An integrated study investigating masticated fuels:
Developing sampling methods, Describing fire behavior, and Evaluating fire effects

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Masticated Fuels

Mechanically altered fuelbeds:

• A less risky, cost-effective method of reducing fire hazard
• Mechanically disintegrate canopy and surface fuels
• Wide variety of methods, techniques, machinery, and outcomes

Disintegrate: to break or decompose into constituent elements, parts, or small particles
Masticated fuels
What makes them unique?

- Canopy fuels are altered and deposited with manipulated surface fuels
- Create different fuelbed properties:
  - Size class
  - Shape
  - Mineral content
  - Bulk densities
  - Live:dead ratio
  - Surface area:volume ratio
  - Spatial distribution
  - Fuel components
Masticated fuels
What are the implications?

Ecological impacts
- Weed invasions
- Nitrogen, nutrient cycling
- Native species response
- Water relations

Management impacts
- Sampling techniques
- Post-treatment fire behavior
Objectives:

- Develop sampling methods
- Describe fire behavior
- Build new fuel models
- Evaluate treatment effects
Develop sampling methods
Three methods are being explored

**Cover-depth-bulk density**
- Measure percent cover and fuelbed depth then multiply by bulk density

**Planar intercept sampling (Brown transects)**
- Count intercepts along a sampling plane

**Photoload**
- Visually match fuelbeds to a photo of known loading
Describe fire behavior

Record fire behavior characteristics

Use cameras, sensors, and field measurements
Build fuel models

*Develop a series of fuel models for masticated fuels*

*Augment existing fuel model classifications*
Evaluate treatment effects

Monitor treatments blocks for trends

Major Response Variables

- Tree populations
- Fuel loadings
- Plant species cover
- Weed populations
Methods

Experimental design

Four Blocks

- Control (C)
- Masticate only (M)
- Burn only (B)
- Masticate & Burn (F)

Design

- 10 plots per unit
- Replicate if possible

Measurements:

- Pre-treatment
- After each treatment
- 5 years
- 10 years
Methods
Plot sampling design

Sampling methods
- Trees (macroplot)
  - DBH, height, species
  - Allometric (FUEL CALC)
- Logs (transects)
  - Dia, length, rot
- Fine woody, shrub, herbs (microplot)
  - Collection by class
  - Transect
  - PHOTOLOAD
- Duff, litter (nanoplot)
  - Collection
  - Depth
- Plants
  - Cover, height on microplots
  - Weed population surveys
Methods

Synthetic masticated fuelbeds

Created a set of fuelbeds with graduated fuel loadings

Measure:
- Consumption
- Soil heating
- Plant response
Methods

Study areas
All ponderosa pine sites
Treated with Fedco flailer

Sample sites
- Libby
  - Kootenai NF
  - 20 acres
- Brockover Mesa
  - San Juan NF
- Banco Bonito
  - Valles Caldera NP
Results
Before and after photo-pairs

Banco Bonito Site
Post-mastication

Pre-treatment
Results

Before and after photo-pairs

Banco Bonito Site

Pre-treatment

Post-mastication
Results

Before and after photo-pairs

Pre-treatment

Banco Bonito Site

Post-mastication
Results

Banco Bonito – Tree populations

![Bar chart showing tree populations for different treatments at Banco Bonito.](chart.png)
Results

Brockover Mesa – Tree populations

Brockover Mesa Saplings per hectare

Brockover Mesa Mature Trees per hectare

Brockover Mesa Total Trees per hectare

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Trees per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masticate and Burn</td>
<td>7000</td>
</tr>
<tr>
<td>Control</td>
<td>2000</td>
</tr>
<tr>
<td>Burn only</td>
<td>1200</td>
</tr>
<tr>
<td>Masticate only</td>
<td>1500</td>
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</tbody>
</table>

Legend:
- Blue: Pre Treatment
- Orange: Post Treatment
Results - *Banco Bonito – Fuel loadings*

**Transect**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Masticate and Burn</th>
<th>Control</th>
<th>Burn only</th>
<th>Masticate only</th>
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</thead>
<tbody>
<tr>
<td><strong>kg m²</strong></td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>6</td>
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**Photoload**

<table>
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<th>Masticate and Burn</th>
<th>Control</th>
<th>Burn only</th>
<th>Masticate only</th>
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</thead>
<tbody>
<tr>
<td><strong>kg m²</strong></td>
<td>2</td>
<td>0.5</td>
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**Cov-depth-bulk**

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<th>Masticate and Burn</th>
<th>Control</th>
<th>Burn only</th>
<th>Masticate only</th>
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</thead>
<tbody>
<tr>
<td><strong>kg m²</strong></td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>8</td>
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</table>
Results - Brockover Mesa – Fuel loadings

Transect

Photoload

Cov-depth-bulk
Discussion

What have we learned so far?

- Masticated fuelbeds are unique and diverse
  - No “one-size-fits-all”
  - Tailor sampling, fuel model to fit area and treatment

Cover-depth-bulk density method best
- Transects performed well
- Photoloads need masticated photoset
Summary

Study is only half finished
Still waiting for all sites to be burned
10 year measurements need to be taken
Results

Banco Bonito – Fuel loadings

Graphs showing fuel loadings in 
Banco Bonito using different methods.

- **Banco Bonito Fuel Loading**
  - **TRANSECT Method (All Fuels)**
  - Compare fuel loadings among different treatments:
    - Masticate and Burn
    - Control
    - Burn only
    - Masticate only

- **Fine Fuel Only**
  - Pre Treatment vs Post Treatment
  - Treatments: Masticate and Burn, Control, Burn only, Masticate only
Results
Tenderfoot
Canopy fuel Variability Summary