  | 120             | 113 | 104 | 78 |
| 6.5  | 241                                     | 227  | 210  | 14.4 | 56              | 52 | 48 | 65 | 338                              | 318  | 294  | 12.2 | 78              | 73  | 68  | 71 | 531                              | 500   | 462   | 9.7  | 122             | 115 | 106 | 79 |
| 7.0  | 212                                     | 200  | 185  | 15.4 | 57              | 53 | 49 | 65 | 297                              | 280  | 259  | 13.0 | 79              | 75  | 69  | 71 | 467                              | 440   | 406   | 10.4 | 125             | 117 | 109 | 79 |
| 7.5  | 188                                     | 177  | 164  | 16.3 | 58              | 54 | 50 | 66 | 264                              | 248  | 230  | 13.8 | 81              | 76  | 70  | 71 | 414                              | 390   | 361   | 11.0 | 127             | 120 | 111 | 79 |
| 8.0  | 168                                     | 159  | 147  | 17.3 | 59              | 55 | 51 | 66 | 236                              | 222  | 205  | 14.6 | 82              | 78  | 72  | 72 | 371                              | 349   | 323   | 11.7 | 129             | 122 | 113 | 80 |
| 8.5  | 152                                     | 143  | 132  | 18.2 | 60              | 56 | 52 | 66 | 212                              | 200  | 185  | 15.4 | 84              | 79  | 73  | 72 | 334                              | 314   | 291   | 12.3 | 131             | 124 | 114 | 80 |
| 9.0  | 137                                     | 129  | 120  | 19.1 | 61              | 57 | 53 | 66 | 192                              | 181  | 167  | 16.2 | 85              | 80  | 74  | 72 | 302                              | 285   | 263   | 12.9 | 134             | 126 | 116 | 80 |
| 9.5  | 125                                     | 118  | 109  | 20.0 | 62              | 58 | 54 | 67 | 175                              | 165  | 153  | 16.9 | 86              | 81  | 75  | 72 | 275                              | 259   | 240   | 13.5 | 136             | 128 | 118 | 80 |
| 10.0 | 115                                     | 108  | 100  | 21.0 | 62              | 59 | 54 | 67 | 160                              | 151  | 140  | 17.7 | 87              | 82  | 76  | 73 | 252                              | 237   | 219   | 14.1 | 137             | 129 | 120 | 81 |
| 11.0 | 97                                      | 91   | 85   | 22.8 | 64              | 60 | 56 | 67 | 136                              | 128  | 118  | 19.2 | 90              | 84  | 78  | 73 | 214                              | 201   | 186   | 15.3 | 141             | 133 | 123 | 81 |
| 12.0 | 84                                      | 79   | 73   | 24.5 | 66              | 62 | 57 | 68 | 117                              | 110  | 102  | 20.7 | 92              | 86  | 80  | 74 | 184                              | 173   | 160   | 16.5 | 144             | 136 | 126 | 81 |
| 13.0 | 73                                      | 68   | 63   | 26.3 | 67              | 63 | 58 | 68 | 102                              | 96   | 89   | 22.2 | 94              | 88  | 82  | 74 | 160                              | 151   | 139   | 17.7 | 147             | 139 | 128 | 82 |
| 14.0 | 64                                      | 60   | 56   | 28.0 | 68              | 64 | 60 | 68 | 90                               | 84   | 78   | 23.7 | 96              | 90  | 83  | 74 | 141                              | 133   | 123   | 18.9 | 150             | 142 | 131 | 82 |
| 15.0 | 57                                      | 53   | 49   | 29.8 | 70              | 66 | 61 | 69 | 79                               | 75   | 69   | 25.2 | 98              | 92  | 85  | 75 | 125                              | 118   | 109   | 20.1 | 153             | 144 | 133 | 82 |
| 16.0 | 51                                      | 48   | 44   | 31.5 | 71              | 67 | 62 | 69 | 71                               | 67   | 62   | 26.6 | 99              | 93  | 86  | 75 | 112                              | 105   | 97    | 21.2 | 156             | 147 | 136 | 83 |
| 17.0 | 46                                      | 43   | 40   | 33.2 | 72              | 68 | 63 | 69 | 64                               | 60   | 56   | 28.0 | 101             | 95  | 88  | 75 | 101                              | 95    | 88    | 22.4 | 159             | 149 | 138 | 83 |
| 18.0 | 41                                      | 39   | 36   | 34.8 | 73              | 69 | 64 | 70 | 58                               | 55   | 50   | 29.5 | 102             | 96  | 89  | 75 | 91                               | 86    | 79    | 23.5 | 161             | 152 | 140 | 83 |
| 19.0 | 38                                      | 36   | 33   | 36.5 | 74              | 70 | 65 | 70 | 53                               | 50   | 46   | 30.9 | 104             | 98  | 91  | 76 | 83                               | 78    | 72    | 24.6 | 163             | 154 | 142 | 84 |
| 20.0 | 35                                      | 32   | 30   | 38.2 | 75              | 71 | 66 | 70 | 48                               | 45   | 42   | 32.3 | 105             | 99  | 92  | 76 | 76                               | 71    | 66    | 25.7 | 166             | 156 | 144 | 84 |
| 22.0 | 29                                      | 28   | 25   | 41.5 | 77              | 73 | 67 | 71 | 41                               | 39   | 36   | 35.0 | 108             | 102 | 94  | 76 | 64                               | 61    | 56    | 27.9 | 170             | 160 | 148 | 84 |
| 24.0 | 25                                      | 24   | 22   | 44.7 | 79              | 74 | 69 | 71 | 35                               | 33   | 31   | 37.8 | 111             | 104 | 96  | 77 | 55                               | 52    | 48    | 30.1 | 174             | 164 | 152 | 85 |
| 26.0 | 22                                      | 21   | 19   | 47.9 | 81              | 76 | 70 | 71 | 31                               | 29   | 27   | 40.5 | 113             | 107 | 99  | 77 | 48                               | 45    | 42    | 32.3 | 178             | 167 | 155 | 85 |
| 28.0 | 19                                      | 18   | 17   | 51.1 | 82              | 78 | 72 | 72 | 27                               | 25   | 24   | 43.2 | 115             | 109 | 101 | 78 | 42                               | 40    | 37    | 34.4 | 181             | 171 | 158 | 85 |
| 30.0 | 17                                      | 16   | 15   | 54.2 | 84              | 79 | 73 | 72 | 24                               | 23   | 21   | 45.8 | 118             | 111 | 102 | 78 | 38                               | 35    | 33    | 36.5 | 185             | 174 | 161 | 86 |

**Table E12:** Engelmann spruce stocking levels for the ABLA2/VASC/POPU plant association (W-S province), and the ABLA2/POPU and PICO(ABLA2)/VASC/POPU plant community types.

| QMD  | Climate Resilience; SDI 142; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 199; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 312; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7626                                    | 7180 | 6639 | 2.6  | 42              | 39 | 36 | 60 | 10676                            | 10052 | 9295 | 2.2  | 58              | 55  | 51  | 66 | 16777                            | 15795 | 14606 | 1.7  | 92              | 86  | 80  | 73 |
| 1.5  | 3781                                    | 3560 | 3292 | 3.6  | 46              | 44 | 40 | 62 | 5294                             | 4984  | 4609 | 3.1  | 65              | 61  | 57  | 68 | 8319                             | 7832  | 7243  | 2.5  | 102             | 96  | 89  | 75 |
| 2.0  | 2299                                    | 2164 | 2001 | 4.7  | 50              | 47 | 44 | 63 | 3218                             | 3030  | 2802 | 4.0  | 70              | 66  | 61  | 69 | 5057                             | 4762  | 4403  | 3.2  | 110             | 104 | 96  | 77 |
| 2.5  | 1563                                    | 1471 | 1360 | 5.7  | 53              | 50 | 46 | 64 | 2188                             | 2060  | 1905 | 4.8  | 75              | 70  | 65  | 70 | 3438                             | 3237  | 2993  | 3.8  | 117             | 110 | 102 | 78 |
| 3.0  | 1140                                    | 1073 | 992  | 6.6  | 56              | 53 | 49 | 65 | 1596                             | 1503  | 1389 | 5.6  | 78              | 74  | 68  | 71 | 2508                             | 2361  | 2183  | 4.5  | 123             | 116 | 107 | 79 |
| 3.5  | 873                                     | 822  | 760  | 7.6  | 58              | 55 | 51 | 66 | 1222                             | 1151  | 1064 | 6.4  | 82              | 77  | 71  | 72 | 1921                             | 1808  | 1672  | 5.1  | 128             | 121 | 112 | 79 |
| 4.0  | 693                                     | 652  | 603  | 8.5  | 60              | 57 | 53 | 66 | 970                              | 913   | 845  | 7.2  | 85              | 80  | 74  | 72 | 1525                             | 1435  | 1327  | 5.7  | 133             | 125 | 116 | 80 |
| 4.5  | 565                                     | 532  | 492  | 9.4  | 62              | 59 | 54 | 67 | 791                              | 745   | 689  | 8.0  | 87              | 82  | 76  | 73 | 1244                             | 1171  | 1083  | 6.4  | 137             | 129 | 120 | 81 |
| 5.0  | 471                                     | 443  | 410  | 10.3 | 64              | 60 | 56 | 67 | 659                              | 621   | 574  | 8.7  | 90              | 85  | 78  | 73 | 1036                             | 976   | 902   | 7.0  | 141             | 133 | 123 | 81 |
| 5.5  | 399                                     | 376  | 348  | 11.2 | 66              | 62 | 57 | 68 | 559                              | 527   | 487  | 9.5  | 92              | 87  | 80  | 74 | 879                              | 827   | 765   | 7.6  | 145             | 137 | 126 | 82 |
| 6.0  | 344                                     | 324  | 299  | 12.1 | 67              | 64 | 59 | 68 | 481                              | 453   | 419  | 10.2 | 94              | 89  | 82  | 74 | 756                              | 712   | 658   | 8.2  | 148             | 140 | 129 | 82 |
| 6.5  | 299                                     | 282  | 260  | 13.0 | 69              | 65 | 60 | 69 | 419                              | 394   | 365  | 11.0 | 97              | 91  | 84  | 74 | 658                              | 620   | 573   | 8.7  | 152             | 143 | 132 | 82 |
| 7.0  | 263                                     | 248  | 229  | 13.8 | 70              | 66 | 61 | 69 | 368                              | 347   | 321  | 11.7 | 98              | 93  | 86  | 75 | 579                              | 545   | 504   | 9.3  | 155             | 146 | 135 | 83 |
| 7.5  | 234                                     | 220  | 203  | 14.7 | 72              | 67 | 62 | 69 | 327                              | 308   | 285  | 12.4 | 100             | 94  | 87  | 75 | 514                              | 484   | 447   | 9.9  | 158             | 148 | 137 | 83 |
| 8.0  | 209                                     | 197  | 182  | 15.5 | 73              | 69 | 63 | 70 | 292                              | 275   | 255  | 13.1 | 102             | 96  | 89  | 75 | 460                              | 433   | 400   | 10.5 | 160             | 151 | 140 | 83 |
| 8.5  | 188                                     | 177  | 164  | 16.4 | 74              | 70 | 65 | 70 | 263                              | 248   | 229  | 13.8 | 104             | 98  | 90  | 76 | 414                              | 390   | 360   | 11.0 | 163             | 154 | 142 | 84 |
| 9.0  | 170                                     | 160  | 148  | 17.2 | 75              | 71 | 66 | 70 | 239                              | 225   | 208  | 14.5 | 105             | 99  | 92  | 76 | 375                              | 353   | 326   | 11.6 | 166             | 156 | 144 | 84 |
| 9.5  | 155                                     | 146  | 135  | 18.0 | 76              | 72 | 66 | 70 | 217                              | 205   | 189  | 15.2 | 107             | 101 | 93  | 76 | 341                              | 321   | 297   | 12.1 | 168             | 158 | 146 | 84 |
| 10.0 | 142                                     | 134  | 124  | 18.8 | 77              | 73 | 67 | 71 | 199                              | 187   | 173  | 15.9 | 108             | 102 | 94  | 76 | 312                              | 294   | 272   | 12.7 | 170             | 160 | 148 | 84 |
| 11.0 | 120                                     | 113  | 105  | 20.4 | 79              | 75 | 69 | 71 | 169                              | 159   | 147  | 17.3 | 111             | 105 | 97  | 77 | 265                              | 249   | 231   | 13.8 | 175             | 165 | 152 | 85 |
| 12.0 | 104                                     | 98   | 90   | 22.0 | 81              | 77 | 71 | 71 | 145                              | 137   | 126  | 18.6 | 114             | 107 | 99  | 77 | 228                              | 215   | 198   | 14.9 | 179             | 169 | 156 | 85 |
| 13.0 | 90                                      | 85   | 79   | 23.6 | 83              | 78 | 72 | 72 | 126                              | 119   | 110  | 20.0 | 116             | 110 | 101 | 78 | 198                              | 187   | 173   | 15.9 | 183             | 172 | 159 | 86 |
| 14.0 | 79                                      | 75   | 69   | 25.2 | 85              | 80 | 74 | 72 | 111                              | 105   | 97   | 21.3 | 119             | 112 | 103 | 78 | 175                              | 164   | 152   | 17.0 | 187             | 176 | 162 | 86 |
| 15.0 | 70                                      | 66   | 61   | 26.7 | 86              | 81 | 75 | 72 | 99                               | 93    | 86   | 22.6 | 121             | 114 | 105 | 78 | 155                              | 146   | 135   | 18.0 | 190             | 179 | 166 | 86 |
| 16.0 | 63                                      | 59   | 55   | 28.3 | 88              | 83 | 77 | 73 | 88                               | 83    | 77   | 23.9 | 123             | 116 | 107 | 79 | 139                              | 130   | 121   | 19.1 | 193             | 182 | 168 | 87 |
| 17.0 | 57                                      | 53   | 49   | 29.8 | 89              | 84 | 78 | 73 | 79                               | 75    | 69   | 25.2 | 125             | 118 | 109 | 79 | 125                              | 117   | 109   | 20.1 | 197             | 185 | 171 | 87 |
| 18.0 | 51                                      | 48   | 45   | 31.3 | 91              | 85 | 79 | 73 | 72                               | 68    | 63   | 26.4 | 127             | 120 | 111 | 79 | 113                              | 106   | 98    | 21.1 | 200             | 188 | 174 | 87 |
| 19.0 | 47                                      | 44   | 41   | 32.8 | 92              | 87 | 80 | 74 | 65                               | 62    | 57   | 27.7 | 129             | 121 | 112 | 79 | 103                              | 97    | 90    | 22.1 | 203             | 191 | 176 | 87 |
| 20.0 | 43                                      | 40   | 37   | 34.3 | 93              | 88 | 81 | 74 | 60                               | 56    | 52   | 29.0 | 131             | 123 | 114 | 80 | 94                               | 89    | 82    | 23.1 | 205             | 193 | 179 | 88 |
| 22.0 | 36                                      | 34   | 32   | 37.2 | 96              | 90 | 83 | 74 | 51                               | 48    | 44   | 31.5 | 134             | 126 | 117 | 80 | 80                               | 75    | 70    | 25.1 | 211             | 198 | 184 | 88 |
| 24.0 | 31                                      | 29   | 27   | 40.1 | 98              | 92 | 85 | 75 | 44                               | 41    | 38   | 33.9 | 137             | 129 | 120 | 81 | 69                               | 65    | 60    | 27.1 | 216             | 203 | 188 | 88 |
| 26.0 | 27                                      | 26   | 24   | 43.0 | 100             | 94 | 87 | 75 | 38                               | 36    | 33   | 36.4 | 140             | 132 | 122 | 81 | 60                               | 56    | 52    | 29.0 | 221             | 208 | 192 | 89 |
| 28.0 | 24                                      | 23   | 21   | 45.9 | 102             | 96 | 89 | 75 | 33                               | 32    | 29   | 38.8 | 143             | 135 | 125 | 81 | 53                               | 50    | 46    | 30.9 | 225             | 212 | 196 | 89 |
| 30.0 | 21                                      | 20   | 18   | 48.7 | 104             | 98 | 91 | 76 | 30                               | 28    | 26   | 41.1 | 146             | 137 | 127 | 82 | 47                               | 44    | 41    | 32.8 | 229             | 216 | 200 | 90 |

**Table E13:** Engelmann spruce stocking levels for the ABLA2/VAME plant association (W-S province).

| QMD  | Climate Resilience; SDI 143; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 200; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 315; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7693                                    | 7243 | 6698 | 2.6  | 42              | 40 | 37 | 60 | 10770                            | 10140 | 9377 | 2.2  | 59              | 55  | 51  | 66 | 16925                            | 15934 | 14735 | 1.7  | 92              | 87  | 80  | 74 |
| 1.5  | 3815                                    | 3592 | 3321 | 3.6  | 47              | 44 | 41 | 62 | 5341                             | 5028  | 4649 | 3.1  | 66              | 62  | 57  | 68 | 8392                             | 7901  | 7306  | 2.4  | 103             | 97  | 90  | 76 |
| 2.0  | 2319                                    | 2183 | 2019 | 4.7  | 51              | 48 | 44 | 63 | 3247                             | 3057  | 2827 | 3.9  | 71              | 67  | 62  | 69 | 5102                             | 4803  | 4442  | 3.1  | 111             | 105 | 97  | 77 |
| 2.5  | 1576                                    | 1484 | 1372 | 5.6  | 54              | 51 | 47 | 64 | 2207                             | 2078  | 1921 | 4.8  | 75              | 71  | 65  | 70 | 3468                             | 3265  | 3019  | 3.8  | 118             | 111 | 103 | 78 |
| 3.0  | 1150                                    | 1083 | 1001 | 6.6  | 56              | 53 | 49 | 65 | 1610                             | 1516  | 1402 | 5.6  | 79              | 74  | 69  | 71 | 2530                             | 2382  | 2203  | 4.5  | 124             | 117 | 108 | 79 |
| 3.5  | 881                                     | 829  | 767  | 7.6  | 59              | 55 | 51 | 66 | 1233                             | 1161  | 1074 | 6.4  | 82              | 78  | 72  | 72 | 1938                             | 1824  | 1687  | 5.1  | 129             | 122 | 113 | 80 |
| 4.0  | 699                                     | 658  | 609  | 8.5  | 61              | 57 | 53 | 66 | 979                              | 921   | 852  | 7.2  | 85              | 80  | 74  | 72 | 1538                             | 1448  | 1339  | 5.7  | 134             | 126 | 117 | 80 |
| 4.5  | 570                                     | 537  | 496  | 9.4  | 63              | 59 | 55 | 67 | 798                              | 752   | 695  | 7.9  | 88              | 83  | 77  | 73 | 1254                             | 1181  | 1092  | 6.3  | 139             | 130 | 121 | 81 |
| 5.0  | 475                                     | 447  | 414  | 10.3 | 65              | 61 | 56 | 68 | 665                              | 626   | 579  | 8.7  | 91              | 85  | 79  | 73 | 1045                             | 984   | 910   | 6.9  | 143             | 134 | 124 | 81 |
| 5.5  | 403                                     | 379  | 351  | 11.2 | 66              | 63 | 58 | 68 | 564                              | 531   | 491  | 9.4  | 93              | 88  | 81  | 74 | 887                              | 835   | 772   | 7.5  | 146             | 138 | 127 | 82 |
| 6.0  | 347                                     | 326  | 302  | 12.0 | 68              | 64 | 59 | 68 | 485                              | 457   | 423  | 10.2 | 95              | 90  | 83  | 74 | 763                              | 718   | 664   | 8.1  | 150             | 141 | 130 | 82 |
| 6.5  | 302                                     | 284  | 263  | 12.9 | 70              | 65 | 61 | 69 | 423                              | 398   | 368  | 10.9 | 97              | 92  | 85  | 75 | 664                              | 625   | 578   | 8.7  | 153             | 144 | 133 | 82 |
| 7.0  | 266                                     | 250  | 231  | 13.8 | 71              | 67 | 62 | 69 | 372                              | 350   | 324  | 11.6 | 99              | 94  | 86  | 75 | 584                              | 550   | 509   | 9.3  | 156             | 147 | 136 | 83 |
| 7.5  | 236                                     | 222  | 205  | 14.6 | 72              | 68 | 63 | 69 | 330                              | 311   | 287  | 12.3 | 101             | 95  | 88  | 75 | 518                              | 488   | 451   | 9.9  | 159             | 150 | 138 | 83 |
| 8.0  | 211                                     | 198  | 183  | 15.4 | 74              | 69 | 64 | 70 | 295                              | 278   | 257  | 13.1 | 103             | 97  | 90  | 76 | 464                              | 437   | 404   | 10.4 | 162             | 152 | 141 | 83 |
| 8.5  | 190                                     | 179  | 165  | 16.3 | 75              | 70 | 65 | 70 | 266                              | 250   | 231  | 13.8 | 105             | 99  | 91  | 76 | 417                              | 393   | 363   | 11.0 | 165             | 155 | 143 | 84 |
| 9.0  | 172                                     | 162  | 150  | 17.1 | 76              | 71 | 66 | 70 | 241                              | 227   | 210  | 14.5 | 106             | 100 | 93  | 76 | 378                              | 356   | 329   | 11.5 | 167             | 157 | 145 | 84 |
| 9.5  | 157                                     | 147  | 136  | 17.9 | 77              | 73 | 67 | 71 | 219                              | 206   | 191  | 15.1 | 108             | 102 | 94  | 76 | 344                              | 324   | 300   | 12.1 | 170             | 160 | 148 | 84 |
| 10.0 | 143                                     | 135  | 125  | 18.7 | 78              | 74 | 68 | 71 | 201                              | 189   | 175  | 15.8 | 109             | 103 | 95  | 77 | 315                              | 297   | 274   | 12.6 | 172             | 162 | 150 | 84 |
| 11.0 | 121                                     | 114  | 106  | 20.3 | 80              | 75 | 70 | 71 | 170                              | 160   | 148  | 17.2 | 112             | 106 | 98  | 77 | 267                              | 252   | 233   | 13.7 | 176             | 166 | 154 | 85 |
| 12.0 | 104                                     | 98   | 91   | 21.9 | 82              | 77 | 71 | 72 | 146                              | 138   | 127  | 18.5 | 115             | 108 | 100 | 77 | 230                              | 216   | 200   | 14.8 | 181             | 170 | 157 | 85 |
| 13.0 | 91                                      | 86   | 79   | 23.5 | 84              | 79 | 73 | 72 | 127                              | 120   | 111  | 19.9 | 117             | 111 | 102 | 78 | 200                              | 188   | 174   | 15.9 | 185             | 174 | 161 | 86 |
| 14.0 | 80                                      | 75   | 70   | 25.1 | 86              | 81 | 74 | 72 | 112                              | 105   | 98   | 21.2 | 120             | 113 | 104 | 78 | 176                              | 166   | 153   | 16.9 | 188             | 177 | 164 | 86 |
| 15.0 | 71                                      | 67   | 62   | 26.6 | 87              | 82 | 76 | 73 | 99                               | 94    | 87   | 22.5 | 122             | 115 | 106 | 79 | 156                              | 147   | 136   | 17.9 | 192             | 181 | 167 | 86 |
| 16.0 | 64                                      | 60   | 55   | 28.1 | 89              | 84 | 77 | 73 | 89                               | 84    | 77   | 23.8 | 124             | 117 | 108 | 79 | 140                              | 132   | 122   | 19.0 | 195             | 184 | 170 | 87 |
| 17.0 | 57                                      | 54   | 50   | 29.7 | 90              | 85 | 78 | 73 | 80                               | 75    | 70   | 25.1 | 126             | 119 | 110 | 79 | 126                              | 118   | 110   | 20.0 | 198             | 187 | 173 | 87 |
| 18.0 | 52                                      | 49   | 45   | 31.2 | 92              | 86 | 80 | 74 | 73                               | 68    | 63   | 26.3 | 128             | 121 | 112 | 79 | 114                              | 107   | 99    | 21.0 | 201             | 190 | 175 | 87 |
| 19.0 | 47                                      | 44   | 41   | 32.6 | 93              | 87 | 81 | 74 | 66                               | 62    | 58   | 27.6 | 130             | 122 | 113 | 80 | 104                              | 98    | 90    | 22.0 | 204             | 192 | 178 | 88 |
| 20.0 | 43                                      | 41   | 38   | 34.1 | 94              | 89 | 82 | 74 | 60                               | 57    | 53   | 28.8 | 132             | 124 | 115 | 80 | 95                               | 89    | 83    | 23.0 | 207             | 195 | 180 | 88 |
| 22.0 | 37                                      | 34   | 32   | 37.1 | 97              | 91 | 84 | 74 | 51                               | 48    | 45   | 31.3 | 135             | 127 | 118 | 80 | 81                               | 76    | 70    | 25.0 | 213             | 200 | 185 | 88 |
| 24.0 | 32                                      | 30   | 27   | 40.0 | 99              | 93 | 86 | 75 | 44                               | 42    | 38   | 33.8 | 139             | 130 | 121 | 81 | 69                               | 65    | 60    | 26.9 | 218             | 205 | 190 | 89 |
| 26.0 | 27                                      | 26   | 24   | 42.8 | 101             | 95 | 88 | 75 | 38                               | 36    | 33   | 36.2 | 142             | 133 | 123 | 81 | 60                               | 57    | 53    | 28.9 | 222             | 209 | 194 | 89 |
| 28.0 | 24                                      | 23   | 21   | 45.7 | 103             | 97 | 90 | 76 | 34                               | 32    | 29   | 38.6 | 144             | 136 | 126 | 81 | 53                               | 50    | 46    | 30.8 | 227             | 214 | 198 | 89 |
| 30.0 | 21                                      | 20   | 19   | 48.5 | 105             | 99 | 92 | 76 | 30                               | 28    | 26   | 41.0 | 147             | 139 | 128 | 82 | 47                               | 44    | 41    | 32.7 | 231             | 218 | 201 | 90 |

**Table G1:** Grand fir stocking levels for the ABGR/ACGL plant association (B-O province).

| QMD  | Climate Resilience; SDI 144; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 202; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 317; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7733                                    | 7281 | 6733 | 2.6  | 42              | 40 | 37 | 61 | 10827                            | 10193 | 9426 | 2.2  | 59              | 56  | 51  | 67 | 17013                            | 16018 | 14812 | 1.7  | 93              | 87  | 81  | 75 |
| 1.5  | 3835                                    | 3610 | 3338 | 3.6  | 47              | 44 | 41 | 63 | 5368                             | 5054  | 4674 | 3.1  | 66              | 62  | 57  | 69 | 8436                             | 7943  | 7345  | 2.4  | 104             | 97  | 90  | 77 |
| 2.0  | 2331                                    | 2195 | 2030 | 4.6  | 51              | 48 | 44 | 65 | 3264                             | 3073  | 2841 | 3.9  | 71              | 67  | 62  | 71 | 5129                             | 4829  | 4465  | 3.1  | 112             | 105 | 97  | 79 |
| 2.5  | 1585                                    | 1492 | 1380 | 5.6  | 54              | 51 | 47 | 66 | 2218                             | 2089  | 1931 | 4.8  | 76              | 71  | 66  | 72 | 3486                             | 3282  | 3035  | 3.8  | 119             | 112 | 103 | 80 |
| 3.0  | 1156                                    | 1088 | 1006 | 6.6  | 57              | 53 | 49 | 67 | 1618                             | 1524  | 1409 | 5.6  | 79              | 75  | 69  | 73 | 2543                             | 2394  | 2214  | 4.4  | 125             | 118 | 109 | 81 |
| 3.5  | 885                                     | 834  | 771  | 7.5  | 59              | 56 | 51 | 67 | 1240                             | 1167  | 1079 | 6.4  | 83              | 78  | 72  | 73 | 1948                             | 1834  | 1696  | 5.1  | 130             | 123 | 113 | 81 |
| 4.0  | 703                                     | 662  | 612  | 8.5  | 61              | 58 | 53 | 68 | 984                              | 926   | 857  | 7.2  | 86              | 81  | 75  | 74 | 1546                             | 1456  | 1346  | 5.7  | 135             | 127 | 117 | 82 |
| 4.5  | 573                                     | 540  | 499  | 9.4  | 63              | 60 | 55 | 69 | 802                              | 756   | 699  | 7.9  | 89              | 83  | 77  | 75 | 1261                             | 1187  | 1098  | 6.3  | 139             | 131 | 121 | 83 |
| 5.0  | 478                                     | 450  | 416  | 10.3 | 65              | 61 | 57 | 69 | 669                              | 630   | 582  | 8.7  | 91              | 86  | 79  | 75 | 1051                             | 989   | 915   | 6.9  | 143             | 135 | 125 | 83 |
| 5.5  | 405                                     | 381  | 353  | 11.1 | 67              | 63 | 58 | 70 | 567                              | 534   | 494  | 9.4  | 94              | 88  | 81  | 76 | 891                              | 839   | 776   | 7.5  | 147             | 138 | 128 | 84 |
| 6.0  | 348                                     | 328  | 303  | 12.0 | 68              | 64 | 60 | 70 | 488                              | 459   | 425  | 10.2 | 96              | 90  | 83  | 76 | 767                              | 722   | 667   | 8.1  | 151             | 142 | 131 | 84 |
| 6.5  | 303                                     | 286  | 264  | 12.9 | 70              | 66 | 61 | 70 | 425                              | 400   | 370  | 10.9 | 98              | 92  | 85  | 76 | 667                              | 628   | 581   | 8.7  | 154             | 145 | 134 | 84 |
| 7.0  | 267                                     | 251  | 232  | 13.7 | 71              | 67 | 62 | 71 | 374                              | 352   | 325  | 11.6 | 100             | 94  | 87  | 77 | 587                              | 553   | 511   | 9.3  | 157             | 148 | 137 | 85 |
| 7.5  | 237                                     | 223  | 206  | 14.6 | 73              | 68 | 63 | 71 | 332                              | 312   | 289  | 12.3 | 102             | 96  | 89  | 77 | 521                              | 491   | 454   | 9.8  | 160             | 151 | 139 | 85 |
| 8.0  | 212                                     | 199  | 184  | 15.4 | 74              | 70 | 64 | 71 | 297                              | 279   | 258  | 13.0 | 104             | 97  | 90  | 77 | 466                              | 439   | 406   | 10.4 | 163             | 153 | 142 | 85 |
| 8.5  | 191                                     | 180  | 166  | 16.2 | 75              | 71 | 65 | 72 | 267                              | 251   | 232  | 13.7 | 105             | 99  | 92  | 78 | 420                              | 395   | 365   | 10.9 | 165             | 156 | 144 | 86 |
| 9.0  | 173                                     | 163  | 150  | 17.1 | 76              | 72 | 66 | 72 | 242                              | 228   | 211  | 14.4 | 107             | 101 | 93  | 78 | 380                              | 358   | 331   | 11.5 | 168             | 158 | 146 | 86 |
| 9.5  | 157                                     | 148  | 137  | 17.9 | 77              | 73 | 67 | 72 | 220                              | 207   | 192  | 15.1 | 108             | 102 | 94  | 78 | 346                              | 326   | 301   | 12.1 | 170             | 160 | 148 | 86 |
| 10.0 | 144                                     | 136  | 125  | 18.7 | 79              | 74 | 68 | 72 | 202                              | 190   | 176  | 15.8 | 110             | 104 | 96  | 78 | 317                              | 298   | 276   | 12.6 | 173             | 163 | 150 | 87 |
| 11.0 | 122                                     | 115  | 106  | 20.3 | 81              | 76 | 70 | 73 | 171                              | 161   | 149  | 17.2 | 113             | 106 | 98  | 79 | 269                              | 253   | 234   | 13.7 | 177             | 167 | 154 | 87 |
| 12.0 | 105                                     | 99   | 91   | 21.9 | 83              | 78 | 72 | 73 | 147                              | 138   | 128  | 18.5 | 116             | 109 | 101 | 79 | 231                              | 218   | 201   | 14.8 | 182             | 171 | 158 | 87 |
| 13.0 | 91                                      | 86   | 80   | 23.5 | 84              | 79 | 73 | 74 | 128                              | 121   | 111  | 19.8 | 118             | 111 | 103 | 80 | 201                              | 189   | 175   | 15.8 | 185             | 175 | 161 | 88 |
| 14.0 | 80                                      | 76   | 70   | 25.0 | 86              | 81 | 75 | 74 | 113                              | 106   | 98   | 21.1 | 120             | 113 | 105 | 80 | 177                              | 167   | 154   | 16.9 | 189             | 178 | 165 | 88 |
| 15.0 | 71                                      | 67   | 62   | 26.5 | 88              | 83 | 76 | 74 | 100                              | 94    | 87   | 22.4 | 123             | 116 | 107 | 80 | 157                              | 148   | 137   | 17.9 | 193             | 182 | 168 | 88 |
| 16.0 | 64                                      | 60   | 56   | 28.1 | 89              | 84 | 78 | 75 | 89                               | 84    | 78   | 23.7 | 125             | 118 | 109 | 81 | 140                              | 132   | 122   | 18.9 | 196             | 185 | 171 | 89 |
| 17.0 | 58                                      | 54   | 50   | 29.6 | 91              | 85 | 79 | 75 | 81                               | 76    | 70   | 25.0 | 127             | 119 | 110 | 81 | 127                              | 119   | 110   | 19.9 | 199             | 188 | 174 | 89 |
| 18.0 | 52                                      | 49   | 45   | 31.1 | 92              | 87 | 80 | 75 | 73                               | 69    | 63   | 26.3 | 129             | 121 | 112 | 81 | 115                              | 108   | 100   | 21.0 | 203             | 191 | 176 | 89 |
| 19.0 | 47                                      | 45   | 41   | 32.6 | 93              | 88 | 81 | 76 | 66                               | 63    | 58   | 27.5 | 131             | 123 | 114 | 82 | 104                              | 98    | 91    | 22.0 | 205             | 193 | 179 | 90 |
| 20.0 | 43                                      | 41   | 38   | 34.0 | 95              | 89 | 82 | 76 | 61                               | 57    | 53   | 28.8 | 133             | 125 | 115 | 82 | 95                               | 90    | 83    | 23.0 | 208             | 196 | 181 | 90 |
| 22.0 | 37                                      | 35   | 32   | 37.0 | 97              | 91 | 85 | 76 | 52                               | 49    | 45   | 31.2 | 136             | 128 | 118 | 82 | 81                               | 76    | 71    | 24.9 | 214             | 201 | 186 | 90 |
| 24.0 | 32                                      | 30   | 28   | 39.9 | 99              | 94 | 87 | 77 | 44                               | 42    | 39   | 33.7 | 139             | 131 | 121 | 83 | 70                               | 66    | 61    | 26.9 | 219             | 206 | 191 | 91 |
| 26.0 | 28                                      | 26   | 24   | 42.7 | 102             | 96 | 89 | 77 | 39                               | 36    | 34   | 36.1 | 142             | 134 | 124 | 83 | 61                               | 57    | 53    | 28.8 | 224             | 211 | 195 | 91 |
| 28.0 | 24                                      | 23   | 21   | 45.5 | 104             | 98 | 90 | 77 | 34                               | 32    | 30   | 38.5 | 145             | 137 | 126 | 83 | 53                               | 50    | 46    | 30.7 | 228             | 215 | 199 | 92 |
| 30.0 | 22                                      | 20   | 19   | 48.3 | 106             | 99 | 92 | 78 | 30                               | 28    | 26   | 40.9 | 148             | 139 | 129 | 84 | 47                               | 45    | 41    | 32.6 | 232             | 219 | 202 | 92 |

**Table G2:** Grand fir stocking levels for the ABGR/BRVU, ABGR/CAGE, ABGR/CLUN, ABGR/TABR/CLUN, and ABGR/TABR/LIBO2 (B-O province), and ABGR/ACGL, ABGR/CLUN, ABGR/LIBO2, and ABGR/VAME (W-S province) plant associations; and the PICO(ABGR)/ALSI plant community type.

| QMD  | Climate Resilience; SDI 175; 25% of Max |      |      |      |                 |     |     |    | Lower Limit; SDI 245; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 385; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 9398                                    | 8848 | 8182 | 2.3  | 51              | 48  | 45  | 65 | 13157                            | 12388 | 11455 | 2.0  | 72              | 68  | 62  | 71 | 20676                            | 19466 | 18000 | 1.6  | 113             | 106 | 98  | 79 |
| 1.5  | 4660                                    | 4388 | 4057 | 3.3  | 57              | 54  | 50  | 67 | 6524                             | 6143  | 5680  | 2.8  | 80              | 75  | 70  | 73 | 10252                            | 9653  | 8926  | 2.2  | 126             | 118 | 110 | 81 |
| 2.0  | 2833                                    | 2667 | 2466 | 4.2  | 62              | 58  | 54  | 68 | 3966                             | 3734  | 3453  | 3.6  | 87              | 81  | 75  | 74 | 6233                             | 5868  | 5426  | 2.8  | 136             | 128 | 118 | 82 |
| 2.5  | 1926                                    | 1813 | 1677 | 5.1  | 66              | 62  | 57  | 69 | 2696                             | 2538  | 2347  | 4.3  | 92              | 87  | 80  | 75 | 4237                             | 3989  | 3688  | 3.4  | 144             | 136 | 126 | 83 |
| 3.0  | 1405                                    | 1323 | 1223 | 6.0  | 69              | 65  | 60  | 70 | 1967                             | 1852  | 1712  | 5.1  | 97              | 91  | 84  | 76 | 3091                             | 2910  | 2691  | 4.0  | 152             | 143 | 132 | 84 |
| 3.5  | 1076                                    | 1013 | 937  | 6.8  | 72              | 68  | 63  | 71 | 1506                             | 1418  | 1311  | 5.8  | 101             | 95  | 88  | 77 | 2367                             | 2229  | 2061  | 4.6  | 158             | 149 | 138 | 85 |
| 4.0  | 854                                     | 804  | 744  | 7.7  | 75              | 70  | 65  | 71 | 1196                             | 1126  | 1041  | 6.5  | 104             | 98  | 91  | 77 | 1879                             | 1769  | 1636  | 5.2  | 164             | 154 | 143 | 86 |
| 4.5  | 697                                     | 656  | 606  | 8.5  | 77              | 72  | 67  | 72 | 975                              | 918   | 849   | 7.2  | 108             | 101 | 94  | 78 | 1533                             | 1443  | 1334  | 5.7  | 169             | 159 | 147 | 86 |
| 5.0  | 581                                     | 547  | 505  | 9.3  | 79              | 75  | 69  | 73 | 813                              | 765   | 708   | 7.9  | 111             | 104 | 96  | 79 | 1277                             | 1202  | 1112  | 6.3  | 174             | 164 | 152 | 87 |
| 5.5  | 492                                     | 463  | 429  | 10.1 | 81              | 76  | 71  | 73 | 689                              | 649   | 600   | 8.5  | 114             | 107 | 99  | 79 | 1083                             | 1020  | 943   | 6.8  | 179             | 168 | 156 | 87 |
| 6.0  | 423                                     | 399  | 369  | 10.9 | 83              | 78  | 72  | 73 | 593                              | 558   | 516   | 9.2  | 116             | 110 | 101 | 79 | 932                              | 877   | 811   | 7.3  | 183             | 172 | 159 | 88 |
| 6.5  | 369                                     | 347  | 321  | 11.7 | 85              | 80  | 74  | 74 | 516                              | 486   | 449   | 9.9  | 119             | 112 | 104 | 80 | 811                              | 764   | 706   | 7.9  | 187             | 176 | 163 | 88 |
| 7.0  | 324                                     | 305  | 282  | 12.5 | 87              | 82  | 75  | 74 | 454                              | 428   | 395   | 10.5 | 121             | 114 | 106 | 80 | 714                              | 672   | 621   | 8.4  | 191             | 180 | 166 | 88 |
| 7.5  | 288                                     | 271  | 251  | 13.2 | 88              | 83  | 77  | 75 | 403                              | 379   | 351   | 11.2 | 124             | 116 | 108 | 81 | 633                              | 596   | 551   | 8.9  | 194             | 183 | 169 | 89 |
| 8.0  | 257                                     | 242  | 224  | 14.0 | 90              | 85  | 78  | 75 | 360                              | 339   | 314   | 11.8 | 126             | 118 | 110 | 81 | 566                              | 533   | 493   | 9.4  | 198             | 186 | 172 | 89 |
| 8.5  | 232                                     | 218  | 202  | 14.7 | 91              | 86  | 80  | 75 | 325                              | 306   | 283   | 12.4 | 128             | 120 | 111 | 81 | 510                              | 480   | 444   | 9.9  | 201             | 189 | 175 | 89 |
| 9.0  | 210                                     | 198  | 183  | 15.5 | 93              | 87  | 81  | 75 | 294                              | 277   | 256   | 13.1 | 130             | 122 | 113 | 81 | 462                              | 435   | 402   | 10.4 | 204             | 192 | 178 | 90 |
| 9.5  | 191                                     | 180  | 166  | 16.2 | 94              | 89  | 82  | 76 | 268                              | 252   | 233   | 13.7 | 132             | 124 | 115 | 82 | 421                              | 396   | 366   | 10.9 | 207             | 195 | 180 | 90 |
| 10.0 | 175                                     | 165  | 152  | 17.0 | 95              | 90  | 83  | 76 | 245                              | 231   | 213   | 14.3 | 134             | 126 | 116 | 82 | 385                              | 362   | 335   | 11.4 | 210             | 198 | 183 | 90 |
| 11.0 | 148                                     | 140  | 129  | 18.4 | 98              | 92  | 85  | 76 | 208                              | 196   | 181   | 15.6 | 137             | 129 | 119 | 82 | 326                              | 307   | 284   | 12.4 | 215             | 203 | 188 | 90 |
| 12.0 | 128                                     | 120  | 111  | 19.8 | 100             | 94  | 87  | 77 | 179                              | 168   | 156   | 16.8 | 140             | 132 | 122 | 83 | 281                              | 264   | 245   | 13.4 | 221             | 208 | 192 | 91 |
| 13.0 | 111                                     | 105  | 97   | 21.3 | 102             | 96  | 89  | 77 | 156                              | 147   | 135   | 18.0 | 143             | 135 | 125 | 83 | 245                              | 230   | 213   | 14.3 | 225             | 212 | 196 | 91 |
| 14.0 | 98                                      | 92   | 85   | 22.7 | 105             | 98  | 91  | 78 | 137                              | 129   | 119   | 19.2 | 146             | 138 | 127 | 84 | 215                              | 203   | 187   | 15.3 | 230             | 217 | 200 | 92 |
| 15.0 | 87                                      | 82   | 76   | 24.1 | 106             | 100 | 93  | 78 | 121                              | 114   | 106   | 20.3 | 149             | 140 | 130 | 84 | 191                              | 180   | 166   | 16.2 | 234             | 221 | 204 | 92 |
| 16.0 | 78                                      | 73   | 68   | 25.5 | 108             | 102 | 94  | 78 | 109                              | 102   | 95    | 21.5 | 152             | 143 | 132 | 84 | 171                              | 161   | 149   | 17.2 | 238             | 224 | 208 | 92 |
| 17.0 | 70                                      | 66   | 61   | 26.8 | 110             | 104 | 96  | 78 | 98                               | 92    | 85    | 22.7 | 154             | 145 | 134 | 84 | 154                              | 145   | 134   | 18.1 | 242             | 228 | 211 | 93 |
| 18.0 | 63                                      | 60   | 55   | 28.2 | 112             | 105 | 97  | 79 | 89                               | 83    | 77    | 23.8 | 157             | 147 | 136 | 85 | 139                              | 131   | 121   | 19.0 | 246             | 232 | 214 | 93 |
| 19.0 | 58                                      | 54   | 50   | 29.5 | 114             | 107 | 99  | 79 | 81                               | 76    | 70    | 25.0 | 159             | 150 | 138 | 85 | 127                              | 119   | 110   | 19.9 | 250             | 235 | 217 | 93 |
| 20.0 | 53                                      | 50   | 46   | 30.9 | 115             | 108 | 100 | 79 | 74                               | 70    | 64    | 26.1 | 161             | 152 | 140 | 85 | 116                              | 109   | 101   | 20.8 | 253             | 238 | 220 | 93 |
| 22.0 | 45                                      | 42   | 39   | 33.5 | 118             | 111 | 103 | 80 | 63                               | 59    | 55    | 28.3 | 165             | 156 | 144 | 86 | 98                               | 93    | 86    | 22.6 | 260             | 245 | 226 | 94 |
| 24.0 | 38                                      | 36   | 34   | 36.2 | 121             | 114 | 105 | 80 | 54                               | 51    | 47    | 30.6 | 169             | 159 | 147 | 86 | 85                               | 80    | 74    | 24.4 | 266             | 250 | 232 | 94 |
| 26.0 | 34                                      | 32   | 29   | 38.7 | 124             | 116 | 108 | 81 | 47                               | 44    | 41    | 32.7 | 173             | 163 | 151 | 87 | 74                               | 69    | 64    | 26.1 | 272             | 256 | 237 | 95 |
| 28.0 | 29                                      | 28   | 26   | 41.3 | 126             | 119 | 110 | 81 | 41                               | 39    | 36    | 34.9 | 176             | 166 | 154 | 87 | 65                               | 61    | 56    | 27.9 | 277             | 261 | 241 | 95 |
| 30.0 | 26                                      | 25   | 23   | 43.9 | 128             | 121 | 112 | 81 | 37                               | 34    | 32    | 37.1 | 180             | 169 | 157 | 87 | 58                               | 54    | 50    | 29.6 | 282             | 266 | 246 | 95 |

**Table G3:** Grand fir stocking levels for the ABGR/ACGL-PHMA plant community type (W-S province).

| QMD  | Climate Resilience; SDI 157; 25% of Max |      |      |      |                 |     |     |    | Lower Limit; SDI 220; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 345; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 8431                                    | 7938 | 7340 | 2.4  | 46              | 43  | 40  | 63 | 11804                            | 11113 | 10277 | 2.1  | 64              | 61  | 56  | 69 | 18549                            | 17464 | 16149 | 1.6  | 101             | 95  | 88  | 77 |
| 1.5  | 4181                                    | 3936 | 3640 | 3.5  | 51              | 48  | 45  | 65 | 5853                             | 5511  | 5096  | 2.9  | 72              | 68  | 63  | 71 | 9198                             | 8660  | 8008  | 2.3  | 113             | 106 | 98  | 79 |
| 2.0  | 2542                                    | 2393 | 2213 | 4.4  | 55              | 52  | 48  | 66 | 3558                             | 3350  | 3098  | 3.8  | 78              | 73  | 68  | 72 | 5592                             | 5265  | 4868  | 3.0  | 122             | 115 | 106 | 80 |
| 2.5  | 1728                                    | 1627 | 1504 | 5.4  | 59              | 55  | 51  | 67 | 2419                             | 2277  | 2106  | 4.6  | 82              | 78  | 72  | 73 | 3801                             | 3579  | 3309  | 3.6  | 130             | 122 | 113 | 81 |
| 3.0  | 1260                                    | 1187 | 1097 | 6.3  | 62              | 58  | 54  | 68 | 1764                             | 1661  | 1536  | 5.3  | 87              | 82  | 75  | 74 | 2773                             | 2610  | 2414  | 4.3  | 136             | 128 | 118 | 82 |
| 3.5  | 965                                     | 909  | 840  | 7.2  | 64              | 61  | 56  | 69 | 1351                             | 1272  | 1177  | 6.1  | 90              | 85  | 79  | 75 | 2124                             | 1999  | 1849  | 4.9  | 142             | 134 | 124 | 83 |
| 4.0  | 766                                     | 721  | 667  | 8.1  | 67              | 63  | 58  | 70 | 1073                             | 1010  | 934   | 6.8  | 94              | 88  | 81  | 76 | 1686                             | 1587  | 1467  | 5.5  | 147             | 138 | 128 | 84 |
| 4.5  | 625                                     | 588  | 544  | 9.0  | 69              | 65  | 60  | 70 | 875                              | 824   | 762   | 7.6  | 97              | 91  | 84  | 76 | 1375                             | 1294  | 1197  | 6.0  | 152             | 143 | 132 | 84 |
| 5.0  | 521                                     | 490  | 453  | 9.8  | 71              | 67  | 62  | 71 | 729                              | 686   | 635   | 8.3  | 99              | 94  | 87  | 77 | 1146                             | 1079  | 998   | 6.6  | 156             | 147 | 136 | 85 |
| 5.5  | 442                                     | 416  | 384  | 10.7 | 73              | 69  | 63  | 71 | 618                              | 582   | 538   | 9.0  | 102             | 96  | 89  | 77 | 972                              | 915   | 846   | 7.2  | 160             | 151 | 140 | 85 |
| 6.0  | 380                                     | 358  | 331  | 11.5 | 75              | 70  | 65  | 72 | 532                              | 501   | 463   | 9.7  | 104             | 98  | 91  | 78 | 836                              | 787   | 728   | 7.8  | 164             | 155 | 143 | 86 |
| 6.5  | 331                                     | 311  | 288  | 12.3 | 76              | 72  | 66  | 72 | 463                              | 436   | 403   | 10.4 | 107             | 100 | 93  | 78 | 728                              | 685   | 634   | 8.3  | 168             | 158 | 146 | 86 |
| 7.0  | 291                                     | 274  | 253  | 13.1 | 78              | 73  | 68  | 72 | 407                              | 384   | 355   | 11.1 | 109             | 103 | 95  | 78 | 640                              | 603   | 557   | 8.9  | 171             | 161 | 149 | 86 |
| 7.5  | 258                                     | 243  | 225  | 14.0 | 79              | 75  | 69  | 73 | 362                              | 340   | 315   | 11.8 | 111             | 104 | 97  | 79 | 568                              | 535   | 495   | 9.4  | 174             | 164 | 152 | 87 |
| 8.0  | 231                                     | 217  | 201  | 14.8 | 81              | 76  | 70  | 73 | 323                              | 304   | 282   | 12.5 | 113             | 106 | 98  | 79 | 508                              | 478   | 442   | 9.9  | 177             | 167 | 154 | 87 |
| 8.5  | 208                                     | 196  | 181  | 15.6 | 82              | 77  | 71  | 73 | 291                              | 274   | 253   | 13.1 | 115             | 108 | 100 | 79 | 458                              | 431   | 398   | 10.5 | 180             | 170 | 157 | 87 |
| 9.0  | 188                                     | 177  | 164  | 16.3 | 83              | 78  | 72  | 73 | 264                              | 248   | 230   | 13.8 | 117             | 110 | 101 | 79 | 414                              | 390   | 361   | 11.0 | 183             | 172 | 159 | 88 |
| 9.5  | 172                                     | 162  | 149  | 17.1 | 84              | 80  | 74  | 74 | 240                              | 226   | 209   | 14.5 | 118             | 111 | 103 | 80 | 377                              | 355   | 329   | 11.5 | 186             | 175 | 162 | 88 |
| 10.0 | 157                                     | 148  | 137  | 17.9 | 86              | 81  | 75  | 74 | 220                              | 207   | 191   | 15.1 | 120             | 113 | 104 | 80 | 345                              | 325   | 301   | 12.1 | 188             | 177 | 164 | 88 |
| 11.0 | 133                                     | 125  | 116  | 19.4 | 88              | 83  | 76  | 74 | 186                              | 175   | 162   | 16.4 | 123             | 116 | 107 | 80 | 293                              | 276   | 255   | 13.1 | 193             | 182 | 168 | 89 |
| 12.0 | 115                                     | 108  | 100  | 21.0 | 90              | 85  | 78  | 75 | 160                              | 151   | 140   | 17.7 | 126             | 119 | 110 | 81 | 252                              | 237   | 219   | 14.1 | 198             | 186 | 172 | 89 |
| 13.0 | 100                                     | 94   | 87   | 22.5 | 92              | 87  | 80  | 75 | 140                              | 131   | 122   | 19.0 | 129             | 121 | 112 | 81 | 219                              | 207   | 191   | 15.1 | 202             | 190 | 176 | 89 |
| 14.0 | 88                                      | 83   | 76   | 23.9 | 94              | 88  | 82  | 76 | 123                              | 116   | 107   | 20.2 | 131             | 124 | 114 | 82 | 193                              | 182   | 168   | 16.1 | 206             | 194 | 180 | 90 |
| 15.0 | 78                                      | 73   | 68   | 25.4 | 96              | 90  | 83  | 76 | 109                              | 103   | 95    | 21.5 | 134             | 126 | 116 | 82 | 171                              | 161   | 149   | 17.1 | 210             | 198 | 183 | 90 |
| 16.0 | 70                                      | 66   | 61   | 26.9 | 97              | 92  | 85  | 76 | 97                               | 92    | 85    | 22.7 | 136             | 128 | 118 | 82 | 153                              | 144   | 133   | 18.1 | 214             | 201 | 186 | 90 |
| 17.0 | 63                                      | 59   | 55   | 28.3 | 99              | 93  | 86  | 77 | 88                               | 83    | 76    | 23.9 | 138             | 130 | 120 | 83 | 138                              | 130   | 120   | 19.1 | 217             | 205 | 189 | 91 |
| 18.0 | 57                                      | 53   | 49   | 29.8 | 100             | 94  | 87  | 77 | 80                               | 75    | 69    | 25.2 | 141             | 132 | 122 | 83 | 125                              | 118   | 109   | 20.1 | 221             | 208 | 192 | 91 |
| 19.0 | 52                                      | 49   | 45   | 31.2 | 102             | 96  | 89  | 77 | 72                               | 68    | 63    | 26.4 | 143             | 134 | 124 | 83 | 114                              | 107   | 99    | 21.0 | 224             | 211 | 195 | 91 |
| 20.0 | 47                                      | 45   | 41   | 32.6 | 103             | 97  | 90  | 77 | 66                               | 62    | 58    | 27.6 | 145             | 136 | 126 | 83 | 104                              | 98    | 91    | 22.0 | 227             | 214 | 198 | 91 |
| 22.0 | 40                                      | 38   | 35   | 35.4 | 106             | 100 | 92  | 78 | 56                               | 53    | 49    | 29.9 | 148             | 140 | 129 | 84 | 88                               | 83    | 77    | 23.9 | 233             | 219 | 203 | 92 |
| 24.0 | 35                                      | 33   | 30   | 38.2 | 108             | 102 | 94  | 78 | 48                               | 46    | 42    | 32.3 | 152             | 143 | 132 | 84 | 76                               | 72    | 66    | 25.7 | 239             | 225 | 208 | 92 |
| 26.0 | 30                                      | 28   | 26   | 40.9 | 111             | 104 | 96  | 79 | 42                               | 40    | 37    | 34.6 | 155             | 146 | 135 | 85 | 66                               | 62    | 58    | 27.6 | 244             | 230 | 212 | 93 |
| 28.0 | 26                                      | 25   | 23   | 43.6 | 113             | 106 | 98  | 79 | 37                               | 35    | 32    | 36.9 | 158             | 149 | 138 | 85 | 58                               | 55    | 51    | 29.4 | 249             | 234 | 217 | 93 |
| 30.0 | 23                                      | 22   | 20   | 46.3 | 115             | 108 | 100 | 79 | 33                               | 31    | 29    | 39.1 | 161             | 152 | 140 | 85 | 52                               | 49    | 45    | 31.2 | 253             | 239 | 221 | 93 |

**Table G4:** Grand fir stocking levels for the ABGR/CARU plant association (B-O province) and the ABGR/ARCO plant community type.

| QMD  | Climate Resilience; SDI 139; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 194; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 305; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7451                                    | 7015 | 6487 | 2.6  | 41              | 38 | 35 | 61 | 10432                            | 9822 | 9082 | 2.2  | 57              | 54  | 50  | 67 | 16393                            | 15434 | 14272 | 1.8  | 89              | 84  | 78  | 75 |
| 1.5  | 3695                                    | 3479 | 3217 | 3.7  | 45              | 43 | 39 | 63 | 5173                             | 4870 | 4503 | 3.1  | 63              | 60  | 55  | 69 | 8129                             | 7653  | 7077  | 2.5  | 100             | 94  | 87  | 77 |
| 2.0  | 2246                                    | 2115 | 1956 | 4.7  | 49              | 46 | 43 | 64 | 3145                             | 2961 | 2738 | 4.0  | 69              | 65  | 60  | 70 | 4942                             | 4653  | 4302  | 3.2  | 108             | 102 | 94  | 78 |
| 2.5  | 1527                                    | 1438 | 1329 | 5.7  | 52              | 49 | 45 | 65 | 2138                             | 2013 | 1861 | 4.9  | 73              | 69  | 63  | 71 | 3359                             | 3163  | 2924  | 3.9  | 115             | 108 | 100 | 79 |
| 3.0  | 1114                                    | 1049 | 970  | 6.7  | 55              | 51 | 48 | 66 | 1559                             | 1468 | 1358 | 5.7  | 77              | 72  | 67  | 72 | 2450                             | 2307  | 2133  | 4.5  | 120             | 113 | 105 | 80 |
| 3.5  | 853                                     | 803  | 743  | 7.7  | 57              | 54 | 50 | 67 | 1194                             | 1124 | 1040 | 6.5  | 80              | 75  | 69  | 73 | 1877                             | 1767  | 1634  | 5.2  | 125             | 118 | 109 | 81 |
| 4.0  | 677                                     | 638  | 590  | 8.6  | 59              | 56 | 51 | 67 | 948                              | 893  | 825  | 7.3  | 83              | 78  | 72  | 73 | 1490                             | 1403  | 1297  | 5.8  | 130             | 122 | 113 | 81 |
| 4.5  | 552                                     | 520  | 481  | 9.5  | 61              | 57 | 53 | 68 | 773                              | 728  | 673  | 8.1  | 85              | 80  | 74  | 74 | 1215                             | 1144  | 1058  | 6.4  | 134             | 126 | 117 | 82 |
| 5.0  | 460                                     | 433  | 401  | 10.5 | 63              | 59 | 55 | 68 | 644                              | 607  | 561  | 8.8  | 88              | 83  | 76  | 74 | 1013                             | 953   | 882   | 7.0  | 138             | 130 | 120 | 83 |
| 5.5  | 390                                     | 367  | 340  | 11.4 | 64              | 61 | 56 | 69 | 546                              | 514  | 476  | 9.6  | 90              | 85  | 78  | 75 | 859                              | 808   | 748   | 7.7  | 142             | 133 | 123 | 83 |
| 6.0  | 336                                     | 316  | 292  | 12.2 | 66              | 62 | 57 | 69 | 470                              | 443  | 409  | 10.3 | 92              | 87  | 80  | 75 | 739                              | 695   | 643   | 8.3  | 145             | 137 | 126 | 83 |
| 6.5  | 292                                     | 275  | 255  | 13.1 | 67              | 63 | 59 | 70 | 409                              | 385  | 356  | 11.1 | 94              | 89  | 82  | 76 | 643                              | 606   | 560   | 8.8  | 148             | 140 | 129 | 84 |
| 7.0  | 257                                     | 242  | 224  | 14.0 | 69              | 65 | 60 | 70 | 360                              | 339  | 313  | 11.8 | 96              | 91  | 84  | 76 | 566                              | 533   | 493   | 9.4  | 151             | 142 | 132 | 84 |
| 7.5  | 228                                     | 215  | 199  | 14.8 | 70              | 66 | 61 | 70 | 320                              | 301  | 278  | 12.5 | 98              | 92  | 85  | 76 | 502                              | 473   | 437   | 10.0 | 154             | 145 | 134 | 84 |
| 8.0  | 204                                     | 192  | 178  | 15.7 | 71              | 67 | 62 | 71 | 286                              | 269  | 249  | 13.3 | 100             | 94  | 87  | 77 | 449                              | 423   | 391   | 10.6 | 157             | 148 | 136 | 85 |
| 8.5  | 184                                     | 173  | 160  | 16.5 | 72              | 68 | 63 | 71 | 257                              | 242  | 224  | 14.0 | 101             | 95  | 88  | 77 | 404                              | 381   | 352   | 11.2 | 159             | 150 | 139 | 85 |
| 9.0  | 166                                     | 157  | 145  | 17.4 | 74              | 69 | 64 | 71 | 233                              | 219  | 203  | 14.7 | 103             | 97  | 90  | 77 | 366                              | 345   | 319   | 11.7 | 162             | 152 | 141 | 85 |
| 9.5  | 152                                     | 143  | 132  | 18.2 | 75              | 70 | 65 | 72 | 212                              | 200  | 185  | 15.4 | 104             | 98  | 91  | 78 | 334                              | 314   | 290   | 12.3 | 164             | 155 | 143 | 86 |
| 10.0 | 139                                     | 131  | 121  | 19.0 | 76              | 71 | 66 | 72 | 194                              | 183  | 169  | 16.1 | 106             | 100 | 92  | 78 | 305                              | 287   | 266   | 12.8 | 166             | 157 | 145 | 86 |
| 11.0 | 118                                     | 111  | 102  | 20.7 | 78              | 73 | 68 | 72 | 165                              | 155  | 143  | 17.5 | 109             | 102 | 95  | 78 | 259                              | 244   | 225   | 13.9 | 171             | 161 | 149 | 86 |
| 12.0 | 101                                     | 95   | 88   | 22.3 | 79              | 75 | 69 | 73 | 142                              | 133  | 123  | 18.8 | 111             | 105 | 97  | 79 | 223                              | 210   | 194   | 15.0 | 175             | 165 | 152 | 87 |
| 13.0 | 88                                      | 83   | 77   | 23.9 | 81              | 76 | 71 | 73 | 123                              | 116  | 107  | 20.2 | 114             | 107 | 99  | 79 | 194                              | 183   | 169   | 16.1 | 179             | 168 | 156 | 87 |
| 14.0 | 78                                      | 73   | 67   | 25.5 | 83              | 78 | 72 | 73 | 109                              | 102  | 94   | 21.5 | 116             | 109 | 101 | 79 | 171                              | 161   | 148   | 17.2 | 182             | 172 | 159 | 87 |
| 15.0 | 69                                      | 65   | 60   | 27.0 | 84              | 79 | 74 | 74 | 96                               | 91   | 84   | 22.9 | 118             | 111 | 103 | 80 | 151                              | 143   | 132   | 18.2 | 186             | 175 | 162 | 88 |
| 16.0 | 62                                      | 58   | 54   | 28.6 | 86              | 81 | 75 | 74 | 86                               | 81   | 75   | 24.2 | 120             | 113 | 105 | 80 | 135                              | 127   | 118   | 19.3 | 189             | 178 | 165 | 88 |
| 17.0 | 55                                      | 52   | 48   | 30.1 | 87              | 82 | 76 | 74 | 78                               | 73   | 68   | 25.5 | 122             | 115 | 106 | 80 | 122                              | 115   | 106   | 20.3 | 192             | 181 | 167 | 88 |
| 18.0 | 50                                      | 47   | 44   | 31.7 | 89              | 84 | 77 | 75 | 70                               | 66   | 61   | 26.8 | 124             | 117 | 108 | 81 | 110                              | 104   | 96    | 21.3 | 195             | 184 | 170 | 89 |
| 19.0 | 46                                      | 43   | 40   | 33.2 | 90              | 85 | 78 | 75 | 64                               | 60   | 56   | 28.0 | 126             | 119 | 110 | 81 | 101                              | 95    | 88    | 22.4 | 198             | 186 | 172 | 89 |
| 20.0 | 42                                      | 39   | 36   | 34.7 | 91              | 86 | 79 | 75 | 59                               | 55   | 51   | 29.3 | 128             | 120 | 111 | 81 | 92                               | 87    | 80    | 23.4 | 201             | 189 | 175 | 89 |
| 22.0 | 35                                      | 33   | 31   | 37.7 | 94              | 88 | 82 | 76 | 50                               | 47   | 43   | 31.8 | 131             | 123 | 114 | 82 | 78                               | 73    | 68    | 25.4 | 206             | 194 | 179 | 90 |
| 24.0 | 31                                      | 29   | 27   | 40.6 | 96              | 90 | 83 | 76 | 43                               | 40   | 37   | 34.3 | 134             | 126 | 117 | 82 | 67                               | 63    | 58    | 27.4 | 211             | 199 | 184 | 90 |
| 26.0 | 27                                      | 25   | 23   | 43.5 | 98              | 92 | 85 | 76 | 37                               | 35   | 32   | 36.8 | 137             | 129 | 119 | 82 | 58                               | 55    | 51    | 29.3 | 215             | 203 | 188 | 90 |
| 28.0 | 23                                      | 22   | 20   | 46.4 | 100             | 94 | 87 | 77 | 33                               | 31   | 28   | 39.2 | 140             | 132 | 122 | 83 | 51                               | 48    | 45    | 31.3 | 220             | 207 | 191 | 91 |
| 30.0 | 21                                      | 20   | 18   | 49.2 | 102             | 96 | 89 | 77 | 29                               | 27   | 25   | 41.6 | 143             | 134 | 124 | 83 | 46                               | 43    | 40    | 33.2 | 224             | 211 | 195 | 91 |



**Table G5:** Grand fir stocking levels for the ABGR/GYDR and ABGR/TRCA3 plant associations (B-O province).

| QMD  | Climate Resilience; SDI 173; 25% of Max |      |      |      |                 |     |     |    | Lower Limit; SDI 242; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 380; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 9277                                    | 8735 | 8077 | 2.3  | 51              | 48  | 44  | 65 | 12988                            | 12228 | 11307 | 2.0  | 71              | 67  | 62  | 71 | 20410                            | 19216 | 17769 | 1.6  | 111             | 105 | 97  | 79 |
| 1.5  | 4600                                    | 4331 | 4005 | 3.3  | 56              | 53  | 49  | 67 | 6440                             | 6064  | 5607  | 2.8  | 79              | 74  | 69  | 73 | 10121                            | 9528  | 8811  | 2.2  | 124             | 117 | 108 | 81 |
| 2.0  | 2797                                    | 2633 | 2435 | 4.2  | 61              | 57  | 53  | 68 | 3915                             | 3686  | 3409  | 3.6  | 85              | 80  | 74  | 74 | 6153                             | 5793  | 5356  | 2.9  | 134             | 126 | 117 | 82 |
| 2.5  | 1901                                    | 1790 | 1655 | 5.1  | 65              | 61  | 56  | 69 | 2661                             | 2506  | 2317  | 4.3  | 91              | 85  | 79  | 75 | 4182                             | 3938  | 3641  | 3.5  | 143             | 134 | 124 | 83 |
| 3.0  | 1387                                    | 1306 | 1207 | 6.0  | 68              | 64  | 59  | 70 | 1941                             | 1828  | 1690  | 5.1  | 95              | 90  | 83  | 76 | 3051                             | 2872  | 2656  | 4.1  | 150             | 141 | 130 | 84 |
| 3.5  | 1062                                    | 1000 | 925  | 6.9  | 71              | 67  | 62  | 71 | 1487                             | 1400  | 1295  | 5.8  | 99              | 94  | 86  | 77 | 2337                             | 2200  | 2034  | 4.6  | 156             | 147 | 136 | 85 |
| 4.0  | 843                                     | 794  | 734  | 7.7  | 74              | 69  | 64  | 71 | 1180                             | 1111  | 1028  | 6.5  | 103             | 97  | 90  | 77 | 1855                             | 1746  | 1615  | 5.2  | 162             | 152 | 141 | 85 |
| 4.5  | 688                                     | 647  | 599  | 8.6  | 76              | 72  | 66  | 72 | 963                              | 906   | 838   | 7.2  | 106             | 100 | 93  | 78 | 1513                             | 1424  | 1317  | 5.8  | 167             | 157 | 145 | 86 |
| 5.0  | 573                                     | 540  | 499  | 9.4  | 78              | 74  | 68  | 72 | 802                              | 755   | 698   | 7.9  | 109             | 103 | 95  | 78 | 1261                             | 1187  | 1098  | 6.3  | 172             | 162 | 150 | 86 |
| 5.5  | 486                                     | 458  | 423  | 10.2 | 80              | 75  | 70  | 73 | 680                              | 641   | 592   | 8.6  | 112             | 106 | 98  | 79 | 1069                             | 1007  | 931   | 6.9  | 176             | 166 | 154 | 87 |
| 6.0  | 418                                     | 394  | 364  | 11.0 | 82              | 77  | 71  | 73 | 585                              | 551   | 510   | 9.3  | 115             | 108 | 100 | 79 | 920                              | 866   | 801   | 7.4  | 181             | 170 | 157 | 87 |
| 6.5  | 364                                     | 343  | 317  | 11.8 | 84              | 79  | 73  | 74 | 510                              | 480   | 444   | 9.9  | 117             | 111 | 102 | 80 | 801                              | 754   | 697   | 7.9  | 185             | 174 | 161 | 88 |
| 7.0  | 320                                     | 301  | 279  | 12.5 | 86              | 81  | 74  | 74 | 448                              | 422   | 390   | 10.6 | 120             | 113 | 104 | 80 | 704                              | 663   | 613   | 8.5  | 188             | 177 | 164 | 88 |
| 7.5  | 284                                     | 268  | 247  | 13.3 | 87              | 82  | 76  | 74 | 398                              | 375   | 346   | 11.2 | 122             | 115 | 106 | 80 | 625                              | 589   | 544   | 9.0  | 192             | 181 | 167 | 88 |
| 8.0  | 254                                     | 239  | 221  | 14.1 | 89              | 84  | 77  | 75 | 356                              | 335   | 310   | 11.9 | 124             | 117 | 108 | 81 | 559                              | 526   | 487   | 9.5  | 195             | 184 | 170 | 89 |
| 8.5  | 229                                     | 215  | 199  | 14.8 | 90              | 85  | 79  | 75 | 320                              | 302   | 279   | 12.5 | 126             | 119 | 110 | 81 | 503                              | 474   | 438   | 10.0 | 198             | 187 | 173 | 89 |
| 9.0  | 207                                     | 195  | 180  | 15.6 | 92              | 86  | 80  | 75 | 290                              | 273   | 253   | 13.2 | 128             | 121 | 112 | 81 | 456                              | 429   | 397   | 10.5 | 201             | 190 | 175 | 89 |
| 9.5  | 189                                     | 178  | 164  | 16.3 | 93              | 87  | 81  | 75 | 264                              | 249   | 230   | 13.8 | 130             | 122 | 113 | 81 | 415                              | 391   | 362   | 11.0 | 204             | 192 | 178 | 90 |
| 10.0 | 173                                     | 163  | 150  | 17.1 | 94              | 89  | 82  | 76 | 242                              | 228   | 211   | 14.4 | 132             | 124 | 115 | 82 | 380                              | 358   | 331   | 11.5 | 207             | 195 | 180 | 90 |
| 11.0 | 146                                     | 138  | 128  | 18.5 | 97              | 91  | 84  | 76 | 205                              | 193   | 179   | 15.7 | 135             | 127 | 118 | 82 | 322                              | 303   | 281   | 12.5 | 213             | 200 | 185 | 90 |
| 12.0 | 126                                     | 119  | 110  | 20.0 | 99              | 93  | 86  | 77 | 176                              | 166   | 154   | 16.9 | 139             | 130 | 121 | 83 | 277                              | 261   | 241   | 13.5 | 218             | 205 | 190 | 91 |
| 13.0 | 110                                     | 103  | 96   | 21.4 | 101             | 95  | 88  | 77 | 154                              | 145   | 134   | 18.1 | 142             | 133 | 123 | 83 | 241                              | 227   | 210   | 14.4 | 223             | 209 | 194 | 91 |
| 14.0 | 97                                      | 91   | 84   | 22.8 | 103             | 97  | 90  | 77 | 135                              | 127   | 118   | 19.3 | 144             | 136 | 126 | 83 | 212                              | 200   | 185   | 15.4 | 227             | 214 | 198 | 91 |
| 15.0 | 86                                      | 81   | 75   | 24.2 | 105             | 99  | 92  | 78 | 120                              | 113   | 104   | 20.5 | 147             | 139 | 128 | 84 | 188                              | 177   | 164   | 16.3 | 231             | 218 | 201 | 92 |
| 16.0 | 77                                      | 72   | 67   | 25.6 | 107             | 101 | 93  | 78 | 107                              | 101   | 93    | 21.7 | 150             | 141 | 130 | 84 | 169                              | 159   | 147   | 17.3 | 235             | 222 | 205 | 92 |
| 17.0 | 69                                      | 65   | 60   | 27.0 | 109             | 102 | 95  | 78 | 97                               | 91    | 84    | 22.8 | 152             | 143 | 133 | 84 | 152                              | 143   | 132   | 18.2 | 239             | 225 | 208 | 92 |
| 18.0 | 62                                      | 59   | 54   | 28.4 | 110             | 104 | 96  | 79 | 87                               | 82    | 76    | 24.0 | 155             | 146 | 135 | 85 | 137                              | 129   | 120   | 19.1 | 243             | 229 | 212 | 93 |
| 19.0 | 57                                      | 54   | 50   | 29.7 | 112             | 105 | 98  | 79 | 80                               | 75    | 69    | 25.1 | 157             | 148 | 137 | 85 | 125                              | 118   | 109   | 20.0 | 247             | 232 | 215 | 93 |
| 20.0 | 52                                      | 49   | 45   | 31.1 | 114             | 107 | 99  | 79 | 73                               | 69    | 63    | 26.3 | 159             | 150 | 138 | 85 | 115                              | 108   | 100   | 21.0 | 250             | 235 | 218 | 93 |
| 22.0 | 44                                      | 42   | 38   | 33.7 | 117             | 110 | 101 | 79 | 62                               | 58    | 54    | 28.5 | 163             | 154 | 142 | 86 | 97                               | 91    | 85    | 22.8 | 256             | 241 | 223 | 94 |
| 24.0 | 38                                      | 36   | 33   | 36.4 | 119             | 112 | 104 | 80 | 53                               | 50    | 46    | 30.8 | 167             | 157 | 145 | 86 | 84                               | 79    | 73    | 24.5 | 263             | 247 | 229 | 94 |
| 26.0 | 33                                      | 31   | 29   | 39.0 | 122             | 115 | 106 | 80 | 46                               | 44    | 40    | 33.0 | 171             | 161 | 149 | 86 | 73                               | 69    | 63    | 26.3 | 268             | 253 | 234 | 94 |
| 28.0 | 29                                      | 27   | 25   | 41.6 | 124             | 117 | 108 | 81 | 41                               | 38    | 35    | 35.1 | 174             | 164 | 152 | 87 | 64                               | 60    | 56    | 28.0 | 274             | 258 | 238 | 95 |
| 30.0 | 26                                      | 24   | 22   | 44.1 | 127             | 119 | 110 | 81 | 36                               | 34    | 31    | 37.3 | 177             | 167 | 154 | 87 | 57                               | 53    | 49    | 29.8 | 279             | 263 | 243 | 95 |



**Table G6:** Grand fir stocking levels for the ABGR/LIBO2 plant association (B-O province) and the PICO(ABGR)/VAME-LIBO2 plant community type.

| QMD  | Climate Resilience; SDI 161; 25% of Max |      |      |      |                 |     |     |    | Lower Limit; SDI 226; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 355; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 8660                                    | 8153 | 7539 | 2.4  | 47              | 44  | 41  | 63 | 12123                            | 11414 | 10555 | 2.0  | 66              | 62  | 58  | 69 | 19051                            | 17937 | 16586 | 1.6  | 104             | 98  | 90  | 77 |
| 1.5  | 4294                                    | 4043 | 3738 | 3.4  | 53              | 50  | 46  | 65 | 6012                             | 5660  | 5234  | 2.9  | 74              | 69  | 64  | 71 | 9447                             | 8894  | 8224  | 2.3  | 116             | 109 | 101 | 79 |
| 2.0  | 2610                                    | 2458 | 2273 | 4.4  | 57              | 54  | 50  | 67 | 3655                             | 3441  | 3182  | 3.7  | 80              | 75  | 69  | 73 | 5743                             | 5407  | 5000  | 3.0  | 125             | 118 | 109 | 81 |
| 2.5  | 1774                                    | 1671 | 1545 | 5.3  | 60              | 57  | 53  | 68 | 2484                             | 2339  | 2163  | 4.5  | 85              | 80  | 74  | 74 | 3904                             | 3675  | 3399  | 3.6  | 133             | 125 | 116 | 82 |
| 3.0  | 1294                                    | 1219 | 1127 | 6.2  | 64              | 60  | 55  | 69 | 1812                             | 1706  | 1578  | 5.3  | 89              | 84  | 77  | 75 | 2848                             | 2681  | 2479  | 4.2  | 140             | 132 | 122 | 83 |
| 3.5  | 991                                     | 933  | 863  | 7.1  | 66              | 62  | 58  | 69 | 1388                             | 1307  | 1208  | 6.0  | 93              | 87  | 81  | 75 | 2181                             | 2054  | 1899  | 4.8  | 146             | 137 | 127 | 83 |
| 4.0  | 787                                     | 741  | 685  | 8.0  | 69              | 65  | 60  | 70 | 1102                             | 1037  | 959   | 6.8  | 96              | 91  | 84  | 76 | 1731                             | 1630  | 1507  | 5.4  | 151             | 142 | 132 | 84 |
| 4.5  | 642                                     | 604  | 559  | 8.9  | 71              | 67  | 62  | 71 | 899                              | 846   | 782   | 7.5  | 99              | 93  | 86  | 77 | 1412                             | 1329  | 1229  | 6.0  | 156             | 147 | 136 | 85 |
| 5.0  | 535                                     | 504  | 466  | 9.7  | 73              | 69  | 63  | 71 | 749                              | 705   | 652   | 8.2  | 102             | 96  | 89  | 77 | 1177                             | 1108  | 1025  | 6.5  | 160             | 151 | 140 | 85 |
| 5.5  | 454                                     | 427  | 395  | 10.5 | 75              | 70  | 65  | 72 | 635                              | 598   | 553   | 8.9  | 105             | 99  | 91  | 78 | 998                              | 940   | 869   | 7.1  | 165             | 155 | 143 | 86 |
| 6.0  | 390                                     | 367  | 340  | 11.4 | 77              | 72  | 67  | 72 | 546                              | 514   | 476   | 9.6  | 107             | 101 | 93  | 78 | 858                              | 808   | 747   | 7.7  | 169             | 159 | 147 | 86 |
| 6.5  | 340                                     | 320  | 296  | 12.2 | 78              | 74  | 68  | 72 | 476                              | 448   | 414   | 10.3 | 110             | 103 | 95  | 78 | 747                              | 704   | 651   | 8.2  | 172             | 162 | 150 | 86 |
| 7.0  | 299                                     | 281  | 260  | 13.0 | 80              | 75  | 70  | 73 | 418                              | 394   | 364   | 11.0 | 112             | 105 | 97  | 79 | 658                              | 619   | 572   | 8.7  | 176             | 165 | 153 | 87 |
| 7.5  | 265                                     | 250  | 231  | 13.8 | 81              | 77  | 71  | 73 | 371                              | 350   | 323   | 11.6 | 114             | 107 | 99  | 79 | 584                              | 549   | 508   | 9.3  | 179             | 169 | 156 | 87 |
| 8.0  | 237                                     | 223  | 207  | 14.6 | 83              | 78  | 72  | 73 | 332                              | 313   | 289   | 12.3 | 116             | 109 | 101 | 79 | 522                              | 491   | 454   | 9.8  | 182             | 172 | 159 | 87 |
| 8.5  | 214                                     | 201  | 186  | 15.3 | 84              | 79  | 73  | 74 | 299                              | 282   | 260   | 13.0 | 118             | 111 | 103 | 80 | 470                              | 442   | 409   | 10.3 | 185             | 174 | 161 | 88 |
| 9.0  | 193                                     | 182  | 168  | 16.1 | 85              | 80  | 74  | 74 | 271                              | 255   | 236   | 13.6 | 120             | 113 | 104 | 80 | 426                              | 401   | 371   | 10.9 | 188             | 177 | 164 | 88 |
| 9.5  | 176                                     | 166  | 153  | 16.9 | 87              | 82  | 76  | 74 | 247                              | 232   | 215   | 14.3 | 121             | 114 | 106 | 80 | 388                              | 365   | 338   | 11.4 | 191             | 180 | 166 | 88 |
| 10.0 | 161                                     | 152  | 140  | 17.7 | 88              | 83  | 77  | 74 | 226                              | 213   | 197   | 14.9 | 123             | 116 | 107 | 80 | 355                              | 334   | 309   | 11.9 | 193             | 182 | 168 | 89 |
| 11.0 | 137                                     | 129  | 119  | 19.2 | 90              | 85  | 79  | 75 | 191                              | 180   | 167   | 16.2 | 126             | 119 | 110 | 81 | 301                              | 283   | 262   | 12.9 | 199             | 187 | 173 | 89 |
| 12.0 | 118                                     | 111  | 102  | 20.7 | 92              | 87  | 80  | 75 | 165                              | 155   | 143   | 17.5 | 129             | 122 | 113 | 81 | 259                              | 244   | 225   | 13.9 | 203             | 191 | 177 | 89 |
| 13.0 | 102                                     | 96   | 89   | 22.2 | 94              | 89  | 82  | 76 | 143                              | 135   | 125   | 18.7 | 132             | 124 | 115 | 82 | 225                              | 212   | 196   | 14.9 | 208             | 196 | 181 | 90 |
| 14.0 | 90                                      | 85   | 78   | 23.6 | 96              | 91  | 84  | 76 | 126                              | 119   | 110   | 20.0 | 135             | 127 | 117 | 82 | 198                              | 187   | 173   | 15.9 | 212             | 199 | 184 | 90 |
| 15.0 | 80                                      | 75   | 70   | 25.1 | 98              | 92  | 85  | 76 | 112                              | 105   | 97    | 21.2 | 137             | 129 | 120 | 82 | 176                              | 166   | 153   | 16.9 | 216             | 203 | 188 | 91 |
| 16.0 | 72                                      | 67   | 62   | 26.5 | 100             | 94  | 87  | 77 | 100                              | 94    | 87    | 22.4 | 140             | 132 | 122 | 83 | 157                              | 148   | 137   | 17.9 | 220             | 207 | 191 | 91 |
| 17.0 | 64                                      | 61   | 56   | 27.9 | 101             | 96  | 88  | 77 | 90                               | 85    | 78    | 23.6 | 142             | 134 | 124 | 83 | 142                              | 133   | 123   | 18.8 | 223             | 210 | 194 | 91 |
| 18.0 | 58                                      | 55   | 51   | 29.4 | 103             | 97  | 90  | 77 | 82                               | 77    | 71    | 24.8 | 144             | 136 | 126 | 83 | 128                              | 121   | 112   | 19.8 | 227             | 213 | 197 | 91 |
| 19.0 | 53                                      | 50   | 46   | 30.8 | 105             | 98  | 91  | 78 | 74                               | 70    | 65    | 26.0 | 146             | 138 | 127 | 84 | 117                              | 110   | 102   | 20.7 | 230             | 217 | 200 | 92 |
| 20.0 | 49                                      | 46   | 42   | 32.2 | 106             | 100 | 92  | 78 | 68                               | 64    | 59    | 27.2 | 148             | 140 | 129 | 84 | 107                              | 101   | 93    | 21.7 | 233             | 220 | 203 | 92 |
| 22.0 | 41                                      | 39   | 36   | 34.9 | 109             | 102 | 95  | 78 | 58                               | 54    | 50    | 29.5 | 152             | 143 | 133 | 84 | 91                               | 85    | 79    | 23.6 | 239             | 225 | 208 | 92 |
| 24.0 | 35                                      | 33   | 31   | 37.7 | 111             | 105 | 97  | 79 | 50                               | 47    | 43    | 31.8 | 156             | 147 | 136 | 85 | 78                               | 73    | 68    | 25.4 | 245             | 231 | 213 | 93 |
| 26.0 | 31                                      | 29   | 27   | 40.4 | 114             | 107 | 99  | 79 | 43                               | 41    | 38    | 34.1 | 159             | 150 | 139 | 85 | 68                               | 64    | 59    | 27.2 | 250             | 236 | 218 | 93 |
| 28.0 | 27                                      | 26   | 24   | 43.0 | 116             | 109 | 101 | 79 | 38                               | 36    | 33    | 36.4 | 163             | 153 | 142 | 85 | 60                               | 56    | 52    | 29.0 | 255             | 241 | 222 | 94 |
| 30.0 | 24                                      | 23   | 21   | 45.7 | 118             | 111 | 103 | 80 | 34                               | 32    | 29    | 38.6 | 166             | 156 | 144 | 86 | 53                               | 50    | 46    | 30.8 | 260             | 245 | 227 | 94 |

**Table G7:** Grand fir stocking levels for the ABGR/POMU-ASCA3 plant association (B-O province).

| QMD  | Climate Resilience; SDI 152; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 213; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 334; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 8163                                    | 7685 | 7107 | 2.5  | 45              | 42  | 39 | 62 | 11428                            | 10759 | 9949 | 2.1  | 62              | 59  | 54  | 68 | 17958                            | 16908 | 15635 | 1.7  | 98              | 92  | 85  | 76 |
| 1.5  | 4048                                    | 3811 | 3524 | 3.5  | 50              | 47  | 43 | 64 | 5667                             | 5335  | 4933 | 3.0  | 70              | 65  | 61  | 70 | 8905                             | 8384  | 7753  | 2.4  | 109             | 103 | 95  | 78 |
| 2.0  | 2461                                    | 2317 | 2142 | 4.5  | 54              | 51  | 47 | 66 | 3445                             | 3243  | 2999 | 3.8  | 75              | 71  | 65  | 72 | 5414                             | 5097  | 4713  | 3.0  | 118             | 111 | 103 | 80 |
| 2.5  | 1673                                    | 1575 | 1456 | 5.5  | 57              | 54  | 50 | 67 | 2342                             | 2205  | 2039 | 4.6  | 80              | 75  | 69  | 73 | 3680                             | 3465  | 3204  | 3.7  | 125             | 118 | 109 | 81 |
| 3.0  | 1220                                    | 1149 | 1062 | 6.4  | 60              | 56  | 52 | 68 | 1708                             | 1608  | 1487 | 5.4  | 84              | 79  | 73  | 74 | 2684                             | 2527  | 2337  | 4.3  | 132             | 124 | 115 | 82 |
| 3.5  | 935                                     | 880  | 814  | 7.3  | 62              | 59  | 54 | 68 | 1308                             | 1232  | 1139 | 6.2  | 87              | 82  | 76  | 74 | 2056                             | 1936  | 1790  | 4.9  | 137             | 129 | 120 | 82 |
| 4.0  | 742                                     | 698  | 646  | 8.2  | 65              | 61  | 56 | 69 | 1039                             | 978   | 904  | 7.0  | 91              | 85  | 79  | 75 | 1632                             | 1536  | 1421  | 5.6  | 142             | 134 | 124 | 83 |
| 4.5  | 605                                     | 570  | 527  | 9.1  | 67              | 63  | 58 | 70 | 847                              | 798   | 737  | 7.7  | 94              | 88  | 81  | 76 | 1331                             | 1253  | 1159  | 6.1  | 147             | 138 | 128 | 84 |
| 5.0  | 504                                     | 475  | 439  | 10.0 | 69              | 65  | 60 | 70 | 706                              | 665   | 615  | 8.4  | 96              | 91  | 84  | 76 | 1109                             | 1044  | 966   | 6.7  | 151             | 142 | 132 | 84 |
| 5.5  | 428                                     | 403  | 372  | 10.8 | 71              | 66  | 61 | 71 | 599                              | 564   | 521  | 9.2  | 99              | 93  | 86  | 77 | 941                              | 886   | 819   | 7.3  | 155             | 146 | 135 | 85 |
| 6.0  | 368                                     | 346  | 320  | 11.7 | 72              | 68  | 63 | 71 | 515                              | 485   | 448  | 9.9  | 101             | 95  | 88  | 77 | 809                              | 762   | 705   | 7.9  | 159             | 150 | 138 | 85 |
| 6.5  | 320                                     | 302  | 279  | 12.5 | 74              | 69  | 64 | 71 | 448                              | 422   | 390  | 10.6 | 103             | 97  | 90  | 77 | 705                              | 663   | 613   | 8.4  | 162             | 153 | 141 | 85 |
| 7.0  | 282                                     | 265  | 245  | 13.4 | 75              | 71  | 66 | 72 | 394                              | 371   | 343  | 11.3 | 105             | 99  | 92  | 78 | 620                              | 584   | 540   | 9.0  | 166             | 156 | 144 | 86 |
| 7.5  | 250                                     | 235  | 218  | 14.2 | 77              | 72  | 67 | 72 | 350                              | 330   | 305  | 12.0 | 107             | 101 | 93  | 78 | 550                              | 518   | 479   | 9.6  | 169             | 159 | 147 | 86 |
| 8.0  | 224                                     | 211  | 195  | 15.0 | 78              | 73  | 68 | 72 | 313                              | 295   | 273  | 12.7 | 109             | 103 | 95  | 78 | 492                              | 463   | 428   | 10.1 | 172             | 162 | 150 | 86 |
| 8.5  | 201                                     | 190  | 175  | 15.8 | 79              | 75  | 69 | 73 | 282                              | 265   | 245  | 13.4 | 111             | 105 | 97  | 79 | 443                              | 417   | 386   | 10.7 | 175             | 164 | 152 | 87 |
| 9.0  | 182                                     | 172  | 159  | 16.6 | 81              | 76  | 70 | 73 | 255                              | 240   | 222  | 14.0 | 113             | 106 | 98  | 79 | 401                              | 378   | 349   | 11.2 | 177             | 167 | 154 | 87 |
| 9.5  | 166                                     | 156  | 145  | 17.4 | 82              | 77  | 71 | 73 | 233                              | 219   | 202  | 14.7 | 114             | 108 | 100 | 79 | 365                              | 344   | 318   | 11.7 | 180             | 169 | 157 | 87 |
| 10.0 | 152                                     | 143  | 132  | 18.2 | 83              | 78  | 72 | 73 | 213                              | 200   | 185  | 15.4 | 116             | 109 | 101 | 79 | 334                              | 315   | 291   | 12.3 | 182             | 172 | 159 | 88 |
| 11.0 | 129                                     | 121  | 112  | 19.8 | 85              | 80  | 74 | 74 | 180                              | 170   | 157  | 16.7 | 119             | 112 | 104 | 80 | 284                              | 267   | 247   | 13.3 | 187             | 176 | 163 | 88 |
| 12.0 | 111                                     | 104  | 97   | 21.3 | 87              | 82  | 76 | 74 | 155                              | 146   | 135  | 18.0 | 122             | 115 | 106 | 80 | 244                              | 230   | 212   | 14.4 | 192             | 180 | 167 | 88 |
| 13.0 | 97                                      | 91   | 84   | 22.8 | 89              | 84  | 77 | 75 | 135                              | 127   | 118  | 19.3 | 125             | 117 | 108 | 81 | 212                              | 200   | 185   | 15.4 | 196             | 184 | 170 | 89 |
| 14.0 | 85                                      | 80   | 74   | 24.3 | 91              | 85  | 79 | 75 | 119                              | 112   | 104  | 20.6 | 127             | 120 | 111 | 81 | 187                              | 176   | 163   | 16.4 | 200             | 188 | 174 | 89 |
| 15.0 | 75                                      | 71   | 66   | 25.8 | 92              | 87  | 81 | 75 | 106                              | 99    | 92   | 21.8 | 129             | 122 | 113 | 81 | 166                              | 156   | 144   | 17.4 | 203             | 192 | 177 | 89 |
| 16.0 | 67                                      | 63   | 59   | 27.3 | 94              | 89  | 82 | 76 | 94                               | 89    | 82   | 23.1 | 132             | 124 | 115 | 82 | 148                              | 140   | 129   | 18.4 | 207             | 195 | 180 | 90 |
| 17.0 | 61                                      | 57   | 53   | 28.8 | 96              | 90  | 83 | 76 | 85                               | 80    | 74   | 24.3 | 134             | 126 | 117 | 82 | 134                              | 126   | 116   | 19.4 | 210             | 198 | 183 | 90 |
| 18.0 | 55                                      | 52   | 48   | 30.2 | 97              | 91  | 85 | 76 | 77                               | 72    | 67   | 25.6 | 136             | 128 | 118 | 82 | 121                              | 114   | 105   | 20.4 | 214             | 201 | 186 | 90 |
| 19.0 | 50                                      | 47   | 44   | 31.7 | 99              | 93  | 86 | 76 | 70                               | 66    | 61   | 26.8 | 138             | 130 | 120 | 83 | 110                              | 104   | 96    | 21.4 | 217             | 204 | 189 | 91 |
| 20.0 | 46                                      | 43   | 40   | 33.1 | 100             | 94  | 87 | 77 | 64                               | 60    | 56   | 28.0 | 140             | 132 | 122 | 83 | 101                              | 95    | 88    | 22.3 | 220             | 207 | 191 | 91 |
| 22.0 | 39                                      | 37   | 34   | 36.0 | 103             | 97  | 89 | 77 | 54                               | 51    | 47   | 30.4 | 144             | 135 | 125 | 83 | 85                               | 80    | 74    | 24.3 | 226             | 212 | 196 | 91 |
| 24.0 | 33                                      | 31   | 29   | 38.8 | 105             | 99  | 91 | 78 | 47                               | 44    | 41   | 32.8 | 147             | 138 | 128 | 84 | 74                               | 69    | 64    | 26.2 | 231             | 218 | 201 | 92 |
| 26.0 | 29                                      | 27   | 25   | 41.6 | 107             | 101 | 93 | 78 | 41                               | 38    | 35   | 35.1 | 150             | 141 | 131 | 84 | 64                               | 60    | 56    | 28.0 | 236             | 222 | 206 | 92 |
| 28.0 | 26                                      | 24   | 22   | 44.3 | 109             | 103 | 95 | 78 | 36                               | 34    | 31   | 37.5 | 153             | 144 | 133 | 84 | 56                               | 53    | 49    | 29.9 | 241             | 227 | 210 | 92 |
| 30.0 | 23                                      | 21   | 20   | 47.1 | 112             | 105 | 97 | 79 | 32                               | 30    | 28   | 39.8 | 156             | 147 | 136 | 85 | 50                               | 47    | 44    | 31.7 | 245             | 231 | 214 | 93 |

**Table G8:** Grand fir stocking levels for the ABGR/SPBE plant association (B-O province).

| QMD  | Climate Resilience; SDI 111; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 155; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 243; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5948                                    | 5600 | 5178 | 2.9  | 32              | 31 | 28 | 57 | 8327                             | 7840 | 7249 | 2.5  | 45              | 43  | 40 | 63 | 13085                            | 12319 | 11392 | 2.0  | 71              | 67  | 62  | 71 |
| 1.5  | 2949                                    | 2777 | 2568 | 4.1  | 36              | 34 | 32 | 59 | 4129                             | 3887 | 3595 | 3.5  | 51              | 48  | 44 | 65 | 6488                             | 6109  | 5649  | 2.8  | 80              | 75  | 69  | 73 |
| 2.0  | 1793                                    | 1688 | 1561 | 5.3  | 39              | 37 | 34 | 60 | 2510                             | 2363 | 2185 | 4.5  | 55              | 52  | 48 | 66 | 3944                             | 3714  | 3434  | 3.6  | 86              | 81  | 75  | 74 |
| 2.5  | 1219                                    | 1147 | 1061 | 6.4  | 42              | 39 | 36 | 61 | 1706                             | 1606 | 1485 | 5.4  | 58              | 55  | 51 | 67 | 2681                             | 2524  | 2334  | 4.3  | 91              | 86  | 80  | 75 |
| 3.0  | 889                                     | 837  | 774  | 7.5  | 44              | 41 | 38 | 62 | 1245                             | 1172 | 1084 | 6.4  | 61              | 58  | 53 | 68 | 1956                             | 1841  | 1703  | 5.1  | 96              | 90  | 84  | 76 |
| 3.5  | 681                                     | 641  | 593  | 8.6  | 45              | 43 | 40 | 63 | 953                              | 898  | 830  | 7.3  | 64              | 60  | 55 | 69 | 1498                             | 1410  | 1304  | 5.8  | 100             | 94  | 87  | 77 |
| 4.0  | 540                                     | 509  | 471  | 9.6  | 47              | 44 | 41 | 63 | 757                              | 712  | 659  | 8.2  | 66              | 62  | 57 | 69 | 1189                             | 1119  | 1035  | 6.5  | 104             | 98  | 90  | 77 |
| 4.5  | 441                                     | 415  | 384  | 10.7 | 49              | 46 | 42 | 64 | 617                              | 581  | 537  | 9.0  | 68              | 64  | 59 | 70 | 970                              | 913   | 844   | 7.2  | 107             | 101 | 93  | 78 |
| 5.0  | 367                                     | 346  | 320  | 11.7 | 50              | 47 | 44 | 64 | 514                              | 484  | 448  | 9.9  | 70              | 66  | 61 | 70 | 808                              | 761   | 704   | 7.9  | 110             | 104 | 96  | 78 |
| 5.5  | 312                                     | 293  | 271  | 12.7 | 51              | 48 | 45 | 65 | 436                              | 411  | 380  | 10.7 | 72              | 68  | 63 | 71 | 685                              | 645   | 597   | 8.6  | 113             | 106 | 98  | 79 |
| 6.0  | 268                                     | 252  | 233  | 13.7 | 53              | 50 | 46 | 65 | 375                              | 353  | 327  | 11.6 | 74              | 69  | 64 | 71 | 590                              | 555   | 513   | 9.2  | 116             | 109 | 101 | 79 |
| 6.5  | 233                                     | 220  | 203  | 14.7 | 54              | 51 | 47 | 66 | 327                              | 308  | 284  | 12.4 | 75              | 71  | 66 | 72 | 513                              | 483   | 447   | 9.9  | 118             | 111 | 103 | 80 |
| 7.0  | 205                                     | 193  | 179  | 15.7 | 55              | 52 | 48 | 66 | 287                              | 271  | 250  | 13.2 | 77              | 72  | 67 | 72 | 452                              | 425   | 393   | 10.6 | 121             | 114 | 105 | 80 |
| 7.5  | 182                                     | 172  | 159  | 16.6 | 56              | 53 | 49 | 66 | 255                              | 240  | 222  | 14.0 | 78              | 74  | 68 | 72 | 401                              | 377   | 349   | 11.2 | 123             | 116 | 107 | 80 |
| 8.0  | 163                                     | 153  | 142  | 17.6 | 57              | 54 | 50 | 67 | 228                              | 215  | 199  | 14.8 | 80              | 75  | 69 | 73 | 358                              | 337   | 312   | 11.8 | 125             | 118 | 109 | 81 |
| 8.5  | 147                                     | 138  | 128  | 18.5 | 58              | 54 | 50 | 67 | 205                              | 193  | 179  | 15.6 | 81              | 76  | 70 | 73 | 323                              | 304   | 281   | 12.5 | 127             | 120 | 111 | 81 |
| 9.0  | 133                                     | 125  | 116  | 19.5 | 59              | 55 | 51 | 67 | 186                              | 175  | 162  | 16.4 | 82              | 77  | 72 | 73 | 292                              | 275   | 255   | 13.1 | 129             | 122 | 112 | 81 |
| 9.5  | 121                                     | 114  | 105  | 20.4 | 60              | 56 | 52 | 68 | 169                              | 160  | 148  | 17.2 | 83              | 79  | 73 | 73 | 266                              | 251   | 232   | 13.7 | 131             | 123 | 114 | 82 |
| 10.0 | 111                                     | 104  | 96   | 21.3 | 60              | 57 | 53 | 68 | 155                              | 146  | 135  | 18.0 | 85              | 80  | 74 | 74 | 244                              | 229   | 212   | 14.4 | 133             | 125 | 116 | 82 |
| 11.0 | 94                                      | 88   | 82   | 23.1 | 62              | 58 | 54 | 68 | 131                              | 124  | 114  | 19.6 | 87              | 82  | 76 | 74 | 207                              | 195   | 180   | 15.6 | 136             | 128 | 119 | 82 |
| 12.0 | 81                                      | 76   | 70   | 25.0 | 63              | 60 | 55 | 69 | 113                              | 106  | 98   | 21.1 | 89              | 84  | 77 | 75 | 178                              | 167   | 155   | 16.8 | 140             | 131 | 122 | 83 |
| 13.0 | 70                                      | 66   | 61   | 26.7 | 65              | 61 | 56 | 69 | 98                               | 93   | 86   | 22.6 | 91              | 85  | 79 | 75 | 155                              | 146   | 135   | 18.0 | 143             | 134 | 124 | 83 |
| 14.0 | 62                                      | 58   | 54   | 28.5 | 66              | 62 | 58 | 69 | 87                               | 82   | 75   | 24.1 | 93              | 87  | 81 | 75 | 136                              | 128   | 119   | 19.2 | 146             | 137 | 127 | 83 |
| 15.0 | 55                                      | 52   | 48   | 30.3 | 67              | 63 | 59 | 70 | 77                               | 72   | 67   | 25.6 | 94              | 89  | 82 | 76 | 121                              | 114   | 105   | 20.4 | 148             | 140 | 129 | 84 |
| 16.0 | 49                                      | 46   | 43   | 32.0 | 69              | 65 | 60 | 70 | 69                               | 65   | 60   | 27.0 | 96              | 90  | 84 | 76 | 108                              | 102   | 94    | 21.6 | 151             | 142 | 131 | 84 |
| 17.0 | 44                                      | 42   | 39   | 33.7 | 70              | 66 | 61 | 70 | 62                               | 58   | 54   | 28.5 | 98              | 92  | 85 | 76 | 97                               | 92    | 85    | 22.7 | 153             | 144 | 134 | 84 |
| 18.0 | 40                                      | 38   | 35   | 35.4 | 71              | 67 | 62 | 71 | 56                               | 53   | 49   | 29.9 | 99              | 93  | 86 | 77 | 88                               | 83    | 77    | 23.9 | 156             | 147 | 136 | 85 |
| 19.0 | 36                                      | 34   | 32   | 37.1 | 72              | 68 | 63 | 71 | 51                               | 48   | 44   | 31.4 | 101             | 95  | 88 | 77 | 80                               | 76    | 70    | 25.0 | 158             | 149 | 138 | 85 |
| 20.0 | 33                                      | 31   | 29   | 38.8 | 73              | 69 | 63 | 71 | 47                               | 44   | 41   | 32.8 | 102             | 96  | 89 | 77 | 73                               | 69    | 64    | 26.2 | 160             | 151 | 140 | 85 |
| 22.0 | 28                                      | 27   | 25   | 42.2 | 75              | 70 | 65 | 72 | 40                               | 37   | 35   | 35.6 | 105             | 99  | 91 | 78 | 62                               | 59    | 54    | 28.4 | 164             | 155 | 143 | 86 |
| 24.0 | 24                                      | 23   | 21   | 45.4 | 77              | 72 | 67 | 72 | 34                               | 32   | 30   | 38.4 | 107             | 101 | 93 | 78 | 54                               | 50    | 47    | 30.6 | 168             | 158 | 147 | 86 |
| 26.0 | 21                                      | 20   | 18   | 48.7 | 78              | 74 | 68 | 72 | 30                               | 28   | 26   | 41.2 | 109             | 103 | 95 | 78 | 47                               | 44    | 41    | 32.8 | 172             | 162 | 150 | 86 |
| 28.0 | 19                                      | 18   | 16   | 51.9 | 80              | 75 | 69 | 73 | 26                               | 25   | 23   | 43.9 | 112             | 105 | 97 | 79 | 41                               | 39    | 36    | 35.0 | 175             | 165 | 153 | 87 |
| 30.0 | 17                                      | 16   | 14   | 55.1 | 81              | 77 | 71 | 73 | 23                               | 22   | 20   | 46.6 | 114             | 107 | 99 | 79 | 36                               | 34    | 32    | 37.2 | 179             | 168 | 156 | 87 |

**Table G9:** Grand fir stocking levels for the ABGR/VAME plant association (B-O province) and the PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, and PICO(ABGR)/VAME/PTAQ plant community types.

| QMD  | Climate Resilience; SDI 142; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 199; 35% of Max |       |      |      |                 |     |     |    | Upper Limit; SDI 313; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 7639                                    | 7192 | 6651 | 2.6  | 42              | 39 | 36 | 61 | 10695                            | 10069 | 9311 | 2.2  | 58              | 55  | 51  | 67 | 16806                            | 15823 | 14632 | 1.7  | 92              | 86  | 80  | 75 |
| 1.5  | 3788                                    | 3566 | 3298 | 3.6  | 46              | 44 | 40 | 63 | 5303                             | 4993  | 4617 | 3.1  | 65              | 61  | 57  | 69 | 8334                             | 7846  | 7255  | 2.5  | 102             | 96  | 89  | 77 |
| 2.0  | 2303                                    | 2168 | 2005 | 4.7  | 50              | 47 | 44 | 64 | 3224                             | 3035  | 2807 | 3.9  | 70              | 66  | 61  | 70 | 5066                             | 4770  | 4411  | 3.2  | 111             | 104 | 96  | 79 |
| 2.5  | 1565                                    | 1474 | 1363 | 5.7  | 53              | 50 | 46 | 66 | 2192                             | 2063  | 1908 | 4.8  | 75              | 70  | 65  | 72 | 3444                             | 3242  | 2998  | 3.8  | 117             | 111 | 102 | 80 |
| 3.0  | 1142                                    | 1075 | 994  | 6.6  | 56              | 53 | 49 | 66 | 1599                             | 1505  | 1392 | 5.6  | 78              | 74  | 68  | 72 | 2512                             | 2365  | 2187  | 4.5  | 123             | 116 | 107 | 80 |
| 3.5  | 875                                     | 823  | 761  | 7.6  | 58              | 55 | 51 | 67 | 1224                             | 1153  | 1066 | 6.4  | 82              | 77  | 71  | 73 | 1924                             | 1812  | 1675  | 5.1  | 129             | 121 | 112 | 81 |
| 4.0  | 694                                     | 654  | 604  | 8.5  | 61              | 57 | 53 | 68 | 972                              | 915   | 846  | 7.2  | 85              | 80  | 74  | 74 | 1527                             | 1438  | 1330  | 5.7  | 133             | 125 | 116 | 82 |
| 4.5  | 566                                     | 533  | 493  | 9.4  | 63              | 59 | 54 | 68 | 793                              | 746   | 690  | 8.0  | 88              | 82  | 76  | 74 | 1246                             | 1173  | 1085  | 6.4  | 138             | 130 | 120 | 82 |
| 5.0  | 472                                     | 444  | 411  | 10.3 | 64              | 61 | 56 | 69 | 661                              | 622   | 575  | 8.7  | 90              | 85  | 78  | 75 | 1038                             | 977   | 904   | 7.0  | 142             | 133 | 123 | 83 |
| 5.5  | 400                                     | 377  | 348  | 11.2 | 66              | 62 | 57 | 69 | 560                              | 527   | 488  | 9.5  | 92              | 87  | 80  | 75 | 880                              | 829   | 766   | 7.6  | 145             | 137 | 126 | 83 |
| 6.0  | 344                                     | 324  | 300  | 12.1 | 68              | 64 | 59 | 70 | 482                              | 454   | 420  | 10.2 | 95              | 89  | 82  | 76 | 757                              | 713   | 659   | 8.1  | 149             | 140 | 129 | 84 |
| 6.5  | 300                                     | 282  | 261  | 13.0 | 69              | 65 | 60 | 70 | 420                              | 395   | 365  | 10.9 | 97              | 91  | 84  | 76 | 659                              | 621   | 574   | 8.7  | 152             | 143 | 132 | 84 |
| 7.0  | 264                                     | 248  | 230  | 13.8 | 70              | 66 | 61 | 70 | 369                              | 348   | 321  | 11.7 | 99              | 93  | 86  | 76 | 580                              | 546   | 505   | 9.3  | 155             | 146 | 135 | 85 |
| 7.5  | 234                                     | 220  | 204  | 14.7 | 72              | 68 | 62 | 71 | 328                              | 308   | 285  | 12.4 | 101             | 95  | 87  | 77 | 515                              | 485   | 448   | 9.9  | 158             | 149 | 137 | 85 |
| 8.0  | 209                                     | 197  | 182  | 15.5 | 73              | 69 | 64 | 71 | 293                              | 276   | 255  | 13.1 | 102             | 96  | 89  | 77 | 460                              | 433   | 401   | 10.5 | 161             | 151 | 140 | 85 |
| 8.5  | 188                                     | 177  | 164  | 16.3 | 74              | 70 | 65 | 71 | 264                              | 248   | 230  | 13.8 | 104             | 98  | 91  | 77 | 415                              | 390   | 361   | 11.0 | 163             | 154 | 142 | 86 |
| 9.0  | 171                                     | 161  | 149  | 17.2 | 75              | 71 | 66 | 72 | 239                              | 225   | 208  | 14.5 | 106             | 99  | 92  | 78 | 376                              | 354   | 327   | 11.6 | 166             | 156 | 144 | 86 |
| 9.5  | 155                                     | 146  | 135  | 18.0 | 77              | 72 | 67 | 72 | 218                              | 205   | 189  | 15.2 | 107             | 101 | 93  | 78 | 342                              | 322   | 298   | 12.1 | 168             | 158 | 147 | 86 |
| 10.0 | 142                                     | 134  | 124  | 18.8 | 78              | 73 | 68 | 72 | 199                              | 187   | 173  | 15.9 | 109             | 102 | 95  | 78 | 313                              | 295   | 272   | 12.7 | 171             | 161 | 149 | 86 |
| 11.0 | 121                                     | 114  | 105  | 20.4 | 80              | 75 | 69 | 73 | 169                              | 159   | 147  | 17.3 | 111             | 105 | 97  | 79 | 265                              | 250   | 231   | 13.8 | 175             | 165 | 152 | 87 |
| 12.0 | 104                                     | 98   | 90   | 22.0 | 82              | 77 | 71 | 73 | 145                              | 137   | 126  | 18.6 | 114             | 107 | 99  | 79 | 228                              | 215   | 199   | 14.8 | 179             | 169 | 156 | 87 |
| 13.0 | 90                                      | 85   | 79   | 23.6 | 83              | 78 | 73 | 73 | 126                              | 119   | 110  | 19.9 | 117             | 110 | 102 | 79 | 199                              | 187   | 173   | 15.9 | 183             | 172 | 160 | 88 |
| 14.0 | 79                                      | 75   | 69   | 25.2 | 85              | 80 | 74 | 74 | 111                              | 105   | 97   | 21.3 | 119             | 112 | 104 | 80 | 175                              | 165   | 152   | 17.0 | 187             | 176 | 163 | 88 |
| 15.0 | 71                                      | 66   | 61   | 26.7 | 87              | 81 | 75 | 74 | 99                               | 93    | 86   | 22.6 | 121             | 114 | 106 | 80 | 155                              | 146   | 135   | 18.0 | 190             | 179 | 166 | 88 |
| 16.0 | 63                                      | 59   | 55   | 28.2 | 88              | 83 | 77 | 74 | 88                               | 83    | 77   | 23.9 | 123             | 116 | 107 | 80 | 139                              | 131   | 121   | 19.0 | 194             | 182 | 169 | 89 |
| 17.0 | 57                                      | 53   | 49   | 29.8 | 90              | 84 | 78 | 75 | 80                               | 75    | 69   | 25.1 | 125             | 118 | 109 | 81 | 125                              | 118   | 109   | 20.1 | 197             | 185 | 171 | 89 |
| 18.0 | 51                                      | 48   | 45   | 31.3 | 91              | 86 | 79 | 75 | 72                               | 68    | 63   | 26.4 | 127             | 120 | 111 | 81 | 113                              | 107   | 99    | 21.1 | 200             | 188 | 174 | 89 |
| 19.0 | 47                                      | 44   | 41   | 32.8 | 92              | 87 | 80 | 75 | 66                               | 62    | 57   | 27.7 | 129             | 122 | 112 | 81 | 103                              | 97    | 90    | 22.1 | 203             | 191 | 177 | 89 |
| 20.0 | 43                                      | 40   | 37   | 34.2 | 94              | 88 | 81 | 76 | 60                               | 57    | 52   | 28.9 | 131             | 123 | 114 | 82 | 94                               | 89    | 82    | 23.1 | 206             | 194 | 179 | 90 |
| 22.0 | 36                                      | 34   | 32   | 37.2 | 96              | 90 | 84 | 76 | 51                               | 48    | 44   | 31.4 | 134             | 127 | 117 | 82 | 80                               | 75    | 70    | 25.1 | 211             | 199 | 184 | 90 |
| 24.0 | 31                                      | 29   | 27   | 40.1 | 98              | 93 | 86 | 76 | 44                               | 41    | 38   | 33.9 | 138             | 130 | 120 | 82 | 69                               | 65    | 60    | 27.0 | 216             | 204 | 188 | 91 |
| 26.0 | 27                                      | 26   | 24   | 43.0 | 100             | 95 | 87 | 77 | 38                               | 36    | 33   | 36.3 | 141             | 132 | 122 | 83 | 60                               | 56    | 52    | 29.0 | 221             | 208 | 192 | 91 |
| 28.0 | 24                                      | 23   | 21   | 45.8 | 102             | 96 | 89 | 77 | 34                               | 32    | 29   | 38.7 | 143             | 135 | 125 | 83 | 53                               | 50    | 46    | 30.9 | 225             | 212 | 196 | 91 |
| 30.0 | 21                                      | 20   | 19   | 48.6 | 104             | 98 | 91 | 77 | 30                               | 28    | 26   | 41.1 | 146             | 138 | 127 | 84 | 47                               | 44    | 41    | 32.8 | 230             | 216 | 200 | 92 |

**Table G10:** Grand fir stocking levels for the ABGR/VASC plant association (B-O province) and the PICO(ABGR)VASC/CARU plant community type.

| QMD  | Climate Resilience; SDI 115; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 161; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 253; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6176                                    | 5815 | 5377 | 2.9  | 34              | 32 | 29 | 57 | 8646                             | 8140 | 7527 | 2.4  | 47              | 44  | 41  | 63 | 13587                            | 12792 | 11829 | 1.9  | 74              | 70  | 65  | 71 |
| 1.5  | 3062                                    | 2883 | 2666 | 4.1  | 38              | 35 | 33 | 59 | 4287                             | 4037 | 3733 | 3.4  | 53              | 50  | 46  | 65 | 6737                             | 6343  | 5865  | 2.7  | 83              | 78  | 72  | 73 |
| 2.0  | 1862                                    | 1753 | 1621 | 5.2  | 41              | 38 | 35 | 61 | 2606                             | 2454 | 2269 | 4.4  | 57              | 54  | 50  | 67 | 4096                             | 3856  | 3566  | 3.5  | 89              | 84  | 78  | 75 |
| 2.5  | 1265                                    | 1191 | 1102 | 6.3  | 43              | 41 | 38 | 62 | 1772                             | 1668 | 1542 | 5.3  | 60              | 57  | 53  | 68 | 2784                             | 2621  | 2424  | 4.3  | 95              | 89  | 83  | 76 |
| 3.0  | 923                                     | 869  | 804  | 7.4  | 45              | 43 | 39 | 63 | 1292                             | 1217 | 1125 | 6.2  | 63              | 60  | 55  | 69 | 2031                             | 1912  | 1768  | 5.0  | 100             | 94  | 87  | 77 |
| 3.5  | 707                                     | 666  | 616  | 8.4  | 47              | 44 | 41 | 63 | 990                              | 932  | 862  | 7.1  | 66              | 62  | 58  | 69 | 1556                             | 1465  | 1354  | 5.7  | 104             | 98  | 90  | 77 |
| 4.0  | 561                                     | 528  | 489  | 9.5  | 49              | 46 | 43 | 64 | 786                              | 740  | 684  | 8.0  | 69              | 65  | 60  | 70 | 1235                             | 1162  | 1075  | 6.4  | 108             | 101 | 94  | 78 |
| 4.5  | 458                                     | 431  | 399  | 10.5 | 51              | 48 | 44 | 65 | 641                              | 603  | 558  | 8.9  | 71              | 67  | 62  | 71 | 1007                             | 948   | 877   | 7.1  | 111             | 105 | 97  | 79 |
| 5.0  | 381                                     | 359  | 332  | 11.5 | 52              | 49 | 45 | 65 | 534                              | 503  | 465  | 9.7  | 73              | 69  | 63  | 71 | 839                              | 790   | 731   | 7.7  | 114             | 108 | 100 | 79 |
| 5.5  | 323                                     | 305  | 282  | 12.5 | 53              | 50 | 46 | 66 | 453                              | 426  | 394  | 10.5 | 75              | 70  | 65  | 72 | 712                              | 670   | 620   | 8.4  | 117             | 111 | 102 | 80 |
| 6.0  | 278                                     | 262  | 242  | 13.4 | 55              | 51 | 48 | 66 | 390                              | 367  | 339  | 11.4 | 76              | 72  | 67  | 72 | 612                              | 576   | 533   | 9.1  | 120             | 113 | 105 | 80 |
| 6.5  | 242                                     | 228  | 211  | 14.4 | 56              | 53 | 49 | 66 | 339                              | 319  | 295  | 12.2 | 78              | 74  | 68  | 72 | 533                              | 502   | 464   | 9.7  | 123             | 116 | 107 | 80 |
| 7.0  | 213                                     | 201  | 186  | 15.4 | 57              | 54 | 50 | 67 | 298                              | 281  | 260  | 13.0 | 80              | 75  | 69  | 73 | 469                              | 441   | 408   | 10.4 | 125             | 118 | 109 | 81 |
| 7.5  | 189                                     | 178  | 165  | 16.3 | 58              | 55 | 51 | 67 | 265                              | 249  | 231  | 13.8 | 81              | 76  | 71  | 73 | 416                              | 392   | 362   | 11.0 | 128             | 120 | 111 | 81 |
| 8.0  | 169                                     | 159  | 147  | 17.2 | 59              | 56 | 51 | 67 | 237                              | 223  | 206  | 14.6 | 83              | 78  | 72  | 73 | 372                              | 350   | 324   | 11.6 | 130             | 122 | 113 | 81 |
| 8.5  | 152                                     | 143  | 133  | 18.2 | 60              | 57 | 52 | 68 | 213                              | 201  | 186  | 15.4 | 84              | 79  | 73  | 74 | 335                              | 316   | 292   | 12.3 | 132             | 124 | 115 | 82 |
| 9.0  | 138                                     | 130  | 120  | 19.1 | 61              | 57 | 53 | 68 | 193                              | 182  | 168  | 16.1 | 85              | 80  | 74  | 74 | 304                              | 286   | 264   | 12.9 | 134             | 126 | 117 | 82 |
| 9.5  | 126                                     | 118  | 109  | 20.0 | 62              | 58 | 54 | 68 | 176                              | 166  | 153  | 16.9 | 87              | 82  | 75  | 74 | 276                              | 260   | 241   | 13.5 | 136             | 128 | 118 | 82 |
| 10.0 | 115                                     | 108  | 100  | 20.9 | 63              | 59 | 55 | 68 | 161                              | 152  | 140  | 17.7 | 88              | 83  | 76  | 74 | 253                              | 238   | 220   | 14.1 | 138             | 130 | 120 | 82 |
| 11.0 | 98                                      | 92   | 85   | 22.7 | 64              | 61 | 56 | 69 | 137                              | 129  | 119  | 19.2 | 90              | 85  | 78  | 75 | 215                              | 202   | 187   | 15.3 | 142             | 133 | 123 | 83 |
| 12.0 | 84                                      | 79   | 73   | 24.5 | 66              | 62 | 57 | 69 | 117                              | 111  | 102  | 20.7 | 92              | 87  | 80  | 75 | 185                              | 174   | 161   | 16.5 | 145             | 136 | 126 | 83 |
| 13.0 | 73                                      | 69   | 64   | 26.2 | 67              | 63 | 59 | 70 | 102                              | 96   | 89   | 22.2 | 94              | 89  | 82  | 76 | 161                              | 151   | 140   | 17.7 | 148             | 139 | 129 | 84 |
| 14.0 | 64                                      | 60   | 56   | 28.0 | 69              | 65 | 60 | 70 | 90                               | 85   | 78   | 23.6 | 96              | 91  | 84  | 76 | 141                              | 133   | 123   | 18.9 | 151             | 142 | 132 | 84 |
| 15.0 | 57                                      | 54   | 50   | 29.7 | 70              | 66 | 61 | 70 | 80                               | 75   | 70   | 25.1 | 98              | 92  | 85  | 76 | 125                              | 118   | 109   | 20.0 | 154             | 145 | 134 | 84 |
| 16.0 | 51                                      | 48   | 44   | 31.4 | 71              | 67 | 62 | 71 | 71                               | 67   | 62   | 26.5 | 100             | 94  | 87  | 77 | 112                              | 106   | 98    | 21.2 | 157             | 147 | 136 | 85 |
| 17.0 | 46                                      | 43   | 40   | 33.1 | 72              | 68 | 63 | 71 | 64                               | 61   | 56   | 28.0 | 101             | 95  | 88  | 77 | 101                              | 95    | 88    | 22.3 | 159             | 150 | 139 | 85 |
| 18.0 | 42                                      | 39   | 36   | 34.8 | 74              | 69 | 64 | 71 | 58                               | 55   | 51   | 29.4 | 103             | 97  | 90  | 77 | 92                               | 86    | 80    | 23.4 | 162             | 152 | 141 | 85 |
| 19.0 | 38                                      | 36   | 33   | 36.4 | 75              | 70 | 65 | 72 | 53                               | 50   | 46   | 30.8 | 104             | 98  | 91  | 78 | 83                               | 78    | 73    | 24.6 | 164             | 155 | 143 | 86 |
| 20.0 | 35                                      | 33   | 30   | 38.1 | 76              | 71 | 66 | 72 | 49                               | 46   | 42   | 32.2 | 106             | 100 | 92  | 78 | 76                               | 72    | 66    | 25.7 | 166             | 157 | 145 | 86 |
| 22.0 | 29                                      | 28   | 26   | 41.4 | 78              | 73 | 68 | 72 | 41                               | 39   | 36   | 35.0 | 109             | 102 | 95  | 78 | 65                               | 61    | 56    | 27.9 | 171             | 161 | 149 | 86 |
| 24.0 | 25                                      | 24   | 22   | 44.6 | 79              | 75 | 69 | 73 | 35                               | 33   | 31   | 37.7 | 111             | 105 | 97  | 79 | 56                               | 52    | 48    | 30.1 | 175             | 165 | 152 | 87 |
| 26.0 | 22                                      | 21   | 19   | 47.8 | 81              | 76 | 71 | 73 | 31                               | 29   | 27   | 40.4 | 114             | 107 | 99  | 79 | 48                               | 46    | 42    | 32.2 | 179             | 168 | 155 | 87 |
| 28.0 | 19                                      | 18   | 17   | 51.0 | 83              | 78 | 72 | 73 | 27                               | 26   | 24   | 43.1 | 116             | 109 | 101 | 79 | 43                               | 40    | 37    | 34.4 | 182             | 172 | 159 | 87 |
| 30.0 | 17                                      | 16   | 15   | 54.1 | 84              | 79 | 73 | 74 | 24                               | 23   | 21   | 45.7 | 118             | 111 | 103 | 80 | 38                               | 36    | 33    | 36.5 | 186             | 175 | 162 | 88 |

**Table G11:** Grand fir stocking levels for the ABGR/VASC-LIBO2 plant association (B-O province).

| QMD  | Climate Resilience; SDI 154; 25% of Max |      |      |      |                 |     |    |    | Lower Limit; SDI 216; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 340; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 8297                                    | 7812 | 7223 | 2.5  | 45              | 43  | 39 | 63 | 11616                            | 10936 | 10113 | 2.1  | 63              | 60  | 55  | 69 | 18254                            | 17186 | 15892 | 1.7  | 100             | 94  | 87  | 77 |
| 1.5  | 4114                                    | 3874 | 3582 | 3.5  | 50              | 48  | 44 | 65 | 5760                             | 5423  | 5015  | 3.0  | 71              | 67  | 62  | 71 | 9051                             | 8522  | 7880  | 2.4  | 111             | 105 | 97  | 79 |
| 2.0  | 2501                                    | 2355 | 2178 | 4.5  | 55              | 51  | 48 | 66 | 3502                             | 3297  | 3049  | 3.8  | 76              | 72  | 67  | 72 | 5503                             | 5181  | 4791  | 3.0  | 120             | 113 | 105 | 80 |
| 2.5  | 1700                                    | 1601 | 1480 | 5.4  | 58              | 55  | 50 | 67 | 2380                             | 2241  | 2072  | 4.6  | 81              | 76  | 71  | 73 | 3740                             | 3522  | 3256  | 3.7  | 128             | 120 | 111 | 81 |
| 3.0  | 1240                                    | 1168 | 1080 | 6.4  | 61              | 57  | 53 | 68 | 1736                             | 1635  | 1512  | 5.4  | 85              | 80  | 74  | 74 | 2729                             | 2569  | 2375  | 4.3  | 134             | 126 | 117 | 82 |
| 3.5  | 950                                     | 894  | 827  | 7.3  | 63              | 60  | 55 | 69 | 1330                             | 1252  | 1158  | 6.2  | 89              | 84  | 77  | 75 | 2090                             | 1968  | 1819  | 4.9  | 140             | 131 | 122 | 83 |
| 4.0  | 754                                     | 710  | 656  | 8.2  | 66              | 62  | 57 | 69 | 1056                             | 994   | 919   | 6.9  | 92              | 87  | 80  | 75 | 1659                             | 1562  | 1444  | 5.5  | 145             | 136 | 126 | 83 |
| 4.5  | 615                                     | 579  | 535  | 9.0  | 68              | 64  | 59 | 70 | 861                              | 811   | 750   | 7.6  | 95              | 90  | 83  | 76 | 1353                             | 1274  | 1178  | 6.1  | 149             | 141 | 130 | 84 |
| 5.0  | 513                                     | 483  | 446  | 9.9  | 70              | 66  | 61 | 70 | 718                              | 676   | 625   | 8.4  | 98              | 92  | 85  | 76 | 1128                             | 1062  | 982   | 6.7  | 154             | 145 | 134 | 84 |
| 5.5  | 435                                     | 409  | 378  | 10.8 | 72              | 68  | 62 | 71 | 608                              | 573   | 530   | 9.1  | 100             | 95  | 87  | 77 | 956                              | 900   | 832   | 7.3  | 158             | 149 | 137 | 85 |
| 6.0  | 374                                     | 352  | 325  | 11.6 | 73              | 69  | 64 | 71 | 523                              | 493   | 456   | 9.8  | 103             | 97  | 89  | 77 | 823                              | 774   | 716   | 7.8  | 162             | 152 | 141 | 85 |
| 6.5  | 326                                     | 306  | 283  | 12.4 | 75              | 71  | 65 | 72 | 456                              | 429   | 397   | 10.5 | 105             | 99  | 91  | 78 | 716                              | 674   | 623   | 8.4  | 165             | 155 | 144 | 86 |
| 7.0  | 286                                     | 270  | 249  | 13.3 | 77              | 72  | 67 | 72 | 401                              | 377   | 349   | 11.2 | 107             | 101 | 93  | 78 | 630                              | 593   | 548   | 8.9  | 168             | 159 | 147 | 86 |
| 7.5  | 254                                     | 239  | 221  | 14.1 | 78              | 73  | 68 | 72 | 356                              | 335   | 310   | 11.9 | 109             | 103 | 95  | 78 | 559                              | 526   | 487   | 9.5  | 172             | 161 | 149 | 86 |
| 8.0  | 227                                     | 214  | 198  | 14.9 | 79              | 75  | 69 | 73 | 318                              | 300   | 277   | 12.6 | 111             | 105 | 97  | 79 | 500                              | 471   | 435   | 10.0 | 175             | 164 | 152 | 87 |
| 8.5  | 205                                     | 193  | 178  | 15.7 | 81              | 76  | 70 | 73 | 287                              | 270   | 249   | 13.2 | 113             | 106 | 98  | 79 | 450                              | 424   | 392   | 10.6 | 177             | 167 | 154 | 87 |
| 9.0  | 185                                     | 175  | 161  | 16.5 | 82              | 77  | 71 | 73 | 260                              | 244   | 226   | 13.9 | 115             | 108 | 100 | 79 | 408                              | 384   | 355   | 11.1 | 180             | 170 | 157 | 87 |
| 9.5  | 169                                     | 159  | 147  | 17.3 | 83              | 78  | 72 | 73 | 236                              | 223   | 206   | 14.6 | 116             | 110 | 101 | 79 | 371                              | 350   | 323   | 11.6 | 183             | 172 | 159 | 88 |
| 10.0 | 155                                     | 145  | 135  | 18.0 | 84              | 79  | 73 | 74 | 216                              | 204   | 188   | 15.2 | 118             | 111 | 103 | 80 | 340                              | 320   | 296   | 12.2 | 185             | 175 | 161 | 88 |
| 11.0 | 131                                     | 123  | 114  | 19.6 | 86              | 81  | 75 | 74 | 183                              | 173   | 160   | 16.6 | 121             | 114 | 105 | 80 | 288                              | 271   | 251   | 13.2 | 190             | 179 | 166 | 88 |
| 12.0 | 113                                     | 106  | 98   | 21.1 | 89              | 83  | 77 | 75 | 158                              | 149   | 137   | 17.9 | 124             | 117 | 108 | 81 | 248                              | 233   | 216   | 14.2 | 195             | 183 | 170 | 89 |
| 13.0 | 98                                      | 92   | 85   | 22.6 | 90              | 85  | 79 | 75 | 137                              | 129   | 120   | 19.1 | 127             | 119 | 110 | 81 | 216                              | 203   | 188   | 15.3 | 199             | 187 | 173 | 89 |
| 14.0 | 86                                      | 81   | 75   | 24.1 | 92              | 87  | 80 | 75 | 121                              | 114   | 105   | 20.4 | 129             | 122 | 112 | 81 | 190                              | 179   | 165   | 16.3 | 203             | 191 | 177 | 89 |
| 15.0 | 77                                      | 72   | 67   | 25.6 | 94              | 89  | 82 | 76 | 107                              | 101   | 93    | 21.7 | 132             | 124 | 115 | 82 | 169                              | 159   | 147   | 17.3 | 207             | 195 | 180 | 90 |
| 16.0 | 69                                      | 65   | 60   | 27.1 | 96              | 90  | 83 | 76 | 96                               | 90    | 84    | 22.9 | 134             | 126 | 117 | 82 | 151                              | 142   | 131   | 18.3 | 210             | 198 | 183 | 90 |
| 17.0 | 62                                      | 58   | 54   | 28.6 | 97              | 92  | 85 | 76 | 86                               | 81    | 75    | 24.1 | 136             | 128 | 119 | 82 | 136                              | 128   | 118   | 19.3 | 214             | 201 | 186 | 90 |
| 18.0 | 56                                      | 53   | 49   | 30.0 | 99              | 93  | 86 | 77 | 78                               | 74    | 68    | 25.4 | 138             | 130 | 120 | 83 | 123                              | 116   | 107   | 20.2 | 217             | 205 | 189 | 91 |
| 19.0 | 51                                      | 48   | 44   | 31.4 | 100             | 94  | 87 | 77 | 71                               | 67    | 62    | 26.6 | 140             | 132 | 122 | 83 | 112                              | 105   | 97    | 21.2 | 220             | 208 | 192 | 91 |
| 20.0 | 47                                      | 44   | 41   | 32.9 | 102             | 96  | 88 | 77 | 65                               | 61    | 57    | 27.8 | 142             | 134 | 124 | 83 | 102                              | 96    | 89    | 22.2 | 224             | 210 | 195 | 91 |
| 22.0 | 39                                      | 37   | 34   | 35.7 | 104             | 98  | 91 | 77 | 55                               | 52    | 48    | 30.2 | 146             | 137 | 127 | 84 | 87                               | 82    | 76    | 24.1 | 229             | 216 | 200 | 92 |
| 24.0 | 34                                      | 32   | 30   | 38.5 | 107             | 100 | 93 | 78 | 48                               | 45    | 41    | 32.5 | 149             | 141 | 130 | 84 | 75                               | 70    | 65    | 25.9 | 235             | 221 | 204 | 92 |
| 26.0 | 30                                      | 28   | 26   | 41.2 | 109             | 103 | 95 | 78 | 41                               | 39    | 36    | 34.9 | 153             | 144 | 133 | 84 | 65                               | 61    | 57    | 27.8 | 240             | 226 | 209 | 92 |
| 28.0 | 26                                      | 24   | 23   | 44.0 | 111             | 105 | 97 | 79 | 36                               | 34    | 32    | 37.2 | 156             | 147 | 136 | 85 | 57                               | 54    | 50    | 29.6 | 245             | 230 | 213 | 93 |
| 30.0 | 23                                      | 22   | 20   | 46.7 | 113             | 107 | 99 | 79 | 32                               | 30    | 28    | 39.4 | 159             | 149 | 138 | 85 | 51                               | 48    | 44    | 31.5 | 249             | 235 | 217 | 93 |

**Table G12:** Grand fir stocking levels for the ABLA2/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 170; 25% of Max |      |      |      |                 |     |     |    | Lower Limit; SDI 238; 35% of Max |       |       |      |                 |     |     |    | Upper Limit; SDI 375; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 9143                                    | 8608 | 7960 | 2.3  | 50              | 47  | 43  | 64 | 12800                            | 12051 | 11144 | 2.0  | 70              | 66  | 61  | 70 | 20115                            | 18938 | 17512 | 1.6  | 110             | 103 | 96  | 78 |
| 1.5  | 4534                                    | 4268 | 3947 | 3.3  | 56              | 52  | 48  | 66 | 6347                             | 5976  | 5526  | 2.8  | 78              | 73  | 68  | 72 | 9974                             | 9391  | 8683  | 2.2  | 122             | 115 | 107 | 80 |
| 2.0  | 2756                                    | 2595 | 2400 | 4.3  | 60              | 57  | 52  | 68 | 3859                             | 3633  | 3359  | 3.6  | 84              | 79  | 73  | 74 | 6064                             | 5709  | 5279  | 2.9  | 132             | 125 | 115 | 82 |
| 2.5  | 1873                                    | 1764 | 1631 | 5.2  | 64              | 60  | 56  | 69 | 2623                             | 2469  | 2283  | 4.4  | 89              | 84  | 78  | 75 | 4122                             | 3881  | 3588  | 3.5  | 141             | 132 | 122 | 83 |
| 3.0  | 1367                                    | 1287 | 1190 | 6.1  | 67              | 63  | 58  | 70 | 1913                             | 1801  | 1666  | 5.1  | 94              | 88  | 82  | 76 | 3007                             | 2831  | 2618  | 4.1  | 148             | 139 | 128 | 84 |
| 3.5  | 1047                                    | 986  | 911  | 6.9  | 70              | 66  | 61  | 70 | 1465                             | 1380  | 1276  | 5.9  | 98              | 92  | 85  | 76 | 2303                             | 2168  | 2005  | 4.7  | 154             | 145 | 134 | 84 |
| 4.0  | 831                                     | 782  | 723  | 7.8  | 73              | 68  | 63  | 71 | 1163                             | 1095  | 1013  | 6.6  | 102             | 96  | 88  | 77 | 1828                             | 1721  | 1591  | 5.2  | 160             | 150 | 139 | 85 |
| 4.5  | 678                                     | 638  | 590  | 8.6  | 75              | 70  | 65  | 72 | 949                              | 893   | 826   | 7.3  | 105             | 99  | 91  | 78 | 1491                             | 1404  | 1298  | 5.8  | 165             | 155 | 143 | 86 |
| 5.0  | 565                                     | 532  | 492  | 9.4  | 77              | 73  | 67  | 72 | 791                              | 744   | 688   | 8.0  | 108             | 102 | 94  | 78 | 1242                             | 1170  | 1082  | 6.4  | 169             | 160 | 147 | 86 |
| 5.5  | 479                                     | 451  | 417  | 10.2 | 79              | 74  | 69  | 73 | 670                              | 631   | 584   | 8.7  | 111             | 104 | 96  | 79 | 1054                             | 992   | 917   | 6.9  | 174             | 164 | 151 | 87 |
| 6.0  | 412                                     | 388  | 359  | 11.0 | 81              | 76  | 70  | 73 | 577                              | 543   | 502   | 9.3  | 113             | 107 | 99  | 79 | 906                              | 853   | 789   | 7.4  | 178             | 168 | 155 | 87 |
| 6.5  | 359                                     | 338  | 312  | 11.8 | 83              | 78  | 72  | 73 | 502                              | 473   | 437   | 10.0 | 116             | 109 | 101 | 79 | 789                              | 743   | 687   | 8.0  | 182             | 171 | 158 | 87 |
| 7.0  | 316                                     | 297  | 275  | 12.6 | 84              | 79  | 73  | 74 | 442                              | 416   | 385   | 10.7 | 118             | 111 | 103 | 80 | 694                              | 654   | 604   | 8.5  | 186             | 175 | 162 | 88 |
| 7.5  | 280                                     | 264  | 244  | 13.4 | 86              | 81  | 75  | 74 | 392                              | 369   | 341   | 11.3 | 120             | 113 | 105 | 80 | 616                              | 580   | 536   | 9.0  | 189             | 178 | 165 | 88 |
| 8.0  | 250                                     | 236  | 218  | 14.2 | 87              | 82  | 76  | 74 | 351                              | 330   | 305   | 12.0 | 122             | 115 | 107 | 80 | 551                              | 519   | 480   | 9.6  | 192             | 181 | 167 | 88 |
| 8.5  | 226                                     | 212  | 196  | 14.9 | 89              | 84  | 77  | 75 | 316                              | 297   | 275   | 12.6 | 124             | 117 | 108 | 81 | 496                              | 467   | 432   | 10.1 | 196             | 184 | 170 | 89 |
| 9.0  | 204                                     | 192  | 178  | 15.7 | 90              | 85  | 79  | 75 | 286                              | 269   | 249   | 13.3 | 126             | 119 | 110 | 81 | 449                              | 423   | 391   | 10.6 | 199             | 187 | 173 | 89 |
| 9.5  | 186                                     | 175  | 162  | 16.4 | 92              | 86  | 80  | 75 | 260                              | 245   | 227   | 13.9 | 128             | 121 | 112 | 81 | 409                              | 385   | 356   | 11.1 | 201             | 190 | 175 | 89 |
| 10.0 | 170                                     | 160  | 148  | 17.2 | 93              | 87  | 81  | 75 | 238                              | 224   | 208   | 14.5 | 130             | 122 | 113 | 81 | 375                              | 353   | 326   | 11.6 | 204             | 192 | 178 | 90 |
| 11.0 | 144                                     | 136  | 126  | 18.7 | 95              | 90  | 83  | 76 | 202                              | 190   | 176   | 15.8 | 133             | 126 | 116 | 82 | 318                              | 299   | 277   | 12.6 | 210             | 197 | 182 | 90 |
| 12.0 | 124                                     | 117  | 108  | 20.1 | 98              | 92  | 85  | 76 | 174                              | 164   | 151   | 17.0 | 137             | 129 | 119 | 82 | 273                              | 257   | 238   | 13.6 | 215             | 202 | 187 | 90 |
| 13.0 | 108                                     | 102  | 94   | 21.6 | 100             | 94  | 87  | 77 | 151                              | 143   | 132   | 18.2 | 140             | 131 | 121 | 83 | 238                              | 224   | 207   | 14.5 | 219             | 206 | 191 | 91 |
| 14.0 | 95                                      | 90   | 83   | 23.0 | 102             | 96  | 89  | 77 | 133                              | 125   | 116   | 19.4 | 142             | 134 | 124 | 83 | 209                              | 197   | 182   | 15.5 | 224             | 211 | 195 | 91 |
| 15.0 | 84                                      | 79   | 73   | 24.4 | 104             | 98  | 90  | 77 | 118                              | 111   | 103   | 20.6 | 145             | 137 | 126 | 83 | 186                              | 175   | 162   | 16.5 | 228             | 215 | 198 | 92 |
| 16.0 | 76                                      | 71   | 66   | 25.8 | 105             | 99  | 92  | 78 | 106                              | 100   | 92    | 21.8 | 148             | 139 | 128 | 84 | 166                              | 156   | 145   | 17.4 | 232             | 218 | 202 | 92 |
| 17.0 | 68                                      | 64   | 59   | 27.2 | 107             | 101 | 93  | 78 | 95                               | 90    | 83    | 23.0 | 150             | 141 | 131 | 84 | 150                              | 141   | 130   | 18.3 | 236             | 222 | 205 | 92 |
| 18.0 | 62                                      | 58   | 54   | 28.6 | 109             | 102 | 95  | 78 | 86                               | 81    | 75    | 24.2 | 152             | 143 | 133 | 84 | 135                              | 128   | 118   | 19.3 | 239             | 225 | 208 | 92 |
| 19.0 | 56                                      | 53   | 49   | 29.9 | 110             | 104 | 96  | 79 | 79                               | 74    | 68    | 25.3 | 155             | 146 | 135 | 85 | 123                              | 116   | 107   | 20.2 | 243             | 229 | 212 | 93 |
| 20.0 | 51                                      | 48   | 45   | 31.3 | 112             | 105 | 97  | 79 | 72                               | 68    | 63    | 26.5 | 157             | 148 | 136 | 85 | 113                              | 106   | 98    | 21.1 | 246             | 232 | 214 | 93 |
| 22.0 | 44                                      | 41   | 38   | 34.0 | 115             | 108 | 100 | 79 | 61                               | 57    | 53    | 28.7 | 161             | 151 | 140 | 85 | 96                               | 90    | 83    | 22.9 | 253             | 238 | 220 | 93 |
| 24.0 | 37                                      | 35   | 33   | 36.7 | 118             | 111 | 102 | 80 | 52                               | 49    | 46    | 31.0 | 165             | 155 | 143 | 86 | 82                               | 78    | 72    | 24.7 | 259             | 244 | 225 | 94 |
| 26.0 | 33                                      | 31   | 28   | 39.3 | 120             | 113 | 105 | 80 | 46                               | 43    | 40    | 33.2 | 168             | 158 | 146 | 86 | 72                               | 68    | 62    | 26.5 | 264             | 249 | 230 | 94 |
| 28.0 | 29                                      | 27   | 25   | 41.9 | 123             | 115 | 107 | 80 | 40                               | 38    | 35    | 35.4 | 172             | 162 | 149 | 86 | 63                               | 59    | 55    | 28.2 | 270             | 254 | 235 | 95 |
| 30.0 | 25                                      | 24   | 22   | 44.5 | 125             | 118 | 109 | 81 | 36                               | 34    | 31    | 37.6 | 175             | 165 | 152 | 87 | 56                               | 53    | 49    | 30.0 | 275             | 259 | 239 | 95 |



**Table S1:** Subalpine fir stocking levels for the ABLA2/CAGE and ABGR/LIBO2 plant associations (B-O province), and the ABLA2/STOC, PICO(ABGR)/VAME-LIBO2, and PICO(ABLA2)/STOC plant community types.

| QMD  | Climate Resilience; SDI 116; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 163; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 256; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6243                                    | 5878 | 5435 | 2.8  | 34              | 32 | 30 | 56 | 8740                             | 8229 | 7609 | 2.4  | 48              | 45  | 42  | 62 | 13735                            | 12931 | 11957 | 1.9  | 75              | 71  | 65  | 70 |
| 1.5  | 3096                                    | 2915 | 2695 | 4.0  | 38              | 36 | 33 | 58 | 4334                             | 4080 | 3773 | 3.4  | 53              | 50  | 46  | 64 | 6810                             | 6412  | 5929  | 2.7  | 84              | 79  | 73  | 72 |
| 2.0  | 1882                                    | 1772 | 1638 | 5.2  | 41              | 39 | 36 | 60 | 2635                             | 2481 | 2294 | 4.4  | 57              | 54  | 50  | 65 | 4140                             | 3898  | 3605  | 3.5  | 90              | 85  | 79  | 73 |
| 2.5  | 1279                                    | 1204 | 1114 | 6.3  | 44              | 41 | 38 | 61 | 1791                             | 1686 | 1559 | 5.3  | 61              | 57  | 53  | 66 | 2814                             | 2650  | 2450  | 4.2  | 96              | 90  | 84  | 74 |
| 3.0  | 933                                     | 879  | 812  | 7.3  | 46              | 43 | 40 | 62 | 1306                             | 1230 | 1137 | 6.2  | 64              | 60  | 56  | 67 | 2053                             | 1933  | 1787  | 4.9  | 101             | 95  | 88  | 75 |
| 3.5  | 715                                     | 673  | 622  | 8.4  | 48              | 45 | 42 | 62 | 1001                             | 942  | 871  | 7.1  | 67              | 63  | 58  | 68 | 1572                             | 1480  | 1369  | 5.7  | 105             | 99  | 91  | 76 |
| 4.0  | 567                                     | 534  | 494  | 9.4  | 50              | 47 | 43 | 63 | 794                              | 748  | 691  | 8.0  | 69              | 65  | 60  | 69 | 1248                             | 1175  | 1087  | 6.3  | 109             | 103 | 95  | 77 |
| 4.5  | 463                                     | 436  | 403  | 10.4 | 51              | 48 | 44 | 63 | 648                              | 610  | 564  | 8.8  | 72              | 67  | 62  | 69 | 1018                             | 958   | 886   | 7.0  | 112             | 106 | 98  | 77 |
| 5.0  | 386                                     | 363  | 336  | 11.4 | 53              | 50 | 46 | 64 | 540                              | 508  | 470  | 9.7  | 74              | 69  | 64  | 70 | 848                              | 799   | 739   | 7.7  | 116             | 109 | 101 | 78 |
| 5.5  | 327                                     | 308  | 285  | 12.4 | 54              | 51 | 47 | 64 | 458                              | 431  | 399  | 10.5 | 76              | 71  | 66  | 70 | 719                              | 677   | 626   | 8.4  | 119             | 112 | 103 | 78 |
| 6.0  | 281                                     | 265  | 245  | 13.4 | 55              | 52 | 48 | 65 | 394                              | 371  | 343  | 11.3 | 77              | 73  | 67  | 71 | 619                              | 583   | 539   | 9.0  | 122             | 114 | 106 | 78 |
| 6.5  | 245                                     | 231  | 213  | 14.3 | 56              | 53 | 49 | 65 | 343                              | 323  | 299  | 12.1 | 79              | 74  | 69  | 71 | 539                              | 507   | 469   | 9.7  | 124             | 117 | 108 | 79 |
| 7.0  | 215                                     | 203  | 188  | 15.3 | 58              | 54 | 50 | 65 | 302                              | 284  | 263  | 12.9 | 81              | 76  | 70  | 71 | 474                              | 446   | 413   | 10.3 | 127             | 119 | 110 | 79 |
| 7.5  | 191                                     | 180  | 166  | 16.2 | 59              | 55 | 51 | 66 | 268                              | 252  | 233  | 13.7 | 82              | 77  | 72  | 72 | 421                              | 396   | 366   | 10.9 | 129             | 122 | 112 | 79 |
| 8.0  | 171                                     | 161  | 149  | 17.1 | 60              | 56 | 52 | 66 | 239                              | 225  | 208  | 14.5 | 84              | 79  | 73  | 72 | 376                              | 354   | 328   | 11.6 | 131             | 124 | 114 | 80 |
| 8.5  | 154                                     | 145  | 134  | 18.1 | 61              | 57 | 53 | 66 | 216                              | 203  | 188  | 15.3 | 85              | 80  | 74  | 72 | 339                              | 319   | 295   | 12.2 | 134             | 126 | 116 | 80 |
| 9.0  | 139                                     | 131  | 121  | 19.0 | 62              | 58 | 54 | 67 | 195                              | 184  | 170  | 16.0 | 86              | 81  | 75  | 72 | 307                              | 289   | 267   | 12.8 | 136             | 128 | 118 | 80 |
| 9.5  | 127                                     | 120  | 111  | 19.9 | 63              | 59 | 54 | 67 | 178                              | 167  | 155  | 16.8 | 88              | 82  | 76  | 73 | 279                              | 263   | 243   | 13.4 | 138             | 130 | 120 | 81 |
| 10.0 | 116                                     | 109  | 101  | 20.8 | 63              | 60 | 55 | 67 | 163                              | 153  | 142  | 17.6 | 89              | 84  | 77  | 73 | 256                              | 241   | 223   | 14.0 | 139             | 131 | 121 | 81 |
| 11.0 | 99                                      | 93   | 86   | 22.6 | 65              | 61 | 57 | 68 | 138                              | 130  | 120  | 19.1 | 91              | 86  | 79  | 73 | 217                              | 204   | 189   | 15.2 | 143             | 135 | 125 | 81 |
| 12.0 | 85                                      | 80   | 74   | 24.4 | 67              | 63 | 58 | 68 | 119                              | 112  | 103  | 20.6 | 93              | 88  | 81  | 74 | 187                              | 176   | 162   | 16.4 | 147             | 138 | 128 | 82 |
| 13.0 | 74                                      | 70   | 64   | 26.1 | 68              | 64 | 59 | 68 | 103                              | 97   | 90   | 22.1 | 95              | 90  | 83  | 74 | 162                              | 153   | 141   | 17.6 | 150             | 141 | 130 | 82 |
| 14.0 | 65                                      | 61   | 57   | 27.8 | 69              | 65 | 60 | 69 | 91                               | 86   | 79   | 23.5 | 97              | 92  | 85  | 75 | 143                              | 135   | 124   | 18.8 | 153             | 144 | 133 | 82 |
| 15.0 | 58                                      | 54   | 50   | 29.5 | 71              | 67 | 62 | 69 | 81                               | 76   | 70   | 25.0 | 99              | 93  | 86  | 75 | 127                              | 119   | 110   | 19.9 | 156             | 147 | 135 | 83 |
| 16.0 | 52                                      | 49   | 45   | 31.2 | 72              | 68 | 63 | 69 | 72                               | 68   | 63   | 26.4 | 101             | 95  | 88  | 75 | 113                              | 107   | 99    | 21.1 | 158             | 149 | 138 | 83 |
| 17.0 | 46                                      | 44   | 40   | 32.9 | 73              | 69 | 64 | 70 | 65                               | 61   | 57   | 27.8 | 102             | 96  | 89  | 75 | 102                              | 96    | 89    | 22.2 | 161             | 152 | 140 | 83 |
| 18.0 | 42                                      | 40   | 37   | 34.6 | 74              | 70 | 65 | 70 | 59                               | 55   | 51   | 29.2 | 104             | 98  | 91  | 76 | 93                               | 87    | 81    | 23.3 | 163             | 154 | 142 | 84 |
| 19.0 | 38                                      | 36   | 33   | 36.2 | 75              | 71 | 66 | 70 | 54                               | 50   | 47   | 30.6 | 106             | 99  | 92  | 76 | 84                               | 79    | 73    | 24.4 | 166             | 156 | 144 | 84 |
| 20.0 | 35                                      | 33   | 31   | 37.9 | 76              | 72 | 67 | 70 | 49                               | 46   | 43   | 32.0 | 107             | 101 | 93  | 76 | 77                               | 73    | 67    | 25.5 | 168             | 158 | 146 | 84 |
| 22.0 | 30                                      | 28   | 26   | 41.1 | 78              | 74 | 68 | 71 | 42                               | 39   | 36   | 34.8 | 110             | 103 | 96  | 77 | 65                               | 62    | 57    | 27.7 | 173             | 162 | 150 | 85 |
| 24.0 | 26                                      | 24   | 22   | 44.4 | 80              | 76 | 70 | 71 | 36                               | 34   | 31   | 37.5 | 112             | 106 | 98  | 77 | 56                               | 53    | 49    | 29.9 | 177             | 166 | 154 | 85 |
| 26.0 | 22                                      | 21   | 19   | 47.5 | 82              | 77 | 71 | 72 | 31                               | 29   | 27   | 40.2 | 115             | 108 | 100 | 77 | 49                               | 46    | 43    | 32.1 | 181             | 170 | 157 | 85 |
| 28.0 | 20                                      | 18   | 17   | 50.7 | 84              | 79 | 73 | 72 | 27                               | 26   | 24   | 42.8 | 117             | 110 | 102 | 78 | 43                               | 41    | 38    | 34.2 | 184             | 173 | 160 | 86 |
| 30.0 | 17                                      | 16   | 15   | 53.8 | 85              | 80 | 74 | 72 | 24                               | 23   | 21   | 45.5 | 119             | 112 | 104 | 78 | 38                               | 36    | 33    | 36.3 | 188             | 177 | 163 | 86 |



**Table S2:** Subalpine fir stocking levels for the ABGR/VAME plant association (B-O province), and the PICO(ABGR)/ARNE, PICO(ABGR)/VAME, PICO(ABGR)/VAME/CARU, and PICO(ABGR)/VAME/PTAQ plant community types.

| QMD  | Climate Resilience; SDI 129; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 180; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 283; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6914                                    | 6510 | 6020 | 2.7  | 38              | 36 | 33 | 58 | 9680                             | 9114 | 8427 | 2.3  | 53              | 50  | 46  | 64 | 15211                            | 14322 | 13243 | 1.8  | 83              | 78  | 72  | 72 |
| 1.5  | 3429                                    | 3228 | 2985 | 3.8  | 42              | 40 | 37 | 60 | 4800                             | 4519 | 4179 | 3.2  | 59              | 55  | 51  | 66 | 7543                             | 7102  | 6567  | 2.6  | 93              | 87  | 81  | 74 |
| 2.0  | 2084                                    | 1962 | 1815 | 4.9  | 45              | 43 | 40 | 61 | 2918                             | 2747 | 2540 | 4.2  | 64              | 60  | 55  | 67 | 4586                             | 4317  | 3992  | 3.3  | 100             | 94  | 87  | 75 |
| 2.5  | 1417                                    | 1334 | 1233 | 6.0  | 48              | 45 | 42 | 62 | 1984                             | 1867 | 1727 | 5.0  | 68              | 64  | 59  | 68 | 3117                             | 2935  | 2714  | 4.0  | 106             | 100 | 93  | 76 |
| 3.0  | 1034                                    | 973  | 900  | 7.0  | 51              | 48 | 44 | 63 | 1447                             | 1362 | 1260 | 5.9  | 71              | 67  | 62  | 69 | 2274                             | 2141  | 1980  | 4.7  | 112             | 105 | 97  | 77 |
| 3.5  | 792                                     | 745  | 689  | 8.0  | 53              | 50 | 46 | 64 | 1108                             | 1043 | 965  | 6.7  | 74              | 70  | 64  | 70 | 1742                             | 1640  | 1516  | 5.4  | 116             | 110 | 101 | 78 |
| 4.0  | 628                                     | 592  | 547  | 8.9  | 55              | 52 | 48 | 65 | 880                              | 828  | 766  | 7.6  | 77              | 72  | 67  | 70 | 1382                             | 1301  | 1203  | 6.0  | 121             | 114 | 105 | 78 |
| 4.5  | 512                                     | 483  | 446  | 9.9  | 57              | 53 | 49 | 65 | 717                              | 676  | 625  | 8.4  | 79              | 75  | 69  | 71 | 1127                             | 1062  | 982   | 6.7  | 125             | 117 | 108 | 79 |
| 5.0  | 427                                     | 402  | 372  | 10.9 | 58              | 55 | 51 | 66 | 598                              | 563  | 521  | 9.2  | 82              | 77  | 71  | 71 | 940                              | 885   | 818   | 7.3  | 128             | 121 | 112 | 79 |
| 5.5  | 362                                     | 341  | 315  | 11.8 | 60              | 56 | 52 | 66 | 507                              | 477  | 441  | 10.0 | 84              | 79  | 73  | 72 | 797                              | 750   | 694   | 7.9  | 131             | 124 | 114 | 80 |
| 6.0  | 312                                     | 293  | 271  | 12.7 | 61              | 58 | 53 | 67 | 436                              | 411  | 380  | 10.7 | 86              | 81  | 75  | 72 | 685                              | 645   | 597   | 8.6  | 135             | 127 | 117 | 80 |
| 6.5  | 271                                     | 255  | 236  | 13.6 | 63              | 59 | 54 | 67 | 380                              | 358  | 331  | 11.5 | 88              | 82  | 76  | 73 | 597                              | 562   | 520   | 9.2  | 138             | 129 | 120 | 81 |
| 7.0  | 239                                     | 225  | 208  | 14.5 | 64              | 60 | 56 | 67 | 334                              | 315  | 291  | 12.3 | 89              | 84  | 78  | 73 | 525                              | 494   | 457   | 9.8  | 140             | 132 | 122 | 81 |
| 7.5  | 212                                     | 199  | 184  | 15.4 | 65              | 61 | 57 | 68 | 296                              | 279  | 258  | 13.0 | 91              | 86  | 79  | 73 | 466                              | 439   | 406   | 10.4 | 143             | 135 | 124 | 81 |
| 8.0  | 189                                     | 178  | 165  | 16.3 | 66              | 62 | 58 | 68 | 265                              | 250  | 231  | 13.8 | 93              | 87  | 81  | 74 | 417                              | 392   | 363   | 11.0 | 145             | 137 | 127 | 82 |
| 8.5  | 171                                     | 161  | 148  | 17.2 | 67              | 63 | 59 | 68 | 239                              | 225  | 208  | 14.5 | 94              | 89  | 82  | 74 | 375                              | 353   | 327   | 11.6 | 148             | 139 | 129 | 82 |
| 9.0  | 154                                     | 145  | 135  | 18.0 | 68              | 64 | 59 | 68 | 216                              | 204  | 188  | 15.2 | 96              | 90  | 83  | 74 | 340                              | 320   | 296   | 12.2 | 150             | 141 | 131 | 82 |
| 9.5  | 141                                     | 132  | 122  | 18.9 | 69              | 65 | 60 | 69 | 197                              | 185  | 171  | 16.0 | 97              | 91  | 84  | 74 | 310                              | 291   | 269   | 12.7 | 152             | 143 | 133 | 82 |
| 10.0 | 129                                     | 121  | 112  | 19.8 | 70              | 66 | 61 | 69 | 180                              | 170  | 157  | 16.7 | 98              | 93  | 86  | 75 | 283                              | 267   | 247   | 13.3 | 154             | 145 | 134 | 83 |
| 11.0 | 109                                     | 103  | 95   | 21.5 | 72              | 68 | 63 | 69 | 153                              | 144  | 133  | 18.1 | 101             | 95  | 88  | 75 | 240                              | 226   | 209   | 14.5 | 159             | 149 | 138 | 83 |
| 12.0 | 94                                      | 88   | 82   | 23.1 | 74              | 69 | 64 | 70 | 131                              | 124  | 114  | 19.6 | 103             | 97  | 90  | 76 | 207                              | 195   | 180   | 15.6 | 162             | 153 | 141 | 83 |
| 13.0 | 82                                      | 77   | 71   | 24.8 | 75              | 71 | 66 | 70 | 114                              | 108  | 100  | 21.0 | 106             | 99  | 92  | 76 | 180                              | 169   | 157   | 16.7 | 166             | 156 | 144 | 84 |
| 14.0 | 72                                      | 68   | 63   | 26.4 | 77              | 72 | 67 | 70 | 101                              | 95   | 88   | 22.3 | 108             | 101 | 94  | 76 | 158                              | 149   | 138   | 17.8 | 169             | 159 | 147 | 84 |
| 15.0 | 64                                      | 60   | 56   | 28.1 | 78              | 74 | 68 | 71 | 89                               | 84   | 78   | 23.7 | 110             | 103 | 95  | 77 | 140                              | 132   | 122   | 18.9 | 172             | 162 | 150 | 85 |
| 16.0 | 57                                      | 54   | 50   | 29.7 | 80              | 75 | 69 | 71 | 80                               | 75   | 70   | 25.1 | 112             | 105 | 97  | 77 | 126                              | 118   | 109   | 20.0 | 175             | 165 | 153 | 85 |
| 17.0 | 51                                      | 48   | 45   | 31.3 | 81              | 76 | 71 | 71 | 72                               | 68   | 63   | 26.4 | 113             | 107 | 99  | 77 | 113                              | 106   | 98    | 21.1 | 178             | 168 | 155 | 85 |
| 18.0 | 47                                      | 44   | 41   | 32.9 | 82              | 77 | 72 | 72 | 65                               | 61   | 57   | 27.8 | 115             | 108 | 100 | 78 | 102                              | 96    | 89    | 22.2 | 181             | 170 | 158 | 85 |
| 19.0 | 42                                      | 40   | 37   | 34.4 | 84              | 79 | 73 | 72 | 59                               | 56   | 52   | 29.1 | 117             | 110 | 102 | 78 | 93                               | 88    | 81    | 23.2 | 184             | 173 | 160 | 86 |
| 20.0 | 39                                      | 37   | 34   | 36.0 | 85              | 80 | 74 | 72 | 54                               | 51   | 47   | 30.4 | 119             | 112 | 103 | 78 | 85                               | 80    | 74    | 24.3 | 186             | 175 | 162 | 86 |
| 22.0 | 33                                      | 31   | 29   | 39.1 | 87              | 82 | 76 | 73 | 46                               | 43   | 40   | 33.0 | 122             | 115 | 106 | 78 | 72                               | 68    | 63    | 26.4 | 191             | 180 | 166 | 86 |
| 24.0 | 28                                      | 27   | 25   | 42.1 | 89              | 84 | 77 | 73 | 40                               | 37   | 35   | 35.6 | 125             | 117 | 108 | 79 | 62                               | 59    | 54    | 28.4 | 196             | 184 | 170 | 87 |
| 26.0 | 25                                      | 23   | 21   | 45.2 | 91              | 86 | 79 | 73 | 35                               | 32   | 30   | 38.2 | 127             | 120 | 111 | 79 | 54                               | 51    | 47    | 30.5 | 200             | 188 | 174 | 87 |
| 28.0 | 22                                      | 20   | 19   | 48.2 | 93              | 87 | 81 | 74 | 30                               | 29   | 26   | 40.7 | 130             | 122 | 113 | 80 | 48                               | 45    | 42    | 32.5 | 204             | 192 | 178 | 87 |
| 30.0 | 19                                      | 18   | 17   | 51.1 | 94              | 89 | 82 | 74 | 27                               | 25   | 23   | 43.2 | 132             | 125 | 115 | 80 | 42                               | 40    | 37    | 34.5 | 208             | 196 | 181 | 88 |

**Table S3:** Subalpine fir stocking levels for the ABGR/VASC-LIBO2 plant association (B-O province).

| QMD  | Climate Resilience; SDI 58; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 81; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 127; 55% of Max |      |      |      |                 |    |    |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|---------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                  |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                              | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC |
| 1.0  | 3088                                   | 2907 | 2688 | 4.0  | 17              | 16 | 15 | 45 | 4323                            | 4070 | 3764 | 3.4  | 24              | 22 | 21 | 50 | 6793                             | 6396 | 5914 | 2.7  | 37              | 35 | 32 | 58 |
| 1.5  | 1531                                   | 1442 | 1333 | 5.7  | 19              | 18 | 16 | 46 | 2144                            | 2018 | 1866 | 4.8  | 26              | 25 | 23 | 52 | 3369                             | 3172 | 2933 | 3.9  | 41              | 39 | 36 | 60 |
| 2.0  | 931                                    | 876  | 810  | 7.4  | 20              | 19 | 18 | 48 | 1303                            | 1227 | 1135 | 6.2  | 28              | 27 | 25 | 53 | 2048                             | 1928 | 1783 | 5.0  | 45              | 42 | 39 | 61 |
| 2.5  | 633                                    | 596  | 551  | 8.9  | 22              | 20 | 19 | 49 | 886                             | 834  | 771  | 7.5  | 30              | 28 | 26 | 54 | 1392                             | 1311 | 1212 | 6.0  | 47              | 45 | 41 | 62 |
| 3.0  | 462                                    | 435  | 402  | 10.4 | 23              | 21 | 20 | 50 | 646                             | 608  | 563  | 8.8  | 32              | 30 | 28 | 55 | 1015                             | 956  | 884  | 7.0  | 50              | 47 | 43 | 63 |
| 3.5  | 354                                    | 333  | 308  | 11.9 | 24              | 22 | 21 | 50 | 495                             | 466  | 431  | 10.1 | 33              | 31 | 29 | 56 | 778                              | 732  | 677  | 8.0  | 52              | 49 | 45 | 64 |
| 4.0  | 281                                    | 264  | 244  | 13.4 | 24              | 23 | 21 | 51 | 393                             | 370  | 342  | 11.3 | 34              | 32 | 30 | 57 | 617                              | 581  | 537  | 9.0  | 54              | 51 | 47 | 64 |
| 4.5  | 229                                    | 215  | 199  | 14.8 | 25              | 24 | 22 | 51 | 320                             | 302  | 279  | 12.5 | 35              | 33 | 31 | 57 | 504                              | 474  | 438  | 10.0 | 56              | 52 | 48 | 65 |
| 5.0  | 191                                    | 180  | 166  | 16.2 | 26              | 24 | 23 | 52 | 267                             | 251  | 232  | 13.7 | 36              | 34 | 32 | 58 | 420                              | 395  | 365  | 10.9 | 57              | 54 | 50 | 65 |
| 5.5  | 162                                    | 152  | 141  | 17.6 | 27              | 25 | 23 | 52 | 226                             | 213  | 197  | 14.9 | 37              | 35 | 33 | 58 | 356                              | 335  | 310  | 11.9 | 59              | 55 | 51 | 66 |
| 6.0  | 139                                    | 131  | 121  | 19.0 | 27              | 26 | 24 | 53 | 195                             | 183  | 170  | 16.1 | 38              | 36 | 33 | 58 | 306                              | 288  | 267  | 12.8 | 60              | 57 | 52 | 66 |
| 6.5  | 121                                    | 114  | 105  | 20.4 | 28              | 26 | 24 | 53 | 170                             | 160  | 148  | 17.2 | 39              | 37 | 34 | 59 | 267                              | 251  | 232  | 13.7 | 61              | 58 | 53 | 67 |
| 7.0  | 107                                    | 100  | 93   | 21.7 | 28              | 27 | 25 | 53 | 149                             | 140  | 130  | 18.4 | 40              | 38 | 35 | 59 | 234                              | 221  | 204  | 14.6 | 63              | 59 | 55 | 67 |
| 7.5  | 95                                     | 89   | 82   | 23.1 | 29              | 27 | 25 | 54 | 132                             | 125  | 115  | 19.5 | 41              | 38 | 35 | 59 | 208                              | 196  | 181  | 15.5 | 64              | 60 | 56 | 67 |
| 8.0  | 85                                     | 80   | 74   | 24.4 | 30              | 28 | 26 | 54 | 118                             | 111  | 103  | 20.6 | 41              | 39 | 36 | 60 | 186                              | 175  | 162  | 16.4 | 65              | 61 | 57 | 68 |
| 8.5  | 76                                     | 72   | 66   | 25.7 | 30              | 28 | 26 | 54 | 107                             | 100  | 93   | 21.7 | 42              | 40 | 37 | 60 | 168                              | 158  | 146  | 17.3 | 66              | 62 | 57 | 68 |
| 9.0  | 69                                     | 65   | 60   | 27.0 | 30              | 29 | 27 | 55 | 97                              | 91   | 84   | 22.8 | 43              | 40 | 37 | 60 | 152                              | 143  | 132  | 18.2 | 67              | 63 | 58 | 68 |
| 9.5  | 63                                     | 59   | 55   | 28.3 | 31              | 29 | 27 | 55 | 88                              | 83   | 77   | 23.9 | 43              | 41 | 38 | 61 | 138                              | 130  | 120  | 19.1 | 68              | 64 | 59 | 68 |
| 10.0 | 58                                     | 54   | 50   | 29.6 | 31              | 30 | 27 | 55 | 81                              | 76   | 70   | 25.0 | 44              | 41 | 38 | 61 | 127                              | 119  | 110  | 19.9 | 69              | 65 | 60 | 69 |
| 11.0 | 49                                     | 46   | 42   | 32.1 | 32              | 30 | 28 | 55 | 68                              | 64   | 59   | 27.1 | 45              | 42 | 39 | 61 | 107                              | 101  | 93   | 21.7 | 71              | 67 | 62 | 69 |
| 12.0 | 42                                     | 39   | 37   | 34.6 | 33              | 31 | 29 | 56 | 59                              | 55   | 51   | 29.3 | 46              | 43 | 40 | 62 | 92                               | 87   | 80   | 23.3 | 72              | 68 | 63 | 69 |
| 13.0 | 37                                     | 34   | 32   | 37.1 | 34              | 32 | 29 | 56 | 51                              | 48   | 45   | 31.4 | 47              | 44 | 41 | 62 | 80                               | 76   | 70   | 25.0 | 74              | 70 | 64 | 70 |
| 14.0 | 32                                     | 30   | 28   | 39.6 | 34              | 32 | 30 | 57 | 45                              | 42   | 39   | 33.4 | 48              | 45 | 42 | 62 | 71                               | 67   | 62   | 26.7 | 76              | 71 | 66 | 70 |
| 15.0 | 29                                     | 27   | 25   | 42.0 | 35              | 33 | 30 | 57 | 40                              | 38   | 35   | 35.5 | 49              | 46 | 43 | 63 | 63                               | 59   | 55   | 28.3 | 77              | 72 | 67 | 70 |
| 16.0 | 26                                     | 24   | 22   | 44.4 | 36              | 34 | 31 | 57 | 36                              | 34   | 31   | 37.5 | 50              | 47 | 43 | 63 | 56                               | 53   | 49   | 29.9 | 78              | 74 | 68 | 71 |
| 17.0 | 23                                     | 22   | 20   | 46.8 | 36              | 34 | 32 | 58 | 32                              | 30   | 28   | 39.6 | 51              | 48 | 44 | 63 | 51                               | 48   | 44   | 31.6 | 80              | 75 | 69 | 71 |
| 18.0 | 21                                     | 20   | 18   | 49.2 | 37              | 35 | 32 | 58 | 29                              | 27   | 25   | 41.6 | 51              | 48 | 45 | 64 | 46                               | 43   | 40   | 33.2 | 81              | 76 | 70 | 71 |
| 19.0 | 19                                     | 18   | 16   | 51.5 | 37              | 35 | 32 | 58 | 27                              | 25   | 23   | 43.6 | 52              | 49 | 45 | 64 | 42                               | 39   | 36   | 34.7 | 82              | 77 | 71 | 72 |
| 20.0 | 17                                     | 16   | 15   | 53.9 | 38              | 36 | 33 | 58 | 24                              | 23   | 21   | 45.5 | 53              | 50 | 46 | 64 | 38                               | 36   | 33   | 36.3 | 83              | 78 | 72 | 72 |
| 22.0 | 15                                     | 14   | 13   | 58.5 | 39              | 37 | 34 | 59 | 21                              | 19   | 18   | 49.4 | 54              | 51 | 47 | 64 | 32                               | 30   | 28   | 39.4 | 85              | 80 | 74 | 72 |
| 24.0 | 13                                     | 12   | 11   | 63.1 | 40              | 37 | 35 | 59 | 18                              | 17   | 15   | 53.3 | 56              | 52 | 48 | 65 | 28                               | 26   | 24   | 42.5 | 87              | 82 | 76 | 73 |
| 26.0 | 11                                     | 10   | 10   | 67.6 | 41              | 38 | 35 | 59 | 15                              | 15   | 13   | 57.1 | 57              | 54 | 49 | 65 | 24                               | 23   | 21   | 45.6 | 89              | 84 | 78 | 73 |
| 28.0 | 10                                     | 9    | 8    | 72.1 | 41              | 39 | 36 | 60 | 14                              | 13   | 12   | 60.9 | 58              | 55 | 50 | 66 | 21                               | 20   | 19   | 48.6 | 91              | 86 | 79 | 73 |
| 30.0 | 9                                      | 8    | 7    | 76.5 | 42              | 40 | 37 | 60 | 12                              | 11   | 10   | 64.7 | 59              | 56 | 51 | 66 | 19                               | 18   | 16   | 51.6 | 93              | 87 | 81 | 74 |

**Table S4:** Subalpine fir stocking levels for the ABLA2/TRCA3 plant association (B-O province) and the ABLA2/ARCO plant community type.

| QMD  | Climate Resilience; SDI 119; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 167; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 263; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6418                                    | 6042 | 5587 | 2.8  | 35              | 33 | 30 | 57 | 8985                             | 8459 | 7822 | 2.4  | 49              | 46  | 43  | 63 | 14119                            | 13293 | 12292 | 1.9  | 77              | 73  | 67  | 70 |
| 1.5  | 3182                                    | 2996 | 2770 | 4.0  | 39              | 37 | 34 | 59 | 4455                             | 4194 | 3879 | 3.4  | 55              | 51  | 48  | 65 | 7001                             | 6591  | 6095  | 2.7  | 86              | 81  | 75  | 72 |
| 2.0  | 1935                                    | 1821 | 1684 | 5.1  | 42              | 40 | 37 | 60 | 2708                             | 2550 | 2358 | 4.3  | 59              | 56  | 51  | 66 | 4256                             | 4007  | 3705  | 3.4  | 93              | 87  | 81  | 74 |
| 2.5  | 1315                                    | 1238 | 1145 | 6.2  | 45              | 42 | 39 | 61 | 1841                             | 1733 | 1603 | 5.2  | 63              | 59  | 55  | 67 | 2893                             | 2724  | 2519  | 4.2  | 99              | 93  | 86  | 75 |
| 3.0  | 959                                     | 903  | 835  | 7.2  | 47              | 44 | 41 | 62 | 1343                             | 1264 | 1169 | 6.1  | 66              | 62  | 57  | 68 | 2110                             | 1987  | 1837  | 4.9  | 104             | 98  | 90  | 76 |
| 3.5  | 735                                     | 692  | 640  | 8.3  | 49              | 46 | 43 | 63 | 1029                             | 968  | 896  | 7.0  | 69              | 65  | 60  | 69 | 1616                             | 1522  | 1407  | 5.6  | 108             | 102 | 94  | 76 |
| 4.0  | 583                                     | 549  | 508  | 9.3  | 51              | 48 | 44 | 63 | 816                              | 769  | 711  | 7.8  | 71              | 67  | 62  | 69 | 1283                             | 1208  | 1117  | 6.3  | 112             | 105 | 97  | 77 |
| 4.5  | 476                                     | 448  | 414  | 10.3 | 53              | 49 | 46 | 64 | 666                              | 627  | 580  | 8.7  | 74              | 69  | 64  | 70 | 1046                             | 985   | 911   | 6.9  | 116             | 109 | 101 | 78 |
| 5.0  | 396                                     | 373  | 345  | 11.3 | 54              | 51 | 47 | 64 | 555                              | 523  | 483  | 9.5  | 76              | 71  | 66  | 70 | 872                              | 821   | 759   | 7.6  | 119             | 112 | 104 | 78 |
| 5.5  | 336                                     | 316  | 293  | 12.2 | 55              | 52 | 48 | 65 | 471                              | 443  | 410  | 10.3 | 78              | 73  | 68  | 71 | 740                              | 696   | 644   | 8.2  | 122             | 115 | 106 | 78 |
| 6.0  | 289                                     | 272  | 252  | 13.2 | 57              | 53 | 49 | 65 | 405                              | 381  | 352  | 11.1 | 79              | 75  | 69  | 71 | 636                              | 599   | 554   | 8.9  | 125             | 118 | 109 | 79 |
| 6.5  | 252                                     | 237  | 219  | 14.1 | 58              | 55 | 51 | 66 | 352                              | 332  | 307  | 11.9 | 81              | 76  | 71  | 71 | 554                              | 522   | 482   | 9.5  | 128             | 120 | 111 | 79 |
| 7.0  | 221                                     | 209  | 193  | 15.1 | 59              | 56 | 52 | 66 | 310                              | 292  | 270  | 12.7 | 83              | 78  | 72  | 72 | 487                              | 459   | 424   | 10.2 | 130             | 123 | 113 | 80 |
| 7.5  | 197                                     | 185  | 171  | 16.0 | 60              | 57 | 53 | 66 | 275                              | 259  | 240  | 13.5 | 84              | 79  | 74  | 72 | 432                              | 407   | 376   | 10.8 | 133             | 125 | 116 | 80 |
| 8.0  | 176                                     | 166  | 153  | 16.9 | 61              | 58 | 53 | 67 | 246                              | 232  | 214  | 14.3 | 86              | 81  | 75  | 72 | 387                              | 364   | 337   | 11.4 | 135             | 127 | 118 | 80 |
| 8.5  | 158                                     | 149  | 138  | 17.8 | 62              | 59 | 54 | 67 | 222                              | 209  | 193  | 15.1 | 87              | 82  | 76  | 73 | 348                              | 328   | 303   | 12.0 | 137             | 129 | 119 | 81 |
| 9.0  | 143                                     | 135  | 125  | 18.7 | 63              | 60 | 55 | 67 | 201                              | 189  | 175  | 15.8 | 89              | 84  | 77  | 73 | 315                              | 297   | 275   | 12.6 | 139             | 131 | 121 | 81 |
| 9.5  | 131                                     | 123  | 114  | 19.6 | 64              | 61 | 56 | 67 | 183                              | 172  | 159  | 16.6 | 90              | 85  | 78  | 73 | 287                              | 270   | 250   | 13.2 | 141             | 133 | 123 | 81 |
| 10.0 | 120                                     | 113  | 104  | 20.5 | 65              | 61 | 57 | 68 | 167                              | 158  | 146  | 17.3 | 91              | 86  | 79  | 73 | 263                              | 248   | 229   | 13.8 | 143             | 135 | 125 | 81 |
| 11.0 | 101                                     | 95   | 88   | 22.3 | 67              | 63 | 58 | 68 | 142                              | 134  | 124  | 18.8 | 94              | 88  | 82  | 74 | 223                              | 210   | 194   | 15.0 | 147             | 139 | 128 | 82 |
| 12.0 | 87                                      | 82   | 76   | 24.0 | 68              | 64 | 60 | 68 | 122                              | 115  | 106  | 20.3 | 96              | 90  | 83  | 74 | 192                              | 181   | 167   | 16.2 | 151             | 142 | 131 | 82 |
| 13.0 | 76                                      | 71   | 66   | 25.7 | 70              | 66 | 61 | 69 | 106                              | 100  | 93   | 21.8 | 98              | 92  | 85  | 75 | 167                              | 157   | 145   | 17.4 | 154             | 145 | 134 | 83 |
| 14.0 | 67                                      | 63   | 58   | 27.4 | 71              | 67 | 62 | 69 | 93                               | 88   | 81   | 23.2 | 100             | 94  | 87  | 75 | 147                              | 138   | 128   | 18.5 | 157             | 148 | 137 | 83 |
| 15.0 | 59                                      | 56   | 52   | 29.1 | 73              | 68 | 63 | 70 | 83                               | 78   | 72   | 24.6 | 102             | 96  | 89  | 75 | 130                              | 123   | 113   | 19.6 | 160             | 151 | 139 | 83 |
| 16.0 | 53                                      | 50   | 46   | 30.8 | 74              | 70 | 64 | 70 | 74                               | 70   | 65   | 26.0 | 104             | 98  | 90  | 76 | 117                              | 110   | 102   | 20.8 | 163             | 153 | 142 | 84 |
| 17.0 | 48                                      | 45   | 42   | 32.5 | 75              | 71 | 65 | 70 | 67                               | 63   | 58   | 27.4 | 105             | 99  | 92  | 76 | 105                              | 99    | 91    | 21.9 | 165             | 156 | 144 | 84 |
| 18.0 | 43                                      | 41   | 38   | 34.1 | 76              | 72 | 67 | 70 | 61                               | 57   | 53   | 28.8 | 107             | 101 | 93  | 76 | 95                               | 90    | 83    | 23.0 | 168             | 158 | 146 | 84 |
| 19.0 | 39                                      | 37   | 34   | 35.7 | 78              | 73 | 67 | 71 | 55                               | 52   | 48   | 30.2 | 109             | 102 | 94  | 76 | 87                               | 82    | 75    | 24.1 | 171             | 161 | 148 | 84 |
| 20.0 | 36                                      | 34   | 31   | 37.4 | 79              | 74 | 68 | 71 | 50                               | 47   | 44   | 31.6 | 110             | 104 | 96  | 77 | 79                               | 75    | 69    | 25.2 | 173             | 163 | 151 | 85 |
| 22.0 | 31                                      | 29   | 27   | 40.6 | 81              | 76 | 70 | 71 | 43                               | 40   | 37   | 34.3 | 113             | 106 | 98  | 77 | 67                               | 63    | 59    | 27.4 | 177             | 167 | 154 | 85 |
| 24.0 | 26                                      | 25   | 23   | 43.8 | 83              | 78 | 72 | 72 | 37                               | 35   | 32   | 37.0 | 116             | 109 | 101 | 78 | 58                               | 54    | 50    | 29.5 | 182             | 171 | 158 | 85 |
| 26.0 | 23                                      | 22   | 20   | 46.9 | 84              | 79 | 73 | 72 | 32                               | 30   | 28   | 39.6 | 118             | 111 | 103 | 78 | 50                               | 47    | 44    | 31.6 | 186             | 175 | 162 | 86 |
| 28.0 | 20                                      | 19   | 18   | 50.0 | 86              | 81 | 75 | 72 | 28                               | 27   | 25   | 42.3 | 120             | 113 | 105 | 78 | 44                               | 42    | 39    | 33.7 | 189             | 178 | 165 | 86 |
| 30.0 | 18                                      | 17   | 16   | 53.1 | 88              | 83 | 76 | 73 | 25                               | 24   | 22   | 44.8 | 123             | 116 | 107 | 79 | 39                               | 37    | 34    | 35.8 | 193             | 182 | 168 | 86 |

**Table S5:** Subalpine fir stocking levels for the ABLA2/CLUN and ABLA2/MEFE (B-O province), and the TSME/VASC+VAME (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 130; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 182; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 286; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6981                                    | 6573 | 6078 | 2.7  | 38              | 36 | 33 | 58 | 9774                             | 9202 | 8509 | 2.3  | 53              | 50  | 46  | 64 | 15359                            | 14461 | 13372 | 1.8  | 84              | 79  | 73  | 72 |
| 1.5  | 3462                                    | 3259 | 3014 | 3.8  | 42              | 40 | 37 | 60 | 4847                             | 4563 | 4219 | 3.2  | 59              | 56  | 52  | 66 | 7616                             | 7170  | 6631  | 2.6  | 93              | 88  | 81  | 74 |
| 2.0  | 2105                                    | 1981 | 1832 | 4.9  | 46              | 43 | 40 | 62 | 2946                             | 2774 | 2565 | 4.1  | 64              | 61  | 56  | 67 | 4630                             | 4359  | 4031  | 3.3  | 101             | 95  | 88  | 75 |
| 2.5  | 1431                                    | 1347 | 1245 | 5.9  | 49              | 46 | 42 | 63 | 2003                             | 1886 | 1744 | 5.0  | 68              | 64  | 59  | 68 | 3147                             | 2963  | 2740  | 4.0  | 107             | 101 | 93  | 76 |
| 3.0  | 1044                                    | 983  | 909  | 6.9  | 51              | 48 | 45 | 63 | 1461                             | 1376 | 1272 | 5.9  | 72              | 68  | 62  | 69 | 2296                             | 2162  | 1999  | 4.7  | 113             | 106 | 98  | 77 |
| 3.5  | 799                                     | 753  | 696  | 7.9  | 53              | 50 | 46 | 64 | 1119                             | 1054 | 974  | 6.7  | 75              | 70  | 65  | 70 | 1758                             | 1656  | 1531  | 5.3  | 117             | 111 | 102 | 78 |
| 4.0  | 634                                     | 597  | 552  | 8.9  | 55              | 52 | 48 | 65 | 888                              | 836  | 773  | 7.5  | 78              | 73  | 67  | 71 | 1396                             | 1314  | 1215  | 6.0  | 122             | 115 | 106 | 78 |
| 4.5  | 517                                     | 487  | 451  | 9.9  | 57              | 54 | 50 | 65 | 724                              | 682  | 631  | 8.3  | 80              | 75  | 70  | 71 | 1138                             | 1072  | 991   | 6.6  | 126             | 118 | 109 | 79 |
| 5.0  | 431                                     | 406  | 375  | 10.8 | 59              | 55 | 51 | 66 | 604                              | 568  | 526  | 9.1  | 82              | 78  | 72  | 72 | 949                              | 893   | 826   | 7.3  | 129             | 122 | 113 | 80 |
| 5.5  | 366                                     | 344  | 318  | 11.7 | 60              | 57 | 53 | 66 | 512                              | 482  | 446  | 9.9  | 84              | 80  | 74  | 72 | 805                              | 757   | 700   | 7.9  | 133             | 125 | 116 | 80 |
| 6.0  | 315                                     | 296  | 274  | 12.6 | 62              | 58 | 54 | 67 | 440                              | 415  | 383  | 10.7 | 86              | 81  | 75  | 73 | 692                              | 652   | 603   | 8.5  | 136             | 128 | 118 | 80 |
| 6.5  | 274                                     | 258  | 238  | 13.6 | 63              | 59 | 55 | 67 | 383                              | 361  | 334  | 11.5 | 88              | 83  | 77  | 73 | 603                              | 567   | 525   | 9.1  | 139             | 131 | 121 | 81 |
| 7.0  | 241                                     | 227  | 210  | 14.4 | 64              | 61 | 56 | 67 | 337                              | 318  | 294  | 12.2 | 90              | 85  | 78  | 73 | 530                              | 499   | 461   | 9.7  | 142             | 133 | 123 | 81 |
| 7.5  | 214                                     | 201  | 186  | 15.3 | 66              | 62 | 57 | 68 | 299                              | 282  | 261  | 13.0 | 92              | 86  | 80  | 74 | 470                              | 443   | 410   | 10.3 | 144             | 136 | 126 | 81 |
| 8.0  | 191                                     | 180  | 167  | 16.2 | 67              | 63 | 58 | 68 | 268                              | 252  | 233  | 13.7 | 93              | 88  | 81  | 74 | 421                              | 396   | 366   | 10.9 | 147             | 138 | 128 | 82 |
| 8.5  | 172                                     | 162  | 150  | 17.1 | 68              | 64 | 59 | 68 | 241                              | 227  | 210  | 14.4 | 95              | 89  | 83  | 74 | 379                              | 357   | 330   | 11.5 | 149             | 141 | 130 | 82 |
| 9.0  | 156                                     | 147  | 136  | 18.0 | 69              | 65 | 60 | 69 | 218                              | 206  | 190  | 15.2 | 96              | 91  | 84  | 74 | 343                              | 323   | 299   | 12.1 | 152             | 143 | 132 | 82 |
| 9.5  | 142                                     | 134  | 124  | 18.8 | 70              | 66 | 61 | 69 | 199                              | 187  | 173  | 15.9 | 98              | 92  | 85  | 75 | 313                              | 294   | 272   | 12.7 | 154             | 145 | 134 | 83 |
| 10.0 | 130                                     | 122  | 113  | 19.7 | 71              | 67 | 62 | 69 | 182                              | 171  | 158  | 16.6 | 99              | 93  | 86  | 75 | 286                              | 269   | 249   | 13.3 | 156             | 147 | 136 | 83 |
| 11.0 | 110                                     | 104  | 96   | 21.4 | 73              | 68 | 63 | 70 | 154                              | 145  | 134  | 18.1 | 102             | 96  | 89  | 75 | 243                              | 228   | 211   | 14.4 | 160             | 151 | 139 | 83 |
| 12.0 | 95                                      | 89   | 83   | 23.0 | 74              | 70 | 65 | 70 | 133                              | 125  | 116  | 19.5 | 104             | 98  | 91  | 76 | 209                              | 196   | 182   | 15.5 | 164             | 154 | 143 | 84 |
| 13.0 | 83                                      | 78   | 72   | 24.7 | 76              | 72 | 66 | 70 | 116                              | 109  | 101  | 20.9 | 107             | 100 | 93  | 76 | 182                              | 171   | 158   | 16.6 | 167             | 158 | 146 | 84 |
| 14.0 | 73                                      | 68   | 63   | 26.3 | 78              | 73 | 68 | 71 | 102                              | 96   | 89   | 22.2 | 109             | 102 | 95  | 76 | 160                              | 150   | 139   | 17.7 | 171             | 161 | 149 | 84 |
| 15.0 | 64                                      | 61   | 56   | 27.9 | 79              | 74 | 69 | 71 | 90                               | 85   | 79   | 23.6 | 111             | 104 | 96  | 77 | 142                              | 134   | 123   | 18.8 | 174             | 164 | 152 | 85 |
| 16.0 | 58                                      | 54   | 50   | 29.5 | 80              | 76 | 70 | 71 | 81                               | 76   | 70   | 25.0 | 113             | 106 | 98  | 77 | 127                              | 119   | 110   | 19.9 | 177             | 167 | 154 | 85 |
| 17.0 | 52                                      | 49   | 45   | 31.1 | 82              | 77 | 71 | 72 | 73                               | 68   | 63   | 26.3 | 115             | 108 | 100 | 77 | 114                              | 108   | 99    | 21.0 | 180             | 169 | 157 | 85 |
| 18.0 | 47                                      | 44   | 41   | 32.7 | 83              | 78 | 72 | 72 | 66                               | 62   | 57   | 27.6 | 116             | 110 | 101 | 78 | 103                              | 97    | 90    | 22.1 | 183             | 172 | 159 | 86 |
| 19.0 | 43                                      | 40   | 37   | 34.3 | 84              | 79 | 73 | 72 | 60                               | 56   | 52   | 29.0 | 118             | 111 | 103 | 78 | 94                               | 89    | 82    | 23.1 | 186             | 175 | 162 | 86 |
| 20.0 | 39                                      | 37   | 34   | 35.8 | 85              | 80 | 74 | 72 | 55                               | 52   | 48   | 30.3 | 120             | 113 | 104 | 78 | 86                               | 81    | 75    | 24.2 | 188             | 177 | 164 | 86 |
| 22.0 | 33                                      | 31   | 29   | 38.9 | 88              | 83 | 76 | 73 | 47                               | 44   | 41   | 32.9 | 123             | 116 | 107 | 79 | 73                               | 69    | 64    | 26.2 | 193             | 182 | 168 | 87 |
| 24.0 | 29                                      | 27   | 25   | 41.9 | 90              | 85 | 78 | 73 | 40                               | 38   | 35   | 35.5 | 126             | 118 | 109 | 79 | 63                               | 59    | 55    | 28.3 | 198             | 186 | 172 | 87 |
| 26.0 | 25                                      | 23   | 22   | 45.0 | 92              | 86 | 80 | 74 | 35                               | 33   | 30   | 38.0 | 128             | 121 | 112 | 79 | 55                               | 52    | 48    | 30.3 | 202             | 190 | 176 | 87 |
| 28.0 | 22                                      | 21   | 19   | 47.9 | 94              | 88 | 82 | 74 | 31                               | 29   | 27   | 40.5 | 131             | 123 | 114 | 80 | 48                               | 45    | 42    | 32.3 | 206             | 194 | 179 | 88 |
| 30.0 | 19                                      | 18   | 17   | 50.9 | 95              | 90 | 83 | 74 | 27                               | 26   | 24   | 43.0 | 134             | 126 | 116 | 80 | 43                               | 40    | 37    | 34.3 | 210             | 198 | 183 | 88 |

**Table S6:** Subalpine fir stocking levels for the ABLA2/CLUN plant association (W-S province).

| QMD  | Climate Resilience; SDI 107; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 150; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 236; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5760                                    | 5423 | 5014 | 3.0  | 31              | 30 | 27 | 55 | 8064                             | 7592 | 7020 | 2.5  | 44              | 41  | 38 | 61 | 12671                            | 11930 | 11032 | 2.0  | 69              | 65  | 60  | 69 |
| 1.5  | 2856                                    | 2689 | 2486 | 4.2  | 35              | 33 | 31 | 57 | 3998                             | 3765 | 3481 | 3.5  | 49              | 46  | 43 | 63 | 6283                             | 5916  | 5470  | 2.8  | 77              | 73  | 67  | 71 |
| 2.0  | 1736                                    | 1635 | 1512 | 5.4  | 38              | 36 | 33 | 58 | 2431                             | 2289 | 2116 | 4.5  | 53              | 50  | 46 | 64 | 3820                             | 3596  | 3325  | 3.6  | 83              | 78  | 73  | 72 |
| 2.5  | 1180                                    | 1111 | 1027 | 6.5  | 40              | 38 | 35 | 59 | 1652                             | 1556 | 1438 | 5.5  | 56              | 53  | 49 | 65 | 2596                             | 2445  | 2260  | 4.4  | 89              | 83  | 77  | 73 |
| 3.0  | 861                                     | 811  | 750  | 7.6  | 42              | 40 | 37 | 60 | 1205                             | 1135 | 1049 | 6.5  | 59              | 56  | 52 | 66 | 1894                             | 1783  | 1649  | 5.2  | 93              | 88  | 81  | 74 |
| 3.5  | 659                                     | 621  | 574  | 8.7  | 44              | 41 | 38 | 61 | 923                              | 869  | 804  | 7.4  | 62              | 58  | 54 | 67 | 1451                             | 1366  | 1263  | 5.9  | 97              | 91  | 84  | 74 |
| 4.0  | 523                                     | 493  | 456  | 9.8  | 46              | 43 | 40 | 61 | 733                              | 690  | 638  | 8.3  | 64              | 60  | 56 | 67 | 1151                             | 1084  | 1002  | 6.6  | 100             | 95  | 87  | 75 |
| 4.5  | 427                                     | 402  | 372  | 10.9 | 47              | 44 | 41 | 62 | 598                              | 563  | 520  | 9.2  | 66              | 62  | 57 | 68 | 939                              | 884   | 818   | 7.3  | 104             | 98  | 90  | 76 |
| 5.0  | 356                                     | 335  | 310  | 11.9 | 49              | 46 | 42 | 63 | 498                              | 469  | 434  | 10.0 | 68              | 64  | 59 | 68 | 783                              | 737   | 681   | 8.0  | 107             | 100 | 93  | 76 |
| 5.5  | 302                                     | 284  | 263  | 12.9 | 50              | 47 | 43 | 63 | 422                              | 398  | 368  | 10.9 | 70              | 66  | 61 | 69 | 664                              | 625   | 578   | 8.7  | 110             | 103 | 95  | 77 |
| 6.0  | 260                                     | 244  | 226  | 13.9 | 51              | 48 | 44 | 63 | 363                              | 342  | 316  | 11.8 | 71              | 67  | 62 | 69 | 571                              | 538   | 497   | 9.4  | 112             | 106 | 98  | 77 |
| 6.5  | 226                                     | 213  | 197  | 14.9 | 52              | 49 | 45 | 64 | 316                              | 298  | 275  | 12.6 | 73              | 69  | 63 | 70 | 497                              | 468   | 433   | 10.1 | 115             | 108 | 100 | 77 |
| 7.0  | 199                                     | 187  | 173  | 15.9 | 53              | 50 | 46 | 64 | 278                              | 262  | 242  | 13.4 | 74              | 70  | 65 | 70 | 437                              | 412   | 381   | 10.7 | 117             | 110 | 102 | 78 |
| 7.5  | 176                                     | 166  | 154  | 16.9 | 54              | 51 | 47 | 64 | 247                              | 233  | 215  | 14.3 | 76              | 71  | 66 | 70 | 388                              | 365   | 338   | 11.4 | 119             | 112 | 104 | 78 |
| 8.0  | 158                                     | 149  | 137  | 17.9 | 55              | 52 | 48 | 65 | 221                              | 208  | 192  | 15.1 | 77              | 73  | 67 | 71 | 347                              | 327   | 302   | 12.0 | 121             | 114 | 105 | 78 |
| 8.5  | 142                                     | 134  | 124  | 18.8 | 56              | 53 | 49 | 65 | 199                              | 187  | 173  | 15.9 | 78              | 74  | 68 | 71 | 313                              | 294   | 272   | 12.7 | 123             | 116 | 107 | 79 |
| 9.0  | 129                                     | 121  | 112  | 19.8 | 57              | 54 | 49 | 65 | 180                              | 170  | 157  | 16.7 | 80              | 75  | 69 | 71 | 283                              | 267   | 246   | 13.3 | 125             | 118 | 109 | 79 |
| 9.5  | 117                                     | 110  | 102  | 20.7 | 58              | 54 | 50 | 66 | 164                              | 154  | 143  | 17.5 | 81              | 76  | 70 | 71 | 258                              | 243   | 224   | 14.0 | 127             | 119 | 110 | 79 |
| 10.0 | 107                                     | 101  | 93   | 21.7 | 58              | 55 | 51 | 66 | 150                              | 141  | 131  | 18.3 | 82              | 77  | 71 | 72 | 236                              | 222   | 205   | 14.6 | 129             | 121 | 112 | 79 |
| 11.0 | 91                                      | 86   | 79   | 23.5 | 60              | 57 | 52 | 66 | 127                              | 120  | 111  | 19.9 | 84              | 79  | 73 | 72 | 200                              | 188   | 174   | 15.9 | 132             | 124 | 115 | 80 |
| 12.0 | 78                                      | 74   | 68   | 25.4 | 61              | 58 | 53 | 67 | 110                              | 103  | 95   | 21.4 | 86              | 81  | 75 | 72 | 172                              | 162   | 150   | 17.1 | 135             | 127 | 118 | 80 |
| 13.0 | 68                                      | 64   | 59   | 27.2 | 63              | 59 | 55 | 67 | 95                               | 90   | 83   | 23.0 | 88              | 83  | 77 | 73 | 150                              | 141   | 130   | 18.3 | 138             | 130 | 120 | 81 |
| 14.0 | 60                                      | 56   | 52   | 29.0 | 64              | 60 | 56 | 67 | 84                               | 79   | 73   | 24.5 | 90              | 84  | 78 | 73 | 132                              | 124   | 115   | 19.5 | 141             | 133 | 123 | 81 |
| 15.0 | 53                                      | 50   | 46   | 30.8 | 65              | 61 | 57 | 68 | 74                               | 70   | 65   | 26.0 | 91              | 86  | 80 | 73 | 117                              | 110   | 102   | 20.7 | 144             | 135 | 125 | 81 |
| 16.0 | 48                                      | 45   | 41   | 32.5 | 66              | 63 | 58 | 68 | 67                               | 63   | 58   | 27.5 | 93              | 88  | 81 | 74 | 105                              | 99    | 91    | 21.9 | 146             | 138 | 127 | 82 |
| 17.0 | 43                                      | 40   | 37   | 34.3 | 68              | 64 | 59 | 68 | 60                               | 56   | 52   | 29.0 | 95              | 89  | 82 | 74 | 94                               | 89    | 82    | 23.1 | 149             | 140 | 129 | 82 |
| 18.0 | 39                                      | 37   | 34   | 36.0 | 69              | 65 | 60 | 68 | 54                               | 51   | 47   | 30.4 | 96              | 90  | 84 | 74 | 85                               | 80    | 74    | 24.3 | 151             | 142 | 131 | 82 |
| 19.0 | 35                                      | 33   | 31   | 37.7 | 70              | 65 | 61 | 69 | 49                               | 47   | 43   | 31.9 | 97              | 92  | 85 | 75 | 78                               | 73    | 68    | 25.4 | 153             | 144 | 133 | 82 |
| 20.0 | 32                                      | 30   | 28   | 39.4 | 71              | 66 | 61 | 69 | 45                               | 43   | 39   | 33.3 | 99              | 93  | 86 | 75 | 71                               | 67    | 62    | 26.6 | 155             | 146 | 135 | 83 |
| 22.0 | 27                                      | 26   | 24   | 42.8 | 72              | 68 | 63 | 69 | 38                               | 36   | 33   | 36.2 | 101             | 95  | 88 | 75 | 60                               | 57    | 53    | 28.9 | 159             | 150 | 139 | 83 |
| 24.0 | 24                                      | 22   | 21   | 46.2 | 74              | 70 | 65 | 70 | 33                               | 31   | 29   | 39.0 | 104             | 98  | 90 | 76 | 52                               | 49    | 45    | 31.1 | 163             | 153 | 142 | 84 |
| 26.0 | 21                                      | 19   | 18   | 49.5 | 76              | 71 | 66 | 70 | 29                               | 27   | 25   | 41.8 | 106             | 100 | 92 | 76 | 45                               | 43    | 39    | 33.4 | 167             | 157 | 145 | 84 |
| 28.0 | 18                                      | 17   | 16   | 52.8 | 77              | 73 | 67 | 71 | 25                               | 24   | 22   | 44.6 | 108             | 102 | 94 | 76 | 40                               | 37    | 35    | 35.6 | 170             | 160 | 148 | 84 |
| 30.0 | 16                                      | 15   | 14   | 56.0 | 79              | 74 | 69 | 71 | 22                               | 21   | 20   | 47.3 | 110             | 104 | 96 | 77 | 35                               | 33    | 31    | 37.8 | 173             | 163 | 151 | 85 |

**Table S7:** Subalpine fir stocking levels for the ABLA2/LIBO2 (B-O province) and ABLA2/VAME (W-S province) plant associations.

| QMD  | Climate Resilience; SDI 105; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 147; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 230; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5625                                    | 5296 | 4897 | 3.0  | 31              | 29 | 27 | 55 | 7876                             | 7415 | 6856 | 2.5  | 43              | 40  | 37 | 60 | 12376                            | 11652 | 10774 | 2.0  | 68              | 64  | 59  | 68 |
| 1.5  | 2789                                    | 2626 | 2428 | 4.2  | 34              | 32 | 30 | 57 | 3905                             | 3677 | 3400 | 3.6  | 48              | 45  | 42 | 62 | 6137                             | 5778  | 5343  | 2.9  | 75              | 71  | 66  | 70 |
| 2.0  | 1696                                    | 1597 | 1476 | 5.4  | 37              | 35 | 32 | 58 | 2374                             | 2235 | 2067 | 4.6  | 52              | 49  | 45 | 64 | 3731                             | 3512  | 3248  | 3.7  | 81              | 77  | 71  | 71 |
| 2.5  | 1153                                    | 1085 | 1004 | 6.6  | 39              | 37 | 34 | 59 | 1614                             | 1519 | 1405 | 5.6  | 55              | 52  | 48 | 65 | 2536                             | 2388  | 2208  | 4.5  | 86              | 81  | 75  | 73 |
| 3.0  | 841                                     | 792  | 732  | 7.7  | 41              | 39 | 36 | 60 | 1177                             | 1108 | 1025 | 6.5  | 58              | 54  | 50 | 66 | 1850                             | 1742  | 1611  | 5.2  | 91              | 85  | 79  | 73 |
| 3.5  | 644                                     | 606  | 561  | 8.8  | 43              | 41 | 37 | 60 | 902                              | 849  | 785  | 7.5  | 60              | 57  | 52 | 66 | 1417                             | 1334  | 1234  | 6.0  | 95              | 89  | 82  | 74 |
| 4.0  | 511                                     | 481  | 445  | 9.9  | 45              | 42 | 39 | 61 | 716                              | 674  | 623  | 8.4  | 62              | 59  | 54 | 67 | 1125                             | 1059  | 979   | 6.7  | 98              | 92  | 85  | 75 |
| 4.5  | 417                                     | 393  | 363  | 11.0 | 46              | 43 | 40 | 62 | 584                              | 550  | 508  | 9.3  | 64              | 61  | 56 | 67 | 917                              | 864   | 799   | 7.4  | 101             | 95  | 88  | 75 |
| 5.0  | 347                                     | 327  | 303  | 12.0 | 47              | 45 | 41 | 62 | 486                              | 458  | 424  | 10.2 | 66              | 62  | 58 | 68 | 764                              | 720   | 666   | 8.1  | 104             | 98  | 91  | 76 |
| 5.5  | 295                                     | 277  | 257  | 13.1 | 49              | 46 | 42 | 63 | 413                              | 388  | 359  | 11.0 | 68              | 64  | 59 | 68 | 648                              | 610   | 564   | 8.8  | 107             | 101 | 93  | 76 |
| 6.0  | 253                                     | 239  | 221  | 14.1 | 50              | 47 | 43 | 63 | 355                              | 334  | 309  | 11.9 | 70              | 66  | 61 | 69 | 558                              | 525   | 486   | 9.5  | 109             | 103 | 95  | 77 |
| 6.5  | 221                                     | 208  | 192  | 15.1 | 51              | 48 | 44 | 63 | 309                              | 291  | 269  | 12.8 | 71              | 67  | 62 | 69 | 486                              | 457   | 423   | 10.2 | 112             | 105 | 97  | 77 |
| 7.0  | 194                                     | 183  | 169  | 16.1 | 52              | 49 | 45 | 64 | 272                              | 256  | 237  | 13.6 | 73              | 68  | 63 | 69 | 427                              | 402   | 372   | 10.9 | 114             | 107 | 99  | 77 |
| 7.5  | 172                                     | 162  | 150  | 17.1 | 53              | 50 | 46 | 64 | 241                              | 227  | 210  | 14.4 | 74              | 70  | 64 | 70 | 379                              | 357   | 330   | 11.5 | 116             | 109 | 101 | 78 |
| 8.0  | 154                                     | 145  | 134  | 18.1 | 54              | 51 | 47 | 64 | 216                              | 203  | 188  | 15.3 | 75              | 71  | 66 | 70 | 339                              | 319   | 295   | 12.2 | 118             | 111 | 103 | 78 |
| 8.5  | 139                                     | 131  | 121  | 19.0 | 55              | 51 | 48 | 65 | 194                              | 183  | 169  | 16.1 | 77              | 72  | 67 | 70 | 305                              | 287   | 266   | 12.8 | 120             | 113 | 105 | 78 |
| 9.0  | 126                                     | 118  | 109  | 20.0 | 56              | 52 | 48 | 65 | 176                              | 166  | 153  | 16.9 | 78              | 73  | 68 | 71 | 277                              | 260   | 241   | 13.5 | 122             | 115 | 106 | 79 |
| 9.5  | 114                                     | 108  | 100  | 21.0 | 56              | 53 | 49 | 65 | 160                              | 151  | 140  | 17.7 | 79              | 74  | 69 | 71 | 252                              | 237   | 219   | 14.1 | 124             | 117 | 108 | 79 |
| 10.0 | 105                                     | 99   | 91   | 21.9 | 57              | 54 | 50 | 65 | 147                              | 138  | 128  | 18.5 | 80              | 75  | 70 | 71 | 230                              | 217   | 201   | 14.8 | 126             | 118 | 109 | 79 |
| 11.0 | 89                                      | 84   | 77   | 23.8 | 59              | 55 | 51 | 66 | 124                              | 117  | 108  | 20.1 | 82              | 77  | 71 | 72 | 195                              | 184   | 170   | 16.0 | 129             | 121 | 112 | 79 |
| 12.0 | 76                                      | 72   | 67   | 25.7 | 60              | 57 | 52 | 66 | 107                              | 101  | 93   | 21.7 | 84              | 79  | 73 | 72 | 168                              | 158   | 146   | 17.3 | 132             | 124 | 115 | 80 |
| 13.0 | 67                                      | 63   | 58   | 27.5 | 61              | 58 | 53 | 67 | 93                               | 88   | 81   | 23.2 | 86              | 81  | 75 | 72 | 146                              | 138   | 127   | 18.5 | 135             | 127 | 117 | 80 |
| 14.0 | 59                                      | 55   | 51   | 29.3 | 63              | 59 | 54 | 67 | 82                               | 77   | 71   | 24.8 | 88              | 82  | 76 | 73 | 129                              | 121   | 112   | 19.8 | 138             | 130 | 120 | 81 |
| 15.0 | 52                                      | 49   | 45   | 31.1 | 64              | 60 | 55 | 67 | 73                               | 68   | 63   | 26.3 | 89              | 84  | 78 | 73 | 114                              | 108   | 99    | 21.0 | 140             | 132 | 122 | 81 |
| 16.0 | 46                                      | 44   | 40   | 32.9 | 65              | 61 | 56 | 68 | 65                               | 61   | 57   | 27.8 | 91              | 85  | 79 | 73 | 102                              | 96    | 89    | 22.2 | 143             | 134 | 124 | 81 |
| 17.0 | 42                                      | 39   | 36   | 34.7 | 66              | 62 | 57 | 68 | 59                               | 55   | 51   | 29.3 | 92              | 87  | 80 | 74 | 92                               | 87    | 80    | 23.4 | 145             | 137 | 126 | 82 |
| 18.0 | 38                                      | 36   | 33   | 36.4 | 67              | 63 | 58 | 68 | 53                               | 50   | 46   | 30.8 | 94              | 88  | 82 | 74 | 83                               | 78    | 73    | 24.6 | 147             | 139 | 128 | 82 |
| 19.0 | 35                                      | 32   | 30   | 38.2 | 68              | 64 | 59 | 68 | 48                               | 45   | 42   | 32.3 | 95              | 90  | 83 | 74 | 76                               | 71    | 66    | 25.7 | 149             | 141 | 130 | 82 |
| 20.0 | 32                                      | 30   | 27   | 39.9 | 69              | 65 | 60 | 69 | 44                               | 42   | 38   | 33.7 | 96              | 91  | 84 | 74 | 69                               | 65    | 60    | 26.9 | 152             | 143 | 132 | 82 |
| 22.0 | 27                                      | 25   | 23   | 43.3 | 71              | 67 | 62 | 69 | 37                               | 35   | 33   | 36.6 | 99              | 93  | 86 | 75 | 59                               | 55    | 51    | 29.2 | 156             | 146 | 135 | 83 |
| 24.0 | 23                                      | 22   | 20   | 46.7 | 72              | 68 | 63 | 69 | 32                               | 30   | 28   | 39.5 | 101             | 95  | 88 | 75 | 51                               | 48    | 44    | 31.5 | 159             | 150 | 139 | 83 |
| 26.0 | 20                                      | 19   | 17   | 50.1 | 74              | 70 | 64 | 70 | 28                               | 26   | 24   | 42.3 | 104             | 97  | 90 | 76 | 44                               | 42    | 38    | 33.8 | 163             | 153 | 142 | 84 |
| 28.0 | 18                                      | 17   | 15   | 53.4 | 75              | 71 | 66 | 70 | 25                               | 23   | 22   | 45.1 | 106             | 99  | 92 | 76 | 39                               | 37    | 34    | 36.0 | 166             | 156 | 144 | 84 |
| 30.0 | 16                                      | 15   | 14   | 56.7 | 77              | 72 | 67 | 70 | 22                               | 21   | 19   | 47.9 | 108             | 101 | 94 | 76 | 34                               | 32    | 30    | 38.2 | 169             | 159 | 147 | 84 |

**Table S8:** Subalpine fir stocking levels for the ABLA2/LIBO2 plant association (W-S province).

| QMD  | Climate Resilience; SDI 122; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 171; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 268; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6552                                    | 6169 | 5704 | 2.8  | 36              | 34 | 31 | 57 | 9173                             | 8636 | 7986 | 2.3  | 50              | 47  | 44  | 63 | 14414                            | 13571 | 12549 | 1.9  | 79              | 74  | 68  | 71 |
| 1.5  | 3249                                    | 3059 | 2828 | 3.9  | 40              | 38 | 35 | 59 | 4548                             | 4282 | 3960 | 3.3  | 56              | 53  | 49  | 65 | 7147                             | 6729  | 6222  | 2.7  | 88              | 83  | 76  | 73 |
| 2.0  | 1975                                    | 1860 | 1719 | 5.0  | 43              | 41 | 38 | 60 | 2765                             | 2603 | 2407 | 4.3  | 60              | 57  | 53  | 66 | 4345                             | 4091  | 3783  | 3.4  | 95              | 89  | 83  | 74 |
| 2.5  | 1343                                    | 1264 | 1169 | 6.1  | 46              | 43 | 40 | 62 | 1880                             | 1770 | 1636 | 5.2  | 64              | 60  | 56  | 67 | 2954                             | 2781  | 2571  | 4.1  | 101             | 95  | 88  | 75 |
| 3.0  | 979                                     | 922  | 853  | 7.2  | 48              | 45 | 42 | 62 | 1371                             | 1291 | 1194 | 6.1  | 67              | 63  | 59  | 68 | 2155                             | 2029  | 1876  | 4.8  | 106             | 100 | 92  | 76 |
| 3.5  | 750                                     | 706  | 653  | 8.2  | 50              | 47 | 44 | 63 | 1050                             | 989  | 914  | 6.9  | 70              | 66  | 61  | 69 | 1650                             | 1554  | 1437  | 5.5  | 110             | 104 | 96  | 77 |
| 4.0  | 595                                     | 561  | 518  | 9.2  | 52              | 49 | 45 | 64 | 834                              | 785  | 726  | 7.8  | 73              | 68  | 63  | 70 | 1310                             | 1233  | 1140  | 6.2  | 114             | 108 | 100 | 77 |
| 4.5  | 486                                     | 457  | 423  | 10.2 | 54              | 50 | 47 | 64 | 680                              | 640  | 592  | 8.6  | 75              | 71  | 65  | 70 | 1068                             | 1006  | 930   | 6.9  | 118             | 111 | 103 | 78 |
| 5.0  | 405                                     | 381  | 352  | 11.1 | 55              | 52 | 48 | 65 | 567                              | 533  | 493  | 9.4  | 77              | 73  | 67  | 71 | 890                              | 838   | 775   | 7.5  | 121             | 114 | 106 | 78 |
| 5.5  | 343                                     | 323  | 299  | 12.1 | 57              | 53 | 49 | 65 | 480                              | 452  | 418  | 10.2 | 79              | 75  | 69  | 71 | 755                              | 711   | 657   | 8.2  | 125             | 117 | 108 | 79 |
| 6.0  | 295                                     | 278  | 257  | 13.1 | 58              | 55 | 50 | 66 | 413                              | 389  | 360  | 11.0 | 81              | 76  | 71  | 71 | 650                              | 612   | 565   | 8.8  | 128             | 120 | 111 | 79 |
| 6.5  | 257                                     | 242  | 224  | 14.0 | 59              | 56 | 52 | 66 | 360                              | 339  | 313  | 11.8 | 83              | 78  | 72  | 72 | 566                              | 532   | 492   | 9.4  | 130             | 123 | 113 | 80 |
| 7.0  | 226                                     | 213  | 197  | 14.9 | 60              | 57 | 53 | 66 | 317                              | 298  | 276  | 12.6 | 85              | 80  | 74  | 72 | 497                              | 468   | 433   | 10.1 | 133             | 125 | 116 | 80 |
| 7.5  | 201                                     | 189  | 175  | 15.8 | 62              | 58 | 54 | 67 | 281                              | 265  | 245  | 13.4 | 86              | 81  | 75  | 72 | 441                              | 416   | 384   | 10.7 | 135             | 128 | 118 | 80 |
| 8.0  | 179                                     | 169  | 156  | 16.7 | 63              | 59 | 55 | 67 | 251                              | 237  | 219  | 14.1 | 88              | 83  | 76  | 73 | 395                              | 372   | 344   | 11.3 | 138             | 130 | 120 | 81 |
| 8.5  | 162                                     | 152  | 141  | 17.6 | 64              | 60 | 55 | 67 | 226                              | 213  | 197  | 14.9 | 89              | 84  | 78  | 73 | 356                              | 335   | 310   | 11.9 | 140             | 132 | 122 | 81 |
| 9.0  | 146                                     | 138  | 127  | 18.5 | 65              | 61 | 56 | 67 | 205                              | 193  | 178  | 15.7 | 91              | 85  | 79  | 73 | 322                              | 303   | 280   | 12.5 | 142             | 134 | 124 | 81 |
| 9.5  | 133                                     | 126  | 116  | 19.4 | 66              | 62 | 57 | 68 | 187                              | 176  | 162  | 16.4 | 92              | 87  | 80  | 74 | 293                              | 276   | 255   | 13.1 | 144             | 136 | 126 | 81 |
| 10.0 | 122                                     | 115  | 106  | 20.3 | 67              | 63 | 58 | 68 | 171                              | 161  | 149  | 17.2 | 93              | 88  | 81  | 74 | 268                              | 253   | 234   | 13.7 | 146             | 138 | 127 | 82 |
| 11.0 | 103                                     | 97   | 90   | 22.1 | 68              | 64 | 59 | 68 | 145                              | 136  | 126  | 18.6 | 96              | 90  | 83  | 74 | 228                              | 214   | 198   | 14.9 | 150             | 141 | 131 | 82 |
| 12.0 | 89                                      | 84   | 77   | 23.8 | 70              | 66 | 61 | 69 | 125                              | 117  | 108  | 20.1 | 98              | 92  | 85  | 75 | 196                              | 184   | 170   | 16.0 | 154             | 145 | 134 | 83 |
| 13.0 | 77                                      | 73   | 67   | 25.5 | 71              | 67 | 62 | 69 | 108                              | 102  | 94   | 21.5 | 100             | 94  | 87  | 75 | 170                              | 161   | 148   | 17.2 | 157             | 148 | 137 | 83 |
| 14.0 | 68                                      | 64   | 59   | 27.2 | 73              | 69 | 63 | 70 | 95                               | 90   | 83   | 23.0 | 102             | 96  | 89  | 75 | 150                              | 141   | 131   | 18.3 | 160             | 151 | 140 | 83 |
| 15.0 | 60                                      | 57   | 53   | 28.8 | 74              | 70 | 65 | 70 | 85                               | 80   | 74   | 24.4 | 104             | 98  | 90  | 76 | 133                              | 125   | 116   | 19.4 | 163             | 154 | 142 | 84 |
| 16.0 | 54                                      | 51   | 47   | 30.5 | 76              | 71 | 66 | 70 | 76                               | 71   | 66   | 25.8 | 106             | 100 | 92  | 76 | 119                              | 112   | 104   | 20.6 | 166             | 156 | 145 | 84 |
| 17.0 | 49                                      | 46   | 42   | 32.1 | 77              | 72 | 67 | 70 | 68                               | 64   | 59   | 27.2 | 108             | 101 | 94  | 76 | 107                              | 101   | 93    | 21.7 | 169             | 159 | 147 | 84 |
| 18.0 | 44                                      | 42   | 38   | 33.8 | 78              | 73 | 68 | 71 | 62                               | 58   | 54   | 28.5 | 109             | 103 | 95  | 77 | 97                               | 91    | 85    | 22.8 | 172             | 162 | 149 | 84 |
| 19.0 | 40                                      | 38   | 35   | 35.4 | 79              | 75 | 69 | 71 | 56                               | 53   | 49   | 29.9 | 111             | 104 | 96  | 77 | 88                               | 83    | 77    | 23.9 | 174             | 164 | 152 | 85 |
| 20.0 | 37                                      | 35   | 32   | 37.0 | 80              | 76 | 70 | 71 | 51                               | 48   | 45   | 31.3 | 112             | 106 | 98  | 77 | 81                               | 76    | 70    | 24.9 | 177             | 166 | 154 | 85 |
| 22.0 | 31                                      | 29   | 27   | 40.2 | 82              | 78 | 72 | 72 | 44                               | 41   | 38   | 33.9 | 115             | 109 | 100 | 78 | 69                               | 65    | 60    | 27.1 | 181             | 171 | 158 | 85 |
| 24.0 | 27                                      | 25   | 23   | 43.3 | 84              | 79 | 73 | 72 | 38                               | 35   | 33   | 36.6 | 118             | 111 | 103 | 78 | 59                               | 56    | 51    | 29.2 | 185             | 175 | 161 | 86 |
| 26.0 | 23                                      | 22   | 20   | 46.4 | 86              | 81 | 75 | 72 | 33                               | 31   | 28   | 39.2 | 121             | 114 | 105 | 78 | 51                               | 48    | 45    | 31.3 | 189             | 178 | 165 | 86 |
| 28.0 | 21                                      | 19   | 18   | 49.5 | 88              | 83 | 76 | 73 | 29                               | 27   | 25   | 41.8 | 123             | 116 | 107 | 79 | 45                               | 43    | 39    | 33.4 | 193             | 182 | 168 | 87 |
| 30.0 | 18                                      | 17   | 16   | 52.5 | 90              | 84 | 78 | 73 | 26                               | 24   | 22   | 44.4 | 125             | 118 | 109 | 79 | 40                               | 38    | 35    | 35.4 | 197             | 185 | 171 | 87 |



**Table S9:** Subalpine fir stocking levels for the ABLA2/MEFE plant association (W-S province).

| QMD  | Climate Resilience; SDI 103; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 144; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 226; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5505                                    | 5183 | 4792 | 3.0  | 30              | 28 | 26 | 54 | 7706                             | 7256 | 6709 | 2.6  | 42              | 40 | 37 | 60 | 12110                            | 11402 | 10543 | 2.0  | 66              | 62  | 58  | 68 |
| 1.5  | 2730                                    | 2570 | 2376 | 4.3  | 33              | 32 | 29 | 56 | 3821                             | 3598 | 3327 | 3.6  | 47              | 44 | 41 | 62 | 6005                             | 5654  | 5228  | 2.9  | 74              | 69  | 64  | 70 |
| 2.0  | 1659                                    | 1562 | 1445 | 5.5  | 36              | 34 | 32 | 58 | 2323                             | 2187 | 2023 | 4.7  | 51              | 48 | 44 | 63 | 3651                             | 3437  | 3178  | 3.7  | 80              | 75  | 69  | 71 |
| 2.5  | 1128                                    | 1062 | 982  | 6.7  | 38              | 36 | 33 | 59 | 1579                             | 1487 | 1375 | 5.6  | 54              | 51 | 47 | 64 | 2481                             | 2336  | 2160  | 4.5  | 85              | 80  | 74  | 72 |
| 3.0  | 823                                     | 775  | 716  | 7.8  | 40              | 38 | 35 | 59 | 1152                             | 1085 | 1003 | 6.6  | 57              | 53 | 49 | 65 | 1810                             | 1704  | 1576  | 5.3  | 89              | 84  | 77  | 73 |
| 3.5  | 630                                     | 593  | 549  | 8.9  | 42              | 40 | 37 | 60 | 882                              | 831  | 768  | 7.6  | 59              | 56 | 51 | 66 | 1386                             | 1305  | 1207  | 6.0  | 93              | 87  | 81  | 74 |
| 4.0  | 500                                     | 471  | 435  | 10.0 | 44              | 41 | 38 | 61 | 700                              | 659  | 610  | 8.5  | 61              | 58 | 53 | 67 | 1100                             | 1036  | 958   | 6.8  | 96              | 90  | 84  | 74 |
| 4.5  | 408                                     | 384  | 355  | 11.1 | 45              | 42 | 39 | 61 | 571                              | 538  | 497  | 9.4  | 63              | 59 | 55 | 67 | 898                              | 845   | 781   | 7.5  | 99              | 93  | 86  | 75 |
| 5.0  | 340                                     | 320  | 296  | 12.2 | 46              | 44 | 40 | 62 | 476                              | 448  | 414  | 10.3 | 65              | 61 | 57 | 68 | 748                              | 704   | 651   | 8.2  | 102             | 96  | 89  | 75 |
| 5.5  | 288                                     | 271  | 251  | 13.2 | 48              | 45 | 41 | 62 | 404                              | 380  | 351  | 11.2 | 67              | 63 | 58 | 68 | 634                              | 597   | 552   | 8.9  | 105             | 99  | 91  | 76 |
| 6.0  | 248                                     | 234  | 216  | 14.2 | 49              | 46 | 42 | 63 | 347                              | 327  | 302  | 12.0 | 68              | 64 | 59 | 68 | 546                              | 514   | 475   | 9.6  | 107             | 101 | 93  | 76 |
| 6.5  | 216                                     | 203  | 188  | 15.3 | 50              | 47 | 43 | 63 | 302                              | 285  | 263  | 12.9 | 70              | 66 | 61 | 69 | 475                              | 447   | 414   | 10.3 | 109             | 103 | 95  | 77 |
| 7.0  | 190                                     | 179  | 165  | 16.3 | 51              | 48 | 44 | 63 | 266                              | 250  | 232  | 13.8 | 71              | 67 | 62 | 69 | 418                              | 394   | 364   | 11.0 | 112             | 105 | 97  | 77 |
| 7.5  | 169                                     | 159  | 147  | 17.3 | 52              | 49 | 45 | 64 | 236                              | 222  | 206  | 14.6 | 72              | 68 | 63 | 69 | 371                              | 349   | 323   | 11.6 | 114             | 107 | 99  | 77 |
| 8.0  | 151                                     | 142  | 131  | 18.3 | 53              | 50 | 46 | 64 | 211                              | 199  | 184  | 15.4 | 74              | 69 | 64 | 70 | 332                              | 312   | 289   | 12.3 | 116             | 109 | 101 | 78 |
| 8.5  | 136                                     | 128  | 118  | 19.2 | 54              | 50 | 47 | 64 | 190                              | 179  | 165  | 16.3 | 75              | 71 | 65 | 70 | 299                              | 281   | 260   | 13.0 | 118             | 111 | 102 | 78 |
| 9.0  | 123                                     | 116  | 107  | 20.2 | 54              | 51 | 47 | 64 | 172                              | 162  | 150  | 17.1 | 76              | 72 | 66 | 70 | 271                              | 255   | 236   | 13.6 | 120             | 113 | 104 | 78 |
| 9.5  | 112                                     | 105  | 98   | 21.2 | 55              | 52 | 48 | 65 | 157                              | 148  | 137  | 17.9 | 77              | 73 | 67 | 71 | 246                              | 232   | 215   | 14.3 | 121             | 114 | 106 | 78 |
| 10.0 | 103                                     | 97   | 89   | 22.2 | 56              | 53 | 49 | 65 | 144                              | 135  | 125  | 18.7 | 78              | 74 | 68 | 71 | 226                              | 212   | 196   | 14.9 | 123             | 116 | 107 | 79 |
| 11.0 | 87                                      | 82   | 76   | 24.1 | 57              | 54 | 50 | 65 | 122                              | 115  | 106  | 20.3 | 80              | 76 | 70 | 71 | 191                              | 180   | 166   | 16.2 | 126             | 119 | 110 | 79 |
| 12.0 | 75                                      | 70   | 65   | 25.9 | 59              | 55 | 51 | 66 | 105                              | 99   | 91   | 21.9 | 82              | 77 | 72 | 72 | 164                              | 155   | 143   | 17.5 | 129             | 122 | 112 | 79 |
| 13.0 | 65                                      | 61   | 57   | 27.8 | 60              | 56 | 52 | 66 | 91                               | 86   | 79   | 23.5 | 84              | 79 | 73 | 72 | 143                              | 135   | 125   | 18.7 | 132             | 124 | 115 | 80 |
| 14.0 | 57                                      | 54   | 50   | 29.6 | 61              | 58 | 53 | 67 | 80                               | 75   | 70   | 25.0 | 86              | 81 | 75 | 72 | 126                              | 119   | 110   | 20.0 | 135             | 127 | 117 | 80 |
| 15.0 | 51                                      | 48   | 44   | 31.5 | 62              | 59 | 54 | 67 | 71                               | 67   | 62   | 26.6 | 87              | 82 | 76 | 73 | 112                              | 105   | 97    | 21.2 | 137             | 129 | 119 | 81 |
| 16.0 | 45                                      | 43   | 40   | 33.3 | 63              | 60 | 55 | 67 | 64                               | 60   | 55   | 28.1 | 89              | 84 | 77 | 73 | 100                              | 94    | 87    | 22.4 | 140             | 131 | 122 | 81 |
| 17.0 | 41                                      | 39   | 36   | 35.1 | 65              | 61 | 56 | 67 | 57                               | 54   | 50   | 29.6 | 90              | 85 | 79 | 73 | 90                               | 85    | 78    | 23.6 | 142             | 134 | 124 | 81 |
| 18.0 | 37                                      | 35   | 32   | 36.8 | 66              | 62 | 57 | 68 | 52                               | 49   | 45   | 31.1 | 92              | 86 | 80 | 74 | 82                               | 77    | 71    | 24.8 | 144             | 136 | 125 | 81 |
| 19.0 | 34                                      | 32   | 29   | 38.6 | 66              | 63 | 58 | 68 | 47                               | 45   | 41   | 32.6 | 93              | 88 | 81 | 74 | 74                               | 70    | 65    | 26.0 | 146             | 138 | 127 | 82 |
| 20.0 | 31                                      | 29   | 27   | 40.3 | 67              | 63 | 59 | 68 | 43                               | 41   | 38   | 34.1 | 94              | 89 | 82 | 74 | 68                               | 64    | 59    | 27.2 | 148             | 140 | 129 | 82 |
| 22.0 | 26                                      | 25   | 23   | 43.8 | 69              | 65 | 60 | 69 | 37                               | 35   | 32   | 37.0 | 97              | 91 | 84 | 74 | 58                               | 54    | 50    | 29.5 | 152             | 143 | 132 | 82 |
| 24.0 | 23                                      | 21   | 20   | 47.2 | 71              | 67 | 62 | 69 | 32                               | 30   | 27   | 39.9 | 99              | 93 | 86 | 75 | 50                               | 47    | 43    | 31.8 | 156             | 147 | 136 | 83 |
| 26.0 | 20                                      | 18   | 17   | 50.6 | 72              | 68 | 63 | 69 | 27                               | 26   | 24   | 42.8 | 101             | 95 | 88 | 75 | 43                               | 41    | 38    | 34.1 | 159             | 150 | 139 | 83 |
| 28.0 | 17                                      | 16   | 15   | 54.0 | 74              | 70 | 64 | 70 | 24                               | 23   | 21   | 45.6 | 103             | 97 | 90 | 76 | 38                               | 36    | 33    | 36.4 | 162             | 153 | 141 | 83 |
| 30.0 | 15                                      | 14   | 13   | 57.3 | 75              | 71 | 65 | 70 | 21                               | 20   | 19   | 48.4 | 105             | 99 | 92 | 76 | 34                               | 32    | 29    | 38.6 | 165             | 156 | 144 | 84 |



**Table S10:** Subalpine fir stocking levels for the ABLA2/VASC/POPU plant association (W-S province), and the ABLA2/POPU and PICO(ABLA2)/VASC/POPU plant community types.

| QMD  | Climate Resilience; SDI 121; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 169; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 265; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6485                                    | 6105 | 5646 | 2.8  | 35              | 33 | 31 | 57 | 9079                             | 8547 | 7904 | 2.4  | 50              | 47  | 43  | 63 | 14266                            | 13432 | 12420 | 1.9  | 78              | 73  | 68  | 71 |
| 1.5  | 3216                                    | 3027 | 2799 | 4.0  | 39              | 37 | 34 | 59 | 4502                             | 4238 | 3919 | 3.3  | 55              | 52  | 48  | 65 | 7074                             | 6660  | 6159  | 2.7  | 87              | 82  | 76  | 73 |
| 2.0  | 1955                                    | 1840 | 1702 | 5.1  | 43              | 40 | 37 | 60 | 2737                             | 2577 | 2383 | 4.3  | 60              | 56  | 52  | 66 | 4301                             | 4049  | 3744  | 3.4  | 94              | 88  | 82  | 74 |
| 2.5  | 1329                                    | 1251 | 1157 | 6.2  | 45              | 43 | 39 | 61 | 1860                             | 1751 | 1620 | 5.2  | 63              | 60  | 55  | 67 | 2923                             | 2752  | 2545  | 4.1  | 100             | 94  | 87  | 75 |
| 3.0  | 969                                     | 913  | 844  | 7.2  | 48              | 45 | 41 | 62 | 1357                             | 1278 | 1181 | 6.1  | 67              | 63  | 58  | 68 | 2133                             | 2008  | 1857  | 4.9  | 105             | 99  | 91  | 76 |
| 3.5  | 742                                     | 699  | 646  | 8.2  | 50              | 47 | 43 | 63 | 1039                             | 979  | 905  | 7.0  | 69              | 65  | 60  | 69 | 1633                             | 1538  | 1422  | 5.5  | 109             | 103 | 95  | 77 |
| 4.0  | 589                                     | 555  | 513  | 9.2  | 51              | 48 | 45 | 64 | 825                              | 777  | 718  | 7.8  | 72              | 68  | 63  | 69 | 1296                             | 1221  | 1129  | 6.2  | 113             | 107 | 98  | 77 |
| 4.5  | 481                                     | 453  | 418  | 10.2 | 53              | 50 | 46 | 64 | 673                              | 634  | 586  | 8.6  | 74              | 70  | 65  | 70 | 1057                             | 996   | 921   | 6.9  | 117             | 110 | 102 | 78 |
| 5.0  | 401                                     | 377  | 349  | 11.2 | 55              | 51 | 48 | 65 | 561                              | 528  | 488  | 9.5  | 76              | 72  | 67  | 70 | 881                              | 830   | 767   | 7.6  | 120             | 113 | 105 | 78 |
| 5.5  | 340                                     | 320  | 296  | 12.2 | 56              | 53 | 49 | 65 | 476                              | 448  | 414  | 10.3 | 78              | 74  | 68  | 71 | 747                              | 704   | 651   | 8.2  | 123             | 116 | 107 | 79 |
| 6.0  | 292                                     | 275  | 254  | 13.1 | 57              | 54 | 50 | 65 | 409                              | 385  | 356  | 11.1 | 80              | 76  | 70  | 71 | 643                              | 605   | 560   | 8.8  | 126             | 119 | 110 | 79 |
| 6.5  | 254                                     | 240  | 221  | 14.1 | 59              | 55 | 51 | 66 | 356                              | 335  | 310  | 11.9 | 82              | 77  | 71  | 72 | 560                              | 527   | 487   | 9.5  | 129             | 121 | 112 | 79 |
| 7.0  | 224                                     | 211  | 195  | 15.0 | 60              | 56 | 52 | 66 | 313                              | 295  | 273  | 12.7 | 84              | 79  | 73  | 72 | 492                              | 464   | 429   | 10.1 | 132             | 124 | 115 | 80 |
| 7.5  | 199                                     | 187  | 173  | 15.9 | 61              | 57 | 53 | 66 | 278                              | 262  | 242  | 13.4 | 85              | 80  | 74  | 72 | 437                              | 411   | 380   | 10.7 | 134             | 126 | 117 | 80 |
| 8.0  | 178                                     | 167  | 155  | 16.8 | 62              | 58 | 54 | 67 | 249                              | 234  | 217  | 14.2 | 87              | 82  | 76  | 73 | 391                              | 368   | 340   | 11.3 | 136             | 128 | 119 | 80 |
| 8.5  | 160                                     | 151  | 139  | 17.7 | 63              | 59 | 55 | 67 | 224                              | 211  | 195  | 15.0 | 88              | 83  | 77  | 73 | 352                              | 331   | 306   | 12.0 | 139             | 131 | 121 | 81 |
| 9.0  | 145                                     | 136  | 126  | 18.6 | 64              | 60 | 56 | 67 | 203                              | 191  | 177  | 15.7 | 90              | 84  | 78  | 73 | 319                              | 300   | 278   | 12.6 | 141             | 133 | 123 | 81 |
| 9.5  | 132                                     | 124  | 115  | 19.5 | 65              | 61 | 57 | 68 | 185                              | 174  | 161  | 16.5 | 91              | 86  | 79  | 73 | 290                              | 273   | 253   | 13.2 | 143             | 135 | 124 | 81 |
| 10.0 | 121                                     | 114  | 105  | 20.4 | 66              | 62 | 57 | 68 | 169                              | 159  | 147  | 17.2 | 92              | 87  | 80  | 74 | 266                              | 250   | 231   | 13.8 | 145             | 136 | 126 | 81 |
| 11.0 | 102                                     | 96   | 89   | 22.2 | 68              | 64 | 59 | 68 | 143                              | 135  | 125  | 18.7 | 95              | 89  | 82  | 74 | 225                              | 212   | 196   | 14.9 | 149             | 140 | 129 | 82 |
| 12.0 | 88                                      | 83   | 77   | 23.9 | 69              | 65 | 60 | 69 | 123                              | 116  | 107  | 20.2 | 97              | 91  | 84  | 74 | 194                              | 182   | 169   | 16.1 | 152             | 143 | 133 | 82 |
| 13.0 | 77                                      | 72   | 67   | 25.6 | 71              | 67 | 62 | 69 | 107                              | 101  | 93   | 21.6 | 99              | 93  | 86  | 75 | 169                              | 159   | 147   | 17.3 | 156             | 146 | 135 | 83 |
| 14.0 | 67                                      | 64   | 59   | 27.3 | 72              | 68 | 63 | 69 | 94                               | 89   | 82   | 23.1 | 101             | 95  | 88  | 75 | 148                              | 140   | 129   | 18.4 | 159             | 149 | 138 | 83 |
| 15.0 | 60                                      | 56   | 52   | 29.0 | 73              | 69 | 64 | 70 | 84                               | 79   | 73   | 24.5 | 103             | 97  | 90  | 76 | 132                              | 124   | 115   | 19.5 | 162             | 152 | 141 | 83 |
| 16.0 | 54                                      | 50   | 47   | 30.6 | 75              | 70 | 65 | 70 | 75                               | 71   | 65   | 25.9 | 105             | 99  | 91  | 76 | 118                              | 111   | 103   | 20.7 | 164             | 155 | 143 | 84 |
| 17.0 | 48                                      | 45   | 42   | 32.3 | 76              | 72 | 66 | 70 | 68                               | 64   | 59   | 27.3 | 106             | 100 | 93  | 76 | 106                              | 100   | 92    | 21.8 | 167             | 157 | 146 | 84 |
| 18.0 | 44                                      | 41   | 38   | 33.9 | 77              | 73 | 67 | 71 | 61                               | 58   | 53   | 28.7 | 108             | 102 | 94  | 76 | 96                               | 90    | 84    | 22.9 | 170             | 160 | 148 | 84 |
| 19.0 | 40                                      | 37   | 35   | 35.6 | 78              | 74 | 68 | 71 | 56                               | 52   | 48   | 30.1 | 110             | 103 | 95  | 77 | 88                               | 82    | 76    | 24.0 | 172             | 162 | 150 | 85 |
| 20.0 | 36                                      | 34   | 32   | 37.2 | 79              | 75 | 69 | 71 | 51                               | 48   | 44   | 31.4 | 111             | 105 | 97  | 77 | 80                               | 75    | 70    | 25.1 | 175             | 164 | 152 | 85 |
| 22.0 | 31                                      | 29   | 27   | 40.4 | 81              | 77 | 71 | 71 | 43                               | 41   | 38   | 34.1 | 114             | 107 | 99  | 77 | 68                               | 64    | 59    | 27.2 | 179             | 169 | 156 | 85 |
| 24.0 | 27                                      | 25   | 23   | 43.5 | 83              | 79 | 73 | 72 | 37                               | 35   | 32   | 36.8 | 117             | 110 | 102 | 78 | 58                               | 55    | 51    | 29.3 | 184             | 173 | 160 | 86 |
| 26.0 | 23                                      | 22   | 20   | 46.6 | 85              | 80 | 74 | 72 | 32                               | 30   | 28   | 39.4 | 119             | 112 | 104 | 78 | 51                               | 48    | 44    | 31.4 | 188             | 177 | 163 | 86 |
| 28.0 | 20                                      | 19   | 18   | 49.7 | 87              | 82 | 76 | 73 | 28                               | 27   | 25   | 42.0 | 122             | 115 | 106 | 78 | 45                               | 42    | 39    | 33.5 | 191             | 180 | 167 | 86 |
| 30.0 | 18                                      | 17   | 16   | 52.8 | 89              | 83 | 77 | 73 | 25                               | 24   | 22   | 44.6 | 124             | 117 | 108 | 79 | 40                               | 37    | 35    | 35.6 | 195             | 184 | 170 | 87 |

**Table S11:** Subalpine fir stocking levels for the ABLA2/STAM plant community type (W-S province).

| QMD  | Climate Resilience; SDI 111; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 155; 35% of Max |      |      |      |                 |     |    |    | Upper Limit; SDI 243; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |    |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 5948                                    | 5600 | 5178 | 2.9  | 32              | 31 | 28 | 56 | 8327                             | 7840 | 7249 | 2.5  | 45              | 43  | 40 | 61 | 13085                            | 12319 | 11392 | 2.0  | 71              | 67  | 62  | 69 |
| 1.5  | 2949                                    | 2777 | 2568 | 4.1  | 36              | 34 | 32 | 58 | 4129                             | 3887 | 3595 | 3.5  | 51              | 48  | 44 | 63 | 6488                             | 6109  | 5649  | 2.8  | 80              | 75  | 69  | 71 |
| 2.0  | 1793                                    | 1688 | 1561 | 5.3  | 39              | 37 | 34 | 59 | 2510                             | 2363 | 2185 | 4.5  | 55              | 52  | 48 | 65 | 3944                             | 3714  | 3434  | 3.6  | 86              | 81  | 75  | 72 |
| 2.5  | 1219                                    | 1147 | 1061 | 6.4  | 42              | 39 | 36 | 60 | 1706                             | 1606 | 1485 | 5.4  | 58              | 55  | 51 | 66 | 2681                             | 2524  | 2334  | 4.3  | 91              | 86  | 80  | 73 |
| 3.0  | 889                                     | 837  | 774  | 7.5  | 44              | 41 | 38 | 61 | 1245                             | 1172 | 1084 | 6.4  | 61              | 58  | 53 | 66 | 1956                             | 1841  | 1703  | 5.1  | 96              | 90  | 84  | 74 |
| 3.5  | 681                                     | 641  | 593  | 8.6  | 45              | 43 | 40 | 61 | 953                              | 898  | 830  | 7.3  | 64              | 60  | 55 | 67 | 1498                             | 1410  | 1304  | 5.8  | 100             | 94  | 87  | 75 |
| 4.0  | 540                                     | 509  | 471  | 9.6  | 47              | 44 | 41 | 62 | 757                              | 712  | 659  | 8.2  | 66              | 62  | 57 | 68 | 1189                             | 1119  | 1035  | 6.5  | 104             | 98  | 90  | 76 |
| 4.5  | 441                                     | 415  | 384  | 10.7 | 49              | 46 | 42 | 63 | 617                              | 581  | 537  | 9.0  | 68              | 64  | 59 | 68 | 970                              | 913   | 844   | 7.2  | 107             | 101 | 93  | 76 |
| 5.0  | 367                                     | 346  | 320  | 11.7 | 50              | 47 | 44 | 63 | 514                              | 484  | 448  | 9.9  | 70              | 66  | 61 | 69 | 808                              | 761   | 704   | 7.9  | 110             | 104 | 96  | 77 |
| 5.5  | 312                                     | 293  | 271  | 12.7 | 51              | 48 | 45 | 64 | 436                              | 411  | 380  | 10.7 | 72              | 68  | 63 | 69 | 685                              | 645   | 597   | 8.6  | 113             | 106 | 98  | 77 |
| 6.0  | 268                                     | 252  | 233  | 13.7 | 53              | 50 | 46 | 64 | 375                              | 353  | 327  | 11.6 | 74              | 69  | 64 | 70 | 590                              | 555   | 513   | 9.2  | 116             | 109 | 101 | 78 |
| 6.5  | 233                                     | 220  | 203  | 14.7 | 54              | 51 | 47 | 64 | 327                              | 308  | 284  | 12.4 | 75              | 71  | 66 | 70 | 513                              | 483   | 447   | 9.9  | 118             | 111 | 103 | 78 |
| 7.0  | 205                                     | 193  | 179  | 15.7 | 55              | 52 | 48 | 65 | 287                              | 271  | 250  | 13.2 | 77              | 72  | 67 | 70 | 452                              | 425   | 393   | 10.6 | 121             | 114 | 105 | 78 |
| 7.5  | 182                                     | 172  | 159  | 16.6 | 56              | 53 | 49 | 65 | 255                              | 240  | 222  | 14.0 | 78              | 74  | 68 | 71 | 401                              | 377   | 349   | 11.2 | 123             | 116 | 107 | 79 |
| 8.0  | 163                                     | 153  | 142  | 17.6 | 57              | 54 | 50 | 65 | 228                              | 215  | 199  | 14.8 | 80              | 75  | 69 | 71 | 358                              | 337   | 312   | 11.8 | 125             | 118 | 109 | 79 |
| 8.5  | 147                                     | 138  | 128  | 18.5 | 58              | 54 | 50 | 66 | 205                              | 193  | 179  | 15.6 | 81              | 76  | 70 | 71 | 323                              | 304   | 281   | 12.5 | 127             | 120 | 111 | 79 |
| 9.0  | 133                                     | 125  | 116  | 19.5 | 59              | 55 | 51 | 66 | 186                              | 175  | 162  | 16.4 | 82              | 77  | 72 | 72 | 292                              | 275   | 255   | 13.1 | 129             | 122 | 112 | 79 |
| 9.5  | 121                                     | 114  | 105  | 20.4 | 60              | 56 | 52 | 66 | 169                              | 160  | 148  | 17.2 | 83              | 79  | 73 | 72 | 266                              | 251   | 232   | 13.7 | 131             | 123 | 114 | 80 |
| 10.0 | 111                                     | 104  | 96   | 21.3 | 60              | 57 | 53 | 66 | 155                              | 146  | 135  | 18.0 | 85              | 80  | 74 | 72 | 244                              | 229   | 212   | 14.4 | 133             | 125 | 116 | 80 |
| 11.0 | 94                                      | 88   | 82   | 23.1 | 62              | 58 | 54 | 67 | 131                              | 124  | 114  | 19.6 | 87              | 82  | 76 | 73 | 207                              | 195   | 180   | 15.6 | 136             | 128 | 119 | 80 |
| 12.0 | 81                                      | 76   | 70   | 25.0 | 63              | 60 | 55 | 67 | 113                              | 106  | 98   | 21.1 | 89              | 84  | 77 | 73 | 178                              | 167   | 155   | 16.8 | 140             | 131 | 122 | 81 |
| 13.0 | 70                                      | 66   | 61   | 26.7 | 65              | 61 | 56 | 68 | 98                               | 93   | 86   | 22.6 | 91              | 85  | 79 | 73 | 155                              | 146   | 135   | 18.0 | 143             | 134 | 124 | 81 |
| 14.0 | 62                                      | 58   | 54   | 28.5 | 66              | 62 | 58 | 68 | 87                               | 82   | 75   | 24.1 | 93              | 87  | 81 | 74 | 136                              | 128   | 119   | 19.2 | 146             | 137 | 127 | 82 |
| 15.0 | 55                                      | 52   | 48   | 30.3 | 67              | 63 | 59 | 68 | 77                               | 72   | 67   | 25.6 | 94              | 89  | 82 | 74 | 121                              | 114   | 105   | 20.4 | 148             | 140 | 129 | 82 |
| 16.0 | 49                                      | 46   | 43   | 32.0 | 69              | 65 | 60 | 68 | 69                               | 65   | 60   | 27.0 | 96              | 90  | 84 | 74 | 108                              | 102   | 94    | 21.6 | 151             | 142 | 131 | 82 |
| 17.0 | 44                                      | 42   | 39   | 33.7 | 70              | 66 | 61 | 69 | 62                               | 58   | 54   | 28.5 | 98              | 92  | 85 | 75 | 97                               | 92    | 85    | 22.7 | 153             | 144 | 134 | 82 |
| 18.0 | 40                                      | 38   | 35   | 35.4 | 71              | 67 | 62 | 69 | 56                               | 53   | 49   | 29.9 | 99              | 93  | 86 | 75 | 88                               | 83    | 77    | 23.9 | 156             | 147 | 136 | 83 |
| 19.0 | 36                                      | 34   | 32   | 37.1 | 72              | 68 | 63 | 69 | 51                               | 48   | 44   | 31.4 | 101             | 95  | 88 | 75 | 80                               | 76    | 70    | 25.0 | 158             | 149 | 138 | 83 |
| 20.0 | 33                                      | 31   | 29   | 38.8 | 73              | 69 | 63 | 70 | 47                               | 44   | 41   | 32.8 | 102             | 96  | 89 | 75 | 73                               | 69    | 64    | 26.2 | 160             | 151 | 140 | 83 |
| 22.0 | 28                                      | 27   | 25   | 42.2 | 75              | 70 | 65 | 70 | 40                               | 37   | 35   | 35.6 | 105             | 99  | 91 | 76 | 62                               | 59    | 54    | 28.4 | 164             | 155 | 143 | 84 |
| 24.0 | 24                                      | 23   | 21   | 45.4 | 77              | 72 | 67 | 70 | 34                               | 32   | 30   | 38.4 | 107             | 101 | 93 | 76 | 54                               | 50    | 47    | 30.6 | 168             | 158 | 147 | 84 |
| 26.0 | 21                                      | 20   | 18   | 48.7 | 78              | 74 | 68 | 71 | 30                               | 28   | 26   | 41.2 | 109             | 103 | 95 | 77 | 47                               | 44    | 41    | 32.8 | 172             | 162 | 150 | 84 |
| 28.0 | 19                                      | 18   | 16   | 51.9 | 80              | 75 | 69 | 71 | 26                               | 25   | 23   | 43.9 | 112             | 105 | 97 | 77 | 41                               | 39    | 36    | 35.0 | 175             | 165 | 153 | 85 |
| 30.0 | 17                                      | 16   | 14   | 55.1 | 81              | 77 | 71 | 71 | 23                               | 22   | 20   | 46.6 | 114             | 107 | 99 | 77 | 36                               | 34    | 32    | 37.2 | 179             | 168 | 156 | 85 |

**Table S12:** Subalpine fir stocking levels for the ABLA2/VAME plant association (B-O province) and the PICO(ABLA2)/VAME plant community type.

| QMD  | Climate Resilience; SDI 83; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 116; 35% of Max |      |      |      |                 |    |    |    | Upper Limit; SDI 182; 55% of Max |      |      |      |                 |     |     |    |
|------|----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                         |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                     | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC |
| 1.0  | 4444                                   | 4184 | 3869 | 3.4  | 24              | 23 | 21 | 51 | 6222                             | 5858 | 5416 | 2.8  | 34              | 32 | 30 | 56 | 9777                             | 9205 | 8512 | 2.3  | 53              | 50  | 46  | 64 |
| 1.5  | 2204                                   | 2075 | 1918 | 4.8  | 27              | 25 | 24 | 53 | 3085                             | 2905 | 2686 | 4.0  | 38              | 36 | 33 | 58 | 4848                             | 4564 | 4221 | 3.2  | 59              | 56  | 52  | 66 |
| 2.0  | 1340                                   | 1261 | 1166 | 6.1  | 29              | 28 | 25 | 54 | 1875                             | 1766 | 1633 | 5.2  | 41              | 39 | 36 | 60 | 2947                             | 2775 | 2566 | 4.1  | 64              | 61  | 56  | 67 |
| 2.5  | 911                                    | 857  | 793  | 7.4  | 31              | 29 | 27 | 55 | 1275                             | 1200 | 1110 | 6.3  | 43              | 41 | 38 | 61 | 2003                             | 1886 | 1744 | 5.0  | 68              | 64  | 59  | 68 |
| 3.0  | 664                                    | 625  | 578  | 8.7  | 33              | 31 | 28 | 56 | 930                              | 876  | 810  | 7.4  | 46              | 43 | 40 | 61 | 1461                             | 1376 | 1272 | 5.9  | 72              | 68  | 62  | 69 |
| 3.5  | 509                                    | 479  | 443  | 9.9  | 34              | 32 | 30 | 56 | 712                              | 671  | 620  | 8.4  | 48              | 45 | 41 | 62 | 1119                             | 1054 | 974  | 6.7  | 75              | 70  | 65  | 70 |
| 4.0  | 404                                    | 380  | 352  | 11.2 | 35              | 33 | 31 | 57 | 565                              | 532  | 492  | 9.4  | 49              | 46 | 43 | 63 | 888                              | 836  | 773  | 7.5  | 78              | 73  | 67  | 71 |
| 4.5  | 329                                    | 310  | 287  | 12.4 | 36              | 34 | 32 | 58 | 461                              | 434  | 401  | 10.4 | 51              | 48 | 44 | 63 | 725                              | 682  | 631  | 8.3  | 80              | 75  | 70  | 71 |
| 5.0  | 275                                    | 258  | 239  | 13.5 | 37              | 35 | 33 | 58 | 384                              | 362  | 335  | 11.4 | 52              | 49 | 46 | 64 | 604                              | 569  | 526  | 9.1  | 82              | 78  | 72  | 72 |
| 5.5  | 233                                    | 219  | 203  | 14.7 | 38              | 36 | 33 | 59 | 326                              | 307  | 284  | 12.4 | 54              | 51 | 47 | 64 | 512                              | 482  | 446  | 9.9  | 84              | 80  | 74  | 72 |
| 6.0  | 200                                    | 189  | 174  | 15.8 | 39              | 37 | 34 | 59 | 280                              | 264  | 244  | 13.4 | 55              | 52 | 48 | 65 | 441                              | 415  | 384  | 10.7 | 87              | 81  | 75  | 73 |
| 6.5  | 174                                    | 164  | 152  | 17.0 | 40              | 38 | 35 | 59 | 244                              | 230  | 213  | 14.4 | 56              | 53 | 49 | 65 | 384                              | 361  | 334  | 11.5 | 88              | 83  | 77  | 73 |
| 7.0  | 153                                    | 144  | 134  | 18.1 | 41              | 39 | 36 | 60 | 215                              | 202  | 187  | 15.3 | 57              | 54 | 50 | 65 | 337                              | 318  | 294  | 12.2 | 90              | 85  | 79  | 73 |
| 7.5  | 136                                    | 128  | 119  | 19.2 | 42              | 39 | 36 | 60 | 191                              | 179  | 166  | 16.2 | 58              | 55 | 51 | 66 | 299                              | 282  | 261  | 13.0 | 92              | 86  | 80  | 74 |
| 8.0  | 122                                    | 115  | 106  | 20.3 | 42              | 40 | 37 | 60 | 170                              | 160  | 148  | 17.2 | 59              | 56 | 52 | 66 | 268                              | 252  | 233  | 13.7 | 93              | 88  | 81  | 74 |
| 8.5  | 110                                    | 103  | 95   | 21.4 | 43              | 41 | 38 | 61 | 153                              | 144  | 134  | 18.1 | 60              | 57 | 53 | 66 | 241                              | 227  | 210  | 14.4 | 95              | 89  | 83  | 74 |
| 9.0  | 99                                     | 93   | 86   | 22.5 | 44              | 41 | 38 | 61 | 139                              | 131  | 121  | 19.0 | 61              | 58 | 53 | 67 | 218                              | 206  | 190  | 15.2 | 97              | 91  | 84  | 74 |
| 9.5  | 90                                     | 85   | 79   | 23.6 | 45              | 42 | 39 | 61 | 127                              | 119  | 110  | 19.9 | 62              | 59 | 54 | 67 | 199                              | 187  | 173  | 15.9 | 98              | 92  | 85  | 75 |
| 10.0 | 83                                     | 78   | 72   | 24.7 | 45              | 42 | 39 | 61 | 116                              | 109  | 101  | 20.8 | 63              | 59 | 55 | 67 | 182                              | 171  | 158  | 16.6 | 99              | 93  | 86  | 75 |
| 11.0 | 70                                     | 66   | 61   | 26.8 | 46              | 44 | 40 | 62 | 98                               | 92   | 86   | 22.6 | 65              | 61 | 56 | 68 | 154                              | 145  | 134  | 18.1 | 102             | 96  | 89  | 75 |
| 12.0 | 60                                     | 57   | 53   | 28.9 | 47              | 45 | 41 | 62 | 85                               | 80   | 74   | 24.4 | 66              | 62 | 58 | 68 | 133                              | 125  | 116  | 19.5 | 104             | 98  | 91  | 76 |
| 13.0 | 53                                     | 49   | 46   | 30.9 | 48              | 46 | 42 | 62 | 74                               | 69   | 64   | 26.1 | 68              | 64 | 59 | 68 | 116                              | 109  | 101  | 20.9 | 107             | 100 | 93  | 76 |
| 14.0 | 46                                     | 44   | 40   | 33.0 | 49              | 47 | 43 | 63 | 65                               | 61   | 56   | 27.9 | 69              | 65 | 60 | 69 | 102                              | 96   | 89   | 22.2 | 109             | 102 | 95  | 76 |
| 15.0 | 41                                     | 39   | 36   | 35.0 | 50              | 47 | 44 | 63 | 57                               | 54   | 50   | 29.6 | 70              | 66 | 61 | 69 | 90                               | 85   | 79   | 23.6 | 111             | 104 | 96  | 77 |
| 16.0 | 37                                     | 35   | 32   | 37.0 | 51              | 48 | 45 | 63 | 51                               | 48   | 45   | 31.3 | 72              | 68 | 62 | 69 | 81                               | 76   | 70   | 25.0 | 113             | 106 | 98  | 77 |
| 17.0 | 33                                     | 31   | 29   | 39.0 | 52              | 49 | 45 | 64 | 46                               | 44   | 40   | 33.0 | 73              | 69 | 63 | 70 | 73                               | 68   | 63   | 26.3 | 115             | 108 | 100 | 77 |
| 18.0 | 30                                     | 28   | 26   | 41.0 | 53              | 50 | 46 | 64 | 42                               | 39   | 36   | 34.6 | 74              | 70 | 64 | 70 | 66                               | 62   | 57   | 27.6 | 116             | 110 | 101 | 78 |
| 19.0 | 27                                     | 26   | 24   | 43.0 | 54              | 51 | 47 | 64 | 38                               | 36   | 33   | 36.3 | 75              | 71 | 65 | 70 | 60                               | 56   | 52   | 29.0 | 118             | 111 | 103 | 78 |
| 20.0 | 25                                     | 23   | 22   | 44.9 | 54              | 51 | 47 | 64 | 35                               | 33   | 30   | 38.0 | 76              | 72 | 66 | 70 | 55                               | 52   | 48   | 30.3 | 120             | 113 | 104 | 78 |
| 22.0 | 21                                     | 20   | 18   | 48.8 | 56              | 53 | 49 | 65 | 30                               | 28   | 26   | 41.2 | 78              | 74 | 68 | 71 | 47                               | 44   | 41   | 32.9 | 123             | 116 | 107 | 79 |
| 24.0 | 18                                     | 17   | 16   | 52.6 | 57              | 54 | 50 | 65 | 25                               | 24   | 22   | 44.4 | 80              | 75 | 70 | 71 | 40                               | 38   | 35   | 35.4 | 126             | 118 | 109 | 79 |
| 26.0 | 16                                     | 15   | 14   | 56.3 | 58              | 55 | 51 | 66 | 22                               | 21   | 19   | 47.6 | 82              | 77 | 71 | 72 | 35                               | 33   | 30   | 38.0 | 129             | 121 | 112 | 79 |
| 28.0 | 14                                     | 13   | 12   | 60.1 | 60              | 56 | 52 | 66 | 20                               | 18   | 17   | 50.8 | 83              | 79 | 73 | 72 | 31                               | 29   | 27   | 40.5 | 131             | 123 | 114 | 80 |
| 30.0 | 12                                     | 12   | 11   | 63.8 | 61              | 57 | 53 | 66 | 17                               | 16   | 15   | 53.9 | 85              | 80 | 74 | 72 | 27                               | 26   | 24   | 43.0 | 134             | 126 | 116 | 80 |

**Table S13:** Subalpine fir stocking levels for the ABLA2/VASC plant association (B-O province) and the PICO(ABLA2)/VASC plant community type.

| QMD  | Climate Resilience; SDI 114; 25% of Max |      |      |      |                 |    |    |    | Lower Limit; SDI 160; 35% of Max |      |      |      |                 |     |     |    | Upper Limit; SDI 251; 55% of Max |       |       |      |                 |     |     |    |
|------|-----------------------------------------|------|------|------|-----------------|----|----|----|----------------------------------|------|------|------|-----------------|-----|-----|----|----------------------------------|-------|-------|------|-----------------|-----|-----|----|
|      | TREES PER ACRE                          |      |      |      | BASAL AREA/ACRE |    |    |    | TREES PER ACRE                   |      |      |      | BASAL AREA/ACRE |     |     |    | TREES PER ACRE                   |       |       |      | BASAL AREA/ACRE |     |     |    |
|      | EA                                      | IS   | UA   | ES   | EA              | IS | UA | CC | EA                               | IS   | UA   | ES   | EA              | IS  | UA  | CC | EA                               | IS    | UA    | ES   | EA              | IS  | UA  | CC |
| 1.0  | 6122                                    | 5764 | 5330 | 2.9  | 33              | 31 | 29 | 56 | 8571                             | 8070 | 7462 | 2.4  | 47              | 44  | 41  | 62 | 13469                            | 12681 | 11726 | 1.9  | 73              | 69  | 64  | 70 |
| 1.5  | 3036                                    | 2858 | 2643 | 4.1  | 37              | 35 | 32 | 58 | 4250                             | 4001 | 3700 | 3.4  | 52              | 49  | 45  | 64 | 6679                             | 6288  | 5814  | 2.7  | 82              | 77  | 71  | 72 |
| 2.0  | 1846                                    | 1738 | 1607 | 5.2  | 40              | 38 | 35 | 59 | 2584                             | 2433 | 2249 | 4.4  | 56              | 53  | 49  | 65 | 4060                             | 3823  | 3535  | 3.5  | 89              | 83  | 77  | 73 |
| 2.5  | 1254                                    | 1181 | 1092 | 6.3  | 43              | 40 | 37 | 60 | 1756                             | 1654 | 1529 | 5.4  | 60              | 56  | 52  | 66 | 2760                             | 2598  | 2403  | 4.3  | 94              | 89  | 82  | 74 |
| 3.0  | 915                                     | 862  | 797  | 7.4  | 45              | 42 | 39 | 61 | 1281                             | 1206 | 1115 | 6.3  | 63              | 59  | 55  | 67 | 2013                             | 1896  | 1753  | 5.0  | 99              | 93  | 86  | 75 |
| 3.5  | 701                                     | 660  | 610  | 8.5  | 47              | 44 | 41 | 62 | 981                              | 924  | 854  | 7.2  | 66              | 62  | 57  | 68 | 1542                             | 1452  | 1342  | 5.7  | 103             | 97  | 90  | 76 |
| 4.0  | 556                                     | 524  | 484  | 9.5  | 49              | 46 | 42 | 63 | 779                              | 733  | 678  | 8.0  | 68              | 64  | 59  | 68 | 1224                             | 1152  | 1066  | 6.4  | 107             | 101 | 93  | 76 |
| 4.5  | 454                                     | 427  | 395  | 10.5 | 50              | 47 | 44 | 63 | 635                              | 598  | 553  | 8.9  | 70              | 66  | 61  | 69 | 998                              | 940   | 869   | 7.1  | 110             | 104 | 96  | 77 |
| 5.0  | 378                                     | 356  | 329  | 11.5 | 52              | 49 | 45 | 64 | 529                              | 498  | 461  | 9.7  | 72              | 68  | 63  | 69 | 832                              | 783   | 724   | 7.8  | 113             | 107 | 99  | 77 |
| 5.5  | 321                                     | 302  | 279  | 12.5 | 53              | 50 | 46 | 64 | 449                              | 423  | 391  | 10.6 | 74              | 70  | 64  | 70 | 706                              | 664   | 614   | 8.4  | 116             | 110 | 101 | 78 |
| 6.0  | 276                                     | 260  | 240  | 13.5 | 54              | 51 | 47 | 64 | 386                              | 364  | 336  | 11.4 | 76              | 71  | 66  | 70 | 607                              | 571   | 528   | 9.1  | 119             | 112 | 104 | 78 |
| 6.5  | 240                                     | 226  | 209  | 14.5 | 55              | 52 | 48 | 65 | 336                              | 317  | 293  | 12.2 | 77              | 73  | 67  | 71 | 528                              | 498   | 460   | 9.8  | 122             | 115 | 106 | 78 |
| 7.0  | 211                                     | 199  | 184  | 15.4 | 56              | 53 | 49 | 65 | 296                              | 279  | 258  | 13.0 | 79              | 74  | 69  | 71 | 465                              | 438   | 405   | 10.4 | 124             | 117 | 108 | 79 |
| 7.5  | 188                                     | 177  | 163  | 16.4 | 58              | 54 | 50 | 65 | 263                              | 247  | 229  | 13.8 | 81              | 76  | 70  | 71 | 413                              | 388   | 359   | 11.0 | 127             | 119 | 110 | 79 |
| 8.0  | 168                                     | 158  | 146  | 17.3 | 59              | 55 | 51 | 66 | 235                              | 221  | 204  | 14.6 | 82              | 77  | 71  | 72 | 369                              | 347   | 321   | 11.7 | 129             | 121 | 112 | 79 |
| 8.5  | 151                                     | 142  | 131  | 18.3 | 60              | 56 | 52 | 66 | 211                              | 199  | 184  | 15.4 | 83              | 78  | 73  | 72 | 332                              | 313   | 289   | 12.3 | 131             | 123 | 114 | 80 |
| 9.0  | 137                                     | 129  | 119  | 19.2 | 60              | 57 | 53 | 66 | 192                              | 180  | 167  | 16.2 | 85              | 80  | 74  | 72 | 301                              | 283   | 262   | 12.9 | 133             | 125 | 116 | 80 |
| 9.5  | 125                                     | 117  | 108  | 20.1 | 61              | 58 | 53 | 67 | 174                              | 164  | 152  | 17.0 | 86              | 81  | 75  | 72 | 274                              | 258   | 239   | 13.5 | 135             | 127 | 117 | 80 |
| 10.0 | 114                                     | 107  | 99   | 21.0 | 62              | 59 | 54 | 67 | 160                              | 150  | 139  | 17.8 | 87              | 82  | 76  | 73 | 251                              | 236   | 218   | 14.2 | 137             | 129 | 119 | 80 |
| 11.0 | 97                                      | 91   | 84   | 22.8 | 64              | 60 | 56 | 67 | 135                              | 127  | 118  | 19.3 | 89              | 84  | 78  | 73 | 213                              | 200   | 185   | 15.4 | 140             | 132 | 122 | 81 |
| 12.0 | 83                                      | 78   | 72   | 24.6 | 65              | 61 | 57 | 68 | 116                              | 110  | 101  | 20.8 | 91              | 86  | 80  | 73 | 183                              | 172   | 159   | 16.6 | 144             | 135 | 125 | 81 |
| 13.0 | 72                                      | 68   | 63   | 26.4 | 67              | 63 | 58 | 68 | 101                              | 95   | 88   | 22.3 | 93              | 88  | 81  | 74 | 159                              | 150   | 139   | 17.8 | 147             | 138 | 128 | 82 |
| 14.0 | 64                                      | 60   | 55   | 28.1 | 68              | 64 | 59 | 68 | 89                               | 84   | 78   | 23.8 | 95              | 90  | 83  | 74 | 140                              | 132   | 122   | 18.9 | 150             | 141 | 130 | 82 |
| 15.0 | 57                                      | 53   | 49   | 29.8 | 69              | 65 | 60 | 69 | 79                               | 75   | 69   | 25.2 | 97              | 91  | 85  | 75 | 124                              | 117   | 108   | 20.1 | 153             | 144 | 133 | 82 |
| 16.0 | 51                                      | 48   | 44   | 31.5 | 71              | 66 | 61 | 69 | 71                               | 67   | 62   | 26.7 | 99              | 93  | 86  | 75 | 111                              | 105   | 97    | 21.3 | 155             | 146 | 135 | 83 |
| 17.0 | 46                                      | 43   | 40   | 33.2 | 72              | 68 | 62 | 69 | 64                               | 60   | 55   | 28.1 | 100             | 95  | 87  | 75 | 100                              | 94    | 87    | 22.4 | 158             | 149 | 137 | 83 |
| 18.0 | 41                                      | 39   | 36   | 34.9 | 73              | 69 | 63 | 70 | 58                               | 54   | 50   | 29.5 | 102             | 96  | 89  | 75 | 91                               | 85    | 79    | 23.5 | 160             | 151 | 140 | 83 |
| 19.0 | 38                                      | 35   | 33   | 36.6 | 74              | 70 | 64 | 70 | 53                               | 50   | 46   | 30.9 | 104             | 97  | 90  | 76 | 83                               | 78    | 72    | 24.7 | 163             | 153 | 142 | 84 |
| 20.0 | 34                                      | 32   | 30   | 38.3 | 75              | 71 | 65 | 70 | 48                               | 45   | 42   | 32.3 | 105             | 99  | 91  | 76 | 76                               | 71    | 66    | 25.8 | 165             | 155 | 144 | 84 |
| 22.0 | 29                                      | 27   | 25   | 41.5 | 77              | 72 | 67 | 70 | 41                               | 38   | 36   | 35.1 | 108             | 101 | 94  | 76 | 64                               | 60    | 56    | 28.0 | 169             | 159 | 147 | 84 |
| 24.0 | 25                                      | 24   | 22   | 44.8 | 79              | 74 | 69 | 71 | 35                               | 33   | 31   | 37.9 | 110             | 104 | 96  | 77 | 55                               | 52    | 48    | 30.2 | 173             | 163 | 151 | 85 |
| 26.0 | 22                                      | 21   | 19   | 48.0 | 80              | 76 | 70 | 71 | 31                               | 29   | 27   | 40.6 | 113             | 106 | 98  | 77 | 48                               | 45    | 42    | 32.4 | 177             | 167 | 154 | 85 |
| 28.0 | 19                                      | 18   | 17   | 51.2 | 82              | 77 | 71 | 72 | 27                               | 25   | 23   | 43.3 | 115             | 108 | 100 | 77 | 42                               | 40    | 37    | 34.5 | 181             | 170 | 157 | 85 |
| 30.0 | 17                                      | 16   | 15   | 54.3 | 84              | 79 | 73 | 72 | 24                               | 22   | 21   | 45.9 | 117             | 110 | 102 | 78 | 37                               | 35    | 33    | 36.6 | 184             | 173 | 160 | 86 |

## 7. GLOSSARY

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Definitions, taken from Helms (1998) unless noted otherwise, are not the only valid ones for these terms.

**Average stand diameter.** This term is analogous to quadratic mean diameter (QMD). Average stand diameter (ASD) is the “diameter of tree with average basal area” (Daniel et al. 1979b). Compare with QMD, below.

**Basal area.** Cross-sectional area of a single tree stem, including the bark, measured at breast height (4½ feet above the ground); also, the cross-sectional area of all stems in a stand and expressed per unit of land area (square feet per acre). For this stocking guide, basal area per acre was calculated as:  $QMD^2 \times .00545415 \times TPA$  (trees per acre).

**Canopy cover.** Proportion of ground or water surface covered by a vertical projection of the outermost perimeter of the natural spread of foliage or plants, including small openings within a canopy. In some instances, total canopy cover exceeds 100 percent because vegetation layers are tallied separately, resulting in ground being covered by canopy more than once. In other instances (including this guide), ground can be covered by foliage only once and canopy cover never exceeds 100 percent. For this stocking guide, canopy cover was calculated and based on basal area per acre; calculations utilized mathematical equations from Dealy (1985).

**Canopy bulk density (CBD).** Dry weight of available canopy fuel (both foliage and small branches) per unit of canopy volume (including small spaces between adjoining tree crowns). It is strongly influenced by species composition and stand density (Keyes and O’Hara 2002).

**Cohort.** A group of trees developing after a single disturbance, commonly with a predominance of trees of similar age. A single cohort, however, will often include a span of ages ranging from seedlings or sprouts to trees predating the disturbance event (Helms 1998). Stands are typically characterized as single-cohort or multi-cohort depending on whether they contain one or several cohorts (Oliver and Larson 1996).

**Competition.** Extent to which each organism maximizes its fitness by appropriating contested resources from a pool that is not sufficient for all, and by adapting to an environment influenced by all participants in the community or population. For trees, competition causes a density-related scarcity of certain environmental factors (nutrients, moisture, sunlight, etc.), thereby affecting tree growth and development.

**Crown class.** A classification of trees based on their crown position relative to adjacent trees within the same canopy stratum; four primary crown classes are recognized:

- **Dominant** – a tree whose crown extends above the general level of the main canopy, receiving full light from above and partial light from the sides.
- **Codominant** – a tree whose crown helps to form the general level of the main canopy, receiving full light from above and limited light from the sides.
- **Intermediate** – a tree whose crown extends into the lower portion of the main canopy but is shorter than the codominants, receiving limited direct light from above and virtually none from the sides.
- **Subcanopy** (overtopped) – a tree whose crown is completely overtopped (submerged) by the crowns of one or more neighboring trees – it occurs in a subordinate position relative to the main canopy.

**Crown closure.** Point in stand development where vertical projections of crown perimeters within a canopy touch (Helms 1998). Crown closure signals a period when branch growth first begins to slow due to lateral confinement caused by adjacent trees (Oliver and Larson 1996).

**Crown competition factor.** Sum of maximum crown area values for all trees in a stand, divided by its area in acres (Krajicek et al. 1961).

**Density management.** Cutting or killing of trees to increase intertree spacing and improve growth and vigor of retained live trees (Helms 1998); manipulation and control of growing stock to achieve specific management objectives (Long 1985). Density management is often used to improve forest health, open the canopy for selected trees, maintain understory vegetation, or promote late-successional characteristics for biological diversity.

**Density management diagram.** A graphical aide for designing and evaluating density management regimes. Diagrams have been developed for different purposes and tree species; each diagram tends to include slightly different stand attributes and presents them in different formats (McCarter and Long 1986).

**Differentiation.** A divergence in growth patterns for individual trees due to redistribution of growing space during stand development. Differentiation leads to formation of crown classes (see fig. 3-2, and *crown class* in this glossary).

**Disturbance.** A relatively discrete event that disrupts the structure of an ecosystem, community, or population, and changes resource availability or the physical environment. Disturbances include processes such as fires, floods, insect outbreaks, disease epidemics, and wind-storms (Dodson et al. 1998).

**Equilateral spacing.** An expression of intertree distance that assumes tree crowns occupy adjoining hexagons (fig. 3-11). For this stocking guide, equilateral spacing is calculated as:  
$$ES = \sqrt{50300.23/TPA}$$
 (square root of: 50,300.23 divided by the number of trees per acre).

**Even-aged stand structure.** Stand comprised of a single age class where the range of age is no more than  $\pm 20$  percent of the rotation age. Often determined by using diameter, not age.

**Forest health.** The perceived condition of a forest based on concerns about factors such as age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Perception and interpretation of forest health is influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, relative health of stands that comprise the forest, and a forest's appearance at a particular point in time.

**Free growth.** A period in stand development where trees expand to fill unoccupied growing space without direct intertree competition (called open growth when occurring prior to crown closure), or with limited competition leading to initiation of crown differentiation but without tree mortality (Oliver and Larson 1996).

**Full stocking.** A point in even-aged stand development in which differentiation results in a full range of crown classes (Cochran et al. 1994); at full stocking, high stand density is causing intertree competition and some mortality of weaker, less-vigorous trees (self-thinning is occurring). For this stocking guide, full stocking and another stand density benchmark called normal density are assumed to be equivalent (see table 3-2, and *normal density* in this glossary).

**Growing space.** An intangible measure of the total resources of a site (sunlight, moisture, nutrients, etc.) available to a plant (Helms 1998). Growing space refers to the availability of all resources needed by a plant to exist on a given site (O'Hara 1996).

**Growth basal area (GBA).** A forest stockability index that quantifies the basal area per acre at which dominant trees grow at a rate of 1 inch in diameter per decade at age 100 (Hall 1987).

**Heartwood.** In a growing tree, heartwood consists of the inner layers of wood that have ceased to contain living cells, and in which the reserve materials (starch) have been removed or converted into more durable substances. Generally, heartwood is darker in color than sapwood, more durable, less easily attacked by decay producing organisms, and less capable of absorbing preservatives and other liquids. Compare with: *sapwood*.

**Irregular stand structure.** Stand with clear variation in tree age or spatial arrangement; stands lacking a uniform age or size structure. Often determined by using diameter, not age.

**Leaf area index (LAI).** LAI is leaf area per unit of ground area. Projected LAI is the leaf area projected onto a horizontal plane. Total LAI is the total surface area of leaves, including the upper and lower surface of flat leaves and the cylindrical surface of conifer needles; it is approximately twice the value of projected LAI, except in the case of conifer needles, where the projected leaf area is multiplied by  $\pi$  (3.1416) to derive total leaf area (Chapin et al. 2002).

**Lignin.** A complex, non-carbohydrate organic substance produced by plants that imparts rigidity and strength, especially for woody tissues (Doliner and Borden 1984).

**Low thinning.** Removing trees from lower crown classes to favor those in upper crown classes; also referred to as ‘thinning from below’ (fig. 4-2).

**Lower limit of full site occupancy.** Stocking level associated with a point in stand development where a site is fully occupied by trees, and they are interacting (competing) with each other. This point in stand development is marked by initiation of a process that results in differentiation into crown classes. Total volume production for a stand is maximized beyond this point, although individual tree growth is less than the potential for a site. For this stocking guide, the lower limit of full site occupancy is equivalent to another stocking level called the lower limit of a management zone (see table 3-2, and *lower limit of a management zone* below).

**Lower limit of a management zone (LLMZ).** A stocking level establishing the lower limit of a management zone (a management zone has lower and upper limits). For this document, LLMZ was set at 35 percent of maximum density for every tree species–plant association combination. The LLMZ is equivalent to a stand development benchmark called the lower limit of full site occupancy (see table 3-2, and *lower limit of full site occupancy* above).

**Lower limit of self-thinning zone.** Stocking level associated with the lower edge of a zone where stand density and intertree competition are high enough to cause self-thinning – a process whereby a tree can only increase in size by taking growing space away from neighboring trees (see fig. 3-1 and *self-thinning* in this glossary). Lower limit of self-thinning zone is equivalent to a stocking level called the upper limit of a management zone (see table 3-2, and *upper limit of a management zone* in this glossary).

**Management zone.** Stocking zone delineated by setting upper and lower limits. At a national level, it has been defined as “the area defined by the upper and lower bounds of acceptable relative densities in stands managed for a particular objective” (Ernst and Knapp 1985). An upper limit is often established in such a way as to avoid competition-induced mortality (self-thinning). A lower limit generally maintains sufficient stocking to allow a substantial portion of a site’s resources to be captured as tree growth – a benchmark referred to as the *lower limit of full site occupancy* (Cochran et al. 1994, Long 1985).

**Marking guide.** Written instructions describing the trees or stands that are to be cut, left, or otherwise treated during silvicultural operations (Smith et al. 1997); an implementation plan for a silvicultural prescription.

**Maximum density.** Maximum stand density that is possible for a tree species for a particular biophysical environment and mean tree size in self-thinning populations (Long 1996). For this stocking guide, maximum density was calculated as 125% of a stocking level called *full stocking* (see table 3-2).

**Noncommercial thinning.** Tree removal designed not for immediate financial return, but to reduce stocking and thereby concentrate growth on desirable trees. Thinning treatment where trees are too small to be sold for conventional products; excess trees are lopped and scattered across a site after being cut (Powell et al. 2001) or piled for eventual burning.

**Normal density.** Stand density representing full site occupancy but allowing room for development of crop trees; presumed to represent average-maximum competition or the average density of natural, undisturbed, fully stocked stands. For this guide, normal density is equivalent to a density benchmark called full stocking (table 3-2, and *full stocking* in this glossary).

**Overstocked.** Forestland stocked with more trees than normal or that full stocking would require (Dunster and Dunster 1996). In an overstocked forest, stand (tree) density is high enough that intertree competition is occurring, and large, dominant trees are killing small trees in a process called self-thinning. Also see: *self-thinning*; *stocking*.

**Overstory.** In a forest with more than one story (layer), that portion of the trees forming the uppermost canopy layer; in a two-storied forest (stands with two clearly defined canopy layers), the tallest trees form the overstory, the shortest trees the understory.

**Photosynthate.** Organic compounds, mostly carbohydrates, created during photosynthesis – a process whereby the chlorophyll cells of plants use carbon dioxide, water, enzymes, and sunlight (an energy source) to produce photosynthate (oxygen is a ‘by-product’ of this process).

**Plant association.** A plant community with similar physiognomy (form and structure) and floristics; commonly it is a climax community (Allaby 1994). It is believed that (Kimmins 2004):

1. The individual species in an association are, to some extent, adapted to each other;
2. The association is made up of plant species that have similar habitat requirements; and
3. The association has some degree of integration.

Plant association is often considered to be synonymous with habitat type or potential natural community (Powell et al. 2007).

**Plant community type (PCT).** In a potential vegetation classification context, plant community type is a taxonomic unit with no particular successional status implied (Dunster and Dunster 1996). A PCT is a seral stage (early, mid, or late) of a climax unit, such as a plant association.

**Potential vegetation type (PVT).** Any taxonomic unit (except series) described in fine-scale potential vegetation classifications for the Blue Mountains (e.g., Crowe and Clausnitzer 1997, Johnson 2004, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnson and Swanson 2005, Swanson et al. 2010, Wells 2006). For this stocking guide, *PVT is assumed to include plant associations, plant community types, and plant communities*.

**Quadratic mean diameter (QMD).** Tree diameter corresponding to a stand’s mean basal area; in other words, QMD is the diameter of a tree of average basal area in a stand. For this stocking guide, quadratic mean diameter is calculated as:  $QMD = \sqrt{BA/TPA} \times 13.54$ , where BA



is basal area per acre and TPA is trees per acre.

**Reference level.** The stand density normally expected for a stand of given characteristics under a standard condition such as average-maximum competition (Ernst and Knapp 1985). For this stocking guide, maximum density was used as a reference level when calculating three stocking levels: climate resilience, and the upper and lower limits of a management zone.

**Relative density.** The ratio, proportion, or percent represented by existing stand density when compared with a reference level. Relative density is often characterized as a measure of actual (existing) stand density relative to a biological maximum for a given site and tree species (such as comparing existing density with maximum density for ponderosa pine on a particular plant association).

**Resilience.** Capacity of a plant community or ecosystem type to maintain or regain normal function and development following disturbance. (Also refer to footnote #3 on page 42.)

**Resistance.** Tendency of a system to remain in its reference state when exposed to a perturbation (Chapin et al. 2002). The ability of an organism to overcome the activities and adverse effects of a pathogen, parasite, insect, or abiotic factor (Doliner and Borden 1984).

**Sapwood.** The outer layer of woody tissue in tree stems. Sapwood conducts water and nutrients from roots to leaves, so leaf area is correlated with sapwood area. Trees also store carbohydrates, water, and nutrients in their sapwood (Ryan 1989). Compare with: *heartwood*.

**Self-thinning.** Plant mortality caused by interplant competition in crowded, even-aged stands. For self-thinning populations, increasing average tree size is associated with a progressive diminution of tree density (Long and Smith 1984). Self-thinning may also be known as the  $-3/2$  (negative three-halves) power rule because self-thinning lines for many plant species have a slope of  $-3/2$  when plotted on logarithmic axes (Westoby 1984).

**Seral stage:** a phase of secondary successional development; also called seral status. Four seral stages are recognized (Hall et al. 1995):

- **Early Seral:** clear dominance of seral species (western larch, ponderosa pine, lodgepole pine, etc.); PNC species are either absent, or present in very low numbers.
- **Mid Seral:** PNC species are increasing as a result of their active colonization of a site; PNC species are approaching equal proportions with the seral species.
- **Late Seral:** PNC species are now dominant, although long-lived seral species (ponderosa pine, western larch, etc.) are still present in the plant community.
- **Potential Natural Community (PNC):** biotic community that one presumes would be established and maintained over time under present environmental conditions; early and mid-seral species are scarce or absent in the plant composition.

**Silvicultural prescription.** A planned series of treatments designed to change existing tree composition and structure so it better meets the goals and objectives established for a stand (Helms 1998). A written statement or document defining the objectives to be attained from silvicultural treatments. Objectives are generally expressed as acceptable ranges of the various indices being used to characterize stand development (Dunster and Dunster 1996).

**Square spacing.** An expression of intertree distance that assumes that tree crowns occupy the center of adjacent squares (fig. 3-11). Compare with: *equilateral spacing*.

**Stagnation.** Stands of trees whose growth and development have been suppressed or almost stopped due to poor site conditions or excessive stocking (Dunster and Dunster 1996).

**Stand.** A contiguous group of trees that are sufficiently uniform in age-class distribution, composition, and structure, and growing on a site with sufficiently uniform abiotic characteristics, to qualify as a distinguishable and mappable unit.

**Stand density.** A quantitative measure of tree density expressed in terms of number of trees, basal area, canopy cover, or volume per unit area.

**Stand density index (SDI).** A widely used measure developed by Reineke (1933). It quantifies stand density as the relationship between a stand's existing number of trees per acre and its average tree size (as quadratic mean diameter or average stand diameter). When related to a reference level such as maximum density, SDI functions as a measure of relative density or can be used to establish a stocking level objective.

**Stockability.** Variation in *maximum* mean tree size-density relationships. "In a conceptual sense, stockability can be regarded as the tolerance of a forest system to the presence of and/or competition from increasing numbers of trees. This tolerance may differ with environment [such as plant association] and, in that regard, might be considered an aspect of site quality *independent* of that reflected in site index or potential height growth" (DeBell et al. 1989). Stockability refers to the ecological capacity of a site to support a certain maximum number of trees – a maximum stand density (Hall 1987).

**Stocking.** The amount of anything on a given area, particularly in relation to what is considered optimum. In silviculture, stocking provides an indication of growing-space occupancy relative to a pre-established standard (also see: *reference level*).

**Stocking level.** Stand density objectives expressed as constant or uniform amounts of stocking (Cochran et al. 1994). This guide includes three suggested stocking levels: climate resilience, lower limit of a management zone, and upper limit of a management zone.

**Suppression.** A process causing trees or other vegetation to lose vigor and possibly die when growing space is insufficient to provide adequate photosynthate or moisture for plant growth.

**Two-storied stand structure.** A tree stand with two distinct age classes (cohorts), or an even-aged (single-cohort) stand in which height growth differences between tree species (for mixed-species stands) results in two distinct canopy layers (an *overstory* and an *understory*).

**Understory.** All the vegetation growing under a forest overstory. In some situations, understory is only considered to include small trees (e.g., in a forest comprised of multiple canopy layers, taller trees form an overstory and shorter trees an understory); in other instances, understory is assumed to include herbaceous and shrubby plants in addition to trees. When understory refers to trees only, other plants (herbs and shrubs) are often called an undergrowth to differentiate between these two vegetative components.

**Uneven-aged stand structure.** Stand with trees of three or more distinct age classes (cohorts), occurring either as an intimate mixture or in small, discreet groups; often determined by using tree diameter, not age per se.

**Upper limit of a management zone (ULMZ).** A stocking level establishing an upper limit of a management zone (a management zone has lower and upper limits). The ULMZ was set at 55 percent of maximum density for each combination of tree species and potential vegetation type. ULMZ is equivalent to a stand development benchmark called the lower limit of a self-thinning zone (see table 3-2, and *lower limit of self-thinning zone* in this glossary).

## 8. SPECIES LIST

These lists provide common and scientific names for organisms mentioned in the text, tables, and figures. Table 8-1 includes common and scientific names, and symbols, for plants; table 8-2 provides common and scientific names for organisms other than vascular plants.

**Table 8-1:** Plant names organized alphabetically by common name.

| <u>COMMON NAME</u>         | <u>SCIENTIFIC NAME</u>                 | <u>SYMBOL</u> |
|----------------------------|----------------------------------------|---------------|
| big huckleberry            | <i>Vaccinium membranaceum</i>          | VAME          |
| birchleaf spirea           | <i>Spiraea betulifolia</i>             | SPBE          |
| bitterbrush                | <i>Purshia tridentata</i>              | PUTR          |
| black cottonwood           | <i>Populus trichocarpa</i>             | POTR2         |
| bluebunch wheatgrass       | <i>Agropyron spicatum</i>              | AGSP          |
| buffaloberry (russet)      | <i>Shepherdia canadensis</i>           | SHCA          |
| bracken fern               | <i>Pteridium aquilinum</i>             | PTAQ          |
| chokecherry                | <i>Prunus spp.</i>                     |               |
| Columbia brome             | <i>Bromus vulgaris</i>                 | BRVU          |
| common snowberry           | <i>Symphoricarpos albus</i>            | SYAL          |
| creambush oceanspray       | <i>Holodiscus discolor</i>             | HODI          |
| curlleaf mountain-mahogany | <i>Cercocarpus ledifolius</i>          | CELE          |
| currants                   | <i>Ribes spp.</i>                      |               |
| Douglas-fir, coastal       | <i>Pseudotsuga menziesii menziesii</i> | PSMEM         |
| Douglas-fir, interior      | <i>Pseudotsuga menziesii glauca</i>    | PSMEG         |
| elderberry                 | <i>Sambucus spp.</i>                   |               |
| elk sedge                  | <i>Carex geyeri</i>                    | CAGE          |
| Engelmann spruce           | <i>Picea engelmannii</i>               | PIEN          |
| false bugbane              | <i>Trautvetteria caroliniensis</i>     | TRCA3         |
| fool's huckleberry         | <i>Menziesia ferruginea</i>            | MEFE          |
| gooseberries               | <i>Ribes spp.</i>                      |               |
| grand fir                  | <i>Abies grandis</i>                   | ABGR          |
| grouse huckleberry         | <i>Vaccinium scoparium</i>             | VASC          |
| heartleaf arnica           | <i>Arnica cordifolia</i>               | ARCO          |
| Idaho fescue               | <i>Festuca idahoensis</i>              | FEID          |
| loblolly pine              | <i>Pinus taeda</i>                     | PITA          |
| lodgepole pine             | <i>Pinus contorta</i>                  | PICO          |
| longleaf pine              | <i>Pinus palustris</i>                 | PIPA2         |
| lupines                    | <i>Lupinus spp.</i>                    |               |
| mallow ninebark            | <i>Physocarpus malvaceus</i>           | PHMA          |
| mountain hemlock           | <i>Tsuga mertensiana</i>               | TSME          |
| mountain snowberry         | <i>Symphoricarpos oreophilus</i>       | SYOR          |
| oakfern                    | <i>Gymnocarpium dryopteris</i>         | GYDR          |
| Pacific yew                | <i>Taxus brevifolia</i>                | TABR          |
| peavines                   | <i>Lathyrus spp.</i>                   |               |
| pinegrass                  | <i>Calamagrostis rubescens</i>         | CARU          |

| <u>COMMON NAME</u>   | <u>SCIENTIFIC NAME</u>           | <u>SYMBOL</u> |
|----------------------|----------------------------------|---------------|
| pinemat manzanita    | <i>Arctostaphylos nevadensis</i> | ARNE          |
| ponderosa pine       | <i>Pinus ponderosa</i>           | PIPO          |
| quaking aspen        | <i>Populus tremuloides</i>       | POTR          |
| queencup beadlily    | <i>Clintonia uniflora</i>        | CLUN          |
| raspberry            | <i>Rubus spp.</i>                |               |
| red alder            | <i>Alnus rubra</i>               | ALRU2         |
| red fir              | <i>Abies magnifica</i>           | ABMA          |
| redwood              | <i>Sequoia sempervirens</i>      | SESE3         |
| Rocky Mountain maple | <i>Acer glabrum</i>              | ACGL          |
| Ross sedge           | <i>Carex rossii</i>              | CARO          |
| serviceberry         | <i>Amelanchier spp.</i>          |               |
| Sitka alder          | <i>Alnus sinuata</i>             | ALSI          |
| skunkleaf polemonium | <i>Polemonium pulcherrimum</i>   | POPU          |
| subalpine fir        | <i>Abies lasiocarpa</i>          | ABLA2         |
| sword fern           | <i>Polystichum munitum</i>       | POMU          |
| thimbleberry         | <i>Rubus spp.</i>                |               |
| true firs            | <i>Abies spp.</i>                | ABIES         |
| twinflor             | <i>Linnaea borealis</i>          | LIBO2         |
| twisted stalk        | <i>Streptopus amplexifolius</i>  | STAM          |
| vetches              | <i>Vicia spp.</i>                |               |
| western hemlock      | <i>Tsuga heterophylla</i>        | TSHE          |
| western juniper      | <i>Juniperus occidentalis</i>    | JUOC          |
| western larch        | <i>Larix occidentalis</i>        | LAOC          |
| western needlegrass  | <i>Stipa occidentalis</i>        | STOC          |
| western redcedar     | <i>Thuja plicata</i>             | THPL          |
| western white pine   | <i>Pinus monticola</i>           | PIMO          |
| white fir            | <i>Abies concolor</i>            | ABCO          |
| whitebark pine       | <i>Pinus albicaulis</i>          | PIAL          |
| wild ginger          | <i>Asarum caudatum</i>           | ASCA3         |

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*Sources/Notes:* For species included in an upland vegetation classification for the Blue Mountains floristic province (Johnson and Clausnitzer 1992; Johnson and Simon 1987), plant names and symbols provided here were taken from the parent publication. For other species, nomenclature generally follows the PLANTS database (<http://plants.usda.gov>). Note that scientific names and symbols (codes) may have changed since the late 1980s and early 1990s, when the Blue Mountain upland vegetation classifications were published.

**Table 8-2:** Common and scientific names for organisms other than plants.

| <b><u>COMMON NAME</u></b>             | <b><u>SCIENTIFIC NAME</u></b>                    |
|---------------------------------------|--------------------------------------------------|
| annosus (heterobasidion) root disease | <i>Heterobasidion annosum</i>                    |
| Armillaria root disease               | <i>Armillaria ostoyae</i>                        |
| atropellis canker                     | <i>Atropellis piniphila</i> , <i>A. pinicola</i> |
| balsam woolly adelgid                 | <i>Adelges piceae</i>                            |
| bark beetles                          | <i>Dendroctonus</i> spp. (primarily)             |
| big brown bats                        | <i>Eptesicus fuscus</i>                          |
| Douglas-fir beetle                    | <i>Dendroctonus pseudotsugae</i>                 |
| Douglas-fir dwarf mistletoe           | <i>Arceuthobium douglasii</i>                    |
| Douglas-fir tussock moth              | <i>Orgyia pseudotsugata</i>                      |
| dwarf mistletoes                      | <i>Arceuthobium</i> spp.                         |
| elytroderma needle blight             | <i>Elytroderma deformans</i>                     |
| fir engraver                          | <i>Scolytus ventralis</i>                        |
| Indian paint fungus                   | <i>Echinodontium tinctorium</i>                  |
| larch casebearer                      | <i>Coleophora laricella</i>                      |
| larch dwarf mistletoe                 | <i>Arceuthobium laricis</i>                      |
| lodgepole pine dwarf mistletoe        | <i>Arceuthobium americanum</i>                   |
| Mexican spotted owl                   | <i>Strix occidentalis lucida</i>                 |
| mountain pine beetle                  | <i>Dendroctonus ponderosae</i>                   |
| northern spotted owl                  | <i>Strix occidentalis caurina</i>                |
| pine butterfly                        | <i>Neophasia menapia</i>                         |
| pine engravers                        | <i>Ips</i> spp.                                  |
| Rocky Mountain elk                    | <i>Cervus elaphus</i>                            |
| Rocky Mountain mule deer              | <i>Odocoileus hemionus</i>                       |
| rust red stringy rot                  | <i>Echinodontium tinctorium</i>                  |
| silver-haired bats                    | <i>Lasionycteris noctivagans</i>                 |
| spruce beetle                         | <i>Dendroctonus rufipennis</i>                   |
| western dwarf mistletoe               | <i>Arceuthobium campylopodum</i>                 |
| western pine beetle                   | <i>Dendroctonus brevicomis</i>                   |
| western spruce budworm                | <i>Choristoneura occidentalis</i>                |
| white-headed woodpecker               | <i>Picoides albolarvatus</i>                     |
| white pine blister rust               | <i>Cronartium ribicola</i>                       |

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*Sources/Notes:* Most common and scientific names for insect and disease organisms follow Goheen and Willhite 2006.

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