

This document is part of a series of case studies from Oregon State University, Wood Science and Engineering, describing different technologies for converting forest-derived woody biomass into boiler fuel or higher-value products, and the characteristics of the processed material. The work is sponsored by a USDA Wood Utilization Research grant.

# WOODY BIOMASS

## BRUKS CHIPPER

Converting logging slash to boiler fuel  
Sample Date: August 3, 2010



Bruks chipper transporting chips to empty trailers approximately 0.25 miles below



Bruks chipper gathering scattered slash



Dumping chips into stationary chip van, which held five chip hoppers of material

### Site Description

This study was conducted on private forest land near Sutherlin Oregon, where a Bruks Mobile Chipper was used to process logging slash. The slash, composed of tops, branches, and low grade stemwood, was chipped and sent to a nearby company mill for boiler fuel.

Species composition was mainly Douglas-fir with some cedar. Harvest activity began in the spring, five months before late summer extraction. The operation was a clear cut of a managed stand on moderate to steep terrain, requiring a combination of cable and shovel logging techniques. Weather conditions in the weeks prior to sampling were clear and dry.

### Recovery Operation

A Bruks 805.2 STC mobile chipper, equipped with a 450 hp engine mounted on a Valmet 890.3 eight wheel forwarder was used for biomass processing. A mounted grapple on the forwarder fed the chipper with logging slash. The 27 yard chip hopper was mounted directly to the forwarder which was able to dump directly into a 125 yard chip van. The chipper's cutting wheel consisted of two, 34 inch knives set to cut 45mm (1-1/2") chips. Knife life reportedly ranged from 4-8 hours of operating time. Combined fuel consumption of the chipper and forwarder averaged 9 gallons per hour during operation.

The main advantage of using the mobile chipper was its mobility. At one site, consolidated piles located at the landing were chipped and transported to a chip van located on a flat open area to ease truck maneuvers. Scattered slash throughout another site was simultaneously gathered, chipped and transported to a nearby chip van. Chipping and transportation for a full chip hopper varied with travel distance, but averaged around 20 minutes. At this rate, the chipper was producing 5-6 truckloads of material per eight hour workday.

### Physical Characteristics

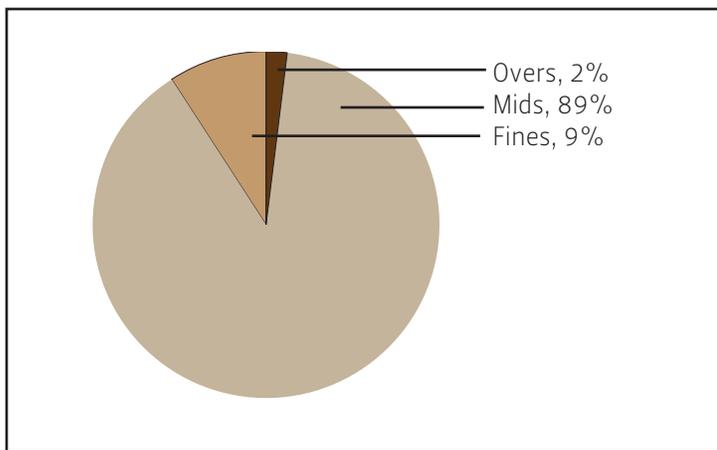
Physical characteristics of interest of processed woody biomass are size distribution, percent dry solids, and bulk density. Reported values for this study are the average of measurements made on 20 gallon samples taken from three different trucks. Gross size distribution was determined by screening material on an oscillating screener with 2" and 3/8" round hole screen decks. Material retained on the 2" screen was considered Overs, material retained on the 3/8" screen was considered Mids, and anything that passed through the 3/8" screen was considered Fines.

Each of these size fractions, and the aggregate samples, were also evaluated for non-combustible ash content and fuel energy value on both a green and a dry basis.

## Physical Characteristics

Fraction	% Dry Solids	% Green Weight	Bulk Density (lb/ft <sup>3</sup> ) dry
Aggregate	68	-	10.3
Overs	73	2	-
Mids	66	89	9.1
Fines	68	9	9.1

## Gross Size Distribution



(top) Processed woody biomass; (bottom) Mids fraction after screen removal of Overs and Fines

## Processed material

Smaller portions of each gross size fraction were further measured by hand and standard sieves to determine detailed size distribution.

### Detailed Size Distribution

Material Size	% of green weight
>6"	0.6
3-6"	6.3
3/8-3"	84.2
1/16-3/8"	7.1
<1/16"	1.8

## Fuel Value Characteristics

Reported heat value and ash content are averages of three samples taken from three different trucks.

### Fuel Value Characteristics

Fraction	% Ash	HHV Btu/dry lb.	LHV Btu/green lb.
Aggregate	0.9	8670	6240
Overs	0.9	8750	6830
Mids	0.8	8550	6900
Fines	1.7	8520	6030

HHV, Higher Heating Value is measured on oven dry samples. LHV, Lower Heating Value is net recoverable heat at original moisture content

### Observation

This versatile technology produced clean biomass fuel chips with a very uniform size distribution

For more information about Woody Biomass case studies and programs in Wood Science and Engineering, contact David Smith, Oregon State University, at 541-737-8506, or email, david.smith@oregonstate.edu

