Effectiveness and Longevity of Ponderosa Pine Fuels Reduction Treatments at Lick Creek Demonstration/Research Forest, Montana

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Introduction

In ponderosa pine (*Pinus ponderosa*) ecosystems of the interior West, fuels reduction treatments are common but their longevity, or long-term effectiveness, are poorly understood. The Lick Creek Demonstration/Research Forest in western Montana is a unique long-term research site for examining ponderosa pine ecosystem restoration in the Northern Rockies. In the early 1990s, two experimental cutting treatments (a commercial thinning and a retention shelterwood) were followed by prescribed fire treatments to achieve long-term forest restoration objectives. These sites were remeasured in 2005 and 2015. The present study is evaluating the effectiveness of these treatments on reducing fuels and potential fire behavior after more than two decades.

Research Questions

Q1: What is the longevity of different fuels treatments (CT vs SW) at Lick Creek?
Q2: How did the burning treatments affect current fuel loads?
Q3: What is the predicted fire behavior 25-years post-treatment?
Q4: How do linear transects estimates of CWD differ from fixed plot sampling?

Methods

Study Design:

- Two blocks (80-100 ac each) with different silvicultural treatments (Fig 1, Table 1):
  - Commercial Thinning
  - Retention Shelterwood
- Within each block, twelve units (with twelve 1/10th-acre plots per unit) randomly assigned to four treatments with three replicates each:
  - Wet/spring burn, dry/fall burn, cut-only, or control (prescribed fires were implemented in the early 1990s, see Table 1)
- Data collection included overstory tree measurements, two 50-ft linear transects, originating from plot center (Figure 2), and full-plot CWD inventory on half of all plots to compare volume estimates to linear transects

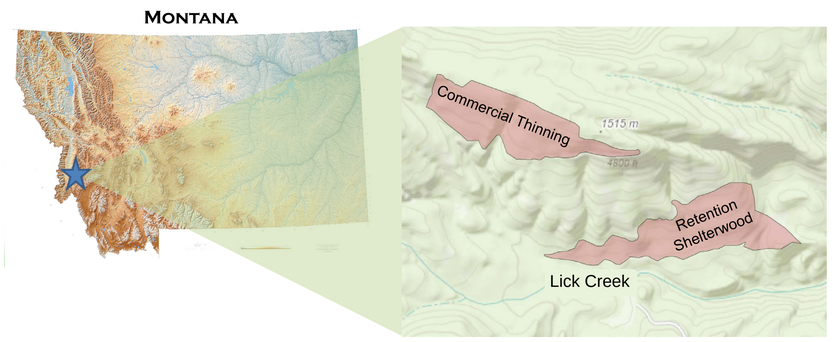

Figure 1. Lick Creek Commercial Thinning and Retention Shelterwood blocks on the Darby Ranger District of Bitterroot National Forest.

Next Steps

- Determine tradeoffs among alternative restoration treatments, with emphasis on post-treatment fuel dynamics and treatment longevity
- Determine whether and by how much the range of treatments at Lick Creek differ and how much change has occurred since immediately post-treatment (compare to post-treatment fuel loadings in Table 2).
- Compare fuel loading estimates between transects and whole-plot inventory methods
- Model fire behavior in each treatment

Implications

The results of this study will provide forest managers with long-term effectiveness of restoration treatments in Northern Rockies ponderosa pine/Douglas-fir forests to help guide future forest restoration efforts.

Figure 3. Fall burn treatment in the Commercial Thinning block.

Figure 4. Wet burn treatment in the Retention Shelterwood block.

Table 1. Treatment types for each research block.

Treatments	
Commercial Thinning	**Retention Shelterwood**
Cut Only (low thinning)	Cut Only (shelterwood w/ reserves)
Cut and Spring Burn	Cut and Wet Burn
Cut and Fall Burn	Cut and Dry Burn
Control	Control

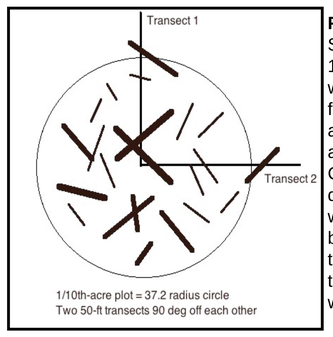

Figure 2. Schematic of 1/10-acre plot with two linear fuels transects at 90 deg. angles. Coarse woody debris (CWD) was measured both along the transects and throughout the whole plot.

Table 2. Initial and post-burn fuel loadings at Lick Creek sites. Adapted from Smith et al (1999).

	Commercial Thinning		Retention Shelterwood	
Fuel Type	Fall	Spring	Wet	Dry
(tons/ac)	----------*initial (post-burning)*----------			
Litter	1.2 (0.1)	1.2 (0.1)	1.4 (0.3)	1.9 (0.4)
Small Woody (<3 in.)	3.6 (1.5)	3.6 (2.1)	4.5 (1.8)	5.3 (1.3)
Large Woody (>3 in.)	4.0 (0.5)	6.0 (2.0)	1.7 (0.4)	3.2 (0.6)
Duff Depth (in.)	1.2 (0.4)	0.9 (0.5)	1.1 (0.9)	1.4 (0.9)

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Literature Cited:

Smith, Helen Y., Arno, Stephen F., eds. 1999. Eight-eight years of change in a managed ponderosa pine forest. Gen. Tech. Repr. RMRS-GTR-23. Ogden, UT: U.S. Department of Agriculture, Rocky Mountain Research Station.