Douglas-fir Decline: Fire & Fuels Issues

May 04, 2023

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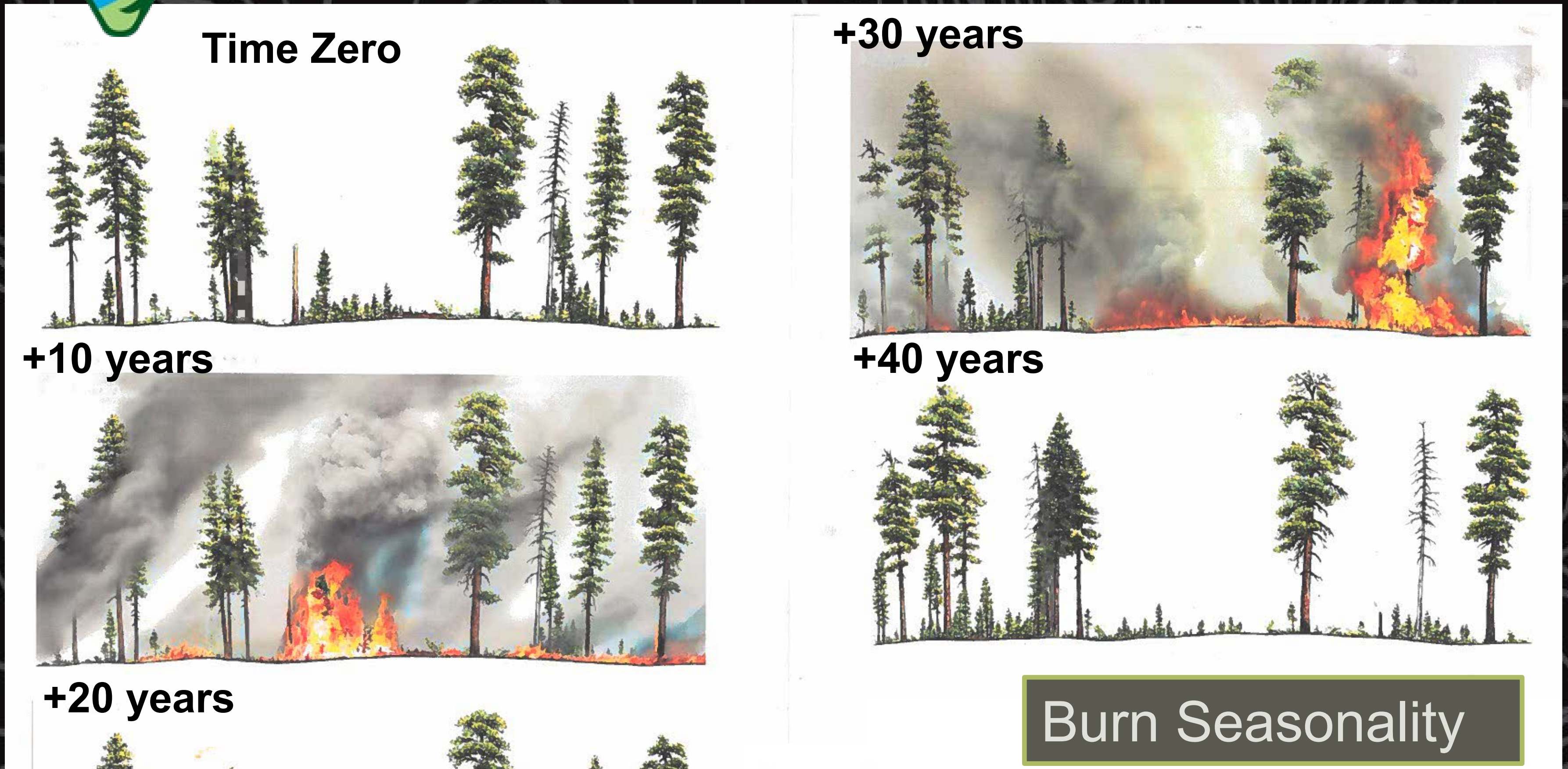
Medford BLM

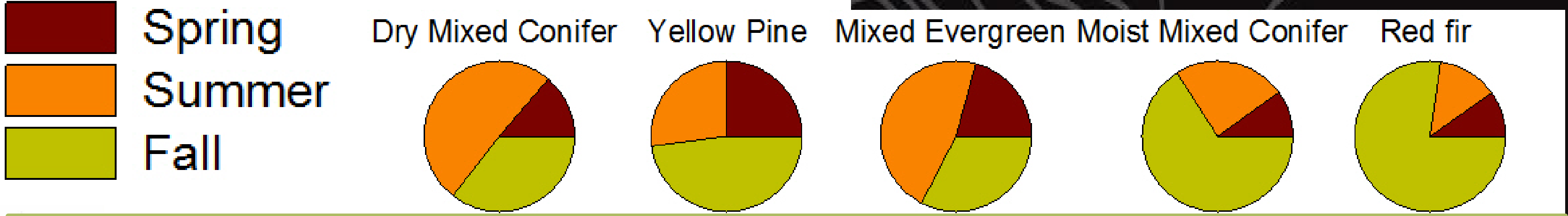
Frequent Fire Forest – Fuel Dynamic in Functional Regime



Van Pelt illustration

- Frequent low-mixed severity fire (median FRI 8yr)
- Patchy discontinuous fuels
- Diverse structure, including large trees
- Limited regeneration of fire intolerant species

Burn Seasonality



Metlen et al. 2018. Regional and local controls on historical fire regimes of dry forests and woodlands in the Rogue River Basin, Oregon, USA. Forest Ecology and Management **430:43-58.**

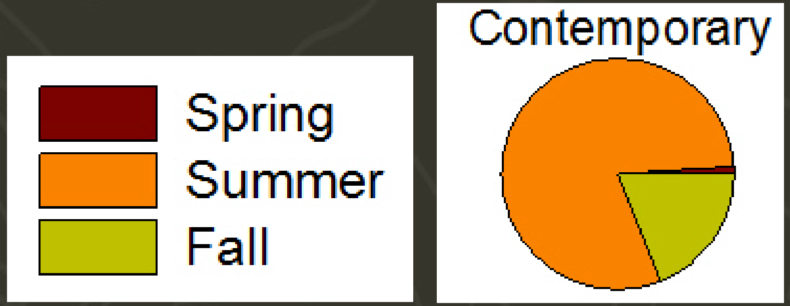
Frequent Fire Forest – Current Fuel Dynamics

Frequent fire ended in 1850, coincident with forced relocation of indigenous people, ending cultural burning

Forested areas are overly dense and homogenous; legacy structure threatened or lacking

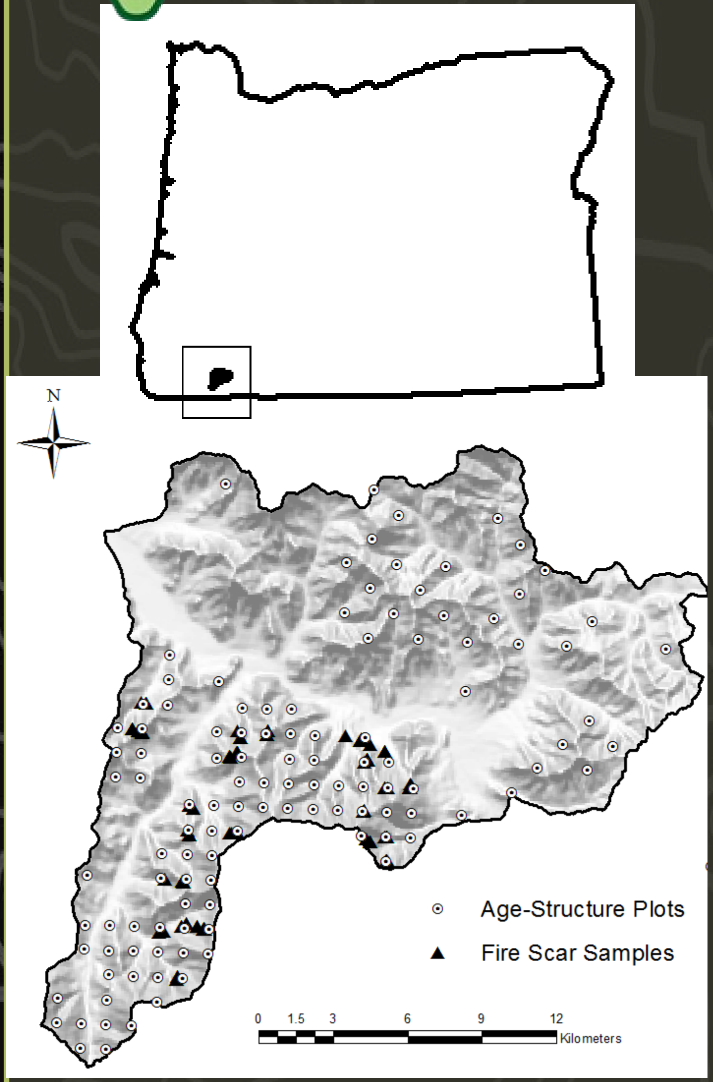
Most fires occur under hottest & driest fire weather

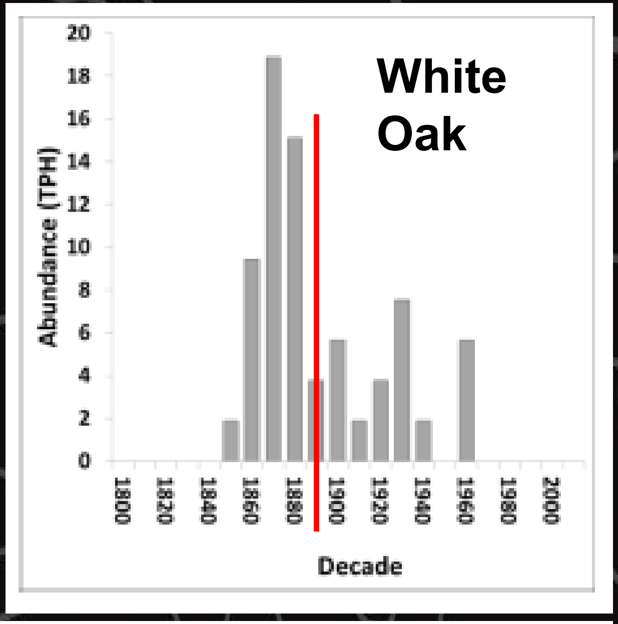
Burn Seasonality

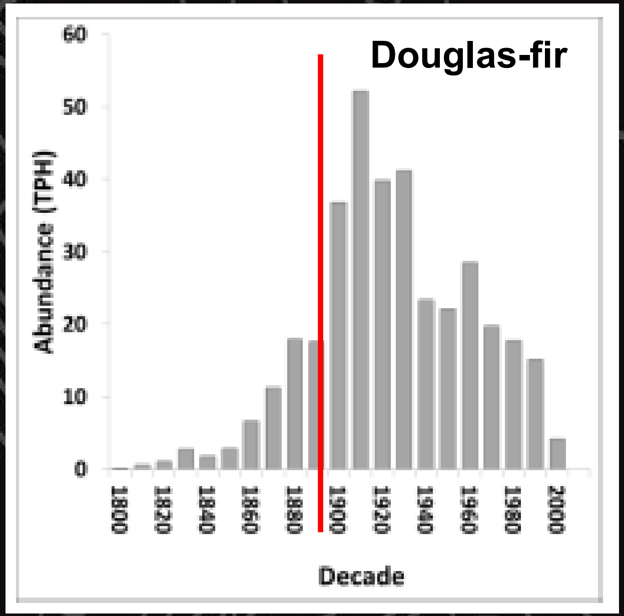


Metlen et al. 2018. Regional and local controls on historical fire regimes of dry forests and woodlands in the Rogue River Basin, Oregon, USA. Forest Ecology and Management **430:43-58.**

Species Composition Shifts (1900-2000)



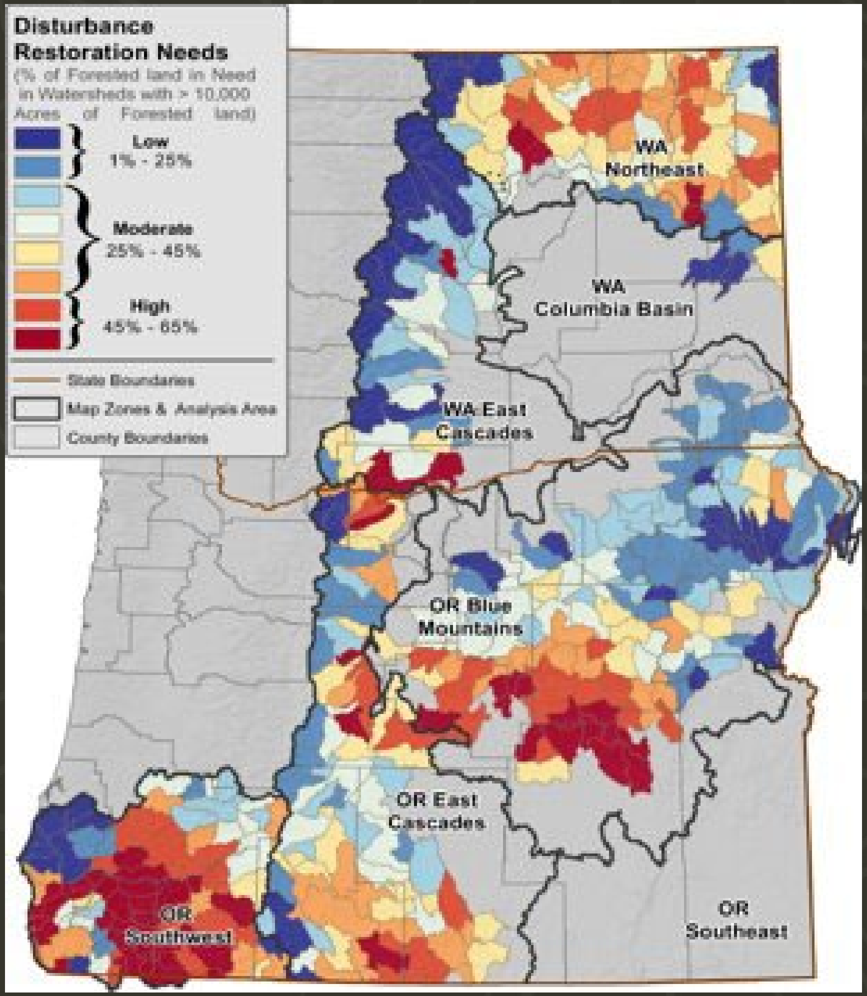




In the frequent fire forest, Douglas-fir has expanded

Comfort E., C. J. Dunn, J. D. Bailey, J. F. Franklin, and K. N. Johnson. unpublished. *Disturbance History and Composition Shifts in a Couple Human-Ecological System of Southwest Oregon, U.S.A. unpublishe*

Restoration Need & Wildfire Risk



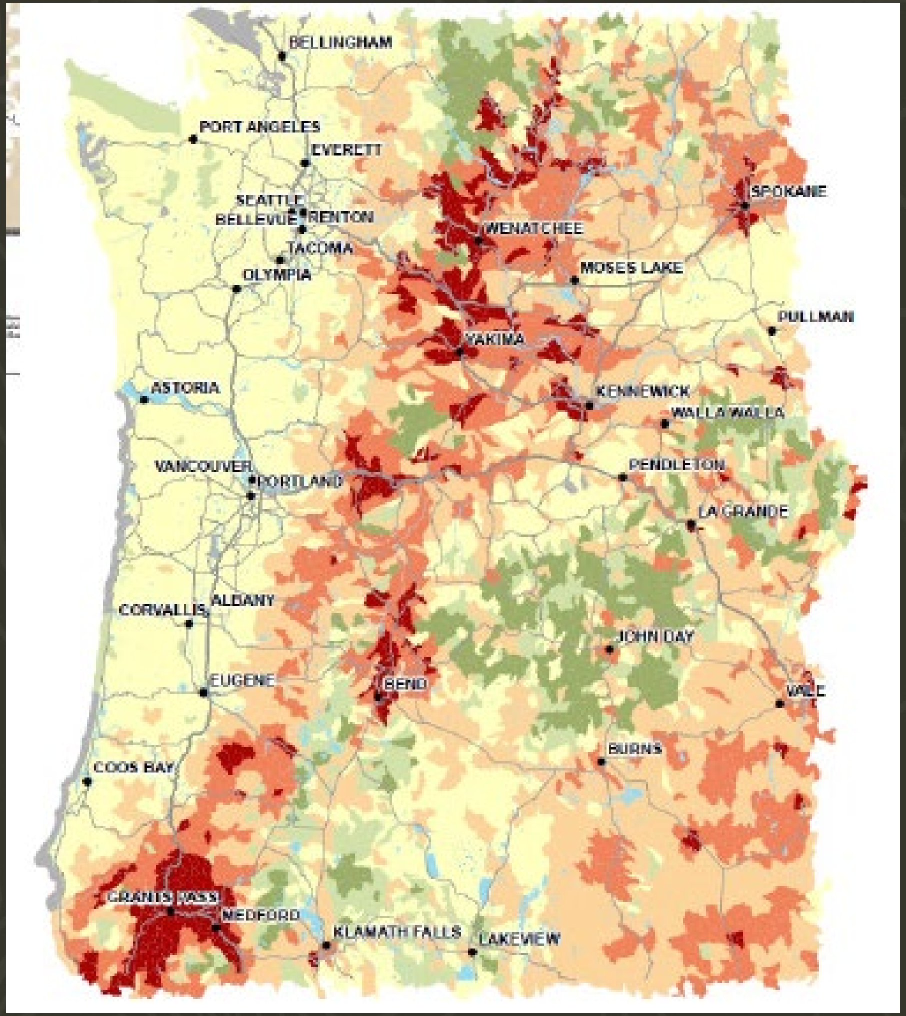
Haugo,R., C. Zanger, T. DeMeo, C. Ringo, A. Shlisky, K. Blankenship, M. Simpson, K. Mellen-McLean, J. Kertis, and M. Stern. 2015. A new approach to evaluate forest structure restoration needs across Oregon and Washington, USA. Forest Ecology and Management 335(1): 37–50. http://dx.doi.org/10.1016/j.foreco.2014.09.014.

51% of southwest Oregon dry forests need restoration via thinning and fire

(Haugo et al. 2015)

50 communities in Oregon with the **highest wildfire risk, 22 of these are in southwest OR**

(Scott et al. 2018).



Scott, Joe H.; Gilbertson-Day, Julie; Stratton, Richard D. 2018. Exposure of human communities to wildfire in the Pacific Northwest. Briefing paper. 10 p. Available at: http://pyrologix.com/ftp/Public/Reports/RiskToCommunities_OR-WA_BriefingPaper.pdf

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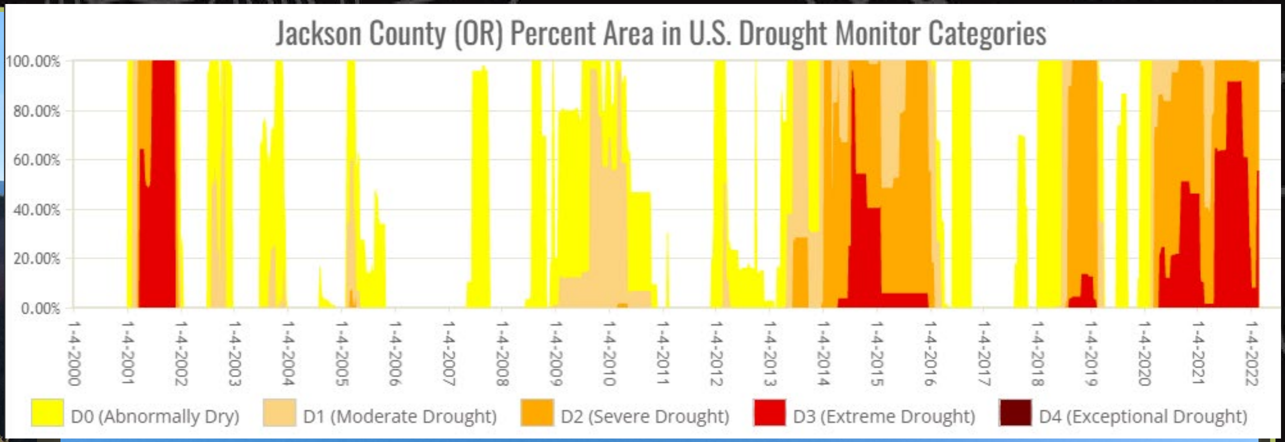
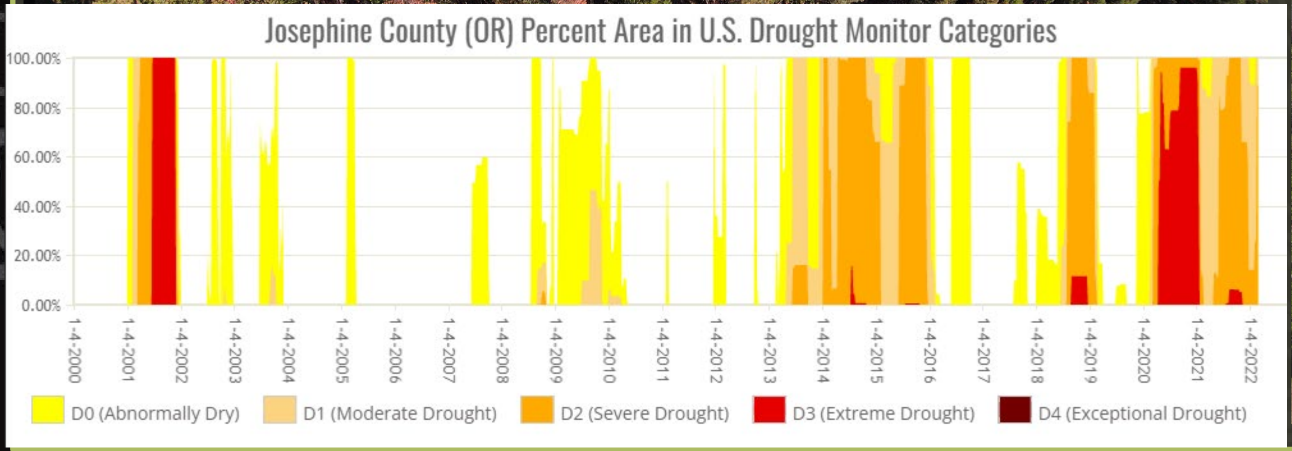
“Traffic Jam” of Live Trees ……+ dead……+dying – Impacts to Fuel Dynamics?



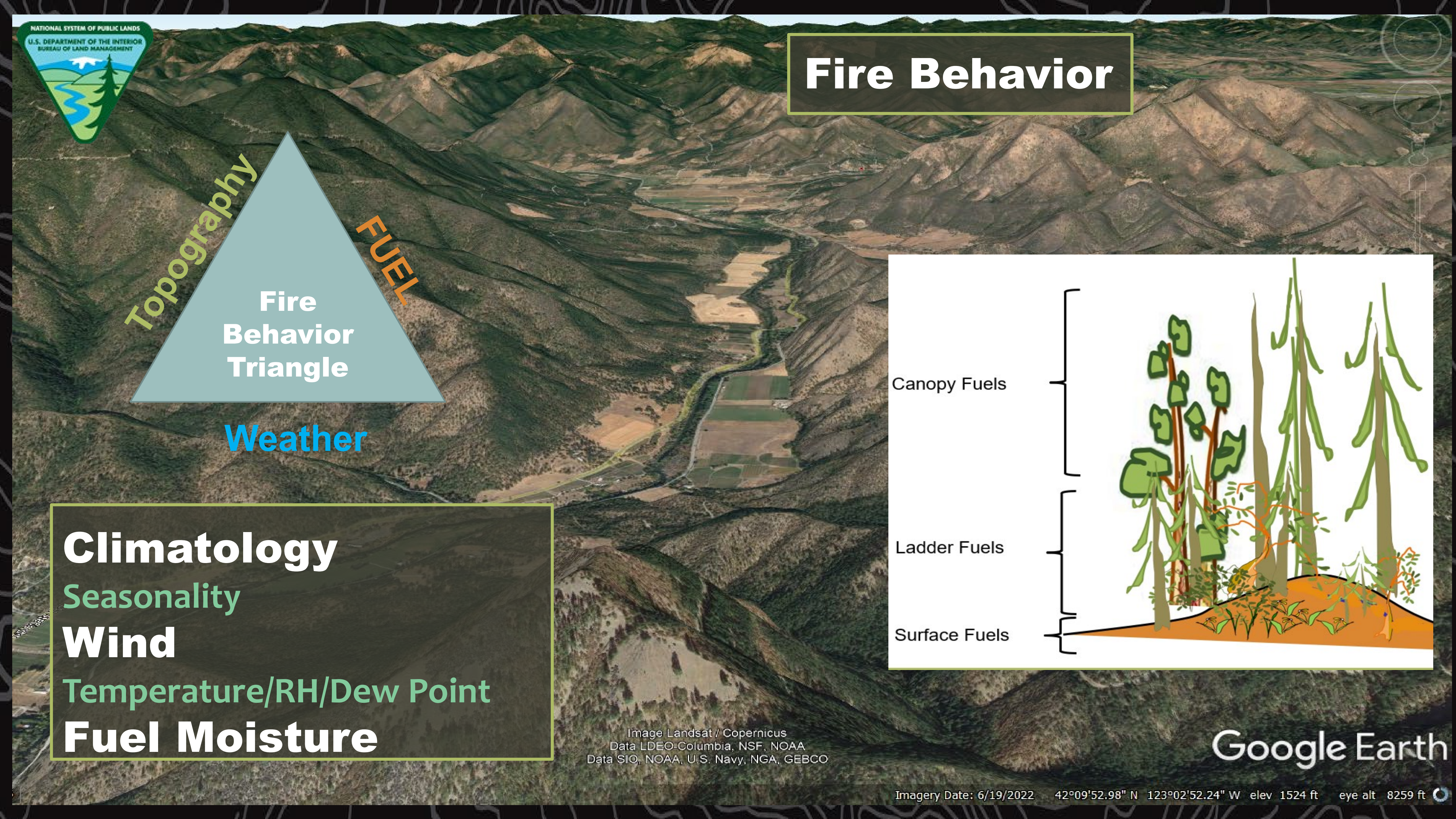


Phases of Conifer Mortality

RED phase
(1 to 2years)

GRAY phase (3 - 10years)

OLD phase
(several
decades)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Fire Behavior
Topography
FUEL
Fire Behavior Triangle
Weather
Climatology
Seasonality
Wind
Temperature/RH/Dew Point
Fuel Moisture
Canopy Fuels
Ladder Fuels
Surface Fuels
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth
Imagery Date: 6/19/2022 42°09'52.98" N 123°02'52.24" W elev 1524 ft eye alt 8259 ft

Mortality Phase Conceptual Influence on Fire Behavior

RED phase – reduced foliar moisture of canopy fuels = increase in torching, crown fire potential, rates of spread and intensities….. however uncertainty surrounding this generality, as canopy fuels may be reduced or discontinuous, particularly if morality happens slowly.

GRAY phase – overall loss of canopy fuels and increase in surface fuels; altered microclimates = ladder fuels begin to grow creating conditions that may cause greater flame lengths, rates of spread, and heat release.

OLD Phase – continued accumulation of large-diameter surface fuels and live surface fuels as new plants establish and grow = increased fire intensity, crown fire potential, ember production, and suppression difficulty.
Increased surface fuel loading = long duration heating and sever fire effects.

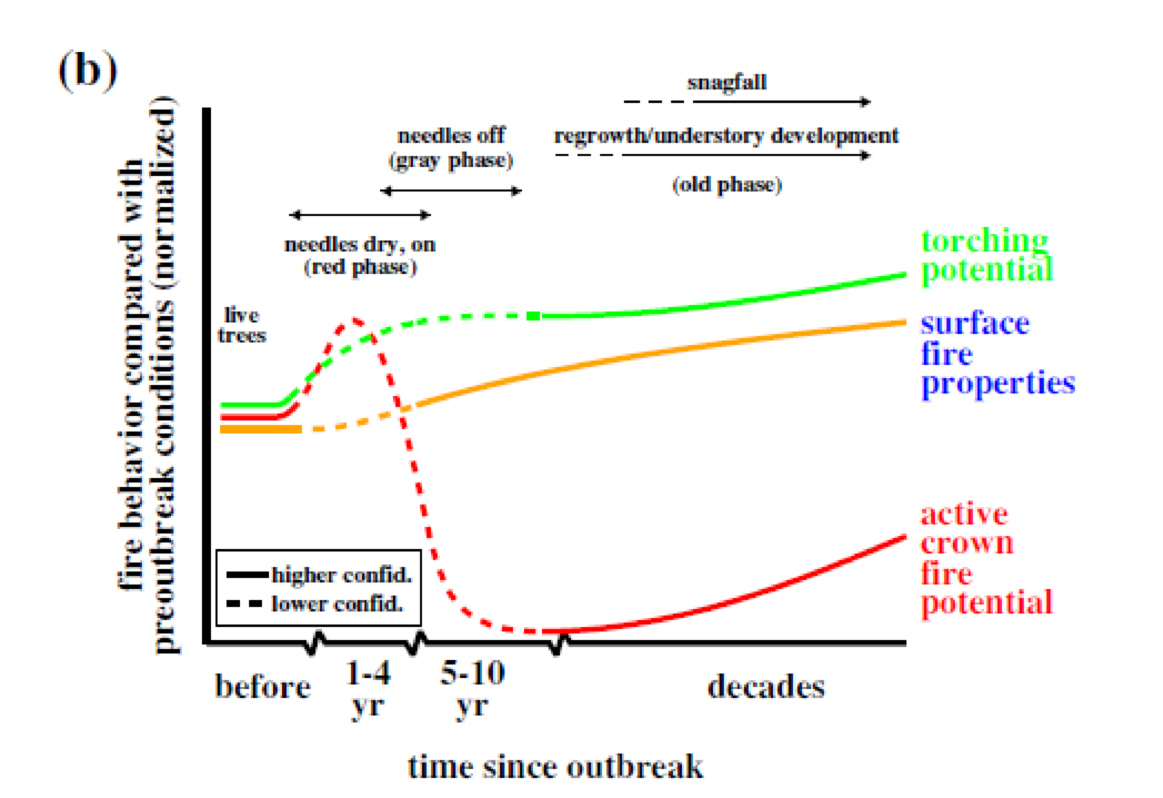


Fig. 2. Conceptual framework of (a) fuels characteristics and (b) fire behavior relative to preoutbreak conditions for red, gray, and old (snagfall and regrowth) phases. Surface fire properties include reaction intensity, rate of spread, and flame length. For postoutbreak phases, solid lines indicate higher confidence in responses based on Fig. 3, and dashed lines indicate lower confidence (more disagreement, fewer studies, or knowledge gaps).

J.A. Hicke, M.C. Johnson, J.L. Hayes, H.K. Preisler. 2012. **Effects of bark beetle-caused tree mortality on wildfire.** Forest Ecology and Management 271: 81–90

Landscape Effects - “Mass Fire” Potential

What happens when red, gray, and old phases and overstocked green trees are represented across the landscape?

- Large scale tree mortality adds long-burning high fuel loads over extensive area – fuel characteristics that match criteria for “mass fire”
- Mass fires or firestorms can occur when large areas are burning simultaneously (e.g. ignition saturation over a large area, long-distance spotting in wildfires)
- Fuel beds need not be continuous so long as the airflow merges to a plume near the ground

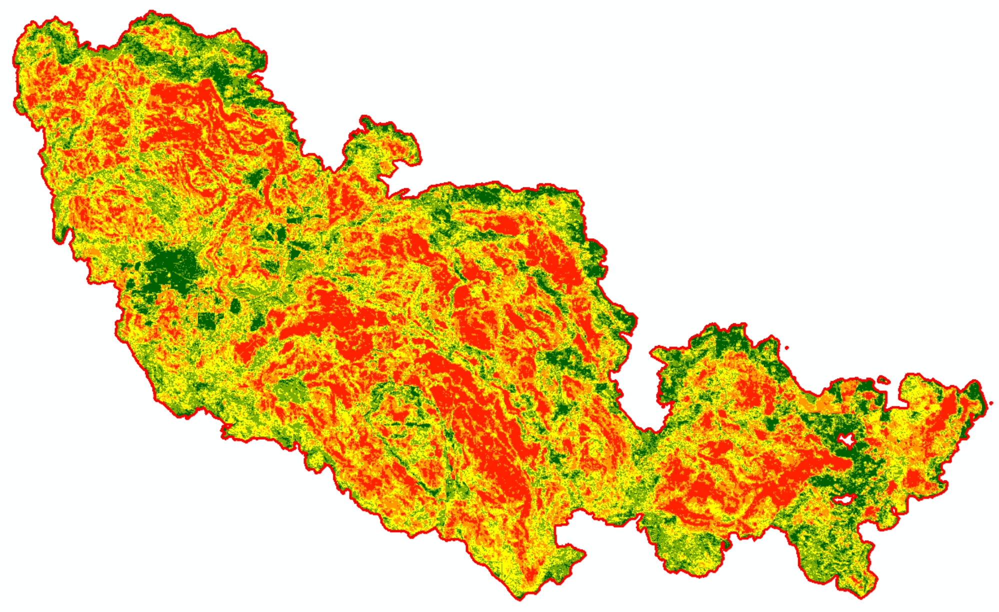
Slide content adapted from: Stephens, S.L., et al. 2018. Drought, tree mortality, and wildfire in forests adapted to frequent fire. *BioScience*, *68*(2), pp.77-88.

Not predictable by fire models

Risks are poorly understood

Strongly contrast with historical fire regimes in Frequent Fire Forests

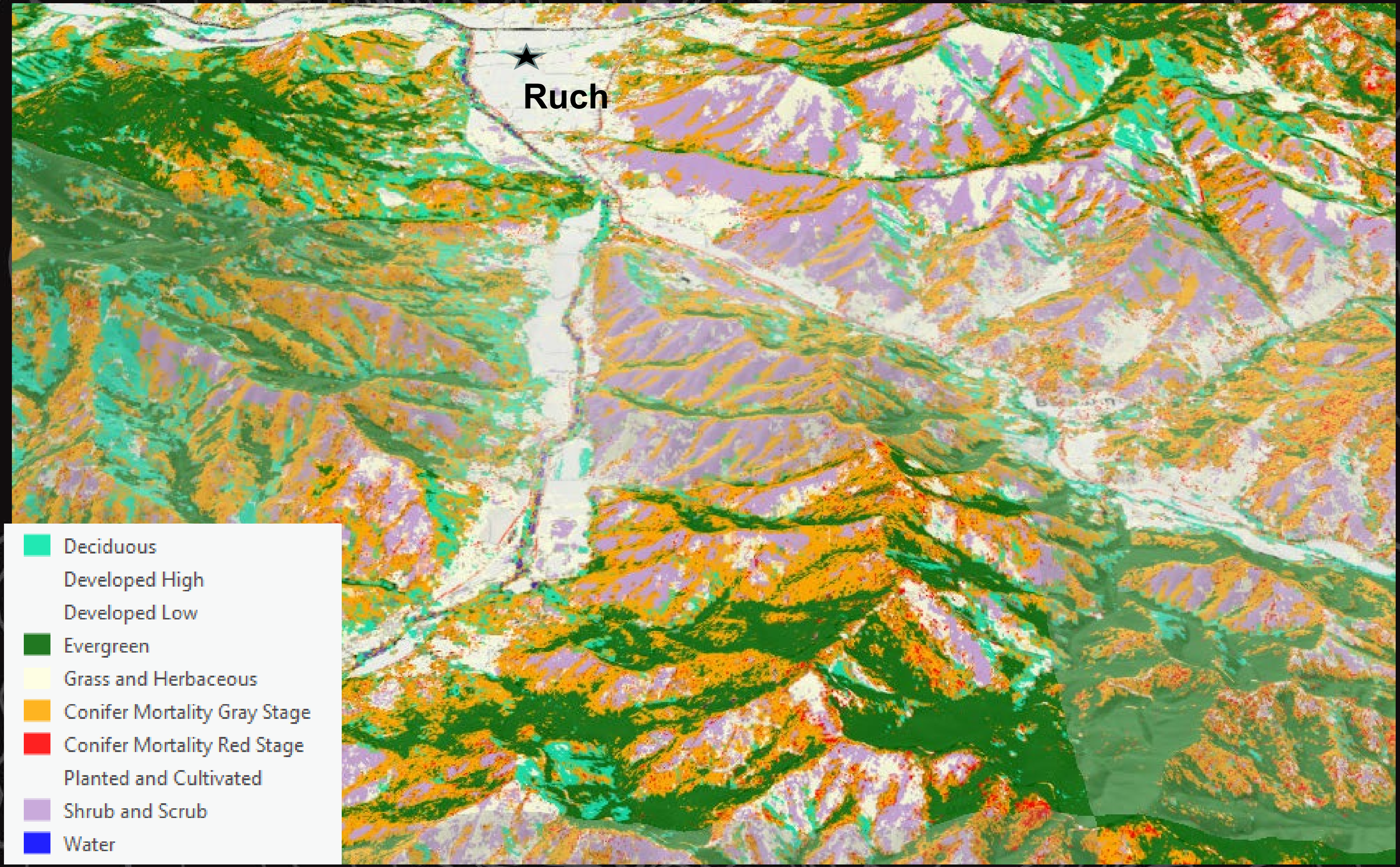
How to quantify? ....different than wildfire



Post-fire mortality spatially contained and relatively quantifiable with remotely sensed imagery

Vegetation Classification – Plant Imagery – BLM NOC

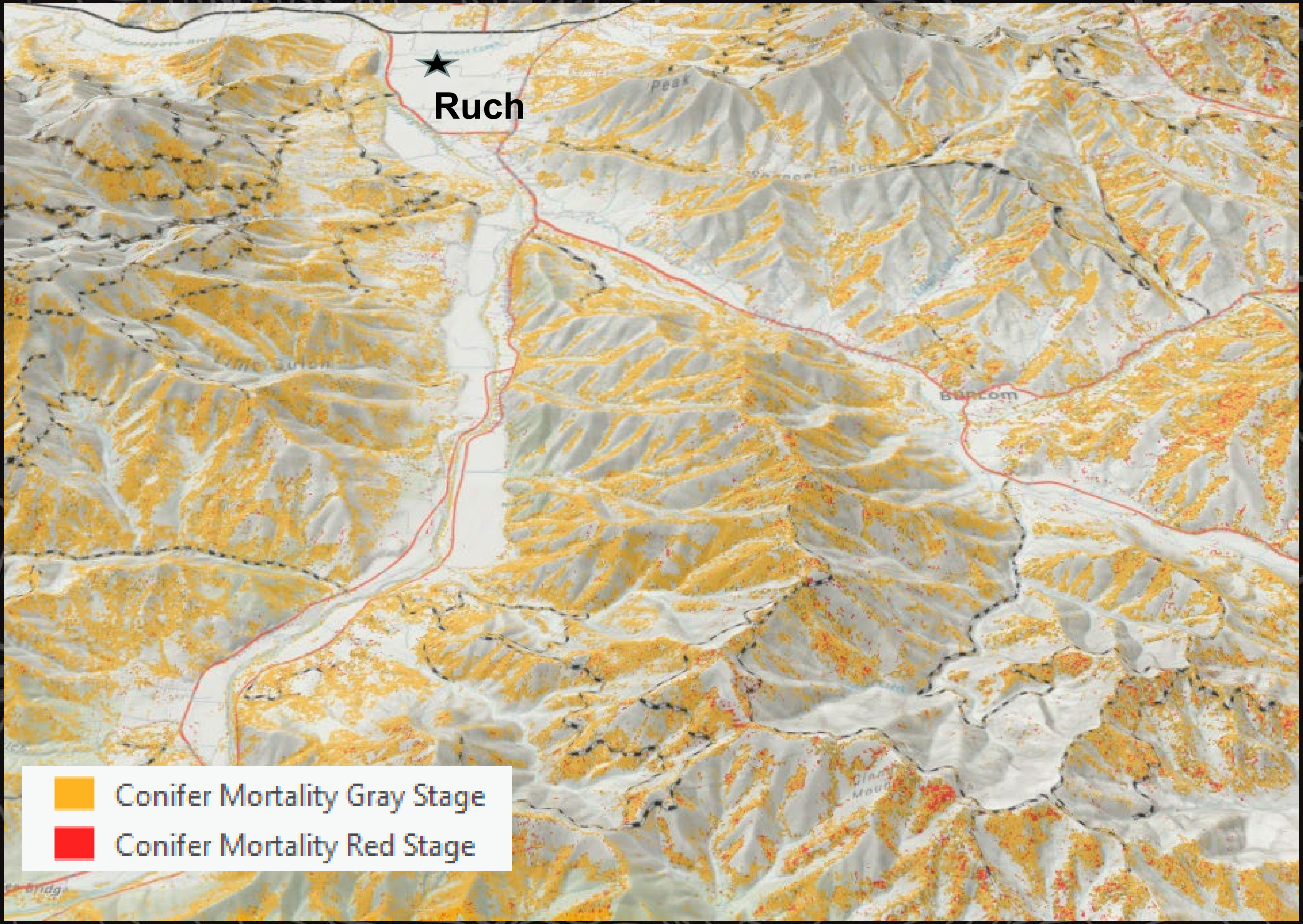
Applied science pilot to assess the use of Planet Scope satellite imagery (copyright Planet Labs PBC 2022) to quantify vegetation cover and conifer mortality on BLM-administered lands and adjacent federal lands (June 2022 data)



Conifer Mortality – Plant Imagery – BLM NOC

Future Refinements:
Enhanced separation of confusion of spectral signals

- Coniferous with deciduous forest;
- Gray stage mortality with oak/shrub;
- Calibrate with more current LiDAR

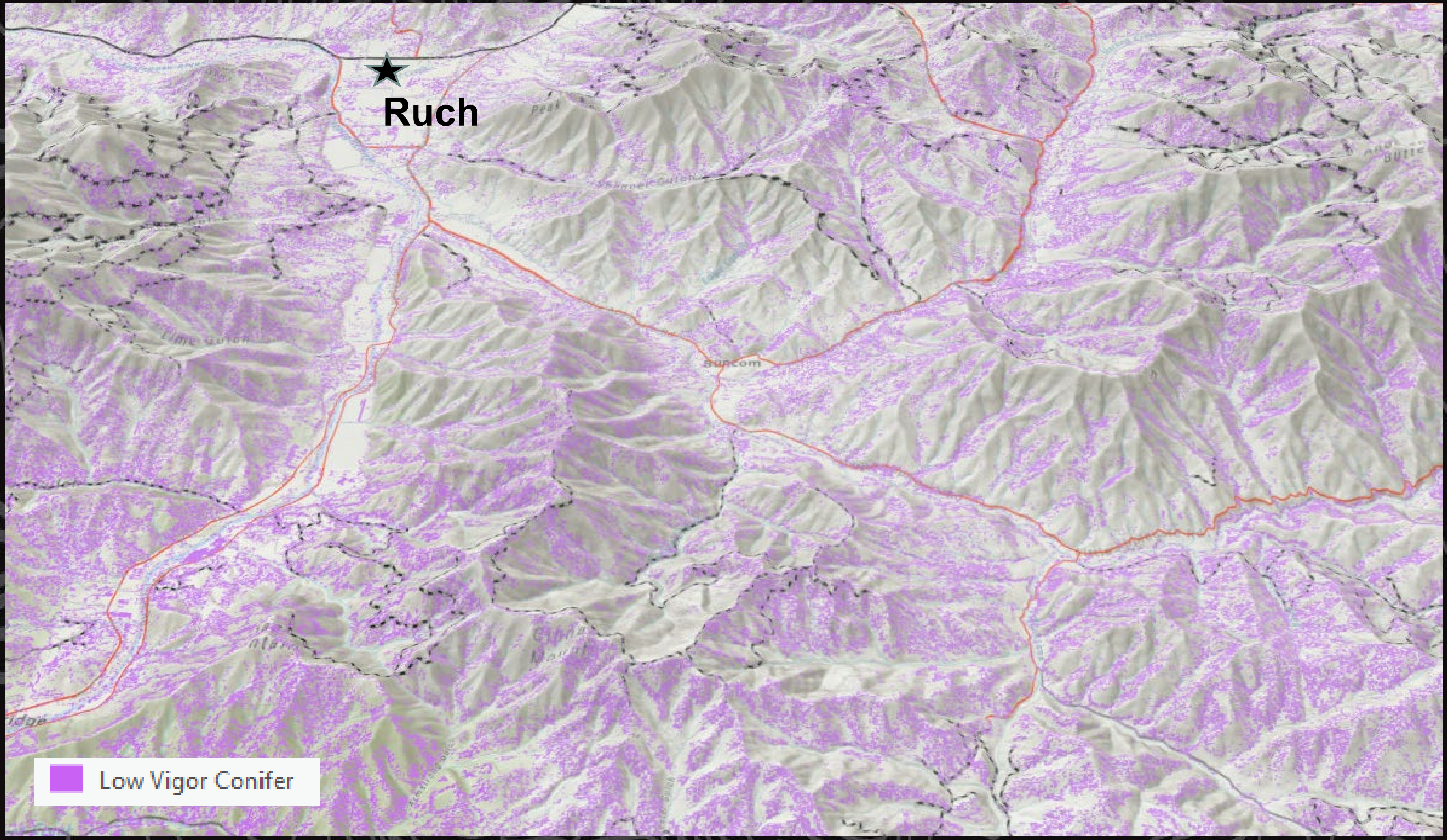


Low Vigor Conifers – Sentinel2 Imagery – BLM MED

Derived from a combination of three Sentinel 2 remotely sensed data products

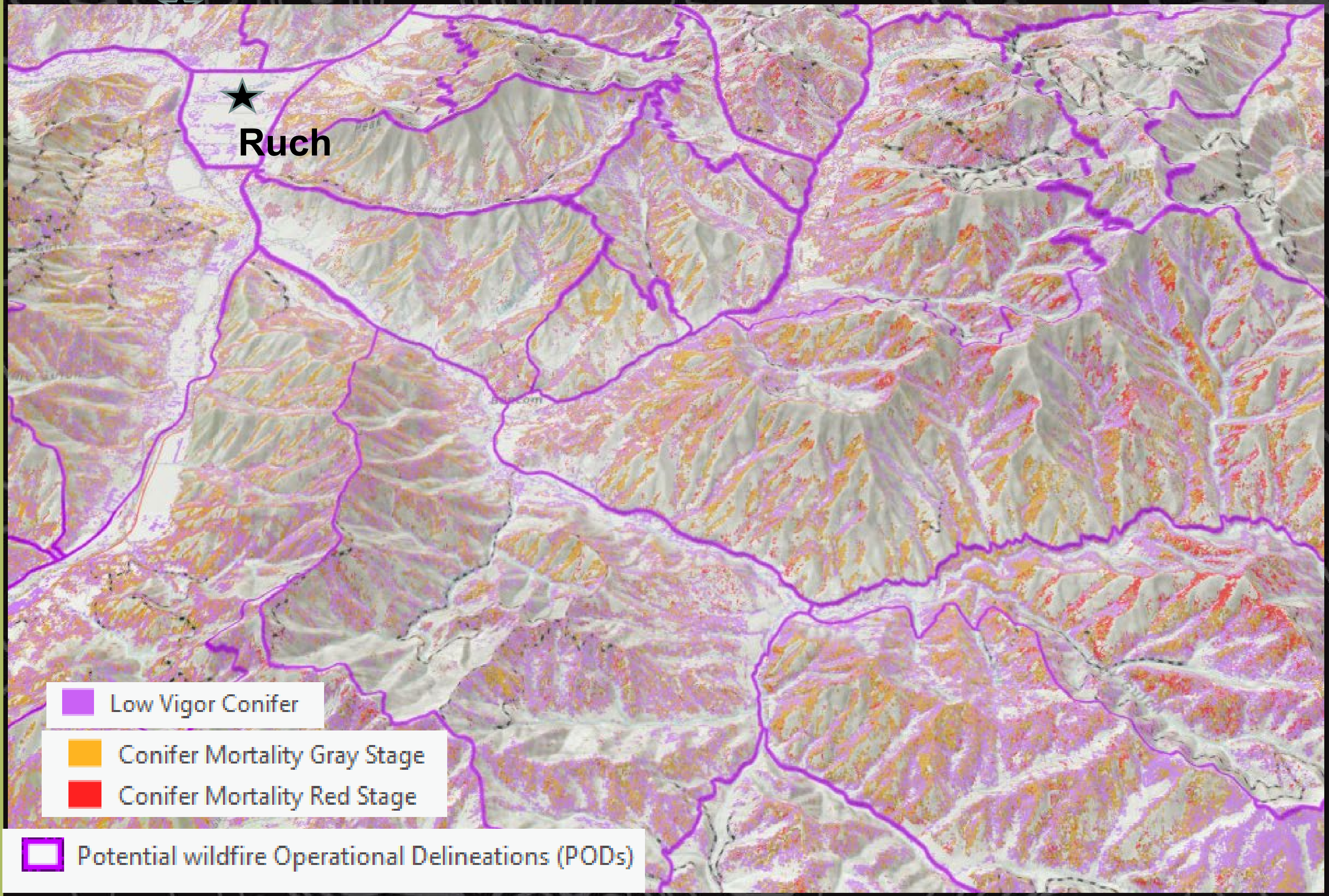
- Normalized Difference Vegetation Index (NDVI) low photosynthetic activity
- Green-Red Vegetation Index (GRVI) to remove shrublands
- Moisture Stress Index to identify low water content foliage

Data is on Rogue Basin All-Lands Explorer



Landscape Management Implications

- Increased Risk to Fire Management Operations Personnel
- **Strategic actions needed that promote resistance to future disturbance**
- Need to facilitate low-moderate severity disturbance & improve vigor in driest forests & woodlands
- **Need to recouple vegetation patterns with topo position & aspect**



Mechanical Fuels Treatments in Mortality Stands

Challenges for treatments within a Douglas Fir Mortality Stands

- Proper mechanism of treatment and removal
- Is it fuels? Is it stewardship? Is it a salvage?
- How to properly prescribe treatments for all three phases of mortality.
- Challenges with varying treatment restraints in different Land Use Allocations (HLB vs LSR vs LWC)
- What is the future condition we're trying to create?

Personnel Safety

- Increased frequency of "Too dangerous for operations" from contractors. Weather and chainsaw are the top exposure factors, causing limbs, tops and potentially whole trees to fall to the ground during operations.

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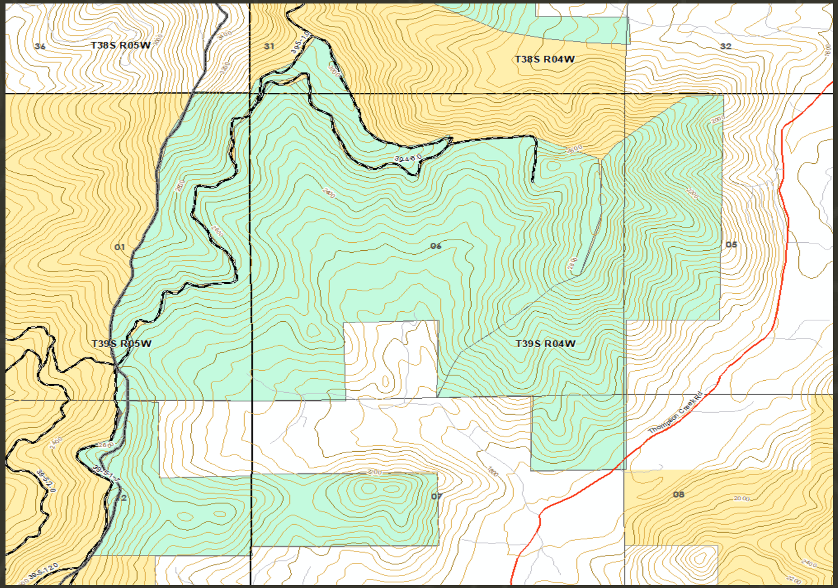
Prescribed Fire in Mortality Stands

Planning and Logistics

- Avoiding unnecessary segmenting of smaller units mitigates perimeter that requires prep/snag mitigation. Larger units lesson the overall ground and stand level disturbance through mechanical action, as well as decrease overall cost per acre. This adds an extra layer of complexity concerning burn duration, mop up & patrol and potential smoke impacts.



- Early unit preparation. When prepping a burn unit with a mortality component, the earlier you fall your snags, the longer the log has to absorb soil moisture and precipitation, mitigating the energy release at the time of ignition. Standing snags will remain dryer though the wet season compared to being felled and bucked to the ground. Best approach is to complete the felling prep in the Fall, to allow logs to be exposed through Winter and Spring, trying to avoid adding fuel to the ground through fire season.

Prescribed Fire in Mortality Stands

Implementation

- The BLM Medford district is building capacity within the fire and fuels program for future drone operations during prescribed fire operations.
- Areal ignition is an added tool we can use to safely implement prescribed fire in mortality stands. This would assist burn supervisors in maintaining greater control over burn intensity, monitoring as well as mitigate personnel exposure inside the unit by allowing the majority of your forces to hold and ignite from the perimeter.
- Drone and helicopter PSD would be the focused method for areal ignition. Each have a specific fit in relation to pace and scale of the project.
- With fire departure being one of the primary causes of our current condition, prescribed fire is one of the best tools outside of natural fire to achieve landscape balance.




Wildfire Suppression Tactics and Risk Management

Douglas Fir mortality in southwest Oregon presents a risk to wildland fire personnel that could only be compared to a high severity wildfire fire scar.

- Mortality stands present major challenges for firefighters, potentially forcing them to utilize indirect strategies to properly manage risk. This "could" potentially lower the effectiveness of initial attack.
- Increased exposure to personnel and public as well as smoke impacts to communities is a likely outcome from potential indirect suppression strategies.

Photo: Lomas Rd.

Photo: Taylor Cr Fire scar

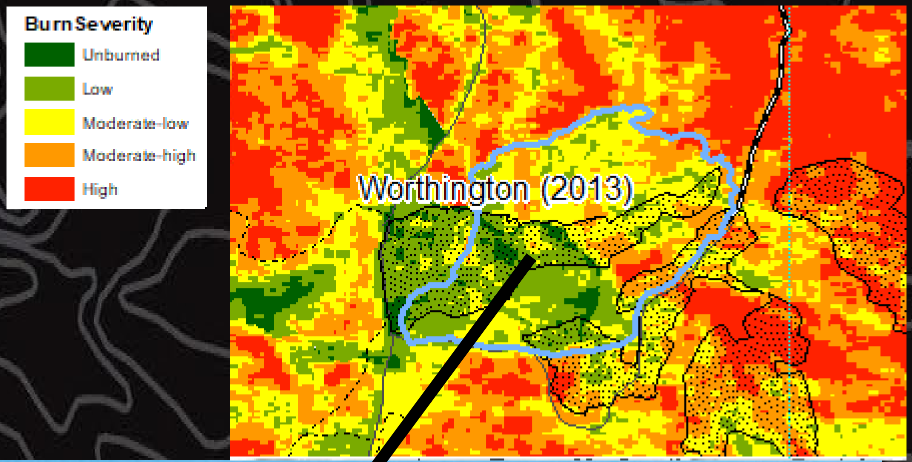
Suppression difficulty Index (SDI), provides a spatial summary of “watch out” situations as well as areas with reduced risk to fire responders that can be used to facilitate strategic and tactical fire management decisions. Every phase of Doug Fir mortality influences the SDI. Red and old stages increase the fires resistance to control as well as risk through fire behavior, where the grey stage mainly presents elevated risk with areal hazards and rolling material which accounts for an avg of 7 fatalities per year. NWCG PMS 841

Summary Points

- **Resilient FF Forest Conditions:** *Low-density; Drought & fire tolerant species; Heterogeneous structure (will influence fire behavior); Stable refugia; and frequent low- to moderate-intensity fire*
- Future wildfire hazard following the recent mortality can be generally characterized by decreased crown fire potential and increased surface fire intensity, based on a shifting of fuels.
- **The Douglas-fir mortality long term and scale impacts to fuel structure and dynamics and potential fire behavior is outside of envelopes for FF Forest and Fire Behavior modeling methods and has the potential to significantly alter fire behavior and forest succession in FF-adapted forests.**
- Douglas-fir mortality presents a risk to prescribed fire personnel and wildland firefighter personnel
- **Treating larger units will reduce exposure, decrease overall cost per acre, and reduce complexity of implementation and necessary snag hazard mitigation along unit boundaries.**
- Exploring new technology and altering strategy and tactics for fire management (Rx & wild) may be necessary

Thank you!

South Obenchain Fire (2020) Burn Severity



Repeat low-mixed severity disturbance

Fuel Reduction Treatment (2003) - Worthington Fire (2012) - South Obenchain Fire (2020)

photo by J.Volpe