Using Fire Regimes & Historic Vegetation to Guide Restoration of Oregon’s Forests

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Restoring Millions of Acres in Western US

**Restoration Goals**

*Restoration*: the process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. (CFLRP 2012)

*Ecological resilience*: the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004).

*Adaptive capacity*: Response and re-alignment to climate change
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Change in Annual Temperature by the 2050s
Model: Ensemble Average, SRES emission scenario: A1B

Change in Annual Precipitation by the 2050s
Model: Ensemble Average, SRES emission scenario: A1B
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Change in Jun-Aug Temperature by the 2050s
Model: Ensemble Average, SRES emission scenario: A1B

Change in Jun-Aug Precipitation by the 2050s
Model: Ensemble Average, SRES emission scenario: A1B

Source: Climate Wizard Website
A1B Emissions Scenario. Ensemble Average
Major Objective: Resilience
- Resistance to disturbance
- Recovery from disturbance
- Climate adaptation

Ecosystem services:
- Provisioning
- Regulating
- Cultural

Help Rural Economies

Improve Ecological Function

Build Trust & Social Capacity

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Scientific Basis for Restoration

Managing for Biodiversity in Young Douglas-Fir Forests of Western Oregon

Silvicultural Approaches to Develop Northern Spotted Owl Nesting Sites, Central Coast Ranges, Oregon

Accelerating Development of Late-Successional Conditions in Young Managed Douglas-Fir Stands: A Simulation Study

Restoration of Dry Forests in Eastern Oregon

Density Management in the 21st Century: West Side Story

Restoring fire-prone Inland Pacific landscapes: seven core principles

Paul F. Hessburg · Derek J. Churchill · Andrew J. Larson · Ryan D. Haugo · Carol Miller · Thomas A. Spies · Malcolm P. North · Nicholas A. Povak · R. Travis Belote · Peter H. Singleton · William L. Gaines · Robert E. Keane · Gregory H. Aplet · Scott L. Stephens · Penelope Morgan · Peter A. Bisson · Bruce E. Rieman · R. Brion Salter · Gordon H. Reeves
Overview

- Summarize ecological basis for restoration of forests based on fire regime
  - Central & Northeastern Oregon
  - Cascades & Coastal Mountains
  - Southwest Oregon

- Provide principles for landscape restoration in dry and moist forests
Historic Reference Conditions Provide Guideposts

Resilient to:
- Centuries of climatic fluctuation
- Variable fire regimes
- Other disturbances: insects, wind, pathogens

Supported biodiversity & other ecological functions

Basis for Heterogeneity
- Biota, physical template, disturbance regime → constrained envelopes

Must critically evaluate Reference Conditions & potentially modify
Multiscale Approach
Historical fire regimes

Low severity
<20% killed

Mixed severity
20-70% killed

High severity
>70% killed
Historical fire regimes

Low-Severity Fire Regime  Moderate-Severity Fire Regime  High-Severity Fire Regime

- Low-Severity Patch
- Moderate-Severity Patch
- High-Severity Patch

Agee 1998
Wildfire Patterns Provided Landscape-level Feedbacks and a Natural Resilience Mechanism.

They maintained patchworks of burned & recovering vegetation in a variety of successional stages and patch sizes

Constrained the frequency, size, & severity of future events
Patchworks varied by disturbance regime & climate

Predictable ranges or envelopes
Three Forested Regions of Oregon
Central & NE Oregon

Fire Regime Group

- Fire Regime Group I
- Fire Regime Group II
- Fire Regime Group III
- Fire Regime Group IV
- Fire Regime Group V
- Indeterminate Fire Regime Characteristics

Fire Regime I (1 to 35 year frequency, low to mixed severity)
Fire Regime II (1 to 35 year frequency, replacement severity)
Fire Regime III (35 to 200 year frequency, low to mixed severity)
Fire Regime IV (35 to 200 year frequency, replacement severity)
Fire Regime V (200 to 1200 year frequency, any severity)
Central & NE Oregon
Central & NE Oregon

Fires have been temporarily excluded & now the climate is warming
Patch - Stand Level
Locally—fires constantly thinned forest patches, reducing density & favoring fire and drought tolerant species. Today, increased density & shade tolerant species have changed forests.
Landscape Level

Bethel Ridge 1936

Bethel Ridge 2012
Forest invades grassland
Landscape Level

Fragmented large patches

Structural classes
- SI
- UR
- Nonforest
- SEOC
- YFMS
- SECC
- OFMS

Historical

Current

Scale: 0 1 2 3 4 5 Km
Increased tree canopy cover, and canopy layers

More contagious landscape

Landscape Level
Low Severity Fire

Historical Current

Leecher Mtn SW 1930

Variable fire severity

Percentage area

Variable fire severity
Mixed Severity Fire

Variable fire severity

Percentage area

Historical

Current
High Severity Fire

Historical

Current

Variable fire severity

Percentage area

Bethel Ridge 1936

Variable fire severity

Percentage area
Across landscapes—fires created patchworks of early, mid, late seral conditions, these patterns spatially controlled future fire sizes. Landscapes are now more contagious and also fragmented.
Western Cascades & Coast Range

Fire Regime Group
- Fire Regime Group I
- Fire Regime Group II
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- Fire Regime Group IV
- Fire Regime Group V
- Indeterminate Fire Regime Characteristics

Fire Regime I (1 to 35 year frequency, low to mixed severity)
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Western Cascades & Coast Range

Long interval between high severity fires

Other disturbances play major role: wind & root rots

Old growth development
Simplified Forest Structure:

- Clear-cutting, site prep, downed wood removal
- Planting 1 species at high stocking, plus shrub control
- Spacing based, crop tree oriented pre-commercial thinning
- Suppression of low-moderate intensity fires

Legacies
Species Diversity
Patchiness
Reduction in old growth
Fragmentation of Landscape
Landscape Level

Aquatic system impacts

Jones et al. 1996
Southwest Oregon

- Huge diversity of vegetation types: mixed conifer, hardwood, shrub, grasslands
- Dry interior forests: low to mixed severity - frequent fire:
- Moist coastal forests: high severity – low frequency fire
- Mixed severity fire ➔ Steep, rugged topography

Map from KS Wild
Southwest Oregon

- Reduction in fire
  - Grassland – shrubland conversion to forests
  - Increased density and shifts to shade tolerant species

- Dispersed regeneration harvesting:
  - Reduction in old growth
  - Fragmentation
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Framing Landscape Restoration: Core principle 1

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

Think, plan, and treat at multiple scales
Framing Landscape Restoration: Core principle 2

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.

Framing Landscape Restoration: **Core principle 3**

Topography provides a natural template for vegetation & habitat patterns
Use topography as a successional and environmental template

Predictable ranges of landscape patterns emerged from climate, topography, disturbance regime, & vegetation.

Restore characteristic patterns and patch sizes of fuel and successional conditions and you restore the fire regime.

Framing Landscape Restoration: Core principle 4

![Change in fire sizes](chart.png)
Target ranges for structure and cover types
- Increase old forest from 5 to 20-30%

Pattern targets
- Increase mean patch size of early seral conditions

Integrate vegetation, habitat, aquatics, disturbance
Deficit & Historic White Fir Abundance

Legend
1920 Inventory
BA/A of WF
0
0.1-5
5.1-10
10.1-15
15.1-20
20.1-30
30-40
Deficit
High : 184
Low : 124
Framing Landscape Restoration: **Core principle 5**

Widely distributed large, old trees provide a critical backbone to forests
Retain and expand on existing relict trees, old forests, and post-disturbance large snags and down logs in these types.
Successional patches are “landscapes within landscapes”

Framing Landscape Restoration: **Core principle 6**

Restore characteristic tree clump and gap variation within patches
Stand Level Treatment Approaches

**Moist Forests**
- Accelerate development of old forests ➔ Variable Density Thinning
- Early Seral communities ➔ Variable Retention

**Dry Forests**
- Reduce risk of high severity fires
- Restore historic forest conditions ➔ Variable Density Thinning ➔ Variable Retention
Land ownership, allocation, management and access patterns disrupt landscape and ecosystem patterns.

Work collaboratively to develop restoration projects that effectively work across ownerships, allocations, and access needs.
Summary

• Historical forests were spatially heterogeneous at multiple scales
• Heterogeneity derived from succession and disturbance process interactions
• Native flora and fauna were adapted to these conditions
• Conditions were resilient to variability in climate and recurrent disturbances
• To restore this resilience, planning and management needed at fine to broad scales
• Restoration should work effectively across land ownerships and land allocations
• It will require active thinking about landscapes as socio-ecological systems that provide services to people within the finite capacities of ecosystems.
• We focus attention on developing landscape-level prescriptions as foundational to restoration planning.

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