Restoring Fire-Prone Inland Pacific Landscapes

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Restoring fire-prone Inland Pacific landscapes: seven core principles

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Road Map

- Historical fire regimes, forest succession >> key linkages btw them
- Management alters fire regimes >> structure, composition, patterns of forests
- This changes processes at patch to regional landscape scales
- More hot-dry windy summers + dense, layered forests >> megafires
- Key principles emerging from study of changes & their mgt implications
Low severity fire (LSF): <20% of the dominant tree cover killed by fire

- LSFs were common in the driest JP, PP, and MC forests >> dry topo-edaphic sites
- Fires frequent, every 5-25 yr >> continuously reducing fuels, thinning trees
- Frequency reinforced LSFs, extreme climatic conditions >> more extreme fires

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High severity fire (HSF): > 70% of the tree cover killed by fire

- HSFs common in wet & cold forests where fires were infrequent (150-300+ yr)
- Most fires were HSF, but mild climatic conditions favored milder fires
- Created variation in fire severity and fire event patch sizes; i.e., a PSD

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Mixed severity fire (MSF): 20-70% of the tree cover killed by fire
- MSFs were common in dry & moist MC forests w/ PP, DF, GF, WF, WL
- Fires occurred w/ intermediate frequency, every 30-50+ yrs
- Occasionally both milder & more severe fires occurred, climate driven
Change in fire sizes

- Presuppression
- Suppression

Frequency

Hectares

$10^1$ $10^2$ $10^3$ $10^4$ $10^5$ $10^6$
Wildfire patterns provided a positive landscape-level feedback and a natural resilience mechanism...

Ongoing wildfires maintained patchworks of burned & recovering vegetation in a variety of fuel conditions, seral stages and patch sizes

• Patchworks spatially interrupted conditions supporting large fires
• Influenced the frequency, size, & severity of future events
• Insect, disease, & weather disturbances added to this complexity
• Extreme weather events overrode these spatial controls
• “Power in the patchwork” & PSDs
Important positive patch-scale feedbacks too:

Frequent LSFs & MSFs reinforced resilience by:

- Reducing surface and ladder fuels
- Increasing the height to live crowns
- Decreasing crown density
- Favoring early seral species
- Favoring medium and large sized, older trees
- Favoring patchy tree and surface fuel cover

How these patch-level feedbacks worked...

Bob Van Pelt drawings...

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Without fire suppression

+ 20 years
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+ 40 years

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+ 60 years
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+ 80 years
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1) Locally—fires continually thinned forest patches, reducing density and fuels

2) Regionally—fires created variable patchworks of grass, shrub, early, mid, late seral conditions, these patterns spatially controlled future fire size & severity
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Lookout Mtn. near Twisp, WA 1930

Lookout Mtn. near Twisp, WA 2011

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Slate Peak

George B. Clisby USFS September 2, 1934
From National Archives and Records Administration, Seattle, WA

16 miles NW of Mazama, WA
Slate Creek drainage

John F Marshall for USFS August 31, 2013

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Framing Landscape Restoration: **Core Principle 1**

Regional landscapes function as multi-level, cross-connected, patchwork hierarchies

Restore connectivity and processes across multi-level landscapes

Wu J., & Loucks, O. L. 1995. Quarterly Review of Biology, 439-466
Framing Landscape Restoration: Core Principle 2

Topography provides a natural template for vegetation & habitat patterns
Use topography and soils as a successional & environmental template for fitting more characteristic successional patterns to the landscape

Perry et al. (2011) For Ecol & Mgt 262:703
Fire and forest succession are the **engine** that drives the system. Restore the fire regime and supportive successional patterns, and the other disturbance regimes will follow.

Keane et al. (2009) For Ecol Manage 258:1025-1037
Collins et al. 2009, Parks et al. 2015;
McGarigal & Romme 2012;
Wiens et al. (2012) Hist. Env Variation... Wiley-Blackwell
Predictable patch size distributions historically emerged from linked climate-disturbance-topography-vegetation interactions. Restore size distributions of successional patches & allow changing climate & disturbance regimes to adapt them.

Change in fire sizes

- Presuppression
- Suppression

Framing Landscape Restoration: **Core Principle 5**

Widely distributed medium and large-sized, old trees provide a critical backbone to dry pine and dry + moist mixed conifer landscapes. Retain and expand on existing relict trees, old forests, and post-disturbance large snags and down logs in these types.

Lutz et al. (2009) For Ecol Manage 257: 2296-2307
Successional patches are “landscapes within landscapes”
In PP & MC patches, restore characteristic tree clump & gap variation

Churchill et al. (2013) For Ecol Manage 291: 442-457
Lydersen et al. (2013) For Ecol Manage 304: 370-38
Land ownership, allocation, management and access patterns disrupt landscape and ecosystem patterns

Work collaboratively across ownerships to develop restoration projects

Rieman et al. (2015) Fisheries, 40:124-135
Summary

• We live in landscapes that were continuously shaped by fire (US: 50-100MM ac/yr)
• Our nearby forests and rangelands need to and will burn. We can influence how often, how severe, how large.
• Historical fire suppression & exclusion, + numerous other factors have created high fuel loads, a fire deficit in forests, & high contagion of crownfire behavior.
• Consequently, today’s wildfires burn hotter and larger than most historical fires.
• Our climate & weather are changing, becoming more bipolar & extreme.
• Extreme weather is increasing fire size & severity in most interior forest types.
• Restoration of forest successional & fuel patterns is needed if your mgt goal is to recalibrate fire, insect, and pathogen disturbance regimes.
• The resulting patterns of successional and fuel conditions are vitally important to processes and species habitat arrangements.
• These principles can guide your work.

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