

Fire Ecology of Westside Forests in the Pacific Northwest



Matt Reilly

USFS PNW Research Station

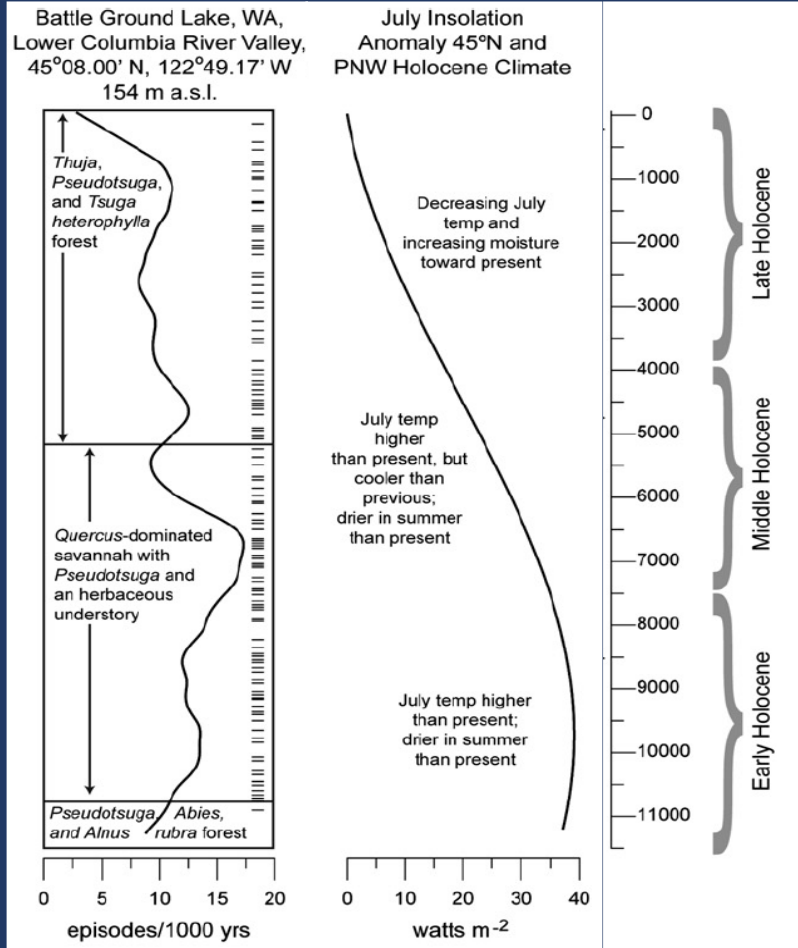
Corvallis, Oregon

Fire is a Fundamental Physical, Evolutionary, and Ecological Process

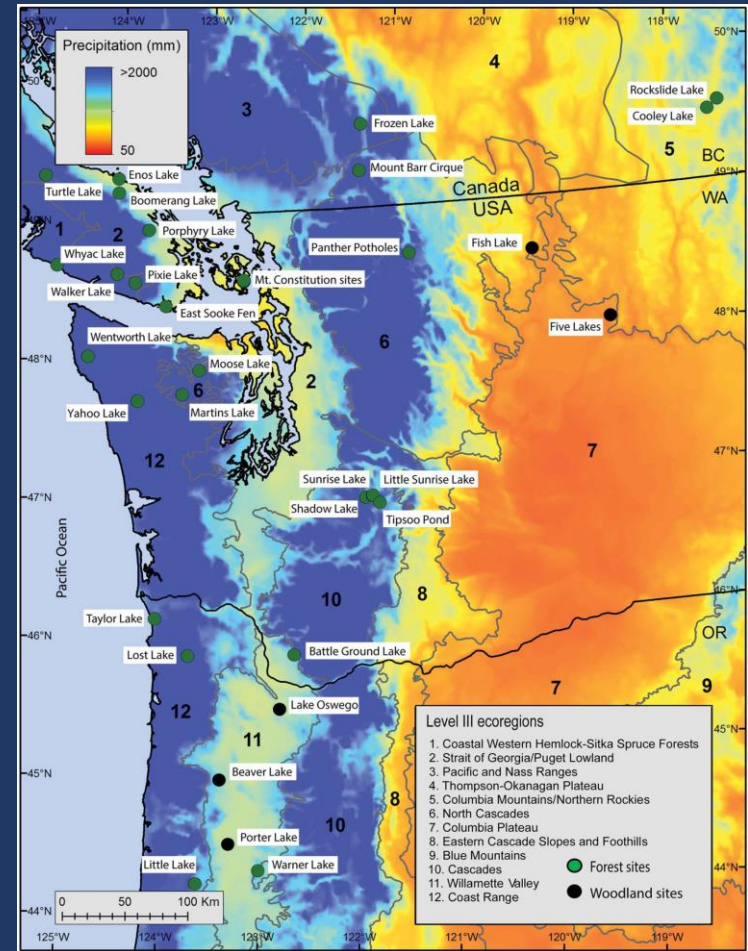
- Oxygen, fuel, and ignition = combustion
- Important part of the natural disturbance regime and driver of stand, landscape, and regional forest dynamics in the Pacific Northwest
- Species are differentially adapted to fire and have traits that affect to resistance and resilience



Long-term Perspective



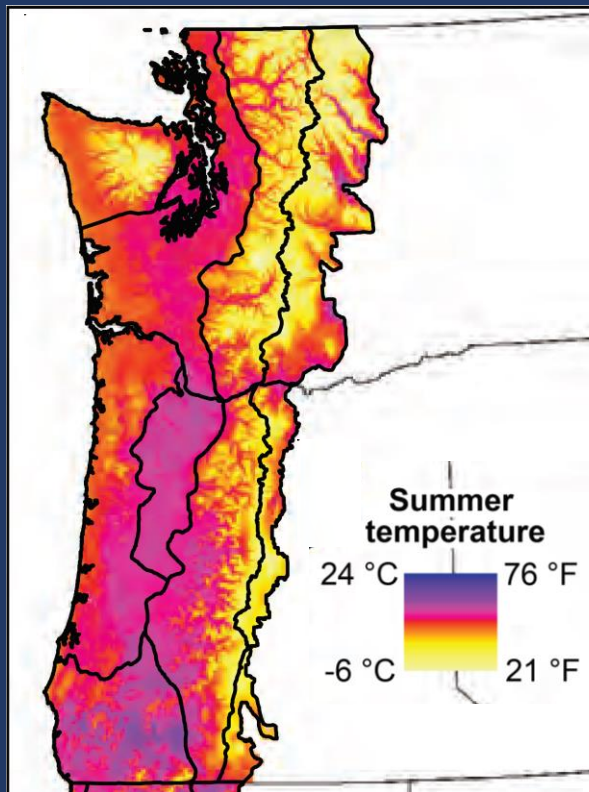
Walsh et al. 2010



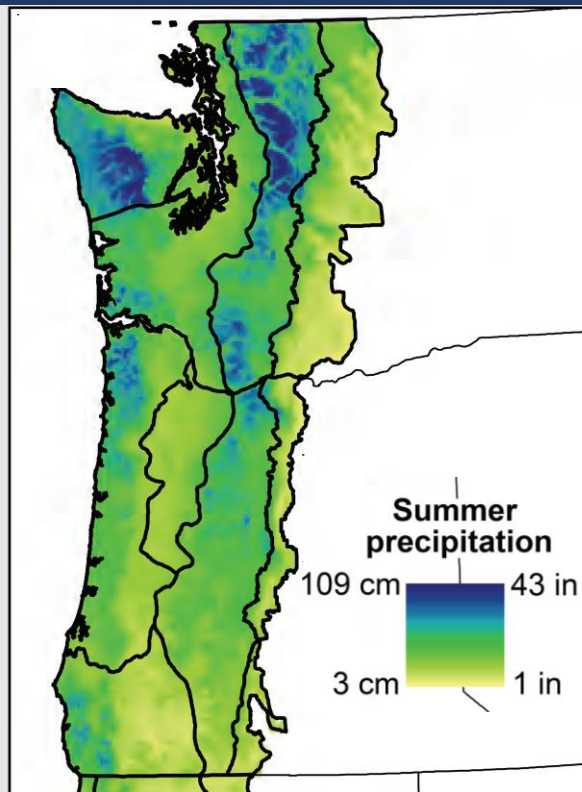
Walsh et al. 2015

The Bioclimatic Setting

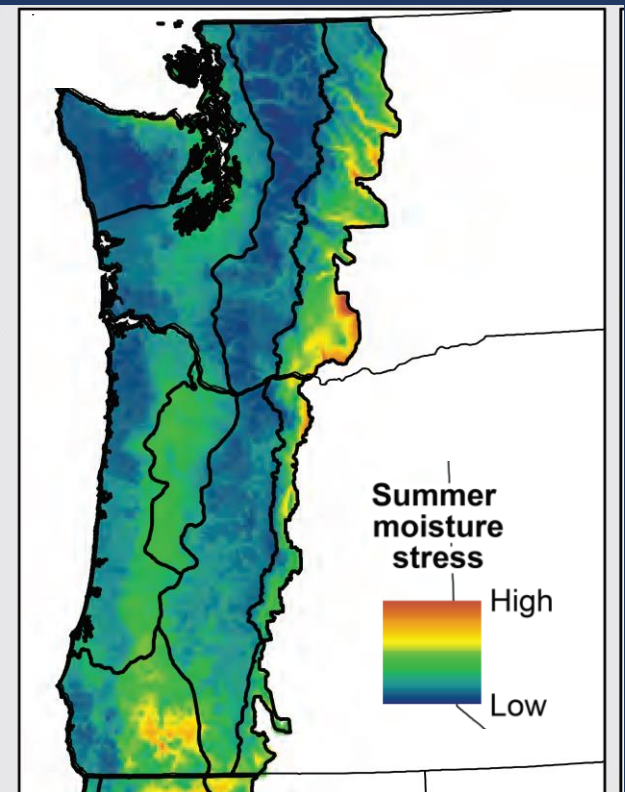
Summer Temperature



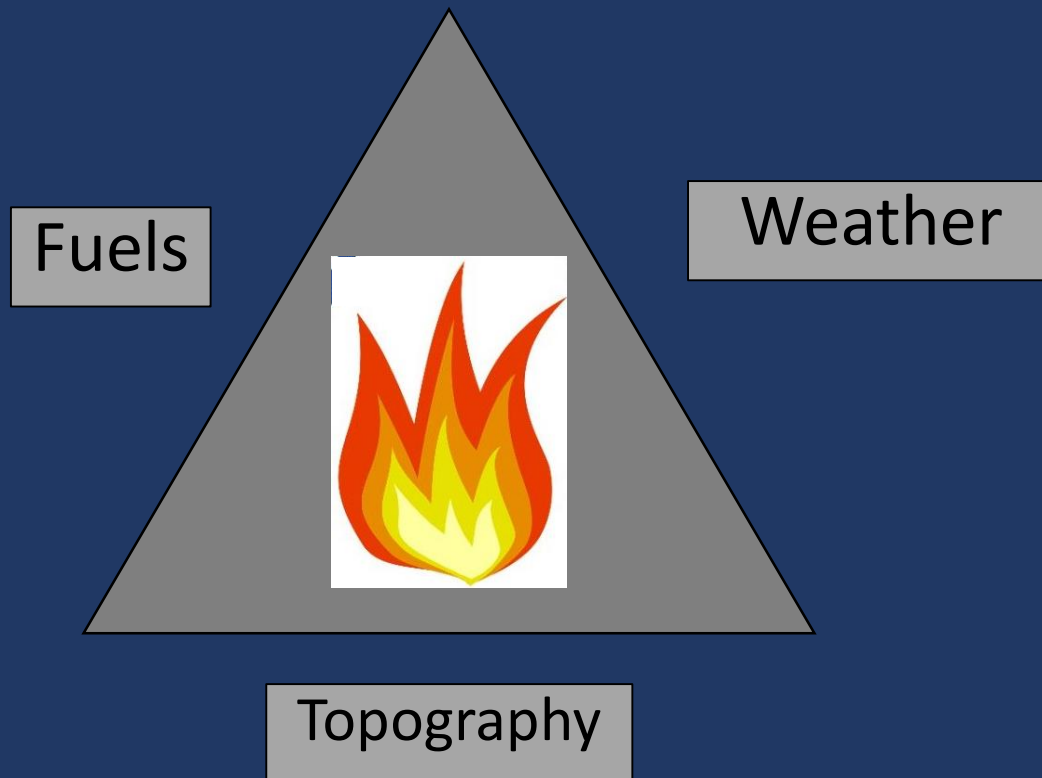
Summer Precipitation



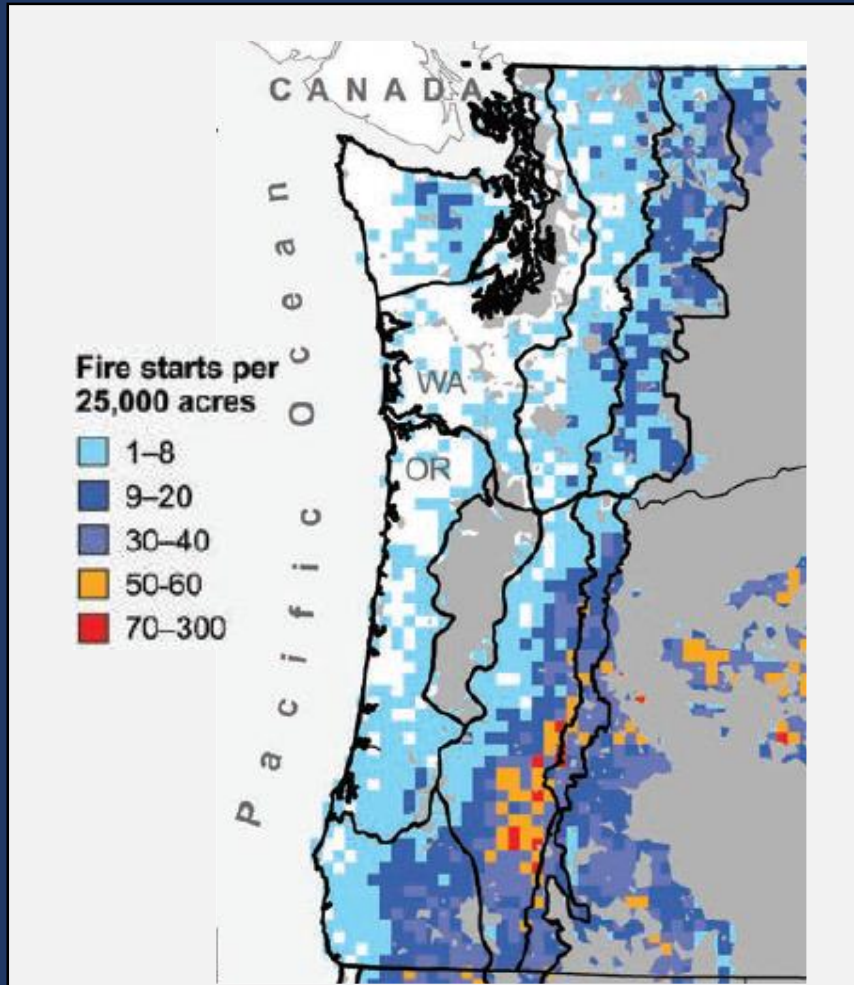
Summer Drought



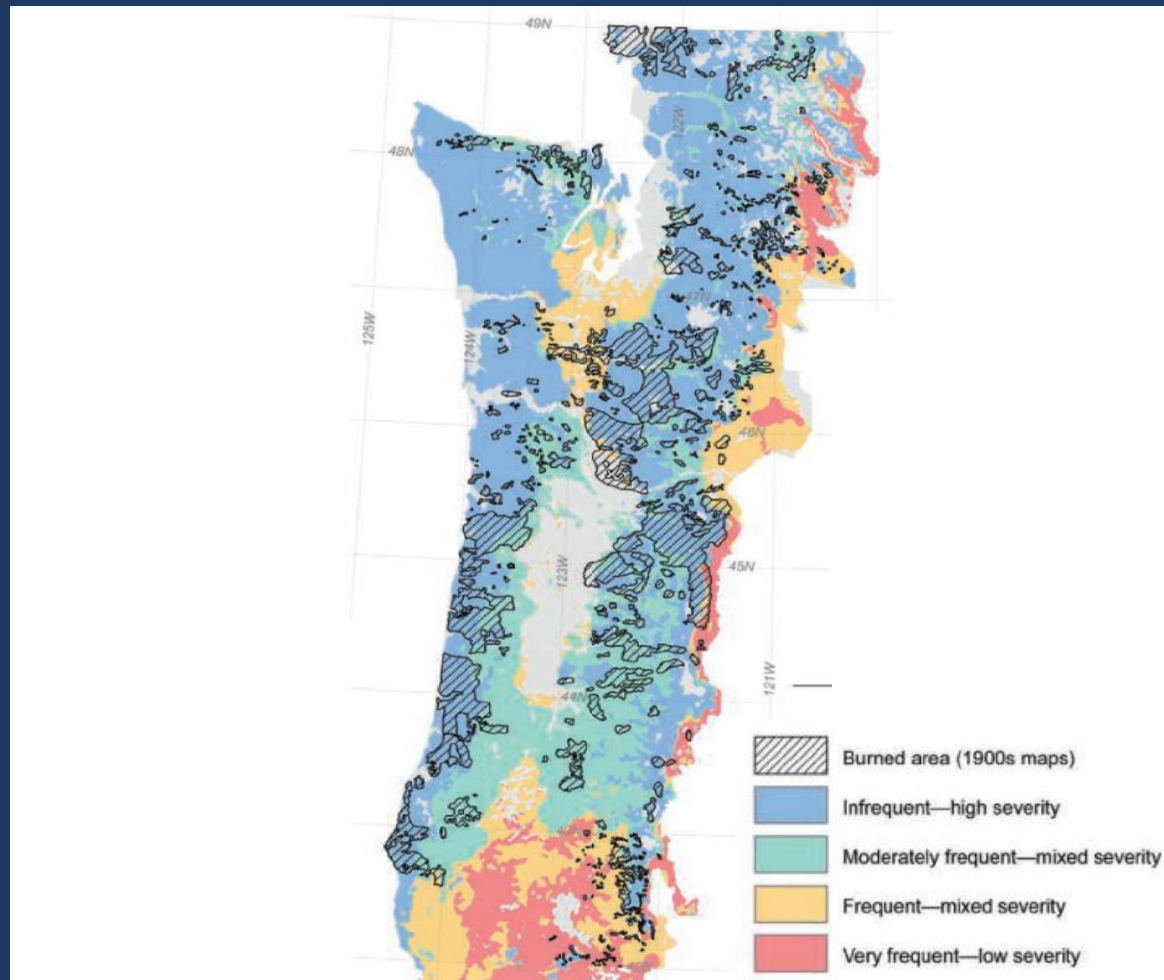
The Fire Environment



Ignition



Presettlement Fire Regimes



Presettlement Fire Regimes

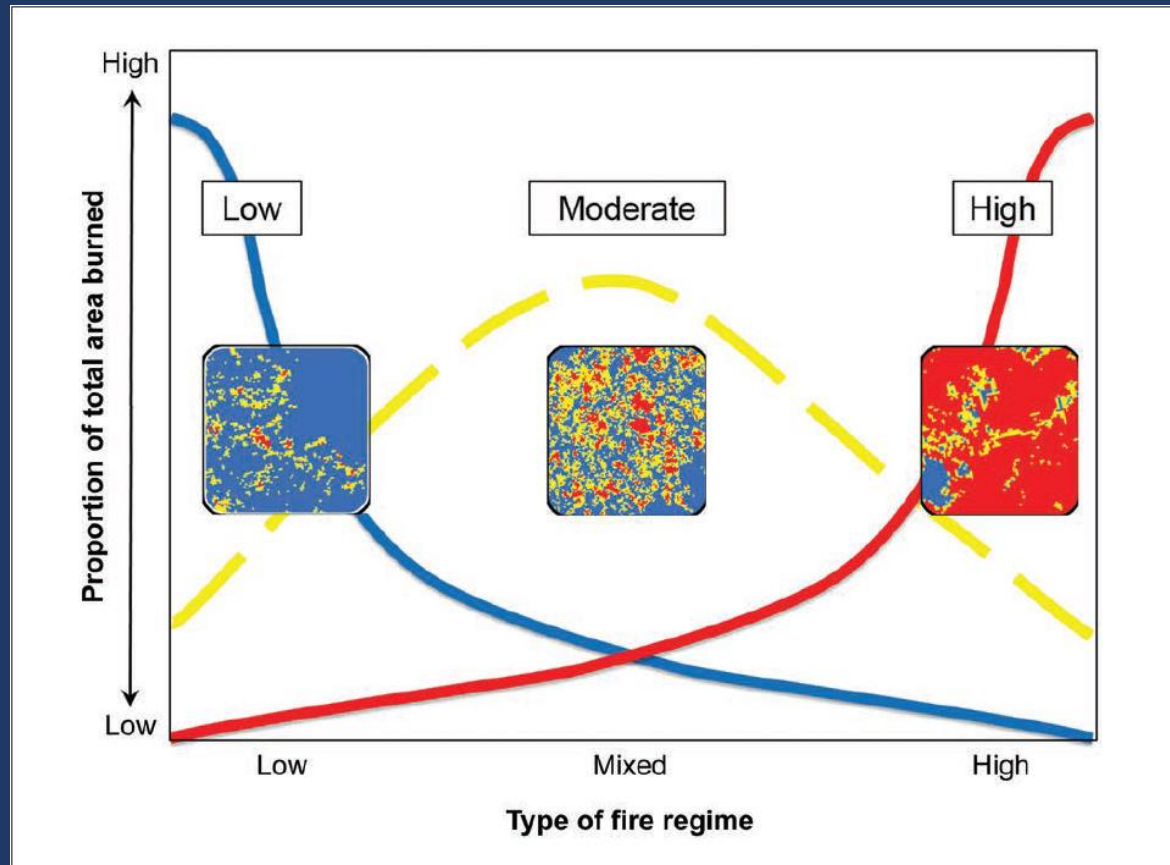


Figure 3-5—Conceptual diagram characterizing the proportions of low-, moderate-, and high-severity fires in three major fire regime classes. Inset panels represent idealized landscape dynamics associated with each regime based on proportions and size class distributions of patches at each of the three levels of severity. From Reilly et al. 2017, who modified it slightly from Agee (1993, 1998).

Frequent, Low-Severity

- More typical of the dry forest east of the Cascades but characteristic of low elevation oak woodlands
- Numerous fire scar studies from ponderosa pine
- Conditions for burning and ignition are abundant, but fuels usually limit fire

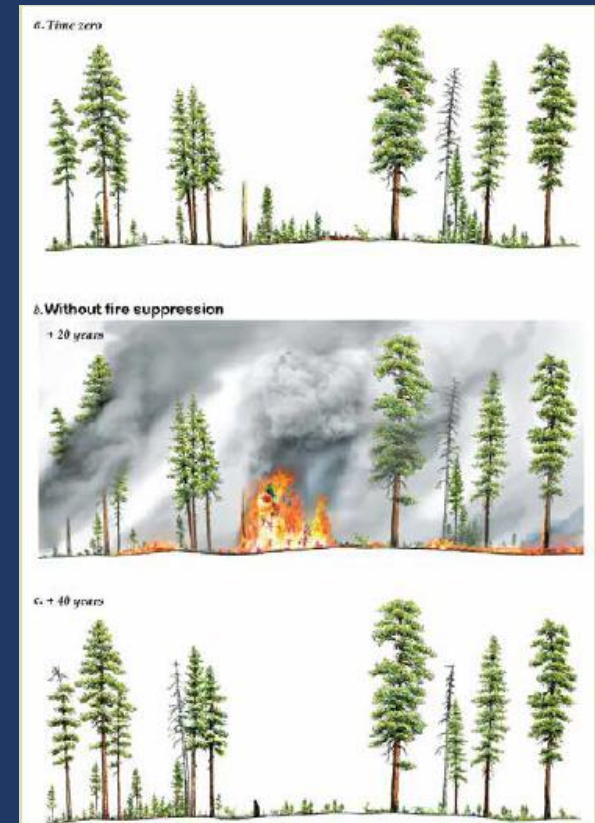


Illustration by Bob Van Pelt

Frequent, Low-Severity

- Long period of fire exclusion
- Increased density and changes in composition
- Increased potential for uncharacteristic fire behavior and effects
- Loss of old legacy trees

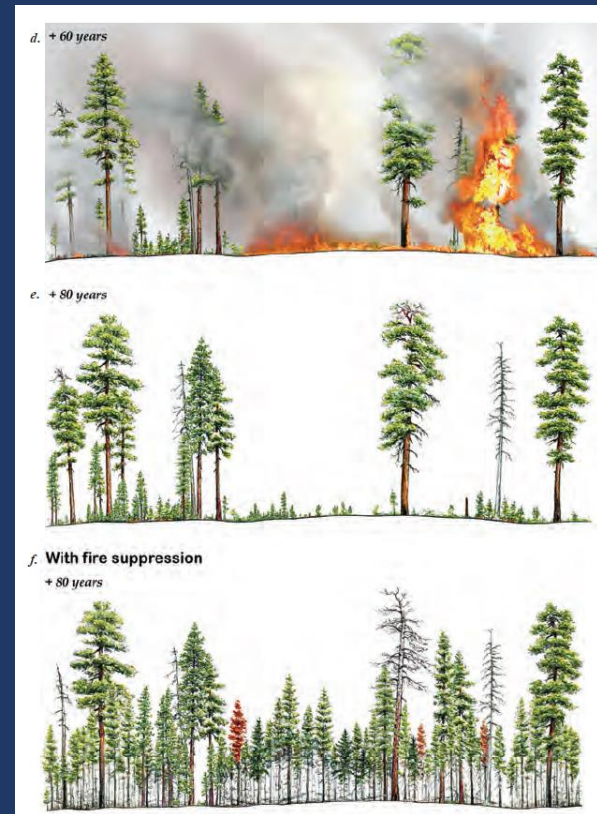


Illustration by Bob Van Pelt

Mixed Severity

- More complex and less well understood
- Limited number of fire scar studies
- Evidence for pre-settlement ecological role

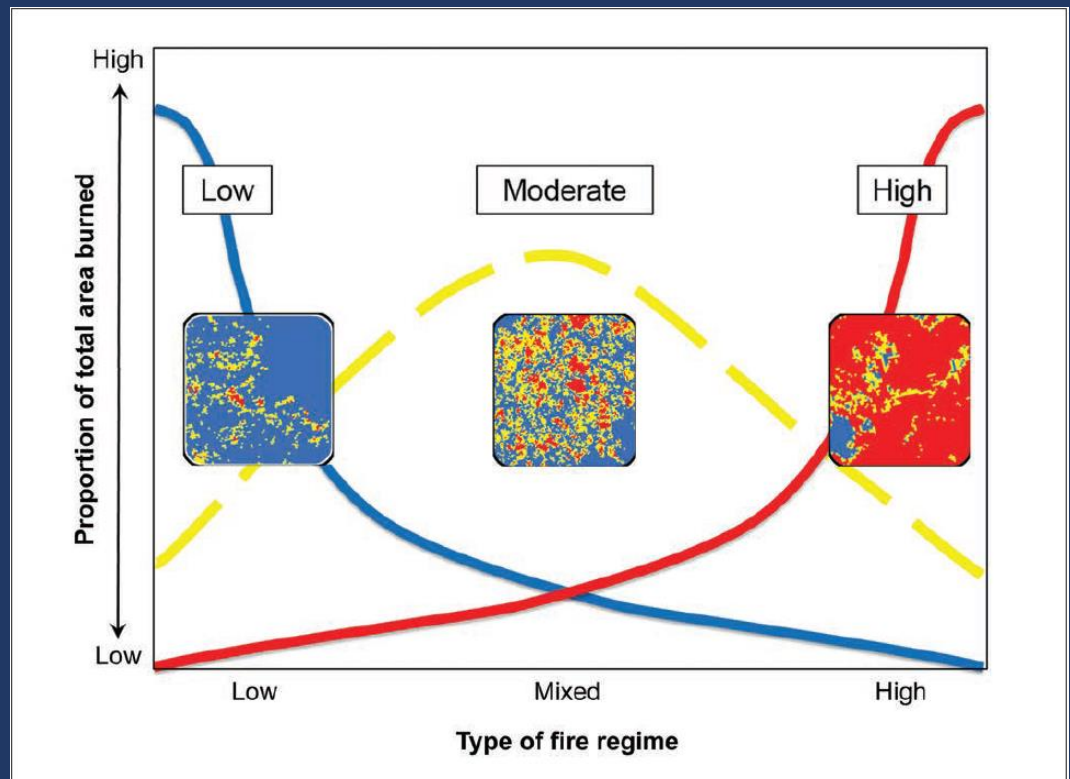
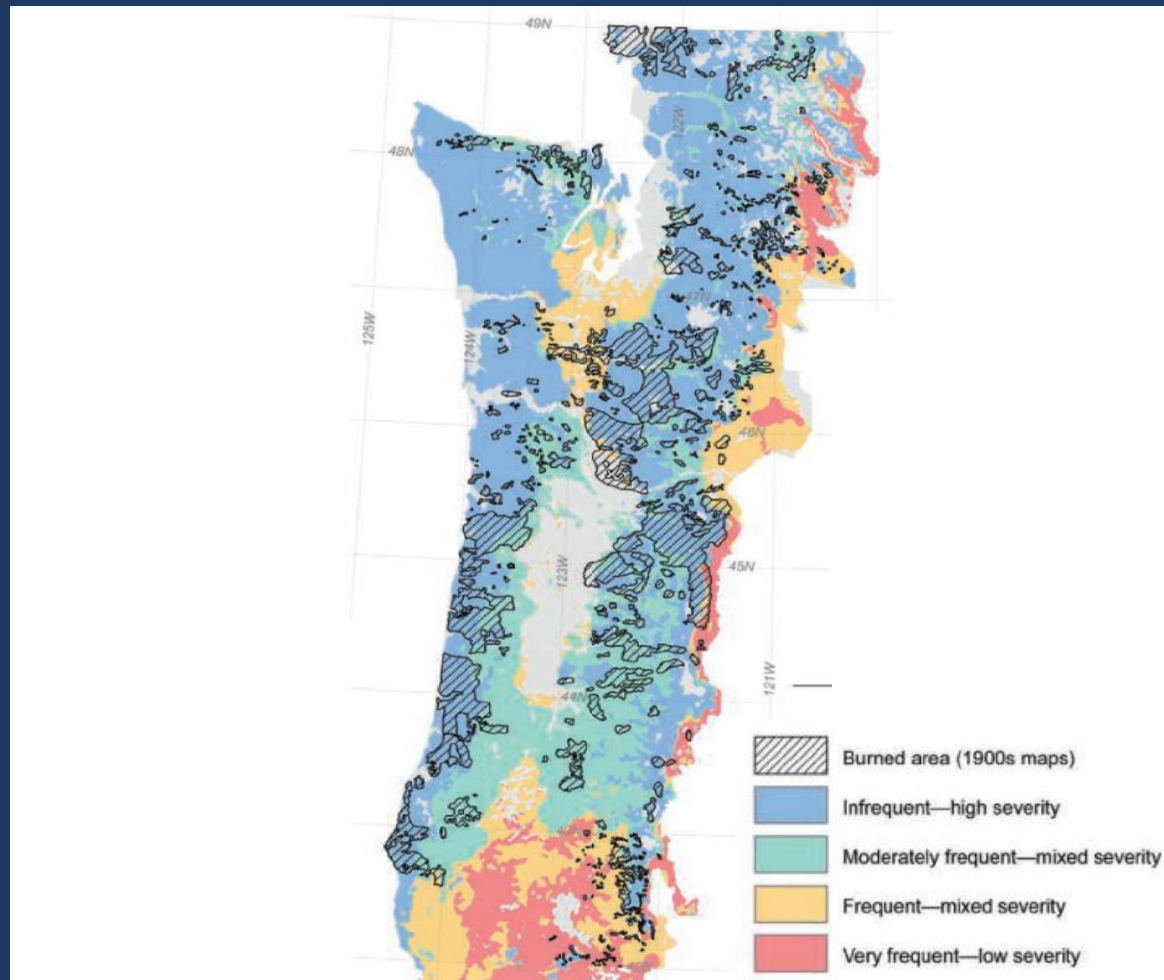


Figure 3-5—Conceptual diagram characterizing the proportions of low-, moderate-, and high-severity fires in three major fire regime classes. Inset panels represent idealized landscape dynamics associated with each regime based on proportions and size class distributions of patches at each of the three levels of severity. From Reilly et al. 2017, who modified it slightly from Agee (1993, 1998).

Presettlement Fire Regimes



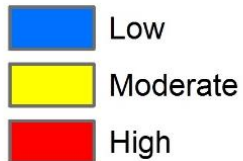
Fine and Coarse Scale Mosaic

- Strong “bottom-up” controls on fire behavior and severity
- Occasional large patches of high severity-fire in weather driven fires
- Fuels and topography are important

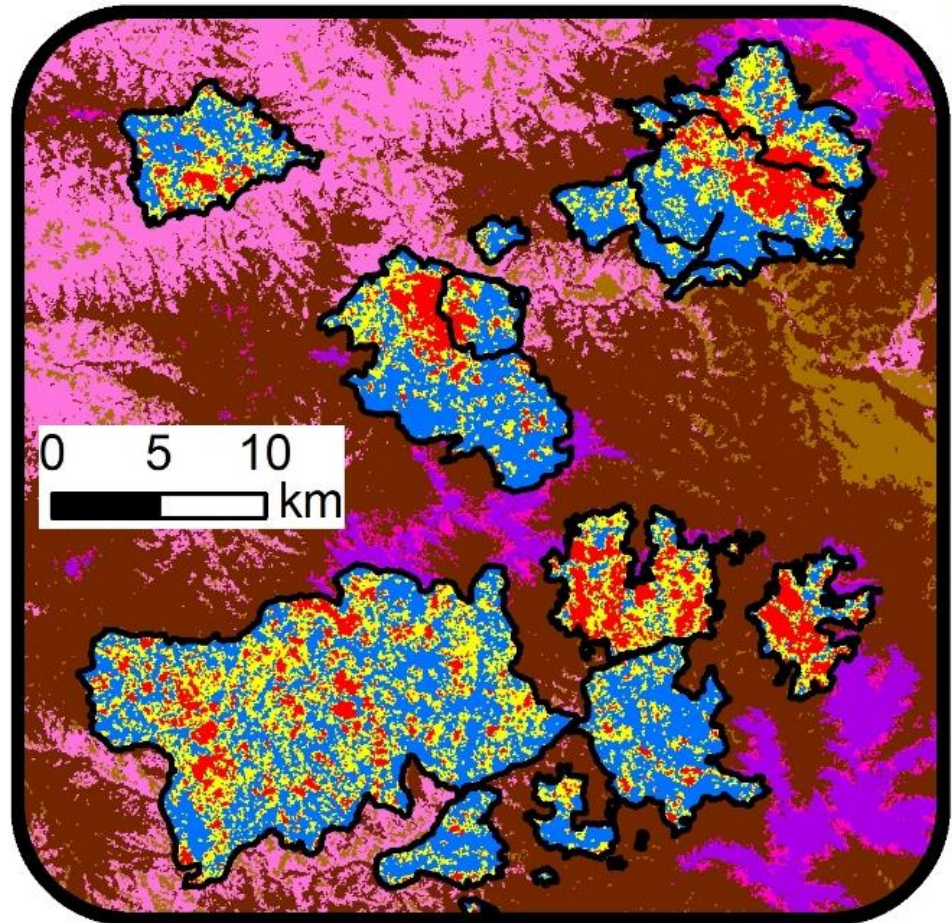


Fine and Coarse Scale Mosaic

Fire Severity



Vegetation Zone



Infrequent, High-Severity

- Long time periods between stand-replacing fires
- Evidence for pre-settlement ecological role
- Primarily in wet or cool forest types



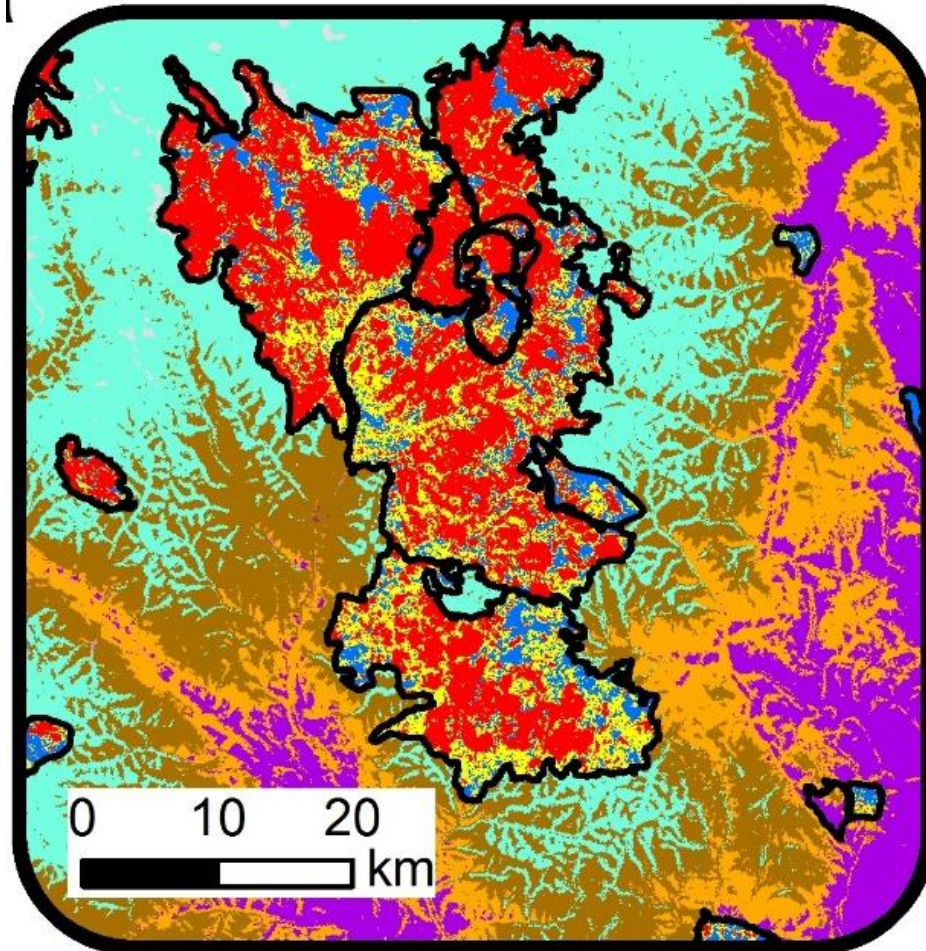
Illustration by Bob Van Pelt

Coarse Scale Mosaic

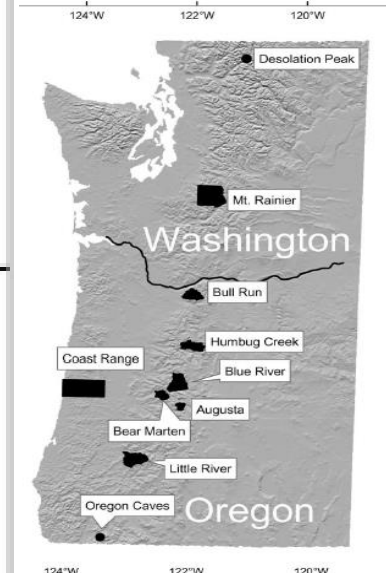
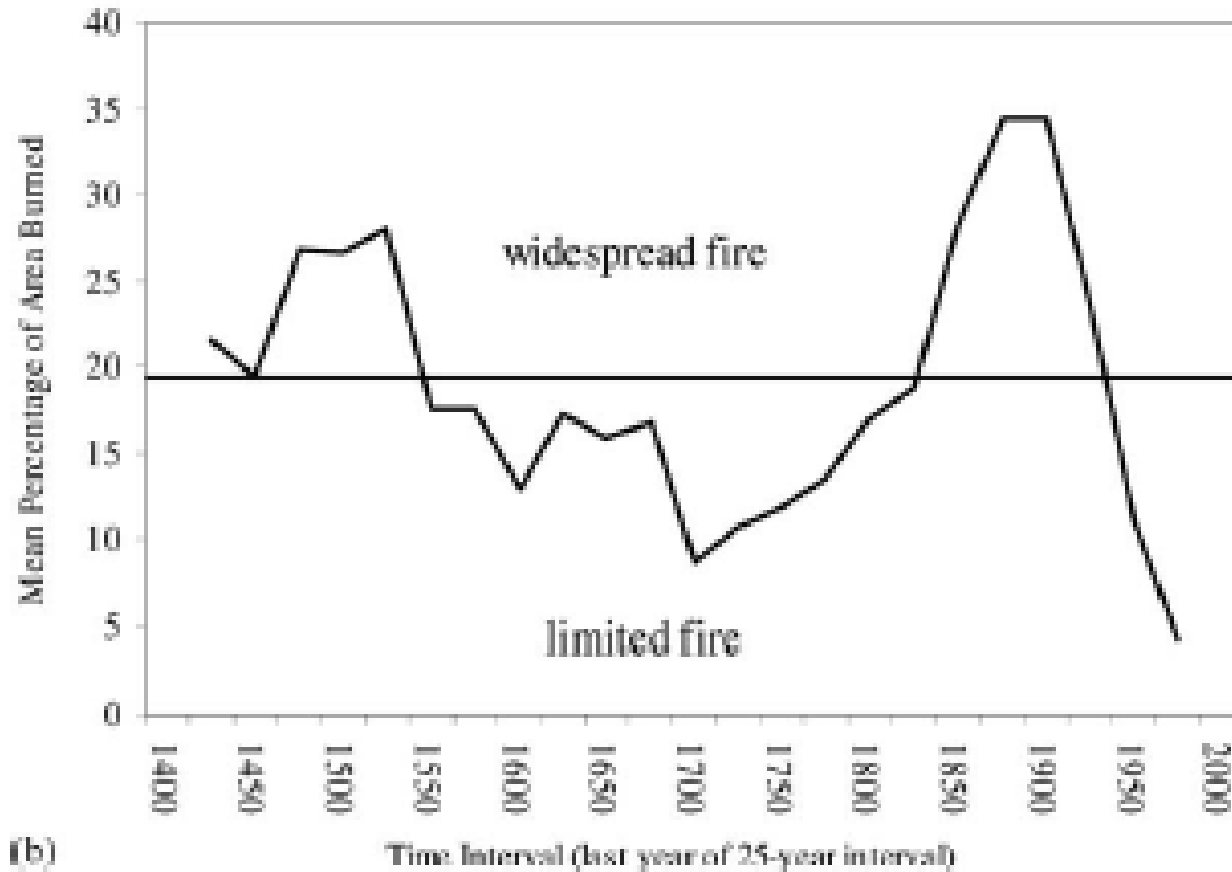
Fire Severity



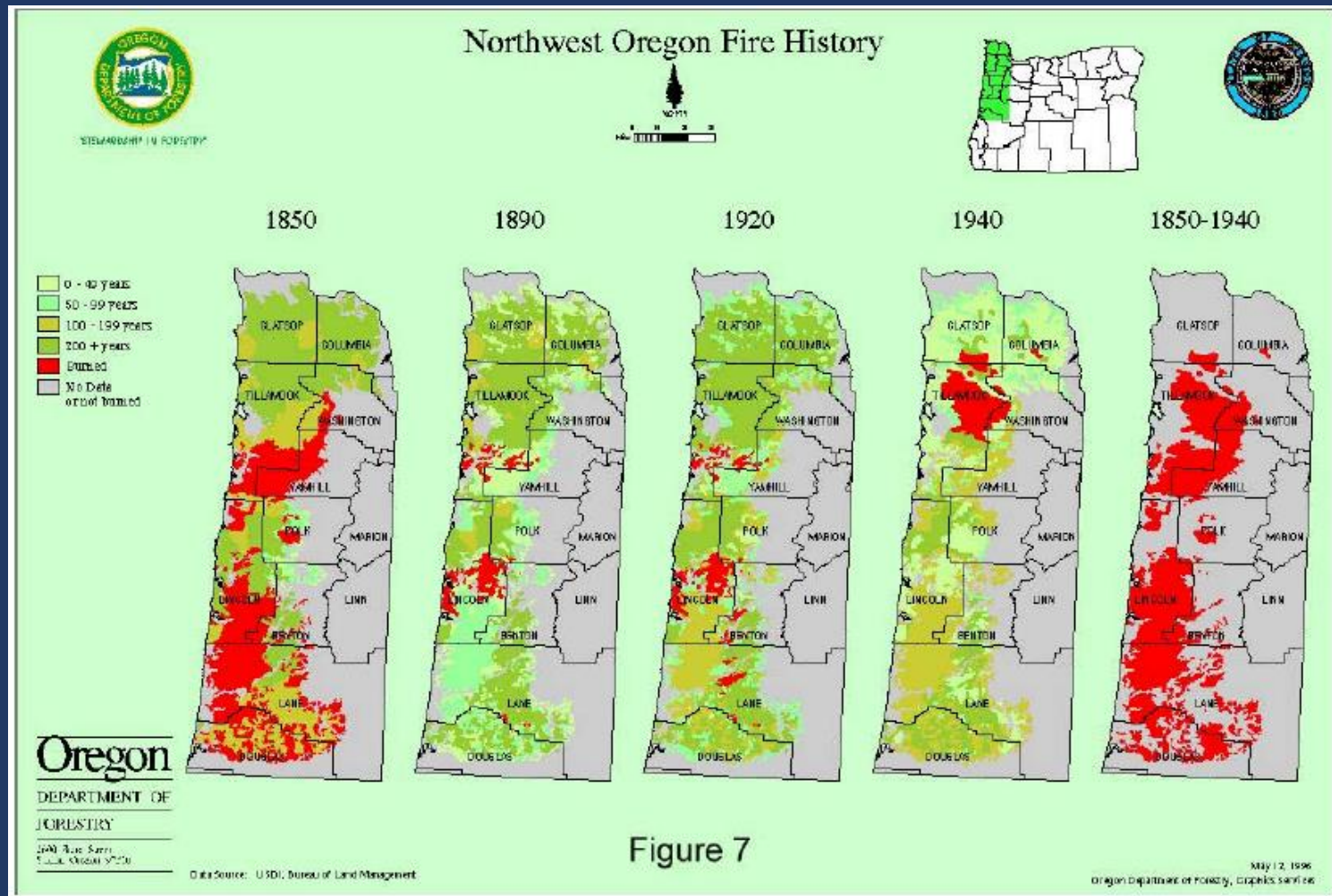
Vegetation Zone



Pre-Settlement Fire Occurrence



Large, High Severity Fires are the Norm



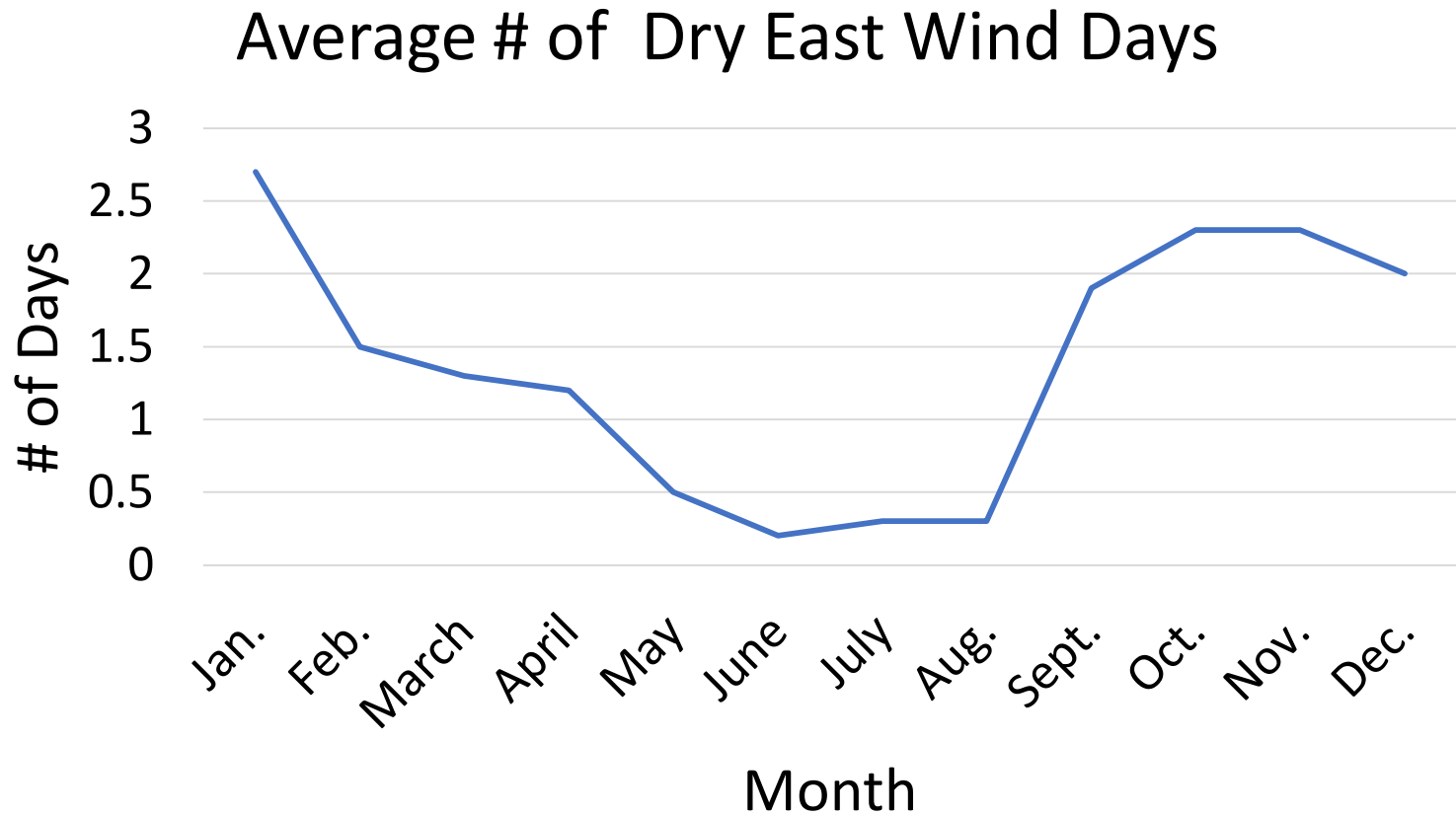
Large, High Severity Fires are the Norm



Figure 11 Tillamook Fire, August 25, 1933 *Courtesy of National Archives*

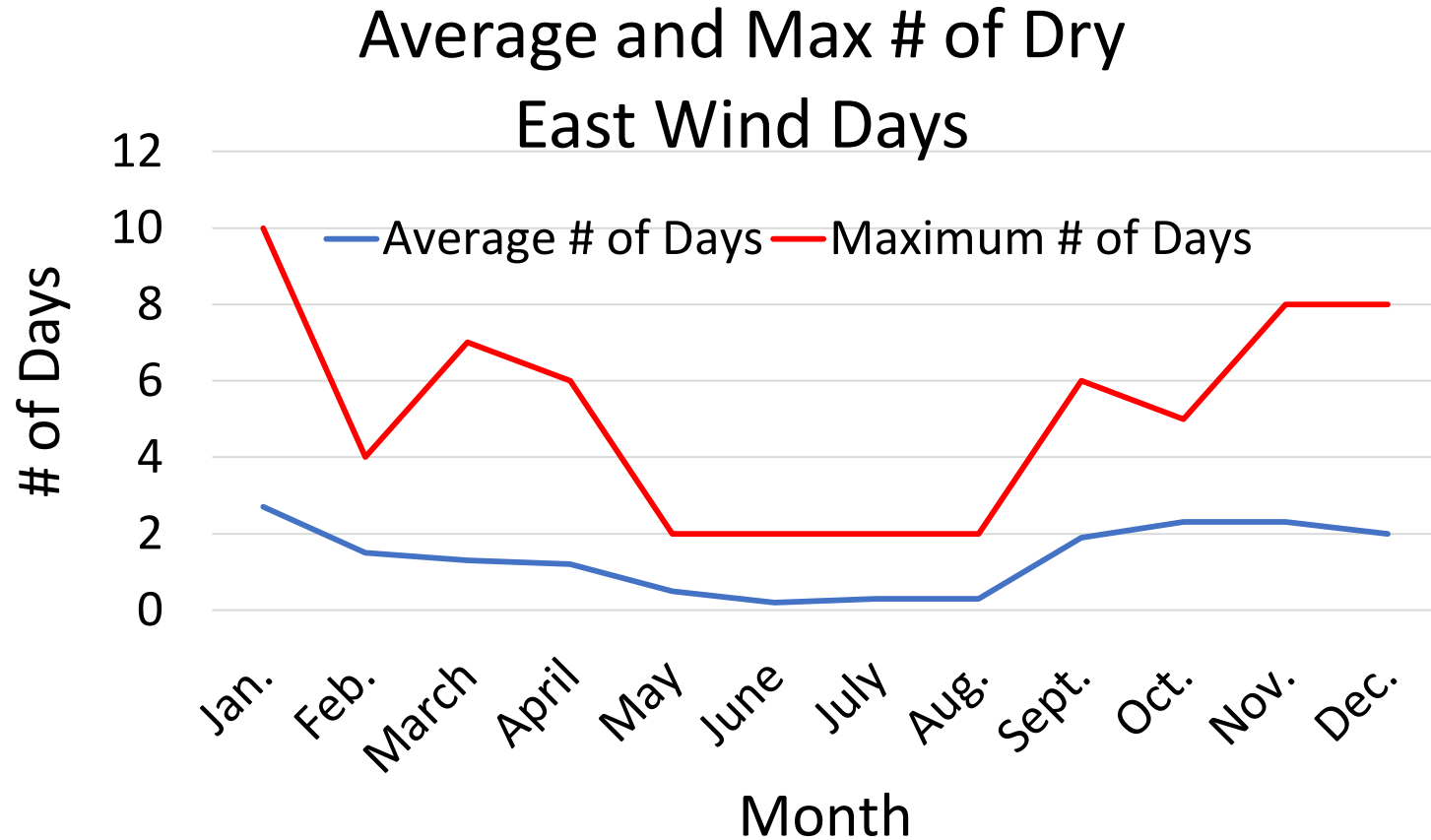
Tillamook Burn 1933

East Wind Events



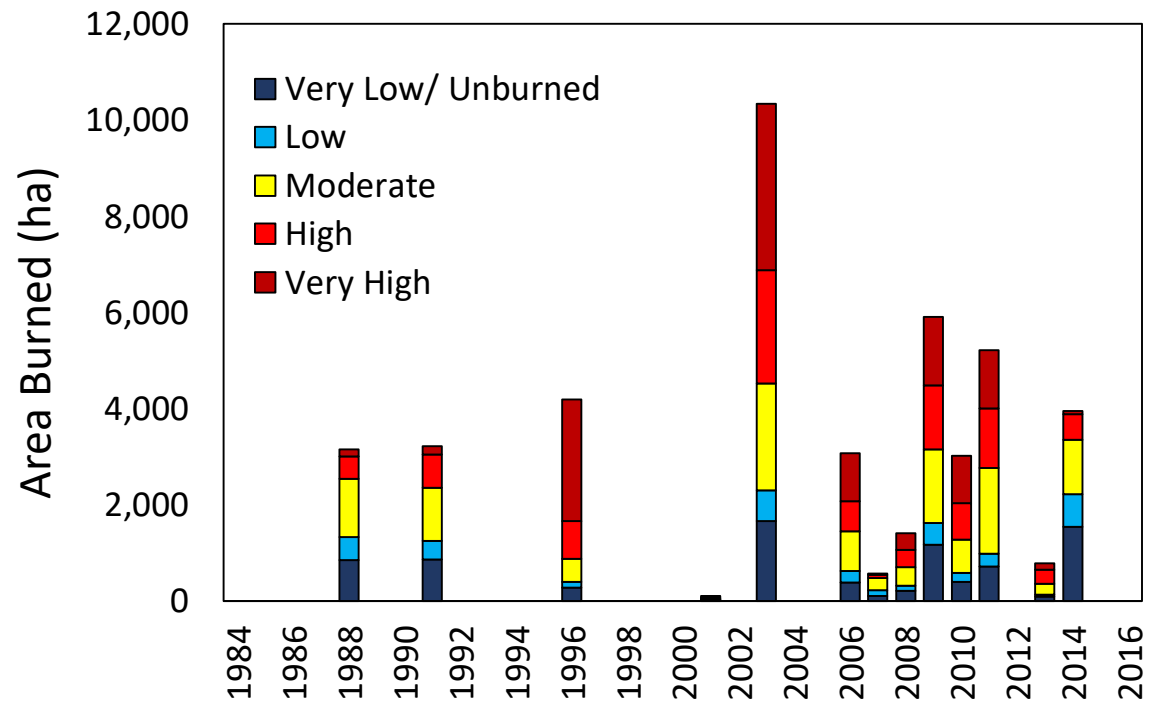
data from Cramer 1957

East Wind Events

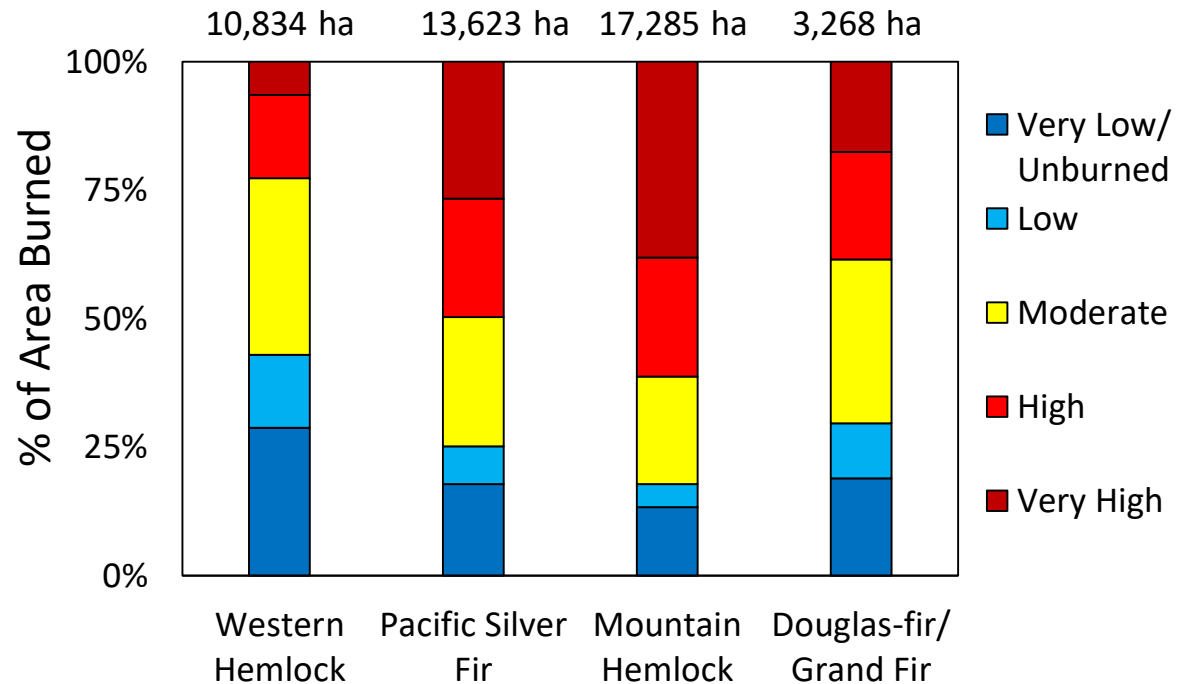


data from Cramer 1957

Increasing Fire Activity

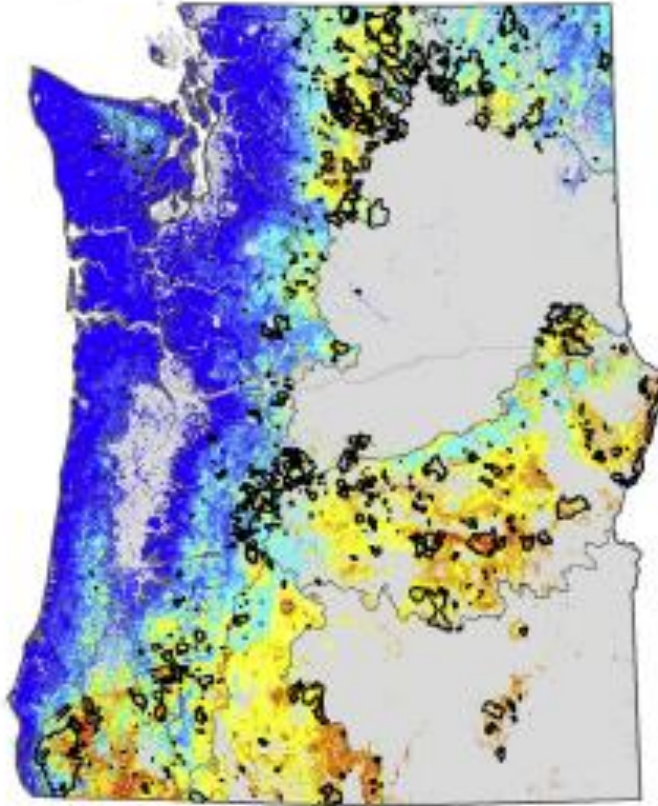


Current Fire Severity



Current Fire Potential

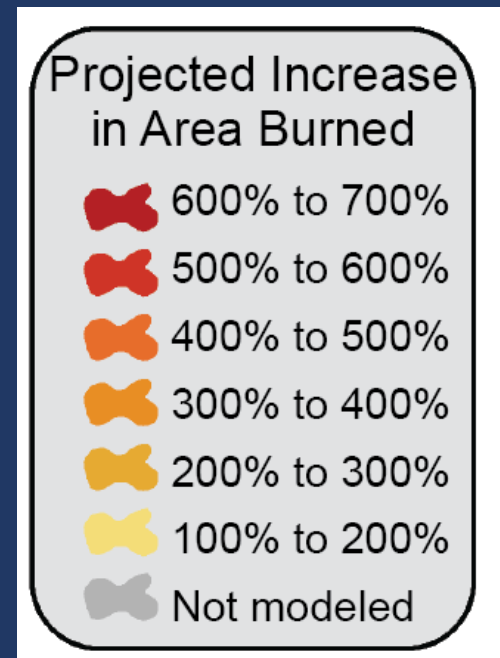
Current Normal (1981–2010)
Large wildfires between 2001–2015



Davis et al. 2017

Future Fire Activity

Study	Geographic Extent	Projected Change from Current	Variable
Stavros et al. 2014	OR, WA, N. CA	+	Large fire occurrence
McKenzie et al. 2004	OR, WA, N. CA	+	Area burned
Littell et al. 2010	WA	+ 200 to 300%	Area burned
Turner et al. 2015	Willamette Valley – OR	+300 to 900%	Area burned
Krawchuck et al. 2009	Global	+	Fire probability
Fried et al. 2004	N. CA	-8%	Area burned
Barr et al. 2010	Klamath Basin - OR and N. CA	+11 to 22%	Area burned
Liu et al. 2012	continental US	no	Fire potential ²
Westerling et al. 2011	N. CA	+100%	Area burned
Rogers et al. 2011	OR, WA	+76 to 310%/ +29 to 40%	Area burned/ Severity
Sheehan et al. 2015	OR, WA	-82% to 14%	Mean Fire Interval



Mote et al. 2014

Things To Consider

- Fire severity
- Patch Size
- Seasonality
- Post-fire climate
- Invasive species
- State changes

