Fire Resilience in Moist Mixed Conifer Forests

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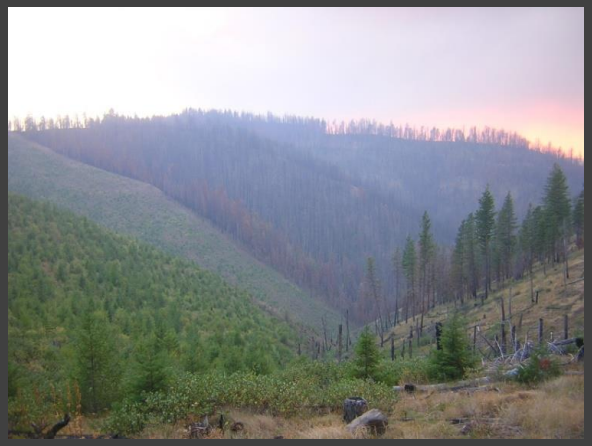
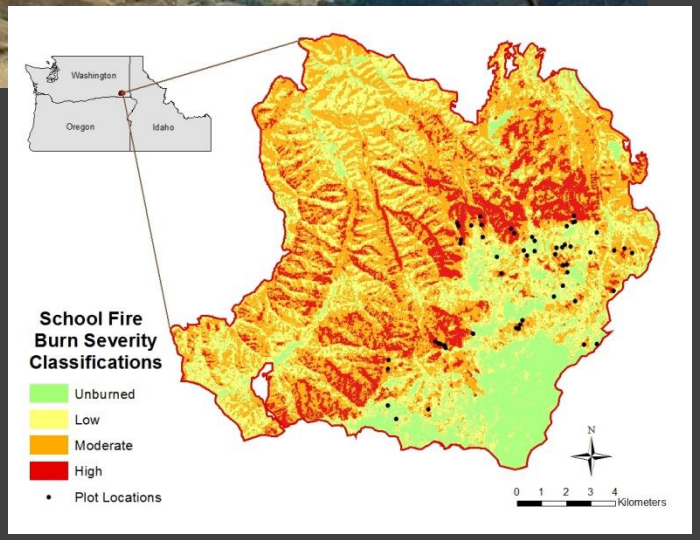
We live in a fire environment



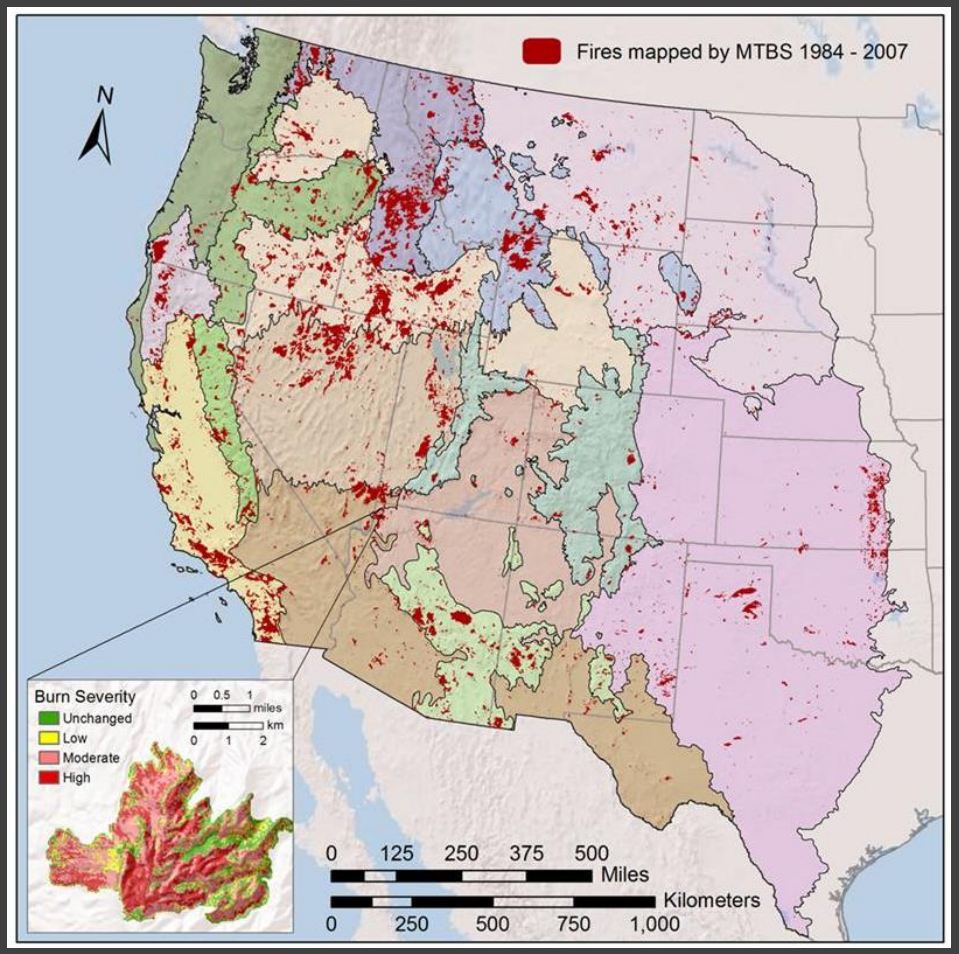
School Fire, Photo by Leigh Lentile

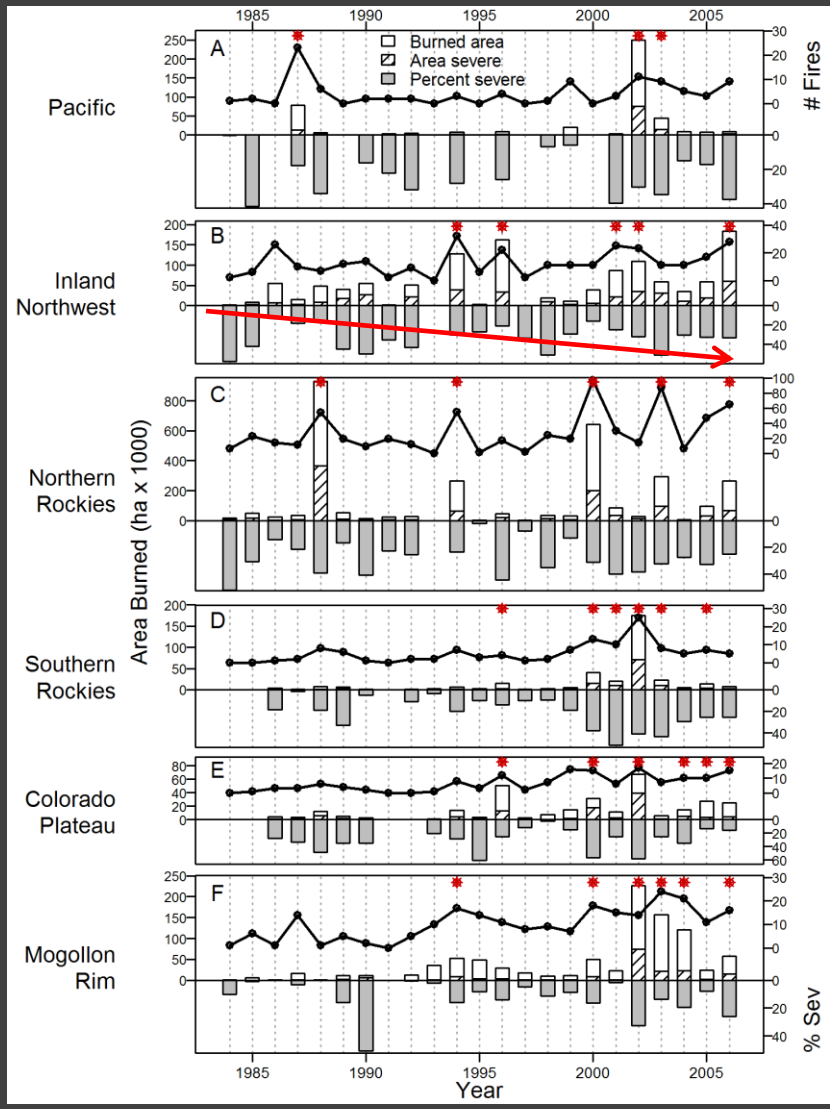


School Fire burned ~50,000 acres in 2005

Columbia Complex burned ~100,000 acres in 2006

Large high severity fires

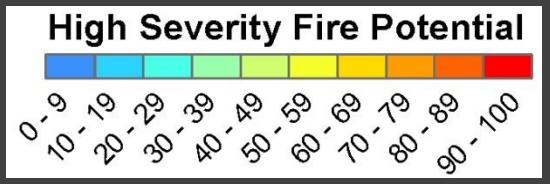


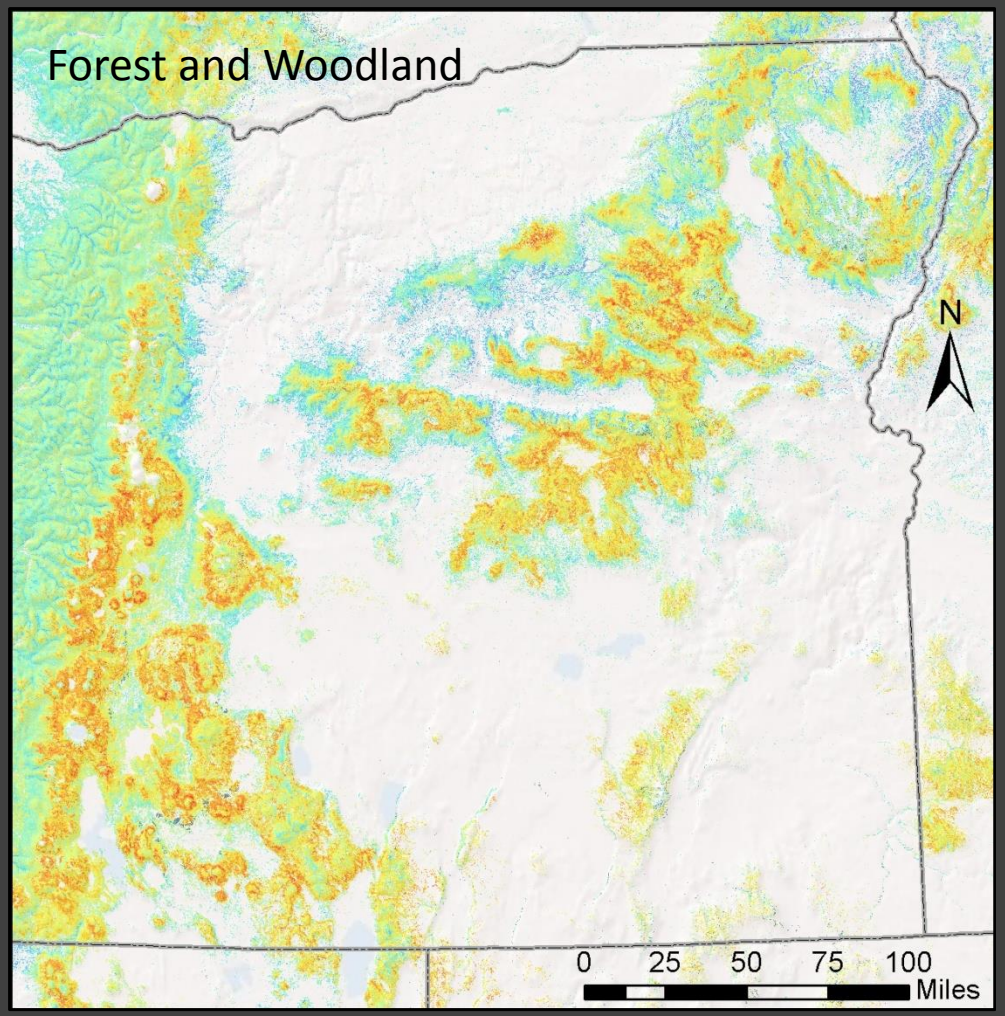


Dillon et al. 2011. Ecosphere

Potential for High Severity Fire

- Predictive statistical models for non-forest vs. forest and woodland settings in 17 mapping regions
- 7,000 fires west-wide 1984 to 2007
- Cross-validated model accuracies 65% to 83%





Dillon et al., 2012. http://www.frames.gov/partner-sites/firesev/firesev-home/

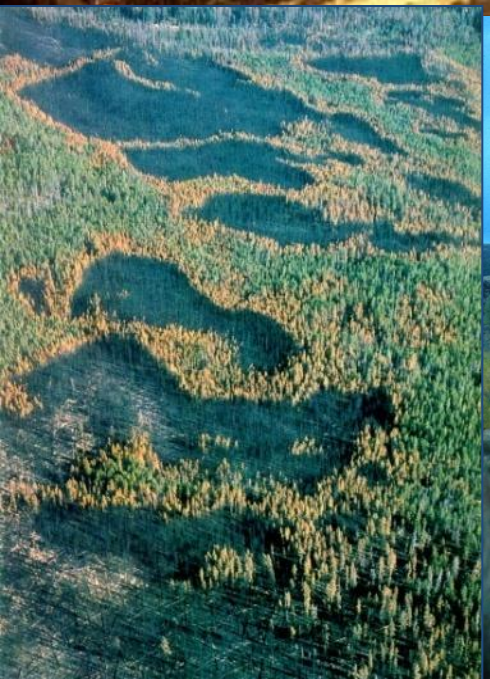
Mixed-conifer forests

www.panoramio.com

www.uwec.edu

www.panoramio.com

Diverse fire effects



Fires…

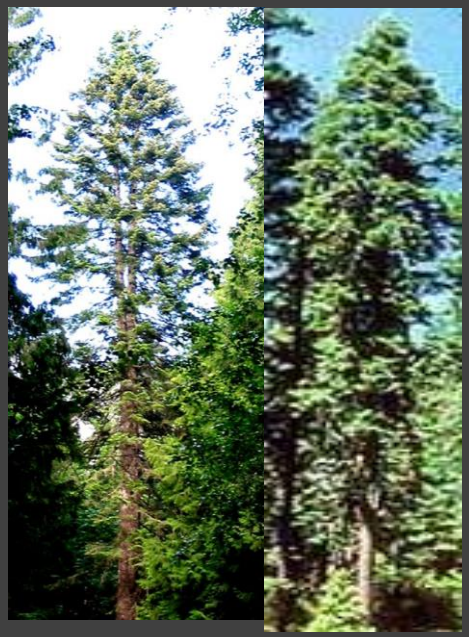
- Alter vegetation
- Recycle nutrients
- Change wildlife habitat
- Affect diversity of species, communities, and landscapes
- Regulate biomass and fuels
- Threaten people and property
- Affect soils, streams, and watersheds

But not the same everywhere!

Fire resilience of tree species

- WL>PP>DF>GF
- Large, old, tall >> small
- Shade intolerant > shade tolerant

Western larch Ponderosa pine



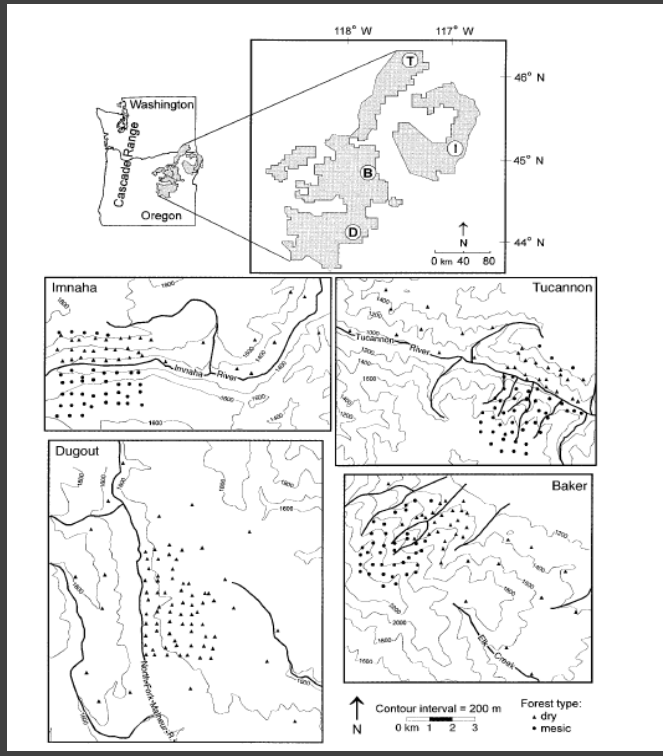
Grand Fir Douglas-fir

Large and old trees

Pictures courtesy Teresa Jain

Historical Fire Regimes

- Mixed severity fires
- Fire frequency unknown and variable based on dry mixed conifer forests
- Fire driven by both top-down (climate) and bottom-up factors (Heyerdahl et al. 2001, 2002)
- Smaller fires more frequent than bigger fires (Wright and Agee 2004)
  - Fire frequency 7-43 yr, highly variable
  - 1 to 37 years between fires >4000 ha
  - Many small, few large
- Topography greatly influences fire frequency (Beatty and Taylor 2001)
  - Fires burned less often on high, cooler, mesic, north-facing sites
  - More often on dry, south-facing sites
- Size, severity less documented than frequency

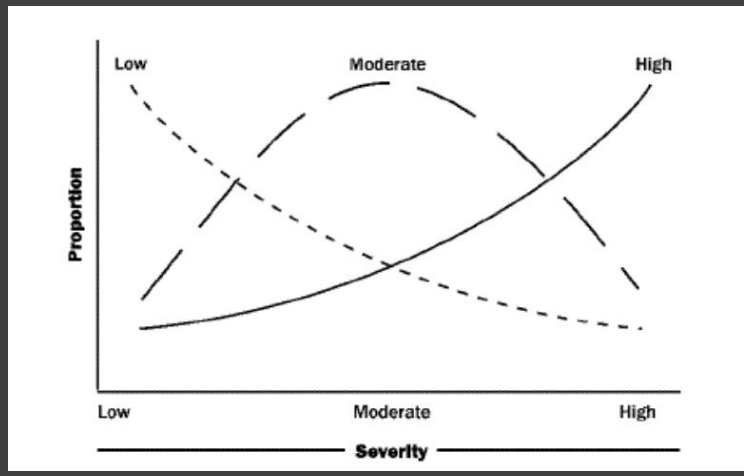


Heyerdahl et al. 2001

Mixed Severity Fires

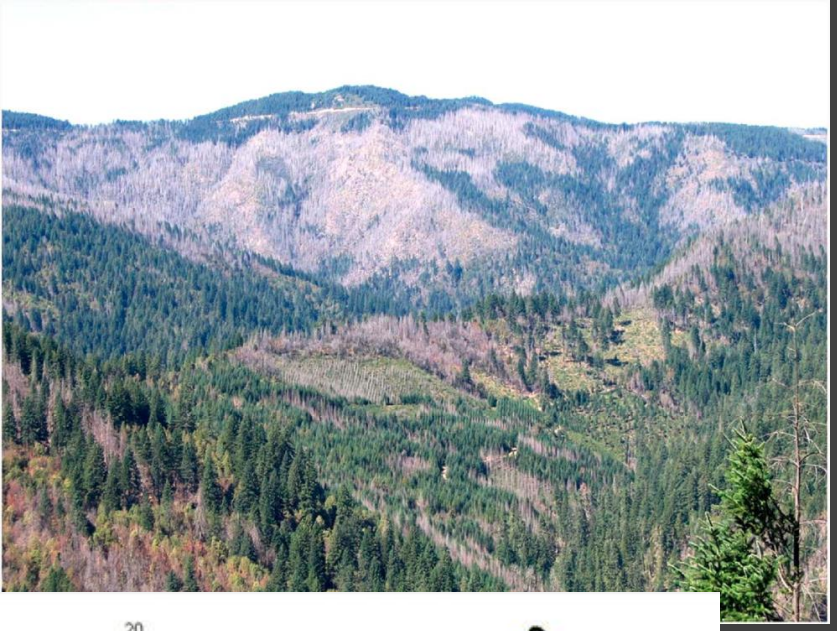
Mixed Severity Fires

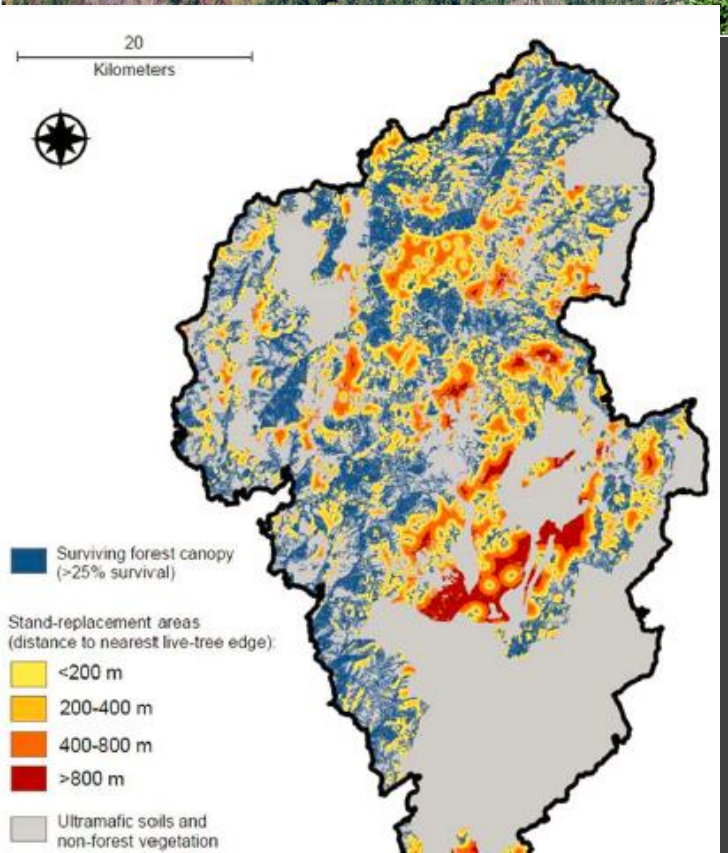
- Varied over space
  - 20-70% mortality
  - Mixed with non-lethal and stand-replacing fires
  - Many small fires (most of which are now suppressed) likely shaped the spread, severity, and recovery of larger fires
  - Fires more likely to burn severely on N-facing slopes and at higher elevations
- Varied over time
  - Larger fires burned less often, climate
  - Variability more important than mean
- Mosaics of vegetation
- Smoke



Agee 1993 Fire Ecol. PNW Forests

Smoky sunrise © Ashley Wells





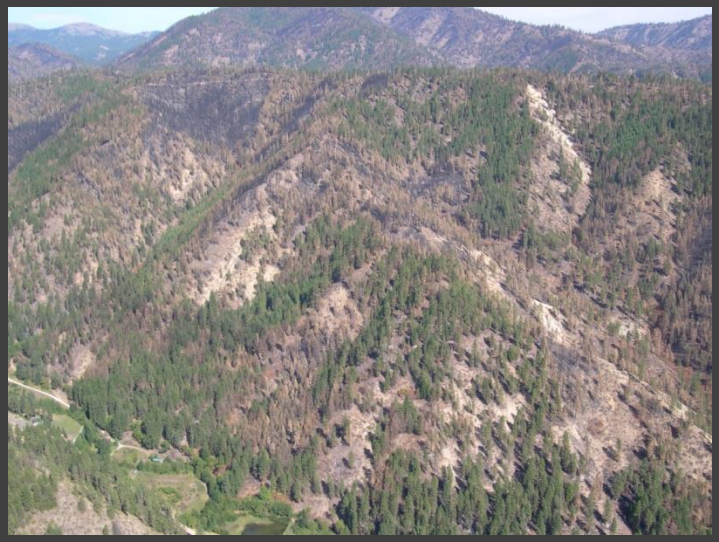
Mixed severity fires

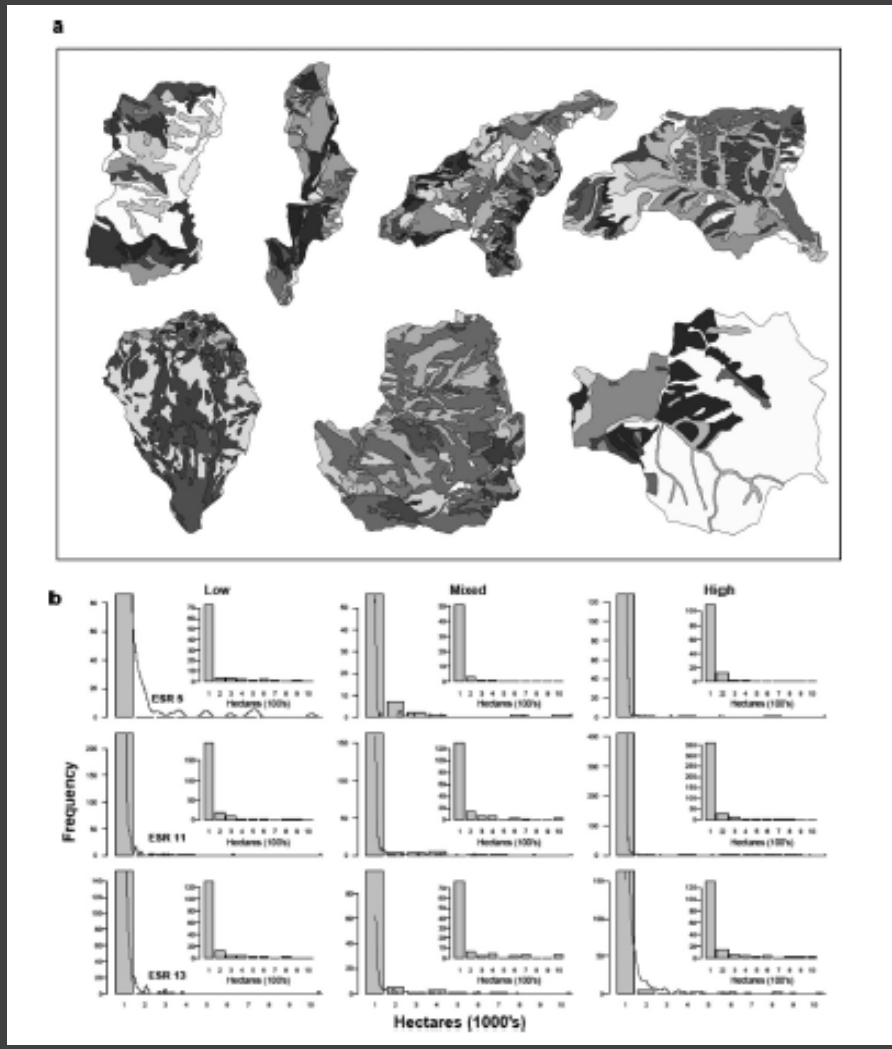
- Unique fire regime, not just something between low and high severity
- Poorly understood
- Complex burn patterns
- Interspersed patches of varying forest age and structure
- High biocomplexity
- Fire effects vary, as do species responses to fire
- Range and variation in fire intervals likely more important than the mean

(Halofsky et al. 2011; Perry et al. 2011)

Photo and map from Halofsky et al. 2011

Many small and few large patches, all interspersed





Photos and figures from Perry et al. 2011

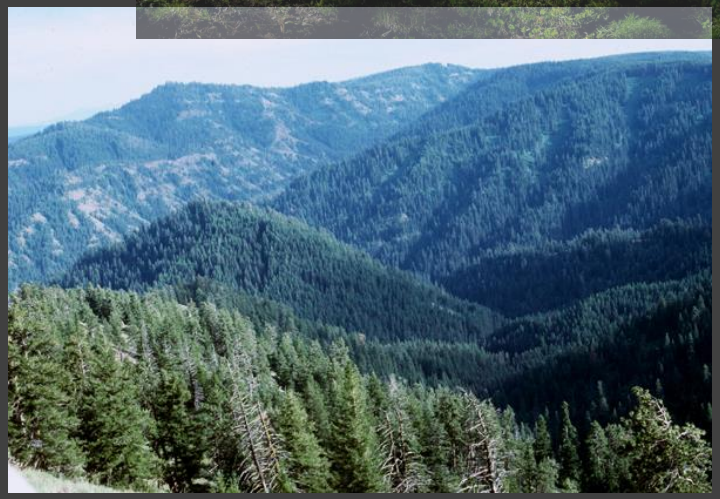
Addressing science gaps

- Science needed to understand causes and consequences of fires at multiple scales
  - Dendrochronology for fire scars and age structure, gridded to capture spatial variability
  - Aerial photography
  - Ecosystem modeling in changing world
- Monitor and learn as we go

http://www.nwhi.org/pix/Hab_desc/H05_4.jpg

Fostering Resilience

- Fires will happen – moderate vs. extreme conditions
- Large, old seral trees, esp. on ridges
- Biological legacies -- structural complexity
- Heterogeneous through time
- Heterogeneous over space
- Patch mosaic, many small
- Patches interspersed – distance to seed source influences vegetation recovery



Fire is a bad master, but a good servant

Finnish Proverb, www.paradox.org

- Reestablish fire as a process[1]
- Reduce costs of wildfire management through reestablishing natural fire regimes and reducing the risk of uncharacteristic wildfire[2]
- Fire-adapted communities
- Manage wildfires to help accomplish restoration goals

[1]http://www.nature.org/wherewework/northamerica/states/newmexico/files/principles_2006_11_01.pdf

[2]www.fs.fed.us, Collaborative Forest Landscape Restoration Act

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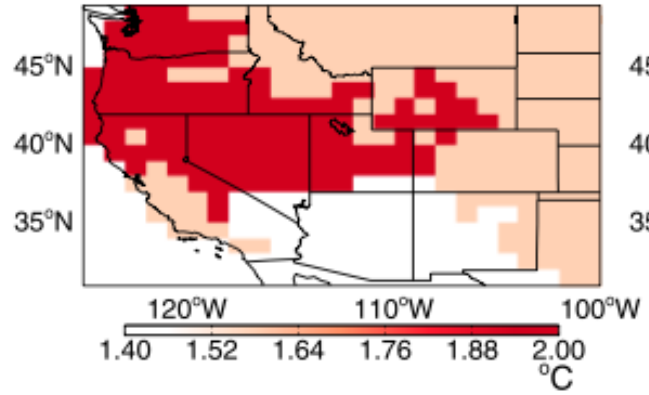
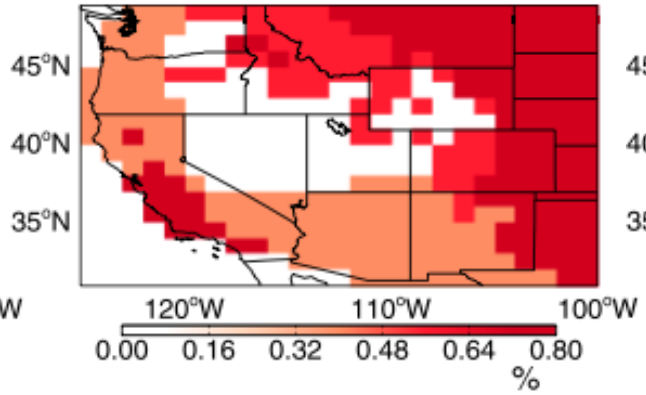
Western US climate & fire, 2045-2055

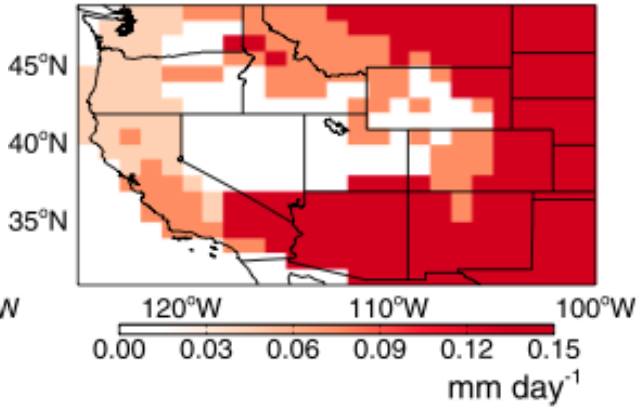
Δ Temperature



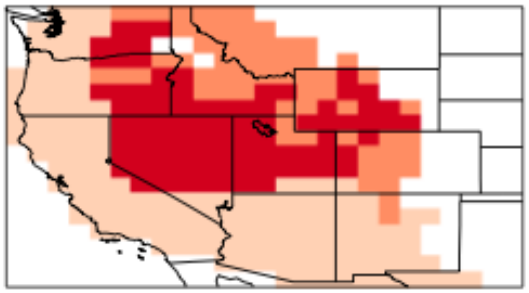
Δ Humidity



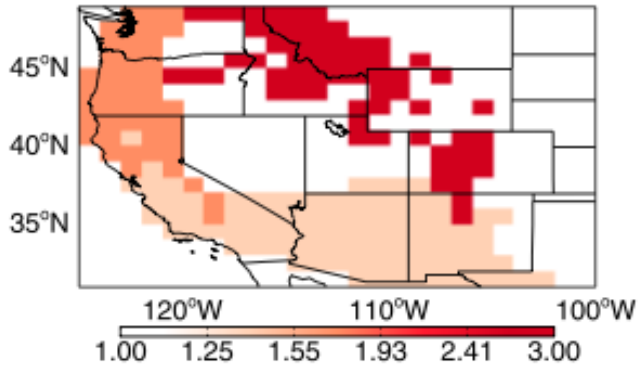
Δ Precipitation



Present day Area Burned



Future / Present



Rocky Mountain forests: ***2.75 x increase by 2050s***

Western US: ***1.54 x increase by 2050***

Spracklen et al. 2009. Climate Change, Wildfire and Aerosols. Geophysical Research Letters.