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Keys for Identifying Forest Series and Plant Associations of Blue and Ochoco Mountains

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FORMATTING NOTE: This document was designed in a half-page layout so it could be cut down to a 6" x 8" size, and stapled in both top corners, for easy field use.

INTRODUCTION

This document provides classification keys for identifying potential vegetation types of Blue and Ochoco Mountains of northeastern Oregon and southeastern Washington. **It is intended for experienced users of Blue-Ochoco Mountains plant association field guide who need Blue-Ochoco keys in a less-bulky format than is provided by carrying the entire field guide**.

Potential vegetation is defined as a community of plants that would become established if all successional sequences were completed, without interference by humans, under existing environmental conditions. Potential vegetation, a theoretical endpoint of plant succession in the absence of disturbance, is used to classify and characterize potential natural plant communities capable of getting established and then maturing under existing climatic conditions.

A group of plant species that frequently occurs together is called a *plant community*. A climax (potential natural) plant community, which perpetuates itself in an absence of disturbance, is called a *plant association*. Plant association is a fundamental unit of potential vegetation classification. A plant association is named for dominant overstory and undergrowth plants, such as a subalpine fir/grouse whortleberry plant association.

Plant association is a specific type of plant community represented by stands occurring in settings where environments are so closely similar that there is a high degree of floristic uniformity in all vegetation layers (Daubenmire 1968). Not only is vegetation uniformity important for plant association identification, but many abiotic components (landform, soils, etc.) should also be consistent across the stands representing any individual association.

Plant associations with the same overstory dominants comprise a *series*, such as a subalpine fir series. Land area capable of supporting a plant association is a *habitat type*. Even though plant associations refer to climax plant communities and habitat types refer to land areas they could potentially occupy, both are used as equivalent terms in the western United States (Powell et al. 2007).

NOTE: Confusion may exist about distinctions between existing vegetation and potential vegetation. *Existing vegetation* differs from potential vegetation because it represents conditions as they exist today – what a land manager finds on the ground and deals with on a daily basis.

This means that these two vegetation classification approaches – potential vegetation and existing vegetation – tend to be used in different ways and for different purposes: existing vegetation is well suited for meeting operational needs because it represents “what is” (current conditions), whereas potential vegetation is ideally suited for planning and assessment processes because it represents “what could be” (ecological site potential) (Westveld 1951).

Plant associations are seldom ‘born’ in a climax condition. Climax stands result from a continuous progression of community types occurring in a successional sequence (a series of stages called a sere); each stage in a successional sequence is called a seral stage (early-seral, mid-seral, late-seral, etc.). Figure 1 illustrates a

common successional sequence involving four seral stages of a montane-zone plant association.

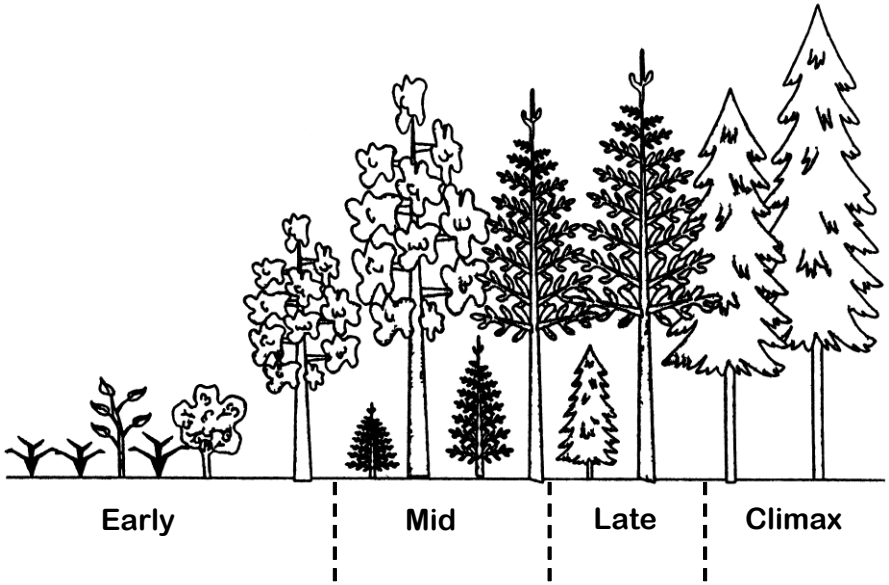

Figure 1–Seral stages for a montane-zone plant association. A series of stages shown in this diagram is called a sere. After a stand-initiating disturbance event such as crown fire or regeneration cutting, a new plant community gets established and it gradually transitions through a series of stages, progressing from a simpler, somewhat disorganized state (an early-seral 'pioneer' stage) to a relatively complex, highly organized state (a climax plant community). An early-seral stage is initially dominated by grasses, forbs, and shrubs (some ecologists refer to this non-tree phase as a very-early stage), but shade-intolerant tree species also get established in early-seral communities. A mid-seral stage has a mix of tree species, with early-seral species (ponderosa pine above) and mid-seral species (Douglas-fir above) present in almost equal amounts. Late-seral stands have both mid-seral and late-seral tree species present (grand fir is a late-seral species above). Although truly climax stands are relatively rare in our disturbance-dominated ecosystems, they feature a species composition where early- or mid-seral tree species are scarce or absent, and tree composition is dominated almost entirely by late-seral species.

Keys contained in this document were reproduced from "Plant Associations of the Blue and Ochoco Mountains" (R6-ERW-TP-036-92) by Charles Grier Johnson, Jr. and Rodrick R. Clausnitzer (published in 1992 by USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest, Baker City, OR. 164 p.).

Potential vegetation type codes are highlighted in a gray color. Type codes are followed by a status identifier (**STOC pct**, for example); a 'pct' identifier provides a

classification status for each potential vegetation type: pa is plant association; pc is plant community; and pct is plant community type.

Ecoclass codes are shown in yellow next to each type code (**GS10**, for example). Ecoclass codes are recorded on field forms and stored in vegetation databases. In most instances, ecoclass codes in this document are the same ones included in Johnson and Clausnitzer (1992).

NAMING CONVENTIONS

Potential vegetation types (PVT) are traditionally referenced by using scientific plant names *(Pseudotsuga menziesii/Symphoricarpos albus)*, common plant names (Douglas-fir/common snowberry), alphanumeric acronyms (PSME/SYAL), and database Ecoclass codes (CDS622). When referring to a potential vegetation type in this document, the following naming conventions are used:

- Species in the same life form are separated with a dash (subalpine fir-whitebark pine), whereas species in different life forms are separated with a slash (grand fir/queencup beadlily).
- Alphanumeric acronyms are derived from scientific plant names: first two letters of genus name are combined with first two letters of species name and capitalized (ABGR for *Abies grandis)*. If more than one species has the same code, then a number is added to differentiate between them (ABLA2 for *Abies lasiocarpa)*. Acronyms included in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992) were generally derived from Garrison et al. (1976).
- Nomenclature for scientific plant names was revised when U.S. Department of Agriculture adopted a new national taxonomy called PLANTS database (USDA NRCS 2009). In this report, PLANTS codes are not used because it is important to maintain a linkage between this document and the original field guide from which the keys were obtained (Johnson and Clausnitzer 1992); the plant association field guide has never been revised and reprinted to include newer PLANTS coding.
- All common names are shown in lower case letters except for proper names (Sandberg's bluegrass; Rocky Mountain maple).
- Ecoclass codes, used for recording PVTs on field forms and in databases, are described in Hall (1998, as supplemented).

DOCUMENT CONTEXT

Keys in this document were reproduced from Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Keys are not included from other field guides for upland plant associations of the Blue Mountains, such as Johnson (2004), Johnson and Simon (1987), Johnson and Swanson (2005), and Swanson et al. (2010).

In addition, this document does not provide keys or ecoclass codes for wetland environments of the Blue Mountains, which are described in Crowe and Clausnitzer (1997) and Wells (2006).

References section of this document contains literature citations for potential vegetation classification field guides for the Blue Mountains.

KEY TO BLUE-OCHOCO MOUNTAINS SERIES

This key pertains to series level of the Blue-Ochoco Mountains field guide. Note that series is an upper level in a three-level hierarchy of fine-scale potential vegetation units – series is the highest level, potential vegetation types (plant associations, plant communities, plant community types) are a middle level, and phases, which were not used when developing Blue Mountains potential vegetation classifications, are the lowest level of a hierarchy (Powell et al. 2007: fig. 2).

A series includes every potential vegetation type with the same dominant plant species at climax. A subalpine fir series, for example, includes every plant association where subalpine fir is presumed to be a dominant overstory tree species when a stand has reached the climax stage described in figure 1.

This key begins by separating vegetation into two broad categories of physiognomy or lifeform – forest (tree dominated stands) and nonforest (shrubland or grassland types).

NOTE: Page number references below refer to pages in this document.

1a. Trees present with coverage equal to or exceeding 10% 2

1b. Trees absent or present with coverage less than 10% 11

2a. Whitebark pine (PIAL) present and reproducing with total coverage equal to or exceeding 10% **See subalpine fir series key** pg. 7

2b. Whitebark pine absent or present with coverage less than 10% 3

3a. Subalpine fir (ABLA2) present and reproducing with total coverage equal to or exceeding 10% **See subalpine fir series key** pg. 7

3b. Subalpine fir absent or present with coverage less than 10% 4

4a. Grand fir (ABGR) present and reproducing with total coverage equal to or exceeding 10% **See grand fir series key** pg. 10

4b. Grand fir absent or present with coverage less than 10% 5

5a. Lodgepole pine (PICO) present with coverage equal to or exceeding 5%..... 6

6a. Lodgepole pine reproducing in the absence of true fir (ABLA2, ABGR) species **See lodgepole pine series key** pg. 13

6b. Lodgepole pine present with reproducing true fir species..... 7

7a. Subalpine fir present and reproducing **See subalpine fir series key** pg. 7

7b. Grand fir present and reproducing **See grand fir series key** pg. 10

5b. Lodgepole pine absent or present with coverage less than 5%..... 8

8a. Douglas-fir (PSME) present and reproducing with total coverage equal to or exceeding 10% **See Douglas-fir series key** pg. 14

8b. Douglas-fir absent or present with coverage less than 10%..... 9

9a. Ponderosa pine (PIPO) present and reproducing with total coverage equal to or exceeding 10% **See ponderosa pine series key** pg. 15

9b. Ponderosa pine absent or present with coverage less than 10% 10

10a. Western juniper (JUOC) present and reproducing with total coverage equal to or exceeding 10% **See western juniper series key** pg. 17

10b. Western juniper absent or present with coverage less than 10% 11

11a. Shrubs present with coverage equal to or exceeding 5% **See shrubland series key** pg. 18

11b. Shrubs absent or present with coverage less than 5% **See grassland series key** pg. 20

KEY TO SUBALPINE FIR (ABLA2) SERIES

Subalpine fir must be present and reproducing successfully; total coverage must equal or exceed 10%; lodgepole pine co-dominated or dominated stands may be assigned to plant associations in this series when subalpine fir is present and reproducing. Whitebark pine stands are assigned to plant communities in this series.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Fool's huckleberry (MEFE) present with coverage equal to or exceeding 10% **ABLA2/MEFE pa** **CES221** pg. 31

1b. Fools' huckleberry absent or with coverage less than 10% 2

2a. White rhododendron (RHAL) present with coverage equal to or exceeding 5% **ABLA2/RHAL pct** **CES214** pg. 42

2b. White rhododendron absent or with coverage less than 5% 3

3a. False bugbane (TRCA3) present and well distributed throughout the stand with coverage equal to or exceeding 1% **ABLA2/TRCA3 pa** **CEF331** pg. 25

3b. False bugbane absent or with coverage less than 1% 4

4a. Queen's cup beadlily (CLUN) present and well distributed throughout the stand with coverage equal to or exceeding 1% **ABLA2/CLUN pa** **CES314** pg. 27

4b. Queen's cup beadlily absent or with coverage less than 1%..... 5

5a. Twinflower (LIBO2) present and well distributed throughout the stand with coverage equal to or exceeding 1% **ABLA2/LIBO2 pa** **CES414** pg. 29

5b. Twinflower absent or with coverage less than 1%..... 6

6a. Big huckleberry (VAME) present with coverage equal to or exceeding 5%..... 7

7a. Lodgepole pine (PICO) dominant or co-dominant with subalpine fir 8

8a. Pinegrass (CARU) coverage equal to or exceeding 1% **PICO(ABLA2)/VAME/CARU pct** **CLS516** p. 42

8b. Pinegrass absent or coverage less than 1%
PICO(ABLA2)/VAME pct CLS514 pg. 42

7b. Lodgepole pine absent or subordinate; subalpine fir dominant
ABLA2/VAME pa CES311 pg. 33

6b. Big huckleberry absent or with coverage less than 5% 9

9a. Heartleaf arnica (ARCO) present with coverage equal to or exceeding 10%
ABLA2/ARCO pct CEF412 pg. 39

9b. Heartleaf arnica absent or with coverage less than 10%..... 10

10a. Alpine fleeceflower (POPH) present with coverage equal to or exceeding 5% **ABLA2-PIAL/POPH pct CAF2** pg. 42

10b. Alpine fleeceflower absent or with coverage less than 5% 11

11a. Drummond's rush (JUDR) present with coverage equal to or exceeding 5% **ABLA2-PIAL/JUDR pct CAG3** pg. 43

11b. Drummond's rush absent or with coverage less than 5% 12

12a. Grouse huckleberry (VASC) present with coverage equal to or exceeding 5%..... 13

13a. Lodgepole pine dominant or co-dominant with subalpine fir
PICO(ABLA2)/VASC pct CLS418 pg. 41

13b. Lodgepole pine absent or subordinate; subalpine fir dominant
ABLA2/VASC pa CES411 pg. 35

12b. Grouse huckleberry absent or with coverage less than 5% 14

14a. Elk sedge (CAGE) present with coverage equal to or exceeding 5% 15

15a. Lodgepole pine (PICO) dominant or co-dominant with subalpine fir
PICO(ABLA2)/CAGE pct CLG322 pg. 43

15b. Lodgepole pine absent or subordinate; subalpine fir dominant
ABLA2/CAGE pa CAG111 pg. 37

14b. Elk sedge absent or with coverage less than 5% 16

16a. Skunk-leaved polemonium (POPU) present with coverage equal to or exceeding 5%

ABLA2-PIAL/POPU pct **CAF0** pg. 43

16b. Skunk-leaved polemonium (POPU) absent or with coverage less than 5%; western needlegrass (STOC) present with coverage equal to or exceeding 5% 17

17a. Lodgepole pine dominant or co-dominant with subalpine fir

PICO(ABLA2)/STOC pct **CLG11** pg. 43

17b. Lodgepole pine absent or subordinate; subalpine fir dominant

ABLA2/STOC pct **CAG4** pg. 40

KEY TO GRAND FIR (ABGR) SERIES

Grand fir must be present and successfully reproducing; total coverage must equal or exceed 10%; lodgepole pine co-dominated or dominated stands may be assigned to plant associations in this series when grand fir is present and reproducing.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Oakfern (GYDR) present with coverage equal to or exceeding 5%
ABGR/GYDR pa **CWF611** pg. 45

1b. Oakfern absent or with coverage less than 5% 2

2a. Ginger (ASCA3) or sword fern (POMU) present and well distributed throughout the stand with coverage equal to or exceeding 1% **ABGR/POMU-ASCA3 pa** **CWF612** pg. 47

2b. Ginger or sword fern absent or with coverage less than 1% 3

3a. False bugbane (TRCA3) present and well distributed throughout the stand with coverage equal to or exceeding 1%
ABGR/TRCA3 pa **CWF512** pg. 49

3b. False bugbane absent or with coverage less than 1% 4

4a. Sitka alder (ALSI) present and dominant as a tall shrub beneath a lodgepole pine overstory
PICO(ABGR)/ALSI pct **CLS58** pg. 78

4b. Sitka alder absent or subordinate in the shrub layer 5

5a. Pacific yew (TABR) present and well distributed throughout the stand with coverage equal to or exceeding 1% 6

6a. Queen's cup beadlily (CLUN) present with coverage equal to or exceeding 5% **ABGR/TABR/CLUN pa** **CWC811** pg. 51

6b. Queen's cup beadlily absent or with coverage less than 5%
ABGR/TABR/LIBO2 pa **CWC812** pg. 53

5b. Pacific yew absent or with coverage less than 1% 7

7a. Rocky Mountain maple (ACGL) present with coverage equal to or exceeding 5% **ABGR/ACGL pa** **CWS541** pg. 55

7b. Rocky Mountain maple absent or with coverage less than 5% 8

8a. Queen's cup beadlily (CLUN) present and well distributed throughout the stand with coverage equal to or exceeding 1%
ABGR/CLUN pa **CWF421** pg. 57

8b. Queen's cup beadlily absent or with coverage less than 1%..... 9

9a. Twinflower (LIBO2) present and well distributed throughout the stand with coverage equal to or exceeding 1%..... 10

10a. Big huckleberry (VAME) present with coverage equal to or exceeding 5%..... 11

11a. Lodgepole pine (PICO) co-dominant or dominant with grand fir **PICO(ABGR)/VAME-LIBO2 pct** **CLF211** p. 76

11b. Lodgepole pine absent or subordinate; grand fir dominant **ABGR/LIBO2 pa** **CWF312** pg. 59

10b. Big huckleberry absent or with coverage less than 5% 12

12a. Grouse huckleberry (VASC) present with coverage equal to or exceeding 5%
ABGR/VASC-LIBO2 pa **CWS812** pg. 63

12b. Grouse huckleberry absent or with coverage less than 5%..... 13

13a. Pinemat manzanita (ARNE) dominant as an understory shrub with lodgepole pine overstory
PICO(ABGR)/ARNE pct **CLS57** pg. 77

13b. Pinemat manzanita absent or subordinate in the shrub layer
ABGR/LIBO2 pa **CWF312** pg. 59

9b. Twinflower absent or with coverage less than 1%..... 14

14a. Big huckleberry (VAME) present with coverage equal to or exceeding 5%..... 15

15a. Lodgepole pine (PICO) co-dominant or dominant with grand fir 16

16a. Pinegrass (CARU) present with coverage equal to or exceeding 1%
PICO(ABGR)/VAME/CARU pct **CLS512** p. 76

16b. Pinegrass absent or with coverage less than 1% 17

17a. Bracken (PTAQ) present with coverage equal to or exceeding 1%
PICO(ABGR)/VAME/PTAQ pct **CLS519** p. 77

17b. Bracken absent or with coverage less than 1%
PICO(ABGR)/VAME pct **CLS513** pg. 76

15b. Lodgepole pine absent or subordinate; grand fir dominant 18

18a. Alaska yellow-cedar (CHNO) present with coverage equal to or exceeding 15%
ABGR-CHNO/VAME pct **CWS232** pg. 78

18b. Alaska yellow cedar absent or with coverage less than 10%
ABGR/VAME pa **CWS212** pg. 61

14b. Big huckleberry absent or with coverage less than 5% 19

19a. Grouse huckleberry (VASC) present with coverage equal to or exceeding 5%..... 20

20a. Lodgepole pine co-dominant or dominant with grand fir
PICO(ABGR)/VASC/CARU pct **CLS417** p. 77

20b. Lodgepole pine absent or subordinate; grand fir dominant
ABGR/VASC pa **CWS811** pg. 65

19b. Grouse huckleberry absent or with coverage less than 5%..... 21

21a. Columbia brome (BRVU) present with coverage equal to or exceeding 5%
ABGR/BRVU pa **CWG211** pg. 67

21b. Columbia brome absent or with coverage less than 5%..... 22

22a. Birchleaf spirea (SPBE) present with coverage equal to or exceeding 5% **ABGR/SPBE pa** **CWS322** pg. 69

22b. Birchleaf spirea absent or with coverage less than 5%..... 23

23a. Pinegrass (CARU) present with coverage equal to or exceeding 5% 24

24a. Lodgepole pine (PICO) dominant or co-dominant with grand fir **PICO(ABGR)/CARU pct** **CLG21** pg. 77

24b. Lodgepole pine absent or subordinate; grand fir dominant
ABGR/CARU pa **CWG113** pg. 71

23b. Pinegrass absent or with coverage less than 5% 25

25a. Heartleaf arnica (ARCO) present with coverage equal to or exceeding 10% **ABGR/ARCO pct** **CWF444** pg. 75

25b. Heartleaf arnica absent or with coverage less than 10%; elk sedge (CAGE) coverage equal to or exceeding 5%
ABGR/CAGE pa **CWG111** pg. 73

KEY TO LODGEPOLE PINE (PICO) SERIES

Lodgepole pine dominates with an absence of true fir in the stand. Grand fir and subalpine fir are not projected as climax dominants in communities assigned to plant associations within this series. Lodgepole pine is projected as a climax species based on cold air ponding and topographic factors.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1. Pinegrass (CARU) present with coverage equal to or exceeding 5%; grouse huckleberry often associated
PICO/CARU pa **CLS416** pg. 79

KEY TO DOUGLAS-FIR (PSME) SERIES

Douglas-fir must be present and successfully reproducing; total coverage must equal or exceed 10%.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Big huckleberry (VAME) present with coverage equal to or exceeding 5%
PSME/VAME pa **CDS821** pg. 81

1b. Big huckleberry absent or with coverage less than 5% 2

2a. Ninebark (PHMA) present with coverage equal to or exceeding 10%
PSME/PHMA pa **CDS711** pg. 83

2b. Ninebark absent or with coverage less than 10% 3

3a. Oceanspray (HODI) present with coverage equal to or exceeding 10%
PSME/HODI pa **CDS611** pg. 85

3b. Oceanspray absent or with coverage less than 10%..... 4

4a. Mountain mahogany (CELE) present with coverage equal to or exceeding 10% **PSME/CELE/CAGE pct** **CDSD** pg. 95

4b. Mountain mahogany absent or with coverage less than 10% 5

5a. Common snowberry (SYAL) present with coverage equal to or exceeding 5% **PSME/SYAL pa** **CDS624** pg. 87

5b. Common snowberry absent or with coverage less than 5%..... 6

6a. Mountain snowberry (SYOR) present with coverage equal to or exceeding 10% **PSME/SYOR pa** **CDS625** pg. 89

6b. Mountain snowberry absent or with coverage less than 10%..... 6

7a. Pinegrass (CARU) present or with coverage equal to or exceeding 5%
PSME/CARU pa **CDG112** pg. 91

7b. Pinegrass absent or with coverage less than 5%; elk sedge (CAGE) coverage equal to or exceeding 5%
PSME/CAGE pa **CDG111** pg. 93

KEY TO PONDEROSA PINE (PIPO) SERIES

Ponderosa pine must be present and successfully reproducing; total coverage must equal or exceed 10%.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Squaw apple (PERA3) present with coverage equal to or exceeding 10% **PIPO/PERA3 pct** **CPS8** pg. 123

1b. Squaw apple absent or with coverage less than 10% 2

2a. Mountain mahogany (CELE) present with coverage equal to or exceeding 10%..... 3

3a. Elk sedge (CAGE) present with coverage equal to or exceeding 5% **PIPO/CELE/CAGE pa** **CPS232** pg. 97

3b. Elk sedge absent or with coverage less than 5% 4

4a. Wheeler's bluegrass (PONE) present with coverage equal to or exceeding 5% **PIPO/CELE/PONE pa** **CPS233** pg. 99

4b. Wheeler's bluegrass absent or with coverage less than 5% **PIPO/CELE/FEID-AGSP pa** **CPS234** pg. 101

2b. Mountain mahogany absent or with coverage less than 10% 5

5a. Common snowberry (SYAL) present with coverage equal to or exceeding 5% **PIPO/SYAL pa** **CPS524** pg. 103

5b. Common snowberry absent or with coverage less than 5%..... 6

6a. Mountain snowberry (SYOR) present with coverage equal to or exceeding 10% **PIPO/SYOR pa** **CPS525** pg. 105

6b. Mountain snowberry absent or with coverage less than 10%..... 7

7a. Pinegrass (CARU) present with coverage equal to or exceeding 5% **PIPO/CARU pa** **CPG221** pg. 107

7b. Pinegrass absent or with coverage less than 5%..... 8

8a. Bitterbrush (PUTR) present with coverage equal to or exceeding 5%..... 9

9a. Ross' sedge (CARO) present with coverage equal to or exceeding 5% **PIPO/PUTR/CARO pa** **CPS221** pg. 111

9b. Ross' sedge absent or with coverage less than 5% 10

10a. Elk sedge (CAGE) present with coverage equal to or exceeding 10%
PIPO/PUTR/CAGE pa **CPS222** pg. 113

10b. Elk sedge absent or with coverage less than 10%
PIPO/PUTR/FEID-AGSP pa **CPS226** pg. 115

8b. Bitterbrush absent or with coverage less than 5% 11

11a. Mountain big sagebrush (ARTRV) present with coverage equal to or exceeding 10% 12

12a. Elk sedge (CAGE) present with coverage equal to or exceeding 5% **PIPO/ARTRV/CAGE pct** **CPS132** pg. 123

12b. Elk sedge absent or with coverage less than 5%
PIPO/ARTRV/FEID-AGSP pa **CPS131** pg. 117

11b. Mountain big sagebrush absent or with coverage less than 10% 13

13a. Elk sedge (CAGE) present with coverage equal to or exceeding 10% **PIPO/CAGE pa** **CPG222** pg. 109

13b. Elk sedge absent or with coverage less than 10%..... 14

14a. Smooth sumac (RHGL) present with coverage equal to or exceeding 10% **PIPO/RHGL pct** **CPS9** pg. 124

14b. Smooth sumac absent or with coverage less than 10% 15

15a. Low sagebrush (ARAR) present with coverage equal to or exceeding 5% **PIPO/ARAR pct** **CPS61** pg. 123

15b. Low sagebrush absent or with coverage less than 5% 16

16a. Idaho fescue (FEID) present with coverage equal to or exceeding 10% **PIPO/FEID pa** **CPG112** pg. 119

16b. Idaho fescue absent or with coverage less than 10%
PIPO/AGSP pa **CPG111** pg. 121

KEY TO WESTERN JUNIPER (JUOC) SERIES

Western juniper must be present with coverage equal to or exceeding 10%.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Mountain mahogany (CELE) present with coverage equal to or exceeding 10% 2

2a. Elk sedge (CAGE) present with coverage equal to or exceeding 10% **JUOC/CELE/CAGE pct** **CJS42** pg. 129

2b. Elk sedge absent or with coverage less than 10% **JUOC/CELE/FEID-AGSP pct** **CJS41** pg. 129

1b. Mountain mahogany absent or with coverage less than 10%..... 3

3a. Bitterbrush (PUTR) present with coverage equal to or exceeding 10% **JUOC/PUTR/FEID-AGSP pa** **CJS321** pg. 125

3b. Bitterbrush absent or with coverage less than 10% 4

4a. Mountain big sagebrush present with coverage equal to or exceeding 10% **JUOC/ARTRV/FEID-AGSP pa** **CJS211** pg. 129

4b. Mountain big sagebrush absent or with coverage less than 10%..... 5

5a. Low sagebrush (ARAR) present with coverage equal to or exceeding 5% **JUOC/ARAR pct** **CJS1** pg. 130

5b. Low sagebrush absent or with coverage less than 5%..... 5

6a. Stiff sagebrush (ARRI) present with coverage equal to or exceeding 5% **JUOC/ARRI pa** **CJS8** pg. 130

6b. Stiff sagebrush absent or with coverage less than 5% **JUOC/FEID-AGSP pa** **CJG111** pg. 127

KEY TO SHRUBLAND VEGETATION

Shrub coverage by diagnostic species must equal or exceed 5%.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Sitka alder (ALSI) present with coverage equal to or exceeding 10%
ALSI pct SM20 pg. 148

1b. Sitka alder absent or with coverage less than 10% 2

2a. Ninebark (PHMA) present with coverage equal to or exceeding 10%
PHMA-SYAL pa SM1111 pg. 131

2b. Ninebark absent or with coverage less than 10% 3

3a. Snowbrush ceanothus (CEVE) present with coverage equal to or exceeding 10% **CEVE pct SM33** pg. 148

3b. Snowbrush ceanothus absent or with coverage less than 10%..... 4

4a. Mountain mahogany (CELE) present with coverage equal to or exceeding 10%..... 5

5a. Elk sedge (CAGE) present with coverage equal to or exceeding 10% **CELE/CAGE pct SD40** pg. 149

5b. Elk sedge absent or with coverage less than 10%
CELE/FEID-AGSP pa SD4111 pg. 133

4b. Mountain mahogany absent or with coverage less than 10% 6

6a. Common snowberry (SYAL) present with coverage equal to or exceeding 10% **SYAL pct SM3111** pg. 148

6b. Common snowberry absent or with coverage less than 10%..... 7

7a. Mountain snowberry (SYOR) present with coverage equal to or exceeding 10% **SYOR pct SM32** pg. 149

7b. Mountain snowberry absent or with coverage less than 10%..... 8

8a. Bitterbrush (PUTR) present with coverage equal to or exceeding 10%
PUTR/FEID-AGSP pa SD3111 pg. 135

8b. Bitterbrush absent or with coverage less than 10%.....9

9a. Mountain big sagebrush (ARTRV) present with coverage equal to or exceeding 5%.....10

10a. Elk sedge (CAGE) present with coverage equal to or exceeding 10% **ARTRV/CAGE pa** **SS4911** pg. 137

10b. Elk sedge absent or with coverage less than 10% 11

11a. Idaho fescue and/or bluebunch wheatgrass present with coverage equal to or exceeding 10% **ARTRV/FEID-AGSP pa** **SD2911** pg. 139

11b. Idaho fescue and/or bluebunch wheatgrass absent or with coverage less than 10% 12

12a. Mountain brome (BRCA) present with coverage equal to or exceeding 5% **ARTRV/BRCA pct** **SS4914** pg. 147

12b. Mountain brome absent or with coverage less than 5%; western needlegrass (STOC) present with coverage equal to or exceeding 5% **ARTRV/STOC pct** **SS4915** pg. 147

9b. Mountain big sagebrush absent or with coverage less than 5%.....13

13a. Low sagebrush (ARAR) present with cover equal or exceeding 10%.....14

14a. Idaho fescue (FEID) or bluebunch wheatgrass (AGSP) present with coverage equal to or exceeding 5% **ARAR/FEID-AGSP pa** **SD1911** pg. 141

14b. Idaho fescue or bluebunch wheatgrass absent or with coverage less than 5% **ARAR/POSA3 pa** **SD9221** pg. 143

13b. Low sagebrush absent or with coverage less than 10%; stiff sagebrush (ARRI) present **ARRI/POSA3 pa** **SD9111** pg. 145

KEY TO GRASSLAND VEGETATION

Trees and shrubs are absent, or their coverage is less than 5%.

NOTES: Page number references in this key refer to type descriptions in Blue-Ochoco Mountains plant association field guide (Johnson and Clausnitzer 1992). Ecoclass codes were not included in the original keys but are added here to assist with field use of this document.

1a. Green fescue (FEVI) present with coverage equal to or exceeding 10% **FEVI pct** **GS11** pg. 158

1b. Green fescue absent or with coverage less than 10% 2

2a. Elk sedge present with coverage greater than 10% **CAGE pct** **GS39** pg. 147

2b. Elk sedge absent or with coverage less than 10% 3

3a. Hood's sedge (CAHO) present with coverage equal to or exceeding 10% **CAHO pct** **GS3912** pg. 158

3b. Hood's sedge absent or with coverage less than 10% 4

4a. Idaho fescue (FEID) present with coverage equal to or exceeding 10% 5

5a. Elevations above 6,000 feet **FEID pct** **GS12** pg. 158

5b. Elevations below 6,000 feet **FEID-AGSP pa** **GB59** pg. 151

4b. Idaho fescue absent or with coverage less than 10% 6

6a. Bluebunch wheatgrass (AGSP) present with coverage equal to or exceeding 10% 7

7a. Onespike oatgrass (DAUN) present and well distributed throughout the stand with coverage equal to or exceeding 1% and soil depth 10 inches or less **AGSP-POSA3-DAUN pct** **GB4911** pg. 157

7b. Onespike oatgrass absent or with coverage less than 1% and soil depth greater than 10 inches **AGSP-POSA3 pa** **GB4121** pg. 153

6b. Bluebunch wheatgrass absent or with coverage less than 10% 8

8a. Sandberg's bluegrass (POSA3) present with coverage equal to or exceeding 5% **POSA3-DAUN pa** **GB9111** pg. 155

8b. Sandberg's bluegrass absent or with coverage less than 5% **STOC pct** **GS10** pg. 159

TIPS FOR IDENTIFYING POTENTIAL VEGETATION TYPES

These tips for identifying potential vegetation types in the field are based on my experience, along with habitat-type training materials such as Lee and Pfister (1978).

1. Pick a relatively homogeneous area in a stand before attempting to use a key. When keying plant associations, avoid microsites (unusual topographic or soil conditions) or ecotones (transitional areas where two or more plant associations adjoin each other).
2. Keys in this document are arranged in an order of precedence, which means you need to work them from *front to back* (within this report) and from *top to bottom* (within an individual key). Begin first with series key on page 5 by determining if site potential is forested (dominated by trees) or nonforested (dominated by shrubs or herbs).
3. For forest sites, determine which tree species are present and interpret their shade tolerance. Why is this important? Because forest series are organized from most tolerant to least tolerant. So, if both Douglas-fir and grand fir have 10% cover in your stand, use the grand fir key because it is more shade tolerant than Douglas-fir. Here is shade tolerance rankings:

SHADE TOLERANCE

Subalpine fir	(most)
Grand (white) fir	|
Engelmann spruce	|
Douglas-fir	|
Western white pine	|
Western juniper	|
Ponderosa pine	|
Lodgepole pine	▼
Western larch	(least)

4. After identifying tree species present in your stand, visually estimate how much canopy coverage each has (by species). Except for lodgepole pine, each tree series requires at least 10% coverage for its key. So, if a stand has 5% coverage of grand fir, 10% coverage of Douglas-fir, and 15% coverage of ponderosa pine, you should use the Douglas-fir series key. Why is this so?
   Of these 3 species, grand fir is most shade-tolerant. Because the series key is organized by tolerance, you will encounter grand fir first as you work down through it. But you only have 5% grand fir cover and the key requires at least 10%, so you must ignore grand fir and select another species. Of the 2 remaining species, Douglas-fir is more tolerant than ponderosa pine and it appears in the series key before ponderosa pine.

Since you have 10% cover of Douglas-fir, you have enough cover to use the Douglas-fir series key to identify a plant association for your stand.

5. After using the series key (pages 5-6) to get you into a correct series, examine a stand's undergrowth carefully to determine plant species composition and relative canopy cover amounts.

6. Determine which primary Blue-Ochoco indicator plant species are present in a stand's undergrowth. Indicator species are used to name potential vegetation types: common snowberry is the undergrowth indicator species for Douglas-fir/common snowberry plant association, for example. WARNING: Just as with trees (see #4 above), there is an order of precedence for indicator plants – if a grand fir stand has both queencup beadlily and twinflower, you will encounter queencup first in the key because it is more shade-tolerant than twinflower.

7. Although you don't need to be a professional botanist to identify plant associations, you should become familiar with three broad groups of plants to effectively use plant association field guides:

   Indicator plants – these species are used to name plant associations (e.g., common snowberry for Douglas-fir/common snowberry type).

   Look-alikes – these plants resemble an indicator species closely enough that it can be difficult to tell them apart. Be careful to not misidentify a plant association by mistaking a look-alike plant for an indicator species!

   Abundant plants – some species are common but aren't used as an indicator plant. A good example is common yarrow, a species with wide ecological amplitude; it occurs from plains to an alpine zone. You could easily see enough yarrow during a typical field day to begin wondering if a species this common must be important in some way. And the answer is: not necessarily, at least in the context of potential vegetation! Learn to recognize these common, non-indicator species so you can safely decide to ignore them in terms of identifying plant associations.

8. Accurate plant identification is important when using a floristic classification system. You might want to carry one or more references to help you identify plant species. Here are some options to consider for the Blue Mountains:

   Hitchcock and Cronquist (1981): this book is tough sledding for all but a professional botanist! But it is an authoritative and long-established botanical reference for the Pacific Northwest.

   Johnson (1998): a comprehensive and illustrated reference for identifying Blue-Ochoco Mountains indicator plants. WARNING: this guide is not very useful for identifying the 'look-alike' or 'abundant' plant groups.

   Kershaw et al. (1998): a good wildflower reference for Blue Mountains; helpful for the 'look-alike' and 'abundant' plant groups.

   Parish et al. (1996): another good wildflower guide that is particularly helpful for the 'look-alike' and 'abundant' plant groups.

   Turner and Gustafson (2006): a good recent wildflower reference for the Pacific Northwest.

9. After using keys to identify a tentative plant association for your stand, take a few minutes to consult constancy tables (appendix C of Johnson and Clausnitzer 1992) and its type description in the field guide. To help with this recommendation, I included a page number for each type description (in Johnson and Clausnitzer 1992) in each series key. Use constancy tables to examine a wide range of plant species associated with each type, and use a type description to see if your stand matches topographic and landform variables reported for an association.

10. Sometimes, you will need to determine a plant association for clearcuts, stand-replacing wildfire areas, or other heavily disturbed sites. Since plant association guides were developed by sampling mature, undisturbed stands (late and climax in fig. 1), it can be difficult to identify an association for disturbed areas because a post-disturbance flora often requires one or more decades to recover to a point where late-seral species are relatively well represented (fig. 1 describes how early-seral species can be quite different than late-seral species for the same plant association). Your best bet for disturbed areas is to extrapolate from a nearby mature stand on a similar ecological setting (same aspect, slope position, elevation, etc.). If a mature stand is not available close by, then look for undergrowth indicator species occupying protected 'safe sites' within a disturbance environment, such as along large down logs or behind stumps.

REFERENCES

Crowe, E.A.; Clausnitzer, R.R. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. Tech. Pub. R6-NR-ECOL-TP-22-97. [Place of publication unknown]: USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 299 p. MidMontaneWetlandPlantAssociations

Daubenmire, R. 1968. Plant communities, a textbook of plant synecology. New York: Harper and Row. 300 p. isbn:978-0060415488

Garrison, G.A.; Skovlin, J.M.; Poulton, C.E.; Winward, A.H. 1976. Northwest range plant names and symbols for ecosystem inventory and analysis. 4th ed. Gen. Tech. Rep. PNW-46. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 263 p. https://www.fs.usda.gov/treesearch/pubs/25373

Hall, F.C. 1998. Pacific Northwest ecoclass codes for seral and potential natural communities. Gen. Tech. Rep. PNW-GTR-418. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 290 p. http://www.treesearch.fs.fed.us/pubs/5567

Hitchcock, C.L.; Cronquist, A. 1981. Flora of the Pacific Northwest. Seattle, WA: University of Washington Press. 730 p. isbn:0-295-95273-3

Johnson, C.G., Jr. 1998. Common plants of the inland Pacific Northwest. R6-NR-ECOL-TP-09-04. Portland, OR: USDA Forest Service, Pacific Northwest Region. 394 p.

Johnson, C.G., Jr. 2004. Alpine and subalpine vegetation of the Wallowa, Seven Devils and Blue Mountains. Tech. Pub. R6-NR-ECOL-TP-03-04. Portland, OR: USDA Forest Service, Pacific Northwest Region. 612 p. http://ecoshare.info/uploads/publications/AlpineVegCompleteBook.pdf

Johnson, C.G., Jr.; Clausnitzer, R.R. 1992. Plant associations of the Blue and Ochoco Mountains. Tech. Pub. R6-ERW-TP-036-92. [Baker City, OR]: USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 164 p. Plant-Associations-of-the-Blue-and-Ochoco-Mountains

Johnson, C.G., Jr.; Simon, S.A. 1987. Plant associations of the Wallowa-Snake province. Tech. Pub. R6-ECOL-TP-255b-86. [Baker City, OR]: USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 272 p. Plant-associations-of-the-wallowa-snake-province

Johnson, C.G., Jr.; Swanson, D.K. 2005. Bunchgrass plant communities of the Blue and Ochoco mountains: a guide for managers. Gen. Tech. Rep. PNW-GTR-641. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 119 p. http://www.treesearch.fs.fed.us/pubs/20801

Kershaw, L.; MacKinnon, A.; Pojar, J. 1998. Plants of the Rocky Mountains. Edmonton, AB: Lone Pine Publishing. 384 p. isbn:1-551505-088-9

Lee, L.C.; Pfister, R.D. 1978. A training manual for Montana forest habitat types. Missoula, MT: Montana Forest and Conservation Experiment Station. 142 p.

Parish, R.; Coupe, R.; Lloyd, D. 1996. Plants of southern interior British Columbia and the inland northwest. Vancouver, BC: Lone Pine Publishing. 463 p. isbn:1-55105-219-9

Powell, D.C.; Johnson, C.G., Jr.; Crowe, E.A.; Wells, A.; Swanson, D.K. 2007. Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho. Gen. Tech. Rep. PNW-GTR-709. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 87 p. http://www.treesearch.fs.fed.us/pubs/27598

Swanson, D.K.; Schmitt, C.L.; Shirley, D.M.; Erickson, V.; Schuetz, K.J.; Tatum, M.L.; Powell, D.C. 2010. Aspen biology, community classification, and management in the Blue Mountains. Gen. Tech. Rep. PNW-GTR-806. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 117 p. http://www.treesearch.fs.fed.us/pubs/35257

Turner, M.; Gustafson, P. 2006. Wildflowers of the Pacific Northwest. Portland, OR: Timber Press. 511 p. isbn:978-0-88192-745-0

U.S. Department of Agriculture, Natural Resources Conservation Service [NRCS]. 2009. The PLANTS database. Baton Rouge, LA: National Plant Data Center. http://plants.usda.gov. (June 2009).

Wells, A.F. 2006. Deep canyon and subalpine riparian and wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman National Forests. Gen. Tech. Rep. PNW-GTR-682. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 277 p. http://www.treesearch.fs.fed.us/pubs/24936

Westveld, M. 1951. Vegetation mapping as a guide to better silviculture. Ecology. 32(3): 508-517. doi:10.2307/1931727

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APPENDIX: SILVICULTURE WHITE PAPERS

White papers are internal reports, and they are produced with a consistent formatting and numbering scheme – all papers dealing with Silviculture, for example, are placed in a silviculture series (Silv) and numbered sequentially. Generally, white papers receive only limited review and, in some instances pertaining to highly technical or narrowly focused topics, the papers may receive no technical peer review at all. For papers that receive no review, the viewpoints and perspectives expressed in the paper are those of the author only, and do not necessarily represent agency positions of the Umatilla National Forest or the USDA Forest Service.

Large or important papers, such as two papers discussing active management considerations for dry and moist forests (white papers Silv-4 and Silv-7, respectively), receive extensive review comparable to what would occur for a research station general technical report (but they don't receive blind peer review, a process often used for journal articles).

White papers are designed to address a variety of objectives:

(1) They guide how a methodology, model, or procedure is used by practitioners on the Umatilla National Forest (to ensure consistency from one unit, or project, to another).
(2) Papers are often prepared to address ongoing and recurring needs; some papers have existed for more than 20 years and still receive high use, indicating that the need (or issue) has long standing – an example is white paper #1 describing the Forest's big-tree program, which has operated continuously for 25 years.
(3) Papers are sometimes prepared to address emerging or controversial issues, such as management of moist forests, elk thermal cover, or aspen forest in the Blue Mountains. These papers help establish a foundation of relevant literature, concepts, and principles that continuously

evolve as an issue matures, and hence they may experience many iterations through time. [But also note that some papers have not changed since their initial development, in which case they reflect historical concepts or procedures.]

(4) Papers synthesize science viewed as particularly relevant to geographical and management contexts for the Umatilla National Forest. This is considered to be the Forest's self-selected 'best available science' (BAS), realizing that non-agency commenters would generally have a different conception of what constitutes BAS – like beauty, BAS is in the eye of the beholder.

(5) The objective of some papers is to locate and summarize the science germane to a particular topic or issue, including obscure sources such as master's theses or Ph.D. dissertations. In other instances, a paper may be designed to wade through an overwhelming amount of published science (dry-forest management), and then synthesize sources viewed as being most relevant to a local context.

(6) White papers function as a citable literature source for methodologies, models, and procedures used during environmental analysis – by citing a white paper, specialist reports can include less verbiage describing analytical databases, techniques, and so forth, some of which change little (if at all) from one planning effort to another.

(7) White papers are often used to describe how a map, database, or other product was developed. In this situation, the white paper functions as a 'user's guide' for the new product. Examples include papers dealing with historical products: (a) historical fire extents for the Tucannon watershed (WP Silv-21); (b) an 1880s map developed from General Land Office survey notes (WP Silv-41); and (c) a description of historical mapping sources (24 separate items) available from the Forest's history website (WP Silv-23).

White papers listed below are available from this website:
Silviculture White Papers

Paper #	Title
1	Big tree program
2	Description of composite vegetation database
3	Range of variation recommendations for dry, moist, and cold forests
4	Active management of Blue Mountains dry forests: Silvicultural considerations
5	Site productivity estimates for upland forest plant associations of Blue and Ochoco Mountains
6	Blue Mountains fire regimes
7	Active management of Blue Mountains moist forests: Silvicultural considerations
8	Keys for identifying forest series and plant associations of Blue and Ochoco Mountains
9	Is elk thermal cover ecologically sustainable?
10	A stage is a stage is a stage…or is it? Successional stages, structural stages, seral stages
11	Blue Mountains vegetation chronology
12	Calculated values of basal area and board-foot timber volume for existing (known) values of canopy cover
13	Created opening, minimum stocking, and reforestation standards from Umatilla National Forest Land and Resource Management Plan
14	Description of EVG-PI database
15	Determining green-tree replacements for snags: A process paper
16	Douglas-fir tussock moth: A briefing paper
17	Fact sheet: Forest Service trust funds
18	Fire regime condition class queries
19	Forest health notes for an Interior Columbia Basin Ecosystem Management Project field trip on July 30, 1998 (handout)
20	Height-diameter equations for tree species of Blue and Wallowa Mountains

Paper #	Title
21	Historical fires in headwaters portion of Tucannon River watershed
22	Range of variation recommendations for insect and disease susceptibility
23	Historical vegetation mapping
24	How to measure a big tree
25	Important Blue Mountains insects and diseases
26	Is this stand overstocked? An environmental education activity
27	Mechanized timber harvest: Some ecosystem management considerations
28	Common plants of south-central Blue Mountains (Malheur National Forest)
29	Potential natural vegetation of Umatilla National Forest
30	Potential vegetation mapping chronology
31	Probability of tree mortality as related to fire-caused crown scorch
32	Review of "Integrated scientific assessment for ecosystem management in the interior Columbia basin, and portions of the Klamath and Great basins" – Forest vegetation
33	Silviculture facts
34	Silvicultural activities: Description and terminology
35	Site potential tree height estimates for Pomeroy and Walla Walla Ranger Districts
36	Stand density protocol for mid-scale assessments
37	Stand density thresholds as related to crown-fire susceptibility
38	Umatilla National Forest Land and Resource Management Plan: Forestry direction
39	Updates of maximum stand density index and site index for Blue Mountains variant of Forest Vegetation Simulator
40	Competing vegetation analysis for southern portion of Tower Fire area

Paper #	Title
41	Using General Land Office survey notes to characterize historical vegetation conditions for Umatilla National Forest
42	Life history traits for common Blue Mountains conifer trees
43	Timber volume reductions associated with green-tree snag replacements
44	Density management field exercise
45	Climate change and carbon sequestration: Vegetation management considerations
46	Knutson-Vandenberg (K-V) program
47	Active management of quaking aspen plant communities in northern Blue Mountains: Regeneration ecology and silvicultural considerations
48	Tower Fire…then and now. Using camera points to monitor postfire recovery
49	How to prepare a silvicultural prescription for uneven-aged management
50	Stand density conditions for Umatilla National Forest: A range of variation analysis
51	Restoration opportunities for upland forest environments of Umatilla National Forest
52	New perspectives in riparian management: Why might we want to consider active management for certain portions of riparian habitat conservation areas?
53	Eastside Screens chronology
54	Using mathematics in forestry: An environmental education activity
55	Silviculture certification: Tips, tools, and trip-ups
56	Vegetation polygon mapping and classification standards: Malheur, Umatilla, and Wallowa-Whitman National Forests
57	State of vegetation databases for Malheur, Umatilla, and Wallowa-Whitman National Forests
58	Seral status for tree species of Blue and Ochoco Mountains

REVISION HISTORY

July 2011: This revision implemented a new white-paper template format, and minor formatting and editing changes were made throughout the document.