Nenana Ridge
Research Prescribed Burns

Quantifying the Effects of Fuels Reduction Treatments on Fire Behavior and Post-fire Vegetation Dynamics in Alaska Black Spruce

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ATTENTION: This is an active fire effects research area. Please do not disturb. For more information, contact the State Division of Forestry at 451-2600.
Pre- and Post-burn Vegetation Sampling

- Understory species composition and density
- Tree seedling density
- Coarse woody debris
- Fine woody debris
- Overstory tree composition, density, basal area and canopy cover
- Stand age
Forest Floor Consumption During the Nenana Ridge Prescribed Fire in Alaska

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Why are we concerned about the consumption of the Boreal forest floor?

- Deep layers
- Large pool of biomass (+100 tons/acre)
- Often drives fire behavior
- Potential for large fire effects
  - Smoke emissions (1 ton of PM2.5/acre)
  - Regional haze
  - Permafrost melting
  - Erosion
  - Plant succession
Forest Floor Consumption and Smoke Characterization Project

Objectives

• Quantify fuel consumption of the forest floor in the treated and control plots

• Compare forest floor consumption within the treated versus non-treated plot sites.

• Use fuel consumption data to validate current forest floor consumption model in Consume.
Pre-fire Inventory Methods

- Standard set of protocols to measure forest floor depth, reduction, and consumption.
- 16 permanent plots for each of the control and treated sites
- 16 forest floor pins per plot
- Independent variables measured including moisture content, weather, and density
Forest Floor Moisture Content & Weather

Live Moss
Dead Moss
Upper Duff
Lower Duff
Mineral Soil
Post Fire Inventory Results

Fuel Moisture (%)

Fuel Type
- Live Moss
- Dead Moss
- Upper Duff
- Lower Duff

A1 Treatment
A1 Control

Graph showing fuel moisture for Live Moss, Dead Moss, Upper Duff, and Lower Duff under A1 Treatment and A1 Control conditions.
Forest Floor Reduction

Bar graph showing the comparison of FF Consumption (inches) between A1 Treatment and A1 Control.

- **A1 Treatment:** 0.49 inches
- **A1 Control:** 2.34 inches
Forest Floor Reduction

Pins that burned

<table>
<thead>
<tr>
<th>Units</th>
<th>A1 Treatment</th>
<th>A1 Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF Consumption (inches)</td>
<td>2.07</td>
<td>2.34</td>
</tr>
</tbody>
</table>
Pins that burned

<table>
<thead>
<tr>
<th>Unit</th>
<th>Measured</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Treatment</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>A1 Control</td>
<td>23</td>
<td>33</td>
</tr>
</tbody>
</table>
Management Implications

- Lower fuel moistures noted in the upper moss layers of treated site due to increased solar radiation and wind.
- When all pins considered, less forest floor consumption noted in treated site versus control site due to mosaic burn.
- Forest floor consumption models predicted treated and control site consumption reasonably well. These models require forest floor depth and upper forest floor moisture as input variables.
- Forest floor moisture content will need to be measured until a moisture model or instrumentation is developed.
Fire Behavior on Nenana Ridge

Objective:
Characterize effect of treatments on Fire Behavior

Bret Butler
US Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory
Sensors

Fire Behavior Packages
- Air/gas temperature
- Flame emissive power
- Incident total heat
- Incident radiant heat
- Air/gas vertical flow
- Air/gas horizontal flow
USDA Forest Service, Fire Behavior Research

Cameras

Fire proof box

Manual or Automatic Trigger (from logger)
Typical Deployment Layout

GPS position
Height of Sensors
Camera Height
Fuels
Compass Orientation
etc
Treatment Data for Plot A1

Heat Flux & Temperature

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Temperature (°C)  
Heat Flux (kW/m²)

Time (minutes)

Unit A-1 Thin Treatment
Summary

• Quantified energy release across Unit A.
• Improved measurement methods and instruments
• Demonstrated potential value of IR imagery
  • Rate of Spread
  • Interpreting point measurements across time and space
• Relating fire behavior to fuels.