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

Bob Keane, Helen Smith
US Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory Missoula MT
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

This study
Integrated study exploring masticated fuels
iMAST
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 (FUELCALC)
- 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

Banco Bonito Site

Post-mastication

Pre-treatment
Results

Banco Bonito – Tree populations

Banco Bonito Total Trees Per Hectare

- Masticate and Burn
- Control
- Burn only
- Masticate only

Trees per hectare

Mature Trees per hectare
Results

Brockover Mesa – Tree populations

Brockover Mesa Saplings per hectare

Brockover Mesa Mature Trees per hectare

Brockover Mesa Total Trees per hectare

- Masticate and Burn
- Control
- Burn only
- Masticate only

Pre Treatment
Post Treatment
Results - Banco Bonito – Fuel loadings

- Transect
  - Masticate and Burn
  - Control
  - Burn only
  - Masticate only

- Photoload
  - Masticate and Burn
  - Control
  - Burn only
  - Masticate only

- Cov-depth-bulk
  - Masticate and Burn
  - Control
  - Burn only
  - Masticate only
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
Thanks
Results

Banco Bonito – Fuel loadings
Results

*Tenderfoot*

Canopy fuel Variability Summary