Dry Forest Resistance, Gone but not Forgotten: An Ecological Perspective on Living with Fire

Andrew Merschel, Peter Beedlow, Henry Lee, Steve Cline, Randy Comeleo, Dave Woodruff, Dave Shaw, Keala Hagmann, Matthew Reilly

Imagine You Just Bought a House in Bend…

What Should You Know About Dry Forests?

Historical Conditions, Fire Regimes, and Resistance

Changes in Structure and Composition

Contemporary Conditions and Disturbance Dynamics

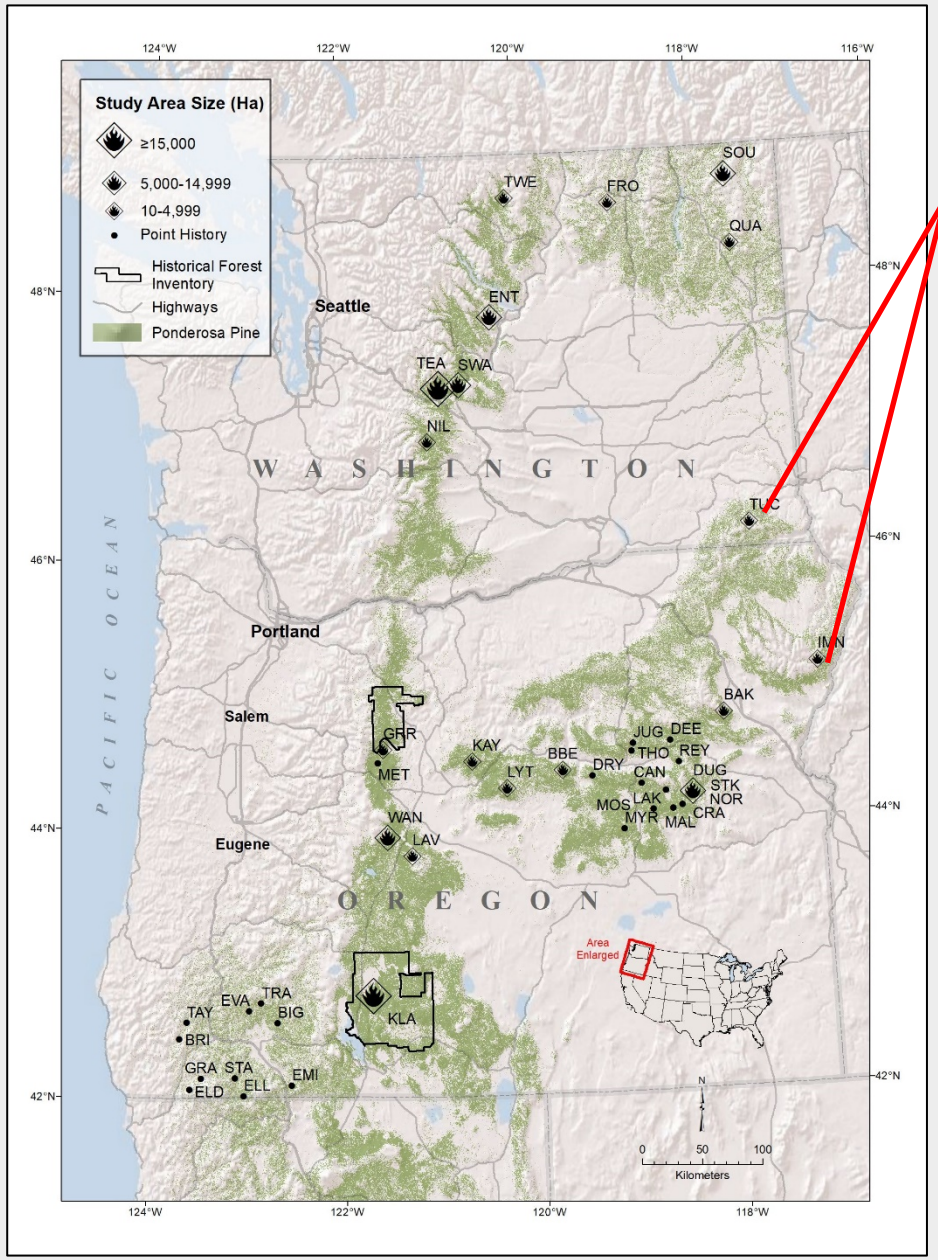
Realistic Expectations for Fire, Disturbances, and Mitigation in the 21st Century

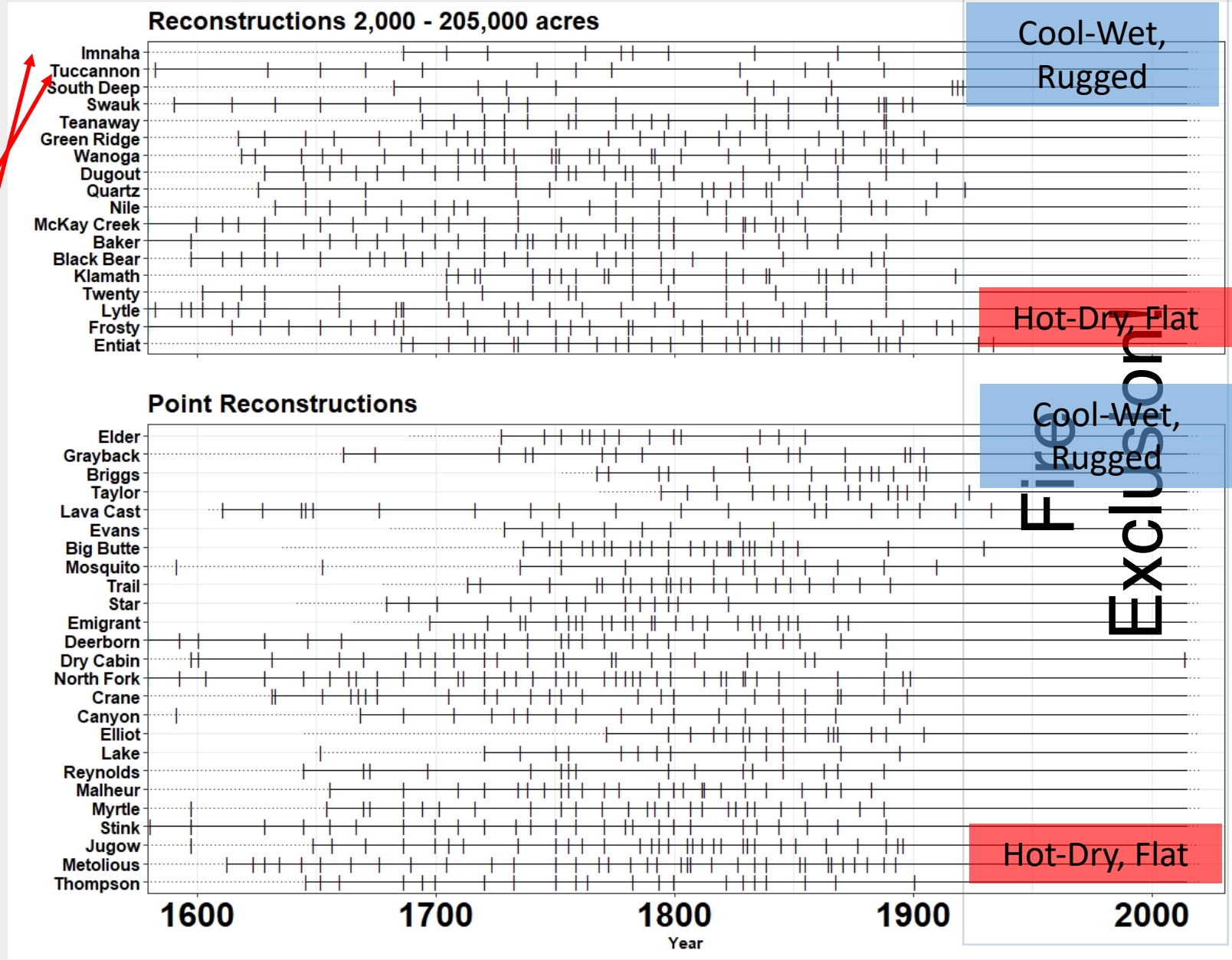
What Should We Do?

Dry Forests in Oregon and Washington

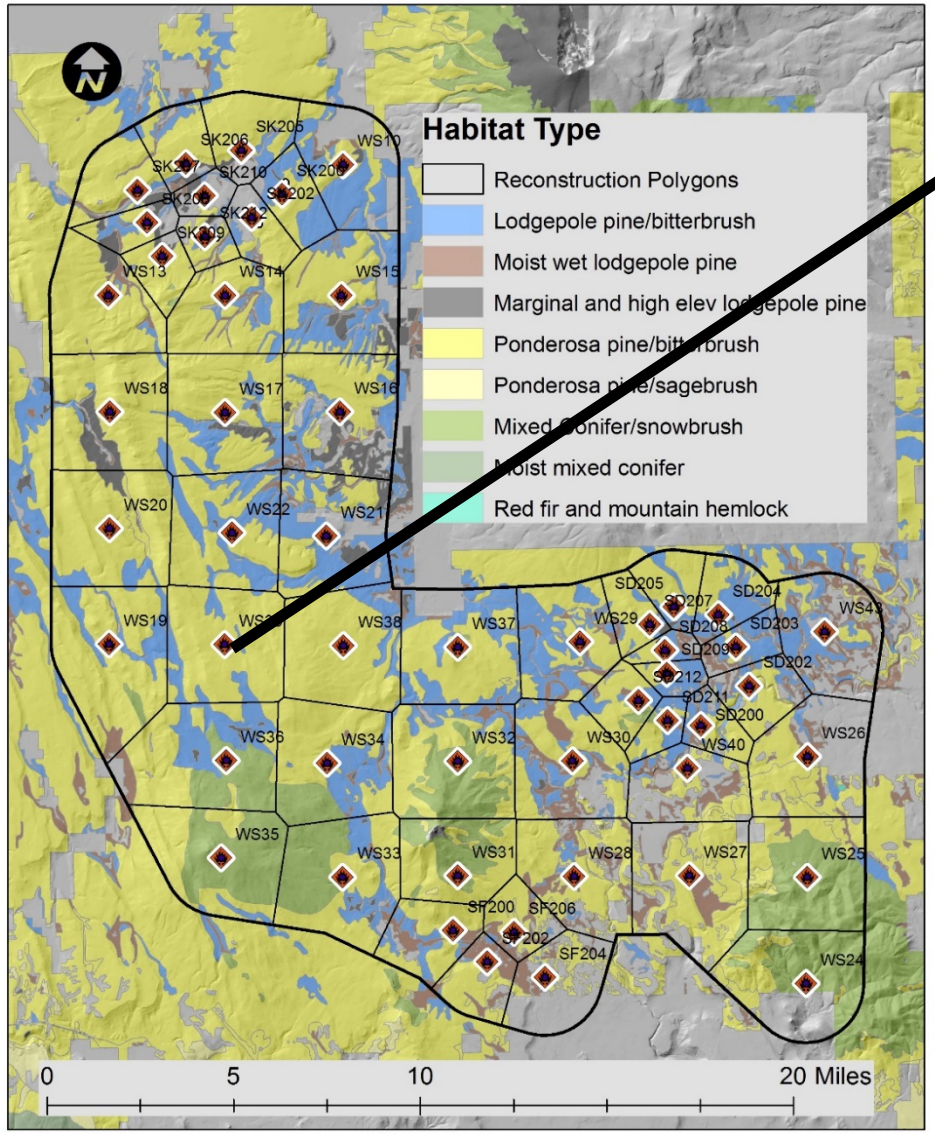
Includes forest where ponderosa is common and rare.

Records of Historical Fire Regimes and Dynamics





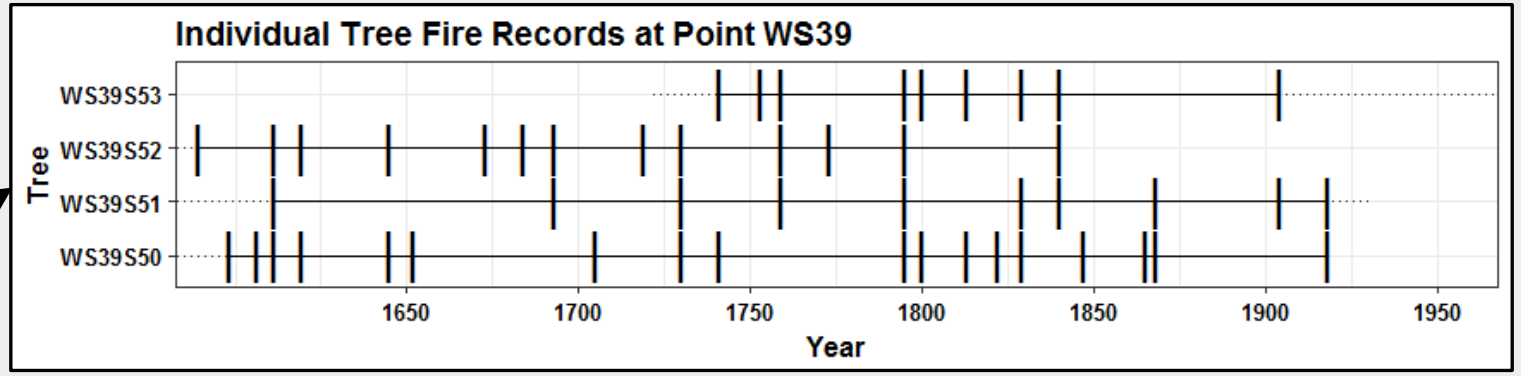
Historical Disturbance Rates and Extent



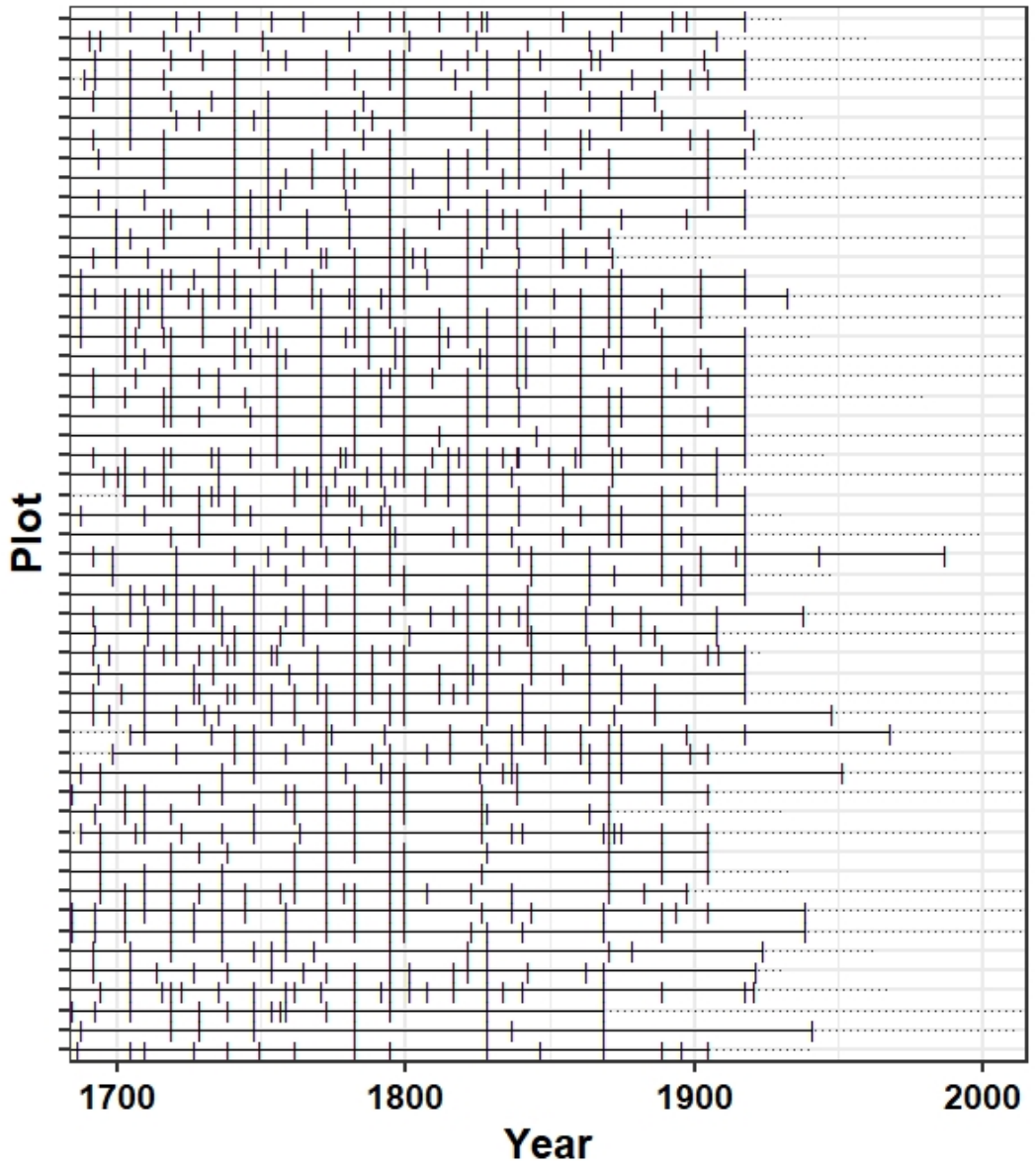
Fire Reconstruction Area

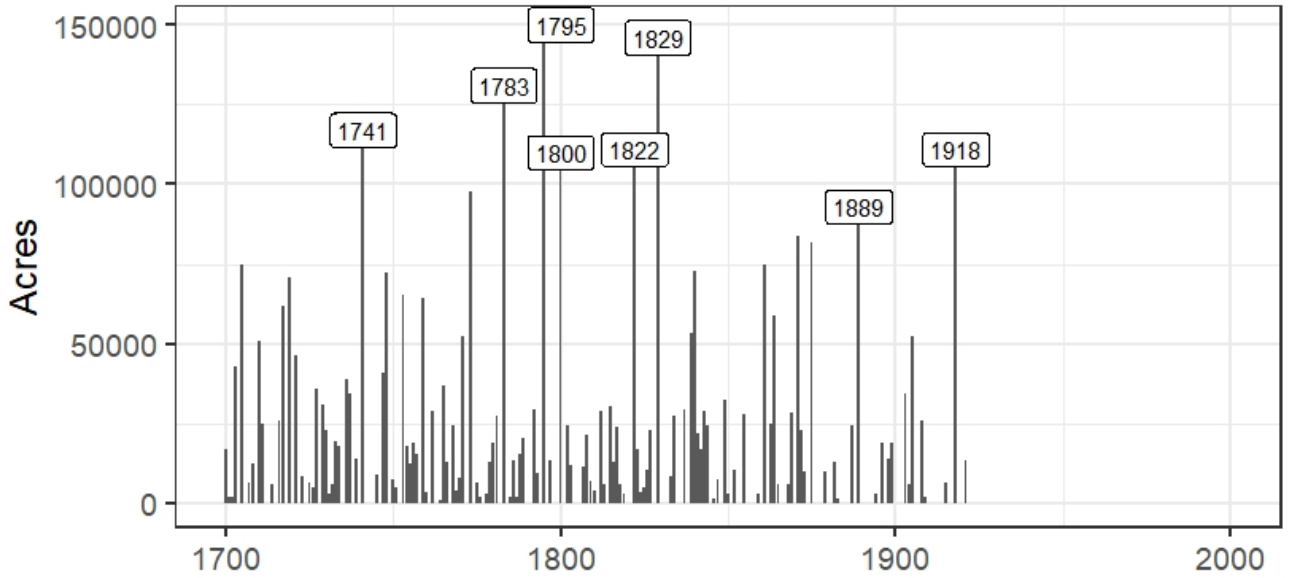
Sample Points

Reconstruction Polygons



Historical Disturbance Rates and Extent



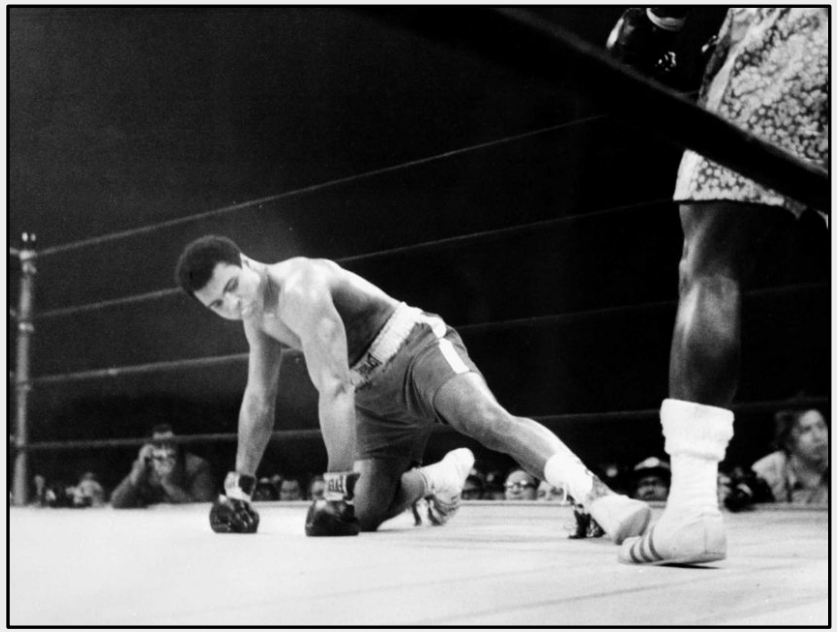


For a 205,000 acre area

Fires > 50,000 acres occurred every 9.5 years

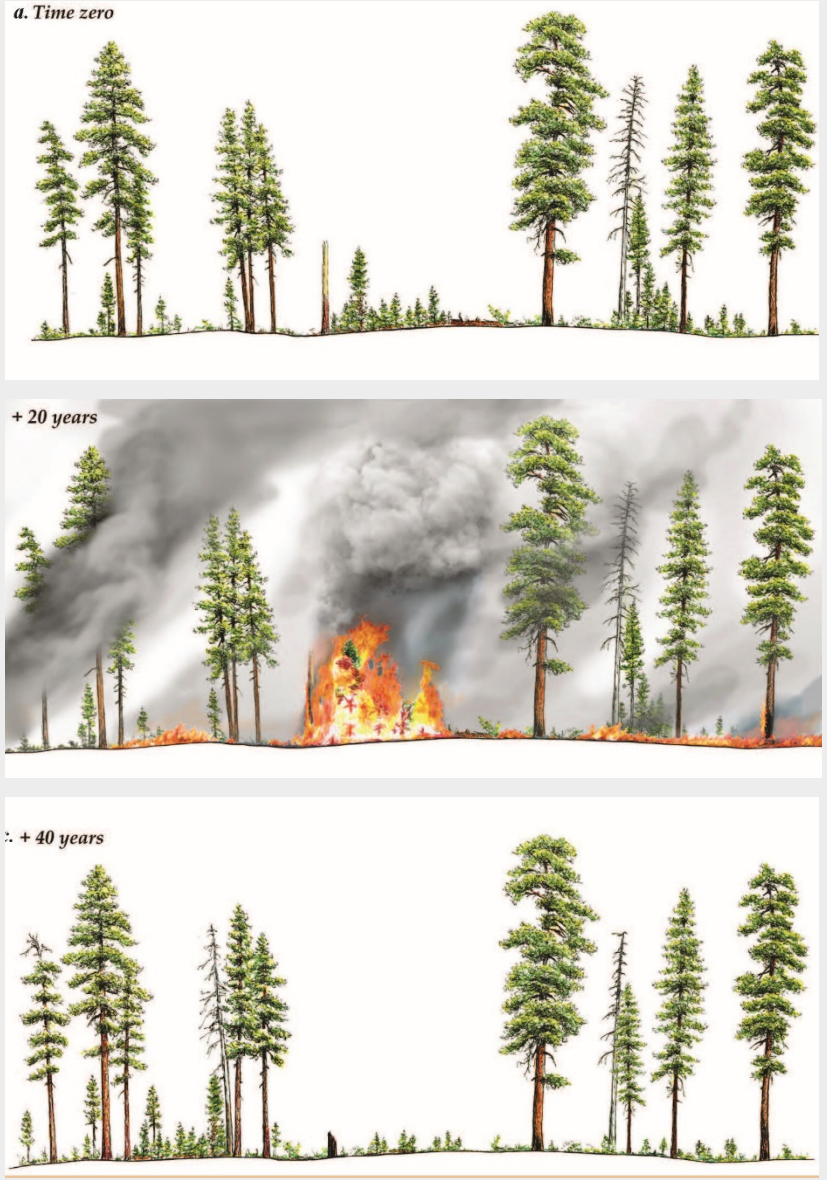
Fire Rotation was **15 years!**

Resilience – Is the capacity of an ecosystem *to respond* to a disturbance *recovering* ecosystem structure and function



Resistance – The property of an ecosystem to remain essentially unchanged when subject to disturbance. Ecosystem structure and function is *maintained* when disturbance occurs.

Ecosystem Resistance in Dry Forests with Frequent Fire



Van Pelt 2008

Structure

- Low-density with large, fire and drought resistant trees
- **No "Stands" -** Multiple successional phases (seedling sapling, stem exclusion, old-growth, early seral, etc.) occurred in a small area and are maintained over time

Dynamics

- Tree mortality and establishment was a fine-scale process
- This produced fine-scale variability in forest structure and many tree age classes

Resistance

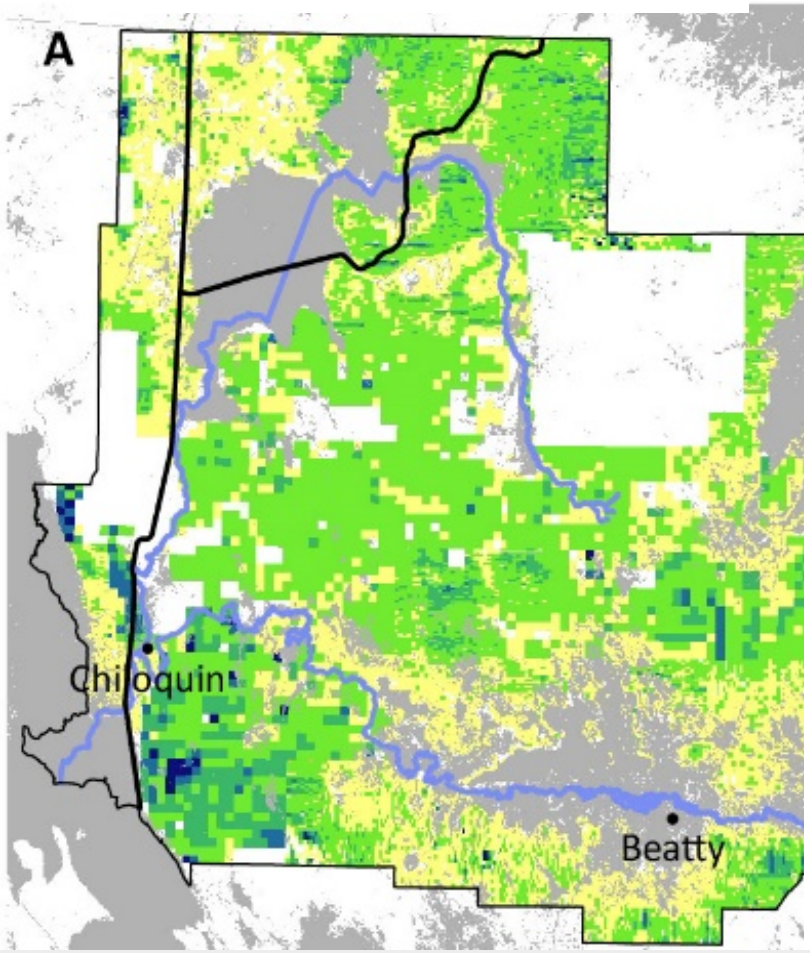
- Ecosystem resistance operated at scales < 2 acres

Vast Areas of Resistant Forest Conditions

Stands with low tree densities and dominance of large-diameter ponderosa pines characterized the inventoried forests across all vegetation zones from xeric ponderosa pine *to moist mixed-conifer*

Densification

Early 1900s



Density of Trees > 6 inches DBH

1920 = 28 trees/acre

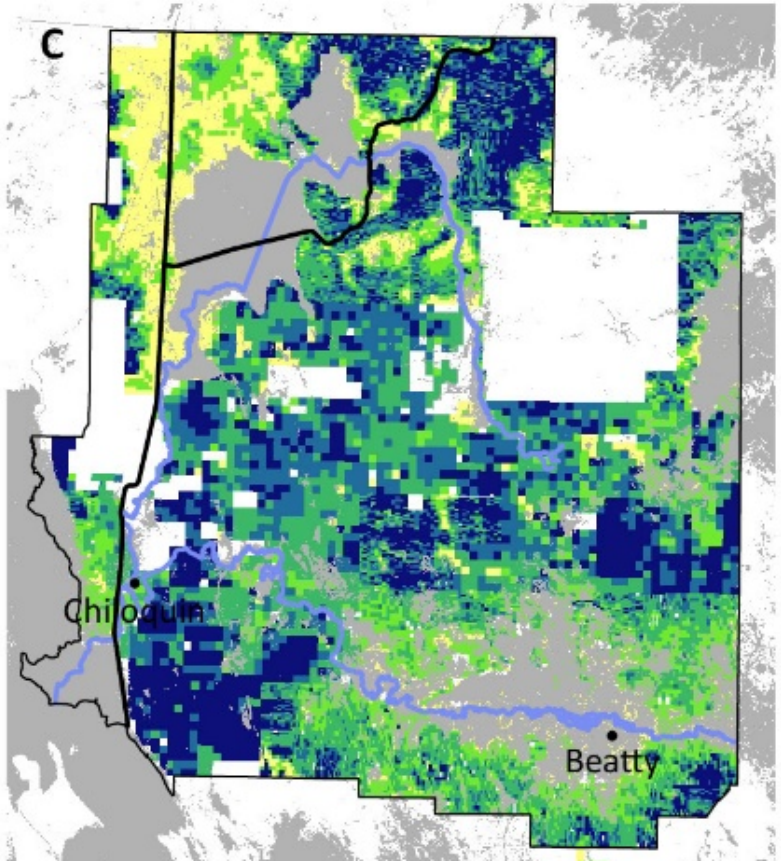
2014 = 95 trees/acre

Hagmann et al. 2014

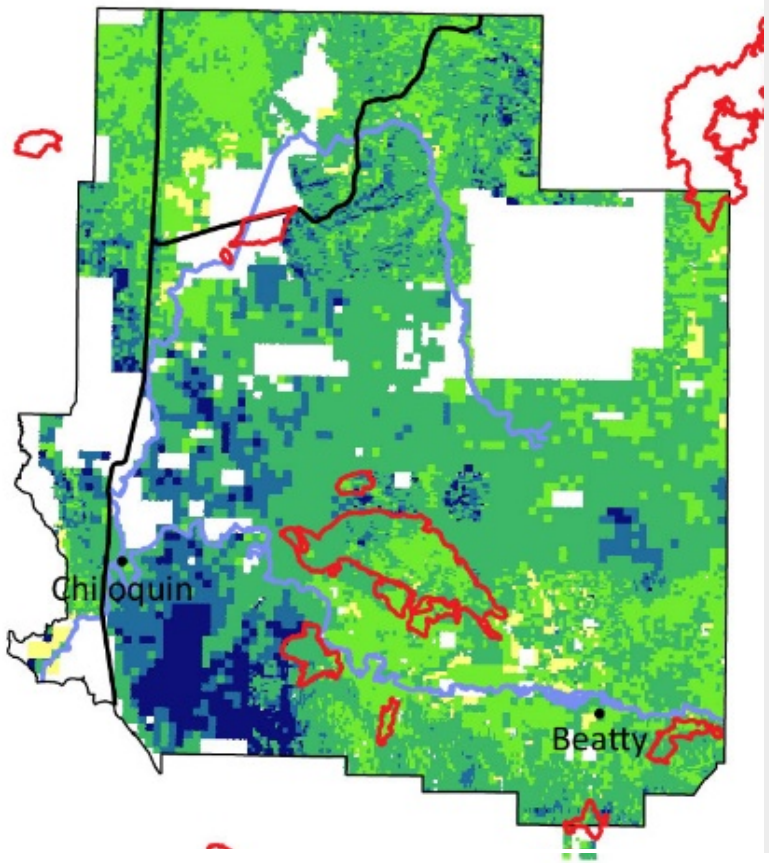
% canopy 0 - 10 11 - 20 21 - 30 31 - 40 41 - 80

Loss of Large Trees > 21” DBH

Early 1900s



2017



Early 1900s

Large trees made up 86% of basal area

Density of large and small trees was nearly equal! (44% to 56%)

Contemporary

Large trees make up 30% of basal area

9 in 10 trees are small

Trees per Acre > 21”

0 **1-4** **5-10** **11-14** **>15**

Hagmann et al. 2014

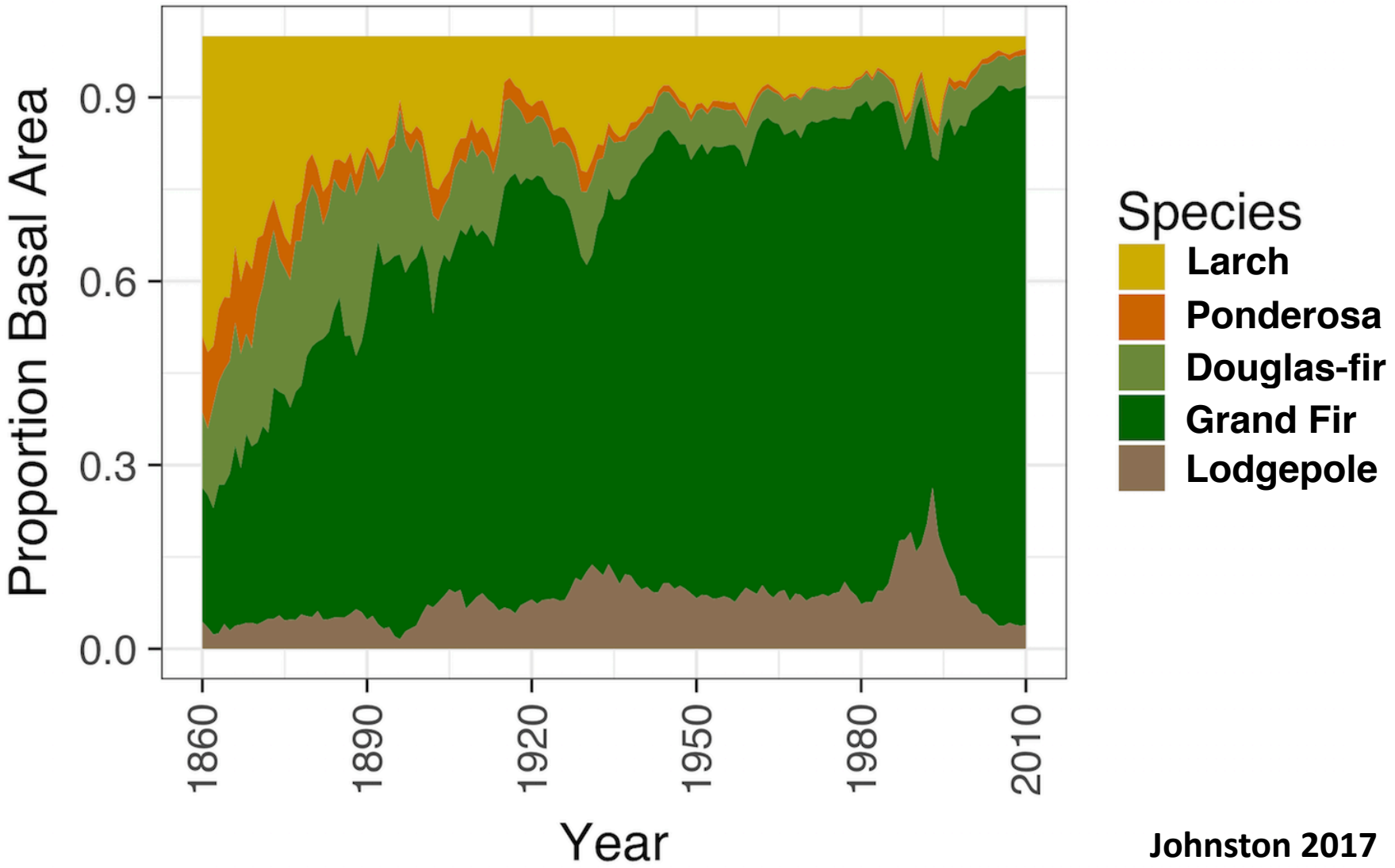
Mesophication – A Shift to Fire and Drought Sensitive Trees

Grand fir	**84%**
Douglas-fir	8%
Western larch	2%
Lodgepole pine	6%
Ponderosa pine	<1%

Historical fire frequency = **12-21 years**

Johnston 2017

Mesophication – A Shift to Fire and Drought Sensitive Trees



Johnston 2017

<u>Historical</u>

Shade intolerant	61%
Shade tolerant	39%

<u>Contemporary</u>

Shade intolerant	4%
Shade tolerant	96%

Contemporary Forest Composition & Historical Fire Frequency

Douglas-fir, incense-cedar, grand fir - Umpqua National Forest

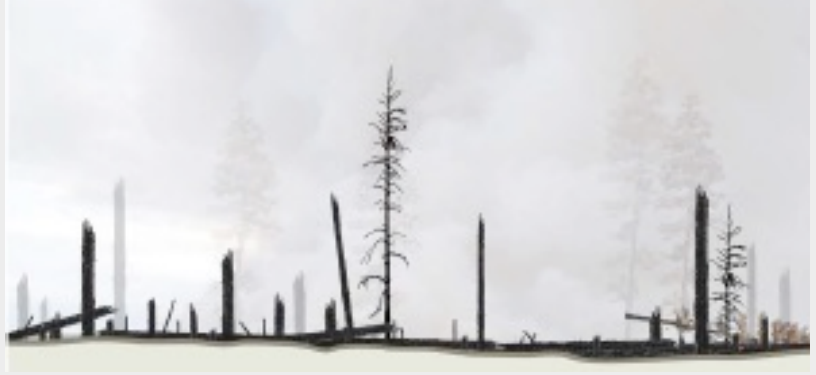
Mean Fire Return Interval from 1690 - 1860 = **6 years!**

Effects of Densification and Mesophication

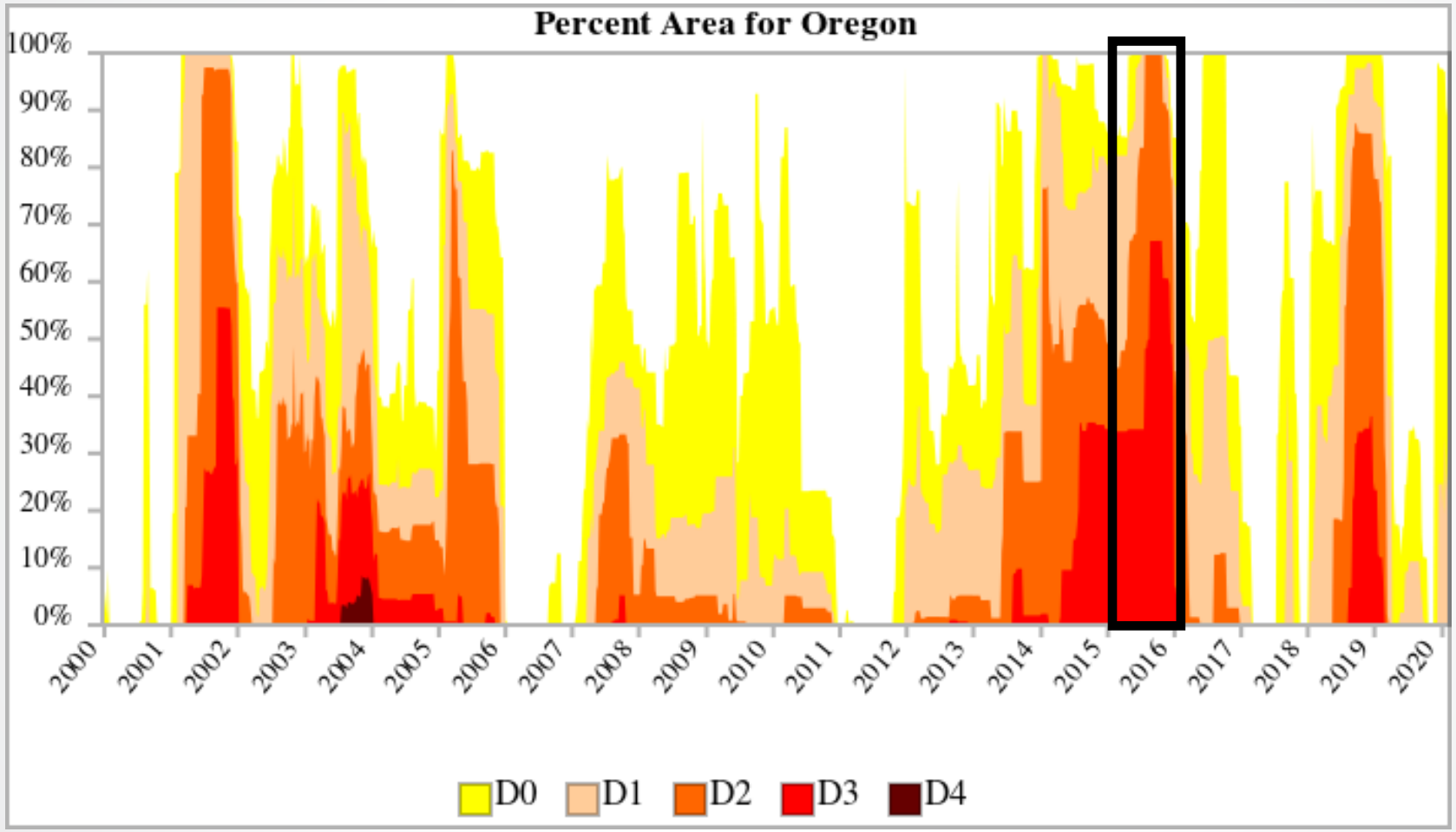
Increased host abundance, susceptibility, and dispersal for biological disturbance agents

Increased competition and susceptibility to drought

Losing Resistance



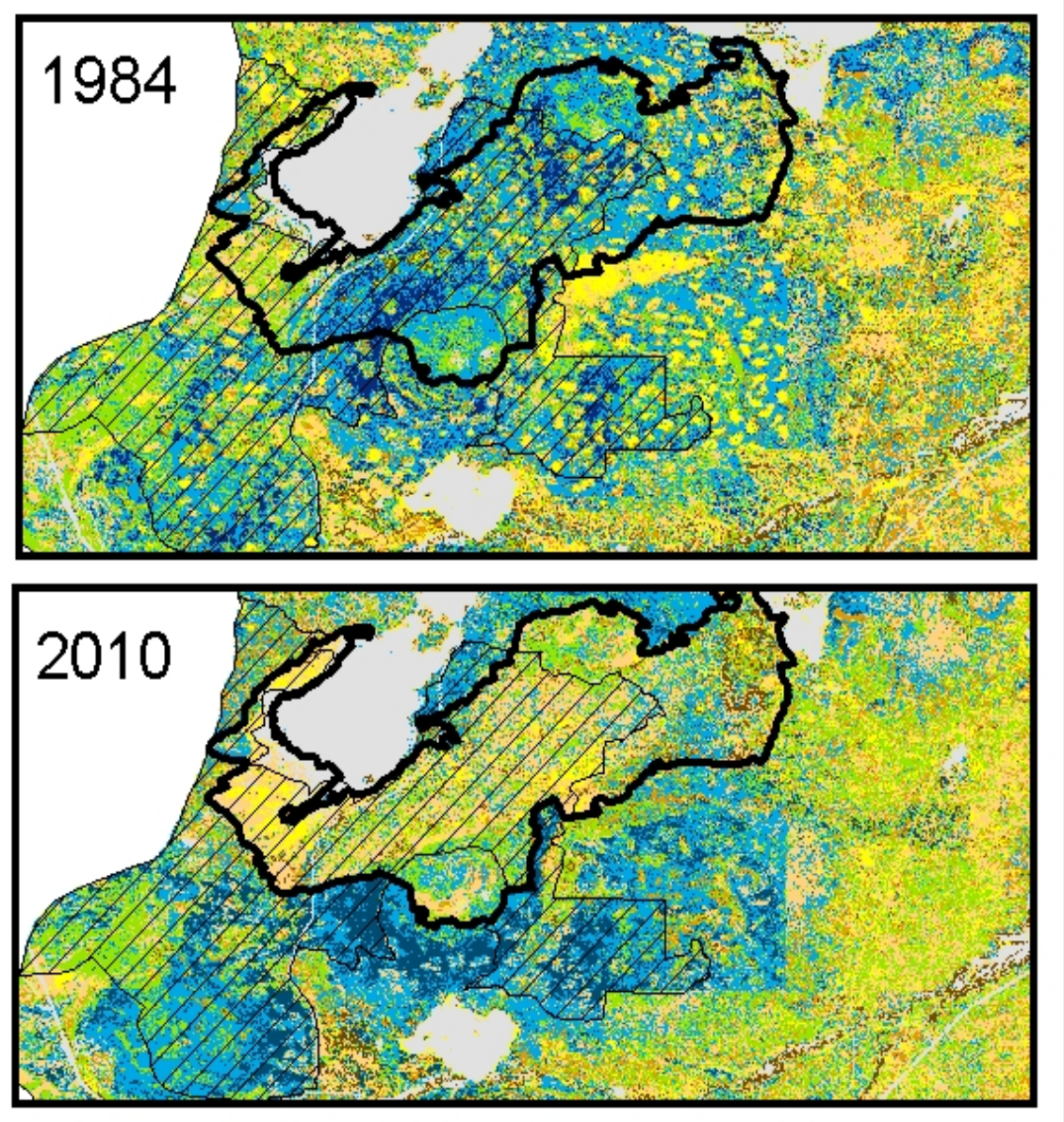
Drought in Oregon 2000-2020



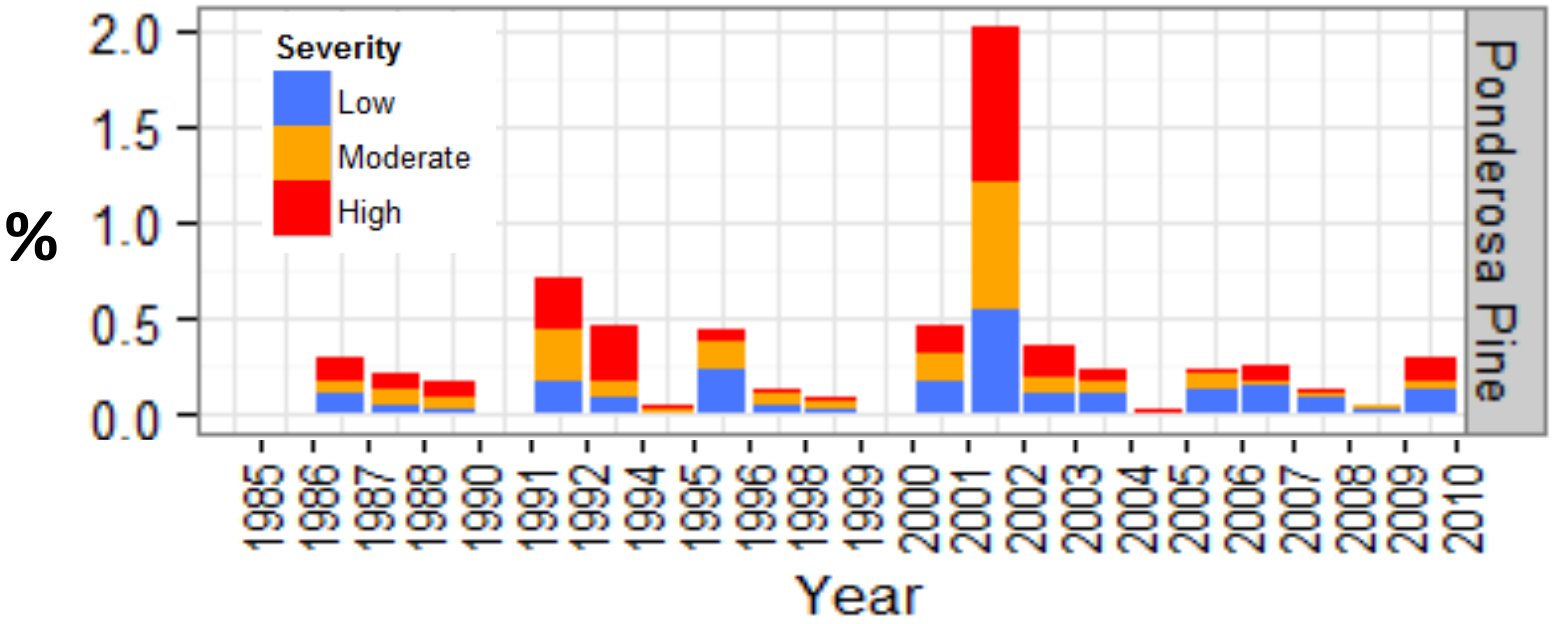
Drought in the past 20 years is unprecedented in historical records

https://www.drought.gov/drought/states/oregon

Contemporary Dynamics
Balancing Disturbances and Growth



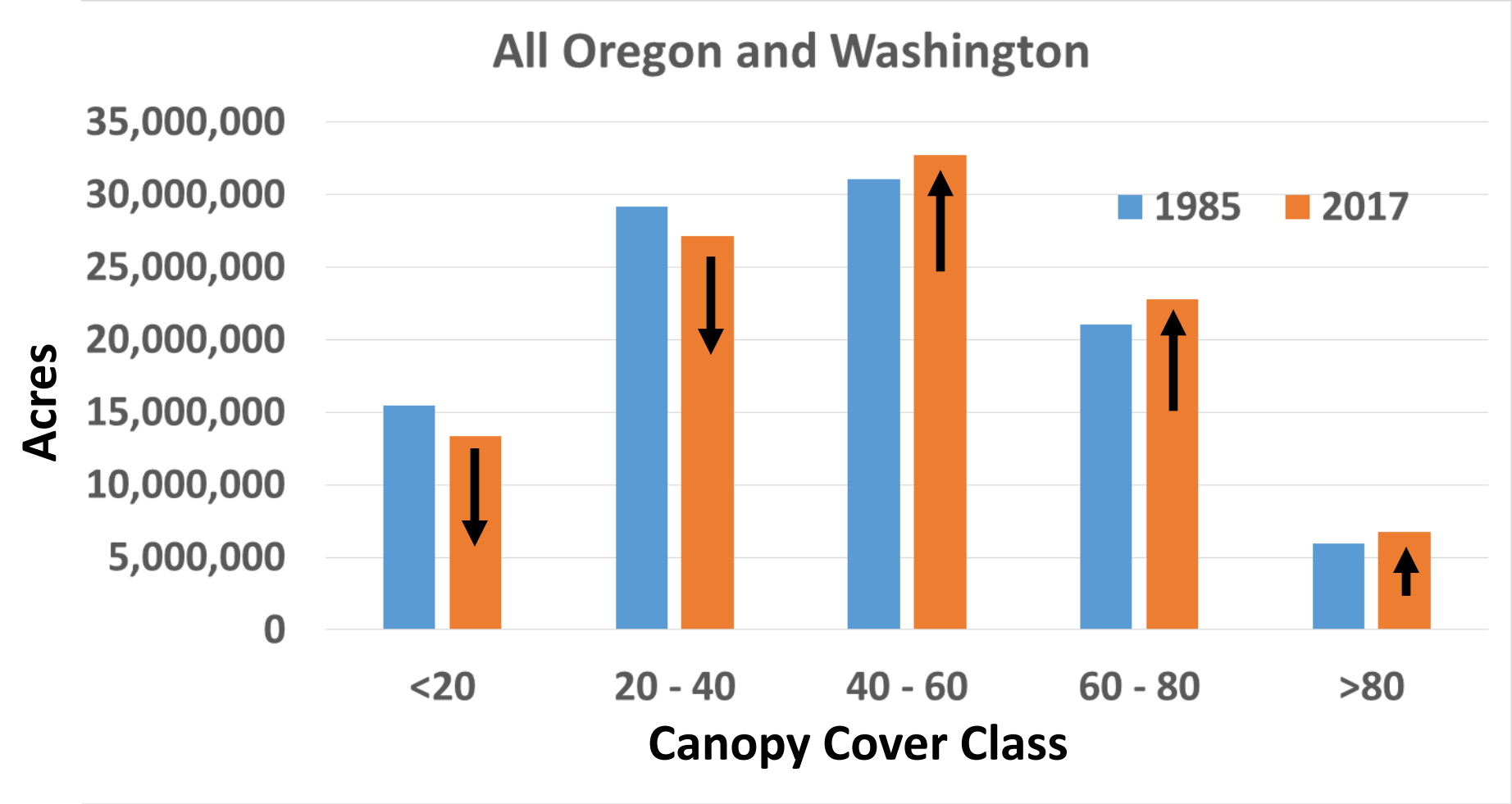
Contemporary Fire Regimes 1985 - 2012



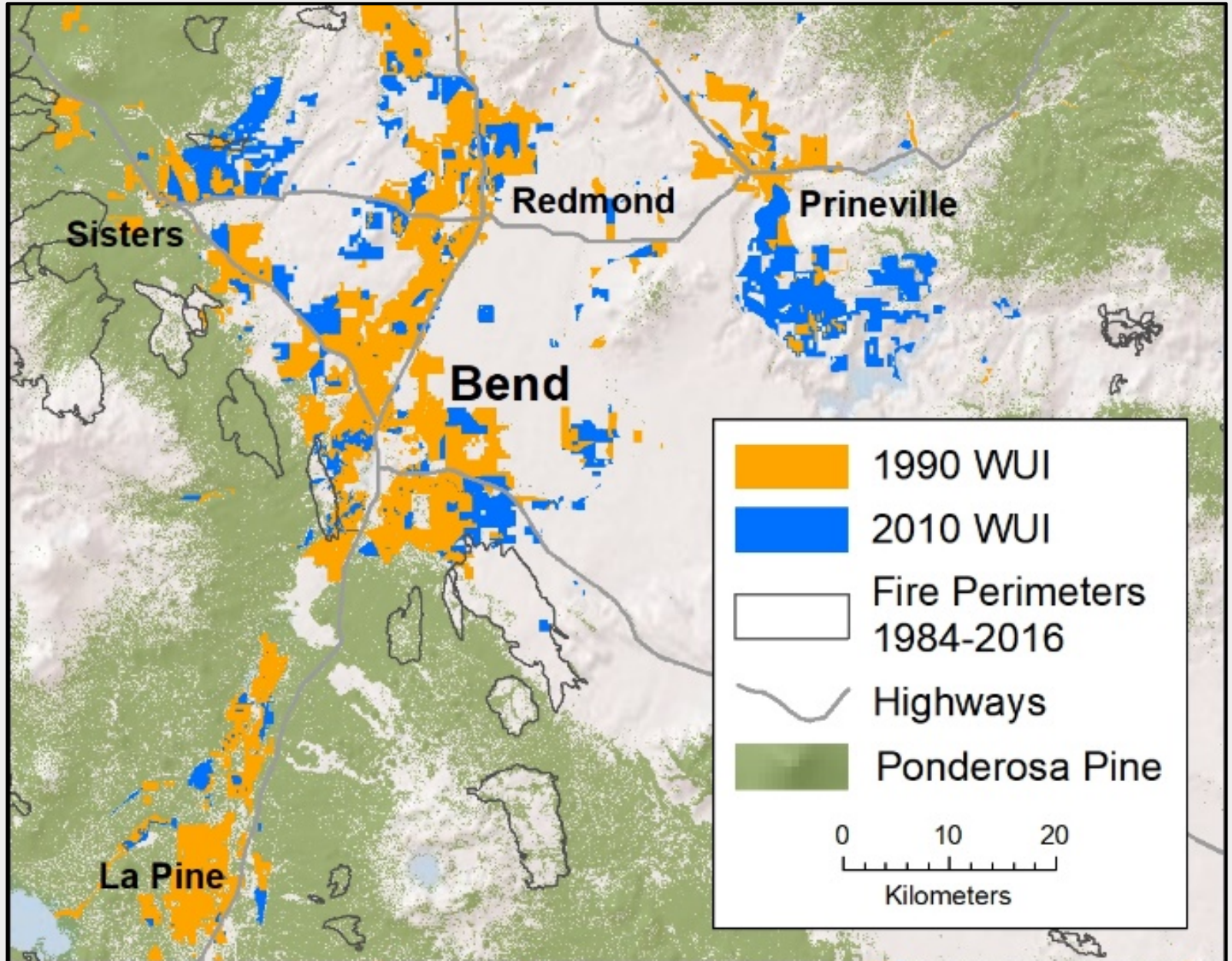
- Fire rotation is still ~20x longer than it was historically!

Reilly et al. 2018

Contemporary Dynamics 1985-2017
Densification Continues



Expansion of the Wildland Urban Interface and Fire



Forecast for Living with Fire & Dry Forests

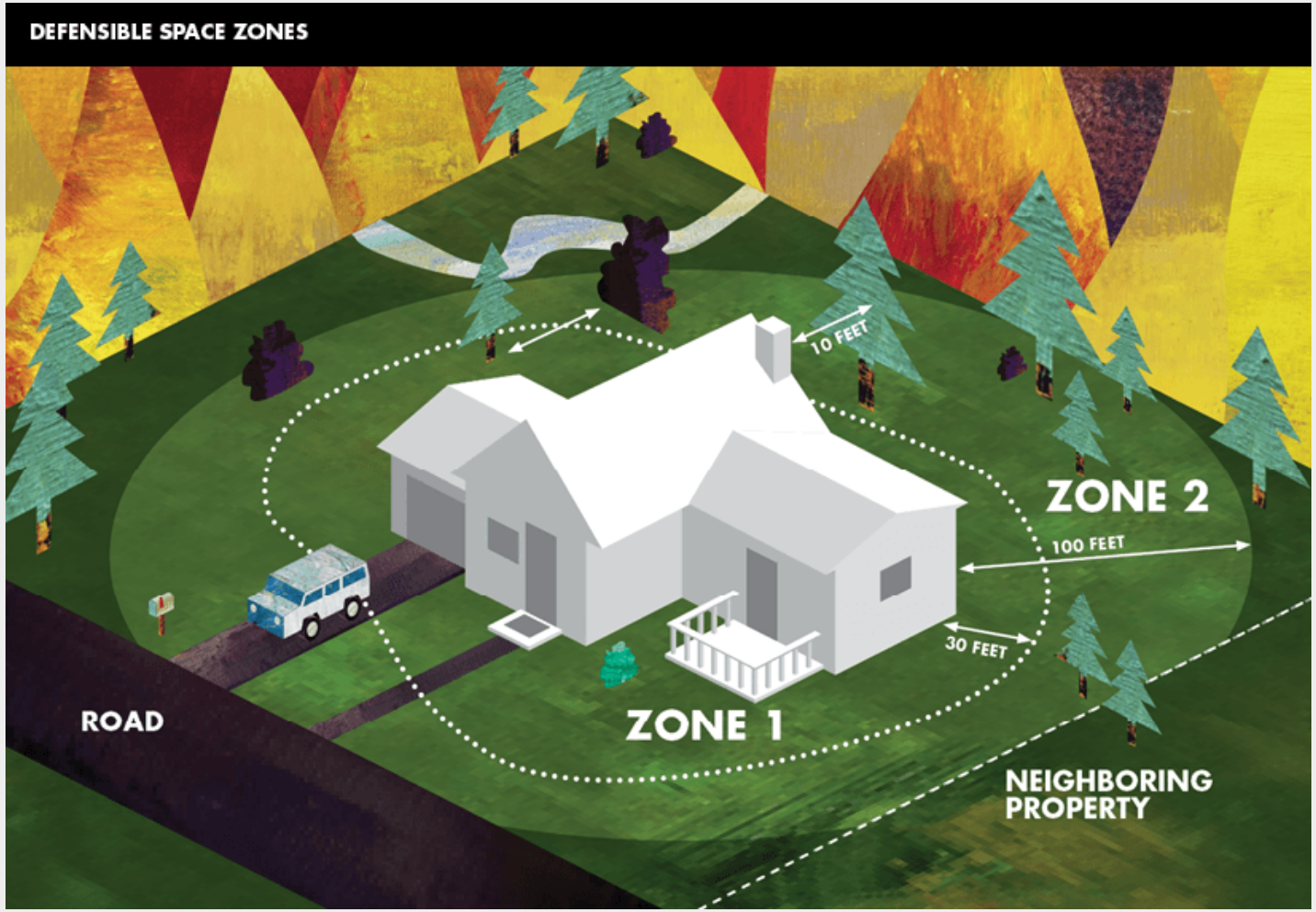
- Large Mixed-Severity Fires with Substantial Local Impacts
- Increased Prescribed Fire and Wildfire Use
- MORE Smoke
- Episodic mortality from Biological Disturbances Agents Triggered by Drought

Mitigation of Fire Effects on Humans and Property

Property damage is determined by conditions on private property, even if the surrounding forest has been treated

Responsibility lies with property owners not public land managers

Firewise



Kramer et al. 2019, Calkin et al. 2014

Mitigation and Planning for Smoke

Smoke-Ready Toolbox for Wildfires

Wildland fires produce air pollution that impacts people's health and other aspects of daily life. The increased frequency and intensity of wildfires in the United States are adversely affecting air quality and putting more people at a health risk from exposure to smoke. Public health officials and others can use the resources in the Smoke Ready Toolbox to help educate the public about the risks of smoke exposure and actions people can take to protect their health.

Smoke & Your Health

- AirNow
- Smoke Advisories
- Fires and Your Health
- Frequent Questions
- Smoke Sense App
- Prepare for Natural Disasters and Recovery
- Before, During, and After a Wildfire (CDC.gov)

Current Fires

- Current Fires
- Current Fire Incident Information System
- NOAA Smoke Forecast Tool
- NOAA's Fire Weather Outlook
- GEOMAC Wildland Fire Support
- MODIS Active Fire Mapping
- National Interagency Coordination Center
- National Interagency Fire Center

Featured Resources

New resource en español now available:

- Caja de herramientas "Smoke Ready" (Listo para el humo) para incendios forestales
- Blog: Using the Smoke Sense App During the Camp fire in California

Wildland Fire Publications, Fact Sheets, and Other Resources

- Fact Sheets
  - Reduce Your Smoke Exposure
  - Protecting Children from Wildfire Smoke and Ash
  - Respiratory Protection
  - Protect Your Pets from Wildfire Smoke
  - Protect Your Large Animals and Livestock
- Wildfire Smoke Guide
- Infographic: Reduce Health Risks from Wildfire Smoke & How to Use a Respirator
- More Wildland Fire Resources

For Health Professionals

- Online Training
- Wildfire Smoke Guide for Public Health Officials

https://www.epa.gov/smoke-ready-toolbox-wildfires

Final Thought(s)

Our dry forests were more prepared for disturbances exacerbated by climate change/drought in 1900 than they are today.

Unprecedented Droughts and Climate Change are a ***catalyst*** for uncharacteristic mortality from disturbances, but forest conditions ultimately determine how a changing climate will impact dry forest ecosystems.

We can’t stop drought or climate change, but we can change how we manage and use wildfire in a way that restores resistance in dry forests.

Harold Weaver in 1943

If it is decided to permit such species as white fir to come in under mature ponderosa pine, how much of the public's money are foresters justified in spending in trying to keep fire out?

Even with unlimited funds, personnel, and equipment, can they give reasonable assurance that they can continue to keep such extremely hazardous stands from burning up?

Will the timber products of such stands justify the high protection costs and fuel hazards?