Too hot, too cold, or just right: Can wildfire restore mixed-conifer forests?

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Catastrophic, disastrous, restorative, natural, necessary
Fire prone landscapes need fire to function properly

Lightning and dry fuels = Fire and fire adaptive traits

13,420 Natural Ignitions 2007-2016
**Fire influenced landscape at all scales**

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- Nutrient cycling  
- Seedbed conditions | - Shrub continuity  
- Ladder fuels  
- Height to base crown | - Tree density  
- Species composition  
- Large trees | - Varied landscape  
- Natural ‘fire breaks’  
- Connectivity |
| Suppression Effects | - ↑ Surface fuels  
- Altered germination conditions | - ↑ Understory fuel amount  
- ↑ Fuel connectivity | - ↑ Stand density  
- Promoted less fire tolerant species | - ↑ Connectivity  
- ↓ Heterogeneity |
## Fire influenced landscape at all scales

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Cannot just love forests back to historical conditions

- Forests developed with thousands of years of natural and indigenous fire
- Cannot easily undo 100+ years of fire suppression
- Management options
  - Mechanical
    - Precise
    - Expensive, sometimes unpopular
  - Fire
    - Natural, sometimes more popular
    - Inexpensive
    - Less control over results
Fire produces varied and uncertain results

**Too hot**

- Beyond restorative to resetting
- Driven by
  - High surface fuel loads
  - Dense understory fuel
  - High tree density
  - Weather conditions

**Too cold**

- Fire only consumes surface fuels
- Both wild and prescribed fires
- Driven by
  - Fuels, topography
  - Manager comfort with risk
  - Weather conditions
Influence of burn severity and tree size on mortality

304 CVS (FIA) plots
74 fires
22,419 trees
Influence of burn severity and tree size on mortality

Know:
- Species
- Size
- Alive or dead
- Alive or dead after fire
- Years measured post-fire
- Fire severity

Survey 1: 1992-1997
Survey 2: 1997-2007

Probability

= tree size + burn severity + years post-fire
Influence of burn severity and tree size on mortality

- Fire Tolerant
- Fire Intolerant
Influence of burn severity and tree size on mortality

Ponderosa Pine (PIPO)

12 inch Ponderosa
Fire Severity 200 (RdNBR)
Influence of burn severity and tree size on mortality

- **Douglas-Fir**
  - Fire Severity (RdNBR) vs. Probability of Mortality
  - Lines represent different tree sizes: 6 in, 12 in, 24 in

- **Grand and White Fir**
  - Fire Severity (RdNBR) vs. Probability of Mortality
  - Lines represent different tree sizes: 6 in, 12 in, 24 in

- **Lodgepole Pine**
  - Fire Severity (RdNBR) vs. Probability of Mortality
  - Lines represent different tree sizes: 4 in, 7 in, 10 in
Restorative burn severity

1880

Today

Probability

= tree size + burn severity + years post-fire
Restorative burn severity

• 25 current stands on the Malheur within inventoried roadless areas
  • Ponderosa pine and dry mixed conifer biophysical groups
• At every fire severity value for each stand
  • Calculate mortality probability for each tree (>6 in.)
  • Calculate basal area and density
• Repeat 5 times for each stand
  • Drawing from range of possibilities not mean
• Compare to known historical conditions
Historical Mean ± SD
Restorative burn severity: Ponderosa pine
Looking forward

• Expand across National Forests in eastern Oregon
• Incorporate more intensively managed stands
• Assess how/when prescribed fires are falling within restorative windows
• Web app for managers to model specific stands
• Create wildfire burn severity maps based on where fires were likely restorative
Restoration maps: Rail Fire

**MTBS Burn Severity Classes**

- Blue = <0.5
- Green = 0.5-0.75
- Yellow = >0.75
- Orange = 0.5-0.75
- Red = <0.5

**Restoration Potential Classes**

Probability restorative fire:

- Blue = <0.5
- Green = 0.5-0.75
- Yellow = >0.75
- Orange = 0.5-0.75
- Red = <0.5
Final thoughts

Wildfires will continue and some will produce undesirable effects.

Begin to understand where and when fire was restorative, optimize our pre- and post-fire management to capitalize on fire as a restoration tool.

Acknowledge in most places fire alone will not restore both historical density and composition:
- 100+ years of fire suppression cannot be easily ‘undone’
- Trade-offs
- Further mechanical treatments or repeated burning
Thanks!

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