Pilot Project for Hog Fuel Generation from Grassland Restoration Debris at the Alex Fraser Research Forest

December 2008

Debris pile

Loader and grinder

Chipping drum & teeth

Ground debris

After one hour

INTRODUCTION

In winter of 2007-08 the Alex Fraser Research Forest, in cooperation with the Cariboo-Chilcotin Ecosystem Restoration Team of the Ministry of Forests and Range, implemented the tree removal phase from a 4.14 ha area of Benchmark Grassland that had been heavily encroached by trees over several decades (see Grassland Benchmark Restoration at the Knife Creek Block, RP #07-14 Implementation Report, 2008). So as to reduce pressure on the grassland area to be restored, most of the woody debris resulting from logging and slashing was piled on a nearby landing for further processing. A common method of wood waste disposal at landings is by open burning. Like many grassland restoration areas, the Knife Creek Grassland Benchmark area lies within a high smoke sensitivity zone. An alternative was to grind the debris and deliver it to the nearby biofuel-fired power plant in the City of Williams Lake where it could be used to produce energy. We conducted a pilot project that tracked the costs of production and transportation of debris-derived hog fuel using the debris pile from our restoration project.

Project Objectives:

1. Process woody debris resulting from removal of grassland encroachment in an alternative method to open burning.
2. Determine actual hog fuel volumes resulting from an estimated volume of woody debris.
3. Determine the cost of hog fuel by unit volume.
4. Identify a suitable hog fuel transportation system.
5. Cooperate with the Epcor Williams Lake Power Plant with hog fuel delivery.
6. Complete the tree removal phase of grassland restoration at the Knife Creek Grassland Benchmark.
7. Develop greater expertise and capacity among participants so that they may further contribute to future biomass processing investigations and trials in our region.

OPERATIONAL MEASUREMENTS, EQUIPMENT and COST SUMMARIES:

Restoration area (AFRF Block 224):

4.14 hectares total

2.5 hectares had encroachment and ingrowth removed

221.2 m^3 of sawlogs were generated, as well as a large debris pile of unmerchantable stems, branches and tops

Estimated species distribution within debris pile:

90 % Douglas-fir, 2 % lodgepole pine, 3 % spruce, 5 % deciduous

UBC Forestry
University of British Columbia

Loading a trailer

A typical load

Bulk pile volume of debris: In forestry circles we think of volume (m^3) as solid wood volume of logs. In dealing with debris, however, we encounter two other measures of volume: pile volume of debris, and pile volume of ground or chipped debris.

Pile volume has been determined by selecting the best fit of the pile to a geometric shape (rectangle, cone, pyramid, trapezoid) and calculating volume using measures of basal area (as determined by GPS) and peak height of debris pile. The pile volume of this pile was approximately 1346 m^3.

Grinding summary: Vermeer HG 600TX horizontal grinder
5 hours grinding time @ ~ 102 m^3 pile volume/hour
$4347.000 grinding cost including loader and mobilization/de-mobilization costs

Hog fuel volume generated from grinding of debris:
~509 m^3 of green chip pile volume or
129.22 Green Metric tonnes (GMt) -- 52 GMt/ha
81.15 Oven Dried metric tonnes (ODt) @ 37% moisture content

Note: *units of measure in use locally are numerous and potentially confusing. We are reporting here using the standard measures adopted by FPInnovations, which are Green Metric tonnes (GMt) and Oven Dried tonnes (ODt).*

Shipping summary: 2 hour cycle time from bush to EPCOR Williams Lake Power Plant and back (includes loading and unloading time)
Loads weighed and sampled for moisture content
Five full loads in 53' tri-axle chip trailers using 2 trucks, totalling $1075.00 hauling cost
Trucking offsets, where available, are paid on the basis of ODt

Planning and implementation supervision:
16 hours ($874.72)

Total project cost: $6296.72 total

Delivered costs: $12.36/$m^3$ chip pile volume, $48.73/GMt, $77.59/ODt

Learnings and Recommendations

- The volume of debris accumulated from block 224 was small relative to the productivity of the grinder we employed. High mobilization costs are therefore borne by a small production volume, making this project expensive on a per unit basis.
  Match equipment to accumulated volumes to improve productivity and reduce costs.
- Units of measure are numerous and confusing. Work to standardize the units of measure to improve communications and facilitate understanding. *Adopt Green Metric tonnes (GMt) and Oven Dry tonnes (ODt) as the standard measures of chips.*
- Circular debris piles stacked for burning are difficult for the loading process because the debris is tangled and needs to be organized before it can be loaded into the grinder. *Organize the debris during logging to facilitate the feeding process and thereby improve grinding productivity and reduce the cost per GMt.*
- Contamination of the debris with steel or refuse reduces the grinding efficiency, increases maintenance costs and devalues the ground material for the end users. We found several links from tire chains that had been pushed into the debris pile during landing cleaning. *Pick up steel off the landing area, and prevent others from depositing trash in the debris piles.*
- Drier material has more energy value per GMt than wetter material. *Allowing material to dry for a season improves the energy value as compared to shipping fresh green material.*
- Low-boy chip vans (familiar on the highway) are not suitable for use on logging roads. High-boy chip vans are available, but do not track as well as some logging truck configurations because of their fixed trailer design. Some logging roads may have sharp corners that these trailers have difficulty negotiating. *Ensure that chip vans will be able to negotiate the roads to the planned chipping site before operations commence.*