Long-term Impacts of Fuel Treatments on Productivity and Aboveground Biomass in Ponderosa Pine Forests of the Intermountain West

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Introduction

In the western United States, high frequency, low-intensity fire regimes have shaped structure and function in many of the dry forests. A century of fire suppression has resulted in increased densities, increased shade-tolerant species composition, decreased individual tree vigor, and increased susceptibility to insects. In mixed and pure ponderosa pine (Pinus ponderosa) forests, restoration efforts often hope to reinstate structure created by historic fire regimes through decreased density, increased tree size, and removal of ladder fuels. Harvesting operations are often paired with prescribed broadcast burning or mechanical removal of surface vegetation. Our study aims to evaluate long term consequences of several commonly used restoration strategies on tree productivity and aboveground biomass 25 years after treatments.

Lick Creek Demonstration Forest

The Lick Creek Demonstration/Research Forest on the Darby Ranger District of the Bitterroot National Forest offers a truly unique opportunity to assess 25-year-effects of cutting and burning restoration treatments. The site was established as a Demonstration/Research forest in 1991 in a cooperative agreement between the Rocky Mountain Research Station, the University of Montana, and the Bitterroot National Forest. Starting in 1992, silvicultural treatments encompassing commonly used restoration strategies in the region were implemented, followed by prescribed burning in 1993 and 1994, under a fully replicated experimental design involving randomization of treated units and a permanent, systematic plot sampling network.

Treatments

- Retention Shelterwood (Two-Age) Commercial Thinning
  - Cut Only (Shelterwood w/ reserves)
  - Cut and Wet Burn
  - Cut and Dry Burn

- Control

Pre-treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>TPA</th>
<th>BA (ft²)/acre</th>
<th>Species % (TPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retention Shelterwood 1992</td>
<td>240</td>
<td>120</td>
<td>72% PIPO</td>
</tr>
<tr>
<td>Post-treatment 1993-1994</td>
<td>92</td>
<td>52</td>
<td>83% PIPO</td>
</tr>
<tr>
<td>Commercial thinning 1992</td>
<td>170</td>
<td>93</td>
<td>93% PIPO</td>
</tr>
<tr>
<td>Post-treatment 1993-1994</td>
<td>112</td>
<td>61</td>
<td>95% PIPO</td>
</tr>
</tbody>
</table>

Acknowledgements

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Objectives

This study aims to examine the impacts of common restoration treatments on long-term residual biomass and productivity in Ponderosa pine stands of the Northern Rockies. We will compare treatment effect on:

- Aboveground biomass and distribution
- Individual tree productivity
- Stand productivity
- Regeneration density and composition
- Stand structure

Timeline

Initial stand data was collected in 2014 and 2015. Data analysis is ongoing with an anticipated completion date of Summer 2016.

Study Site Description

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