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Forest Dynamics after Thinning and Fuel Reduction

Forest Restoration Beyond Fuel Reduction, Bend, OR

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Where are we going?

- Science findings from the national Fire and Fire Surrogate study
- Designed studies for building stand and landscape resiliency at Lookout Mountain

National Fire and Fire Surrogate Study

Frequent, low-severity fires historically shaped many forested landscapes, yet these forests today reflect the effects of fire exclusion.

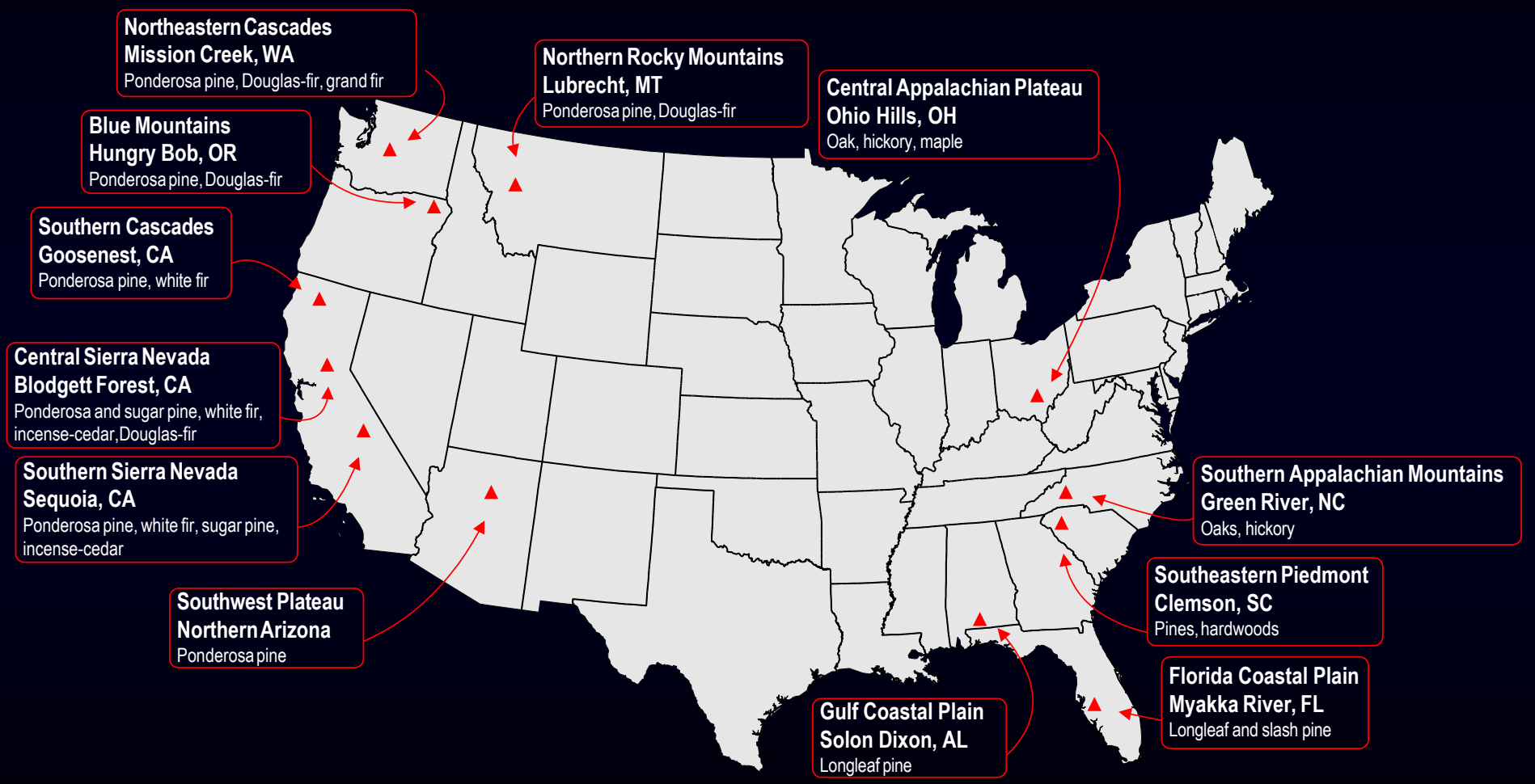
Fire exclusion and the shifting of forest structures not unique to southwest or even the western US.

National Fire and Fire Surrogate Study

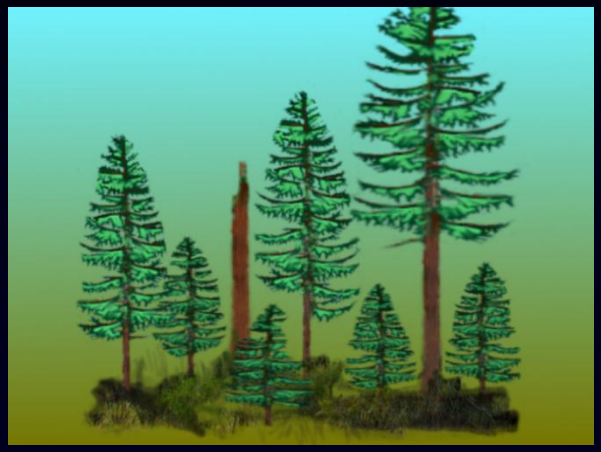
Can “fire surrogate” or mechanical treatments such as thinning play an ecological role similar to fire in the restoration of these forests?

What are the ecological and economic effects of a common set of fuel reduction treatments?

Fire and Fire Surrogate Study Sites



FFS Treatment Structure



Control

Mechanical

Burn

Mechanical + burn

Summary of FFS outputs

Between 1999 and 2010:

- 644 total research products
- 206 papers, including 111 journal papers
- 68 tours
- 114 oral presentations
- 41 graduate students

Numbers of FFS papers by ecosystem component

Overstory vegetation	26	Bark beetles	5
Understory vegetation	19	Pathology and fungi	10
Fuels and fire behavior	29	Economics	5
Soils	29	Sociology	3
Vertebrates	43	Multivariate	14
Invertebrates	12	Study descriptions	11

Findings: Mechanical treatments

- Decreased basal area and stand density, but not surface fuels
- Similar to the untreated control in fuel reduction, fire risk reduction, and responses for most variables
- Not a surrogate for fire for the great majority of ecological variables
- Altered carbon and nitrogen dynamics in different ways than did burning

Findings: Mechanical treatments (2)

- Created or maintained more mesic conditions for plant responses
- Little effect on arthropod species
- No effect on bark beetles or bark-foraging bird species at western sites
- Attracted foliage-gleaning and canopy-nesting bird species at some eastern sites
- Maintained within-stand patchiness

Findings: Burn Treatment

- Little effect on large and live tree structures, but increased small snag density and decreased woody fuel mass
- Decreased density of small trees and decreased number of logs
- Increased number of snags and increased number of invasive species
- Reduced total fuel loading but not surface, crown, or available fuel potentials

Findings: Burn treatments (2)

- Retained more carbon in the soil
- Enhance short-term productivity, but at the expense of nutrient standing stocks
- Decreased soil moisture which favored more xeric plant species
- Favored shorter-lived, herbaceous plant species
- Caused short-term decreases in shrub cover
- Fuel reduction greater with fall burns than spring burns at western sites

Findings: Burn treatments (3)

- Increased bark beetle activity, which in turn attracted bark-foraging birds
- Increased patchiness, leading to heterogeneity in nutrients and increased stand-level plant species richness
- Created heterogeneity similar to wildfires due to spatial variation in topographic and biotic factors
- Altered feeding guild structure of arthropod communities

Findings: Mechanical + burn treatments

- Decreased basal area and stand density similarly to the mechanical treatments
- Snag density was unchanged or *decreased* after treatment at western sites, while snag density *increased* at three eastern sites.
- Generally greater magnitude of change for soils, plants, invertebrates (particularly bark beetle activity), and vertebrates
- Likely were the most effective treatments in increasing resiliency of the overstory structure and composition

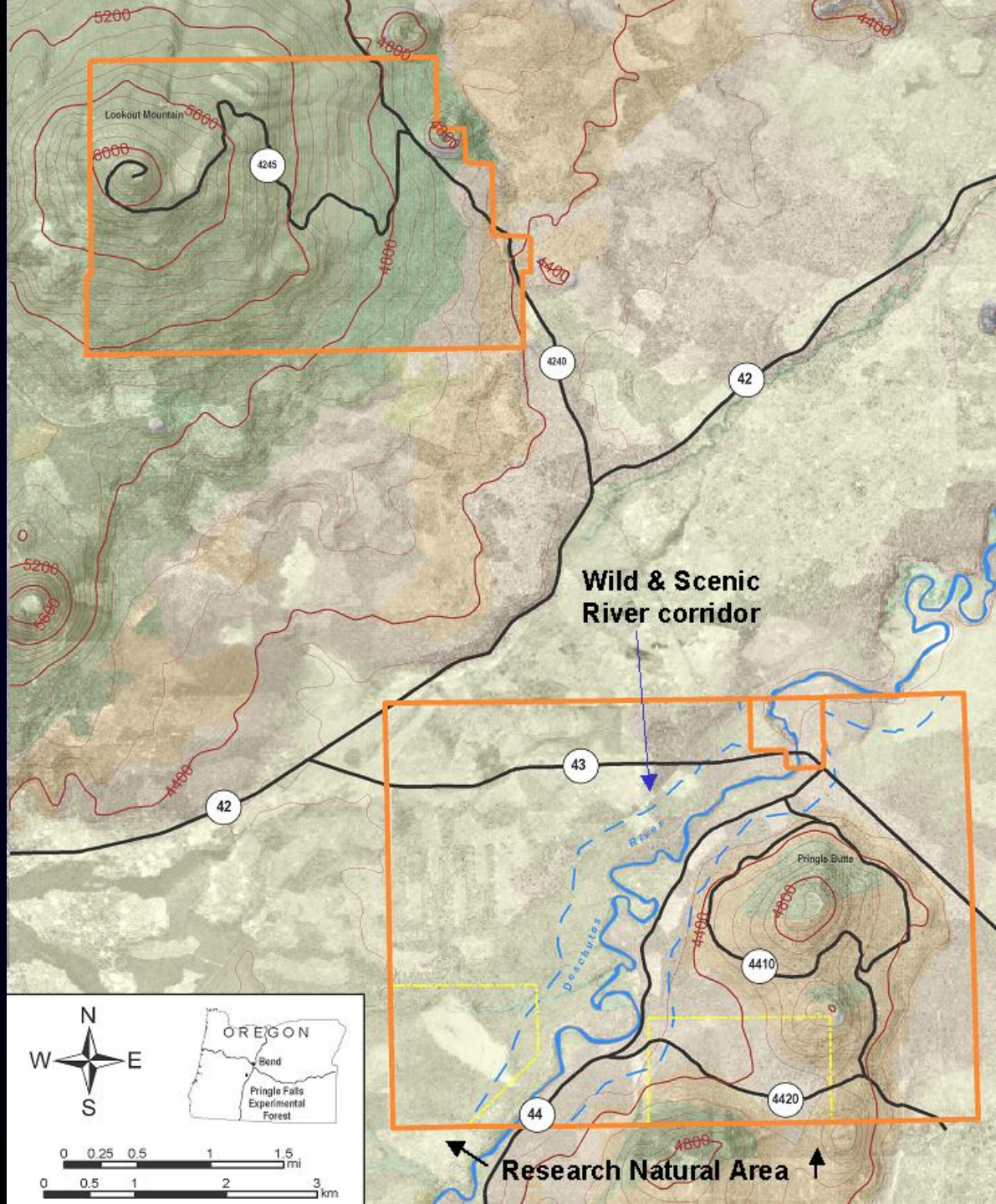
Findings: Mechanical + burn treatments

- Diverged more from the other treatments in soil chemistry response with increased time after treatments
- Favored herbaceous species, including exotics
- Created potential tradeoffs such as changes in down woody debris or large snags, and changes in natives plant species or exotic plant species
- Caused greatest shifts in diameter distributions toward late-successional structure, may provide best tool for increasing stand resiliency

Stand structure in early 1900s

Pringle Falls Experimental Forest

- Established 1931
- 11,055 acres
- Two units: Pringle Butte, and Lookout Mountain



Current stand structure

- Closed-canopy forest, little major disturbance since stand-replacement fires in 1845 and 1890, and low thinning in the 1970s
- High and increasing probability that Lookout Mountain will support a landscape-scale western pine beetle/mountain pine beetle outbreak or wildfire

Current conditions

Block	Acres	SDI	BA $ft^2\ acre^{-1}$	Density trees $acre^{-1}$	Diameter inches
1 (upper -east)	651	214	140	101	15.9
2 (upper-west)	841	257	180	92	18.9
3 (lower-east)	899	267	185	101	18.3
4 (lower-west)	554	223	150	93	17.2

Mean growth rate for ponderosa pine is 27 rings per inch, while suggested Upper Management Zone (UMZ) (Cochran 1992) equals 13 rings per inch

Management on Lookout Mountain

- Buffer the *Levels-of-Growing-Stock Study* and the *Ponderosa Pine-Grand Fir Spacing Study* to prevent loss from insects and wildfire
- Enhance growth rate and reduce susceptibility to insect infestation and wildfire in ponderosa pine
- Protect and enhance future research opportunities

Key research landmarks

Sept. 2005	Project introduced to Program Manager
Oct. 2006	Potential partners and collaborators meeting
April 2008	Study plan drafted after technical review
Oct. 2008	PFEF Strategic Business Plan
Dec. 2008	Study plan revised after blind external technical and statistical review
Mar. 2009	Study plan approved by Station Director

Study plan goals

- Refine management options for restoring resiliency in ponderosa pine ecosystems
- Evaluate the effects of thinning and fuel reduction on long-term susceptibility to fire, insects, wind, climate change, and other forest disturbances

Research questions

1. How does the residual stand structure resulting from a set of fuel reduction treatments interact locally with wind to cause additional structural changes?

2. How does a dominant shrub, giant chinquapin (*Chrysolepis chrysophylla*), respond to a set of fuel reduction treatments?

Research questions

3. What set of fuel reduction treatments best accelerate the development of large trees while reintroducing natural disturbance processes that provide greater ecosystem resiliency?

4. What is the influence of climate change interacting with a set of fuel reduction treatments on vegetation dynamics and forest structure?

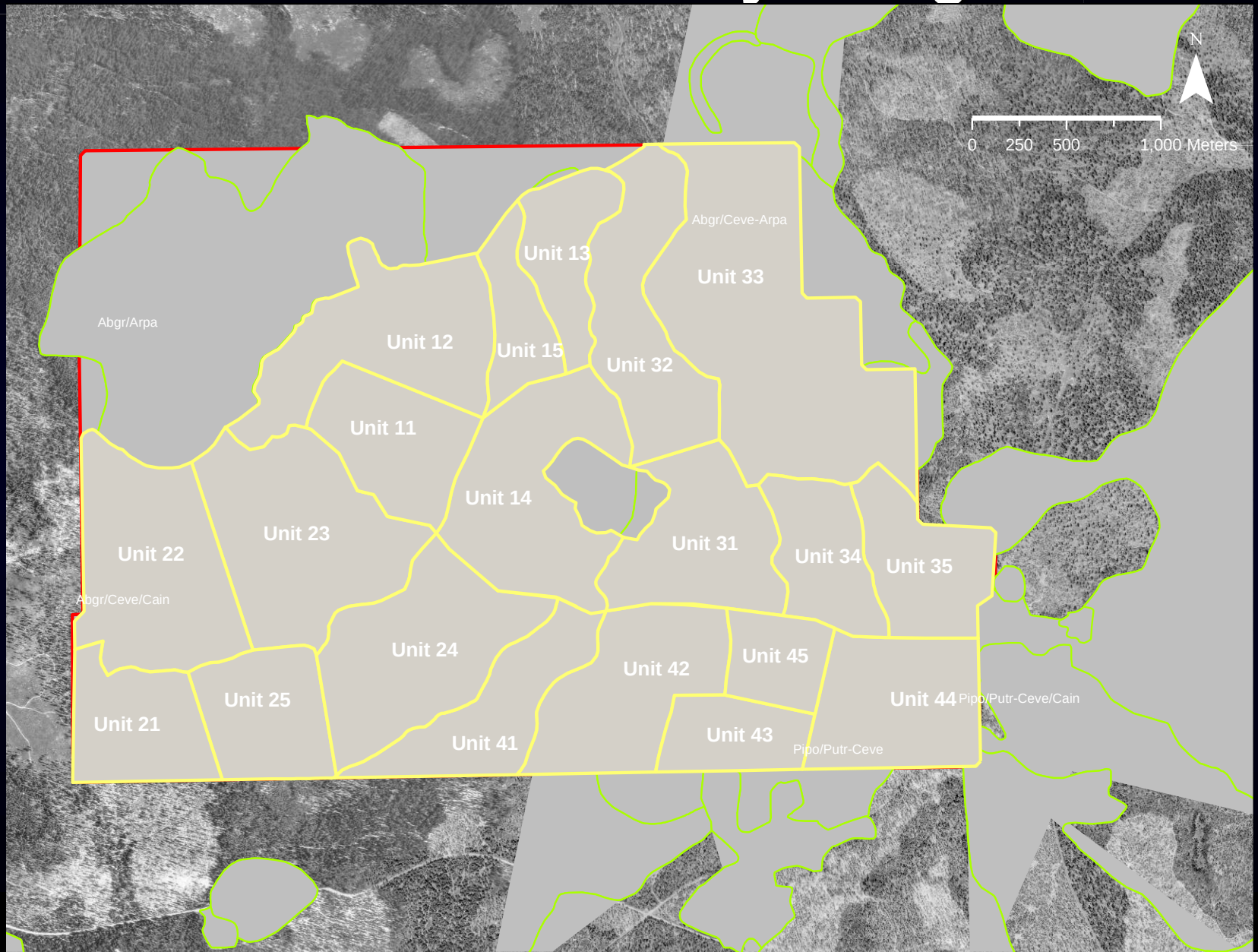
Research questions

5. Can single cohort stands be readily converted to multi-cohort stands?
6. Do multi-cohort stands share the same risks of multiple, interacting stresses as single-cohort stands?

Treatments

1. Thin from below to UMZ, mow, and underburn
2. Thin from below to 75% of UMZ, mow, and underburn
3. Thin from below to 50% of UMZ, mow, and underburn
4. Thin from below to 75% of UMZ, regeneration cut 10% of area in openings to begin transition to a multi-cohort stand structure
5. Control: retain for near-term the current structure

Lookout Mountain study design



Treatment targets

Treatment	Acres	SDI	BA
Block 1 Mixed conifer/snowbrush/sedge	651	214	140
11: 75% of UMZ	118	117	76
12: 50% of UMZ	192	78	51
13: 75% of UMZ + gaps	83	117	76
14: UMZ	194	156	101
15: Untreated	64	212	138
Block 4 Ponderosa pine/bitterbrush	554	223	150
41: 50% of UMZ	116	51	35
42: UMZ	160	102	70
43: 75% of UMZ + gaps	70	77	53
44: 75% of UMZ	147	77	53
45: Untreated	61	229	154

Key project landmarks in NEPA

Aug. 2006	Letter of cooperation from District Ranger and Forest Supervisor
April 2008	Scoping Letter distributed
Sept. 2009	DEIS released for public review
Jan. 2010	Biological Opinion of “not likely to jeopardize” NSO by USFWS
March 2010	Record of Decision (ROD) and FEIS signed and notice published

Effects of preferred alternative

- Implements core study plan
- Treatments on 2,554 acres (including controls)
- Harvest (thin) nearly 50 million bdft
- Build 1 mile temporary road for access to 4 units
- Amend Deschutes Forest Plan: Interim Wildlife Standard 6.d from Regional Forester's Forest Plan Amendment #2 (Eastside Screen)- not applicable on 22 acres LOS in Sheridan Late Successional Reserve
- Amend Deschutes Forest Plan: Interim Wildlife Standard 6.d.2.a from Regional Forester's Forest Plan Amendment #2 (Eastside Screen)- 21 inch limit not applicable on 370 acres (266 treated)

Post-NEPA landmarks

May 2010	Two appeals and 2nd FOIA request filed
June 2010	ROD affirmed and all requested relief by appeal denied by Regional Forester
Sept. 2010	Lawsuit filed in District Court of Oregon
March 2011	Block 4 sold at auction

Additional research

- Multi-scaled monitoring of weather
- Stand dynamics and bak beetle susceptibility
- Autecology of giant chinquapin
- Resiliency of ponderosa pine after treatments
- Combustion of large wood and tree regeneration
- Forest dynamics and NSP prey species and foraging habitat
- Forest dynamics and white-headed woodpecker nest availability
- Large wood, soil microbes, and soil temperature
- Change detection with LiDAR

Questions