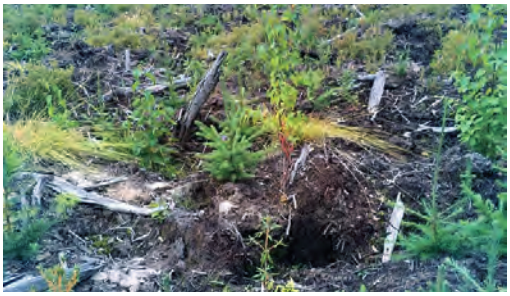
CENTRE FOR BOREAL RESEARCH
TECHNICAL NOTE #33
FOREST RECLAMATION AND BOREAL REFORESTATION - SEPTEMBER 2019

Site Preparation: Application of Rough and Loose Mounding and Furrowing (RipPlow) on a Wood Mulched Site





INTRODUCTION

The practice of mulching forested sites for industrial activities during winter operations is a useful construction practice as it minimizes soil disturbance by protecting the forest floor. However, wood mulch can be counterproductive during the revegetation phase as this mulch exhibits alternating periods of excess moisture or extreme dryness, both situations hindering seed-based plant re-establishment (Figure 1). Applying site preparation techniques that act to displace the mulch and expose the soil surface can enhance substrate conditions for establishment and growth of desirable plant species.

TECHNIQUES

Two oil sands exploration sites (winter access) located approximately 500 kilometers north-west of Edmonton, Alberta, were selected to evaluate mulch displacement using two site preparation techniques:

1. Rough and Loose mounding, also known as unconventional mounding (see technical note #1)
2. Furrowing utilizing a RipPlow (a specialized tool attached to a Caterpillar D7, see technical notes #3 and #4)

The study sites were surrounded by mature forest dominated by black spruce (*Picea mariana*) and tamarack (*Larix lariciana*), as well as a lesser component of white spruce (*Picea glauca*), aspen (*Populus tremuloides*) and jack pine (*Pinus banksiana*). Site preparation occurred in 2014 and woody plants were established in fall 2015. Vegetation surveys were conducted over two years to determine the effectiveness of mulch displacement and microsite development, which are important for facilitating and sustaining the regeneration of forest plants.

Figure 1. The only vegetation growing where wood mulch was applied were horsetails (*Equisetum spp.*).

SITE PREPARATION TECHNIQUE #1: ROUGH AND LOOSE

The Rough and Loose technique at this site used a 325 Caterpillar excavator with a smooth bucket, which created microsites by scooping the soil and flipping it over, resulting in the partial burial of wood mulch and exposure of organic and mineral soils (Figures 2, 3 and 4). It can be employed with a range of excavator sizes, though consideration of ground frost will limit use of larger equipment. In this trial, frost depth was 4-6 inches.

Figure 3. Site immediately following Rough and Loose treatment.

Figure 2. Rough and Loose application in the winter.

Figure 4. Site conditions the following spring.

SITE PREPARATION TECHNIQUE #2: RIPPLOW TECHNIQUE

The RipPlow technique used a dozer and specialized RipPlow attachment to furrow the mulch and expose soil (Figures 5, 6 and 7). It created microsites by lifting the soil and fracturing larger soil clods. The fissures and cracks created (greater than 50 centimeters in depth) allow water and frost to penetrate the entire rooting soil profile and aid in continual decompaction over several years as the soil slowly settles over time.

Figure 6. Site after RipPlow application.

Figure 5. Winter furrowing with a RipPlow attachment.

Figure 7. Site conditions the following spring.

CONCLUSIONS/APPLICATIONS

Results from two years (2015 and 2016) of vegetation surveys have demonstrated that both Rough and Loose (Figures 8 and 9) and the RipPlow (Figures 10 and 11) techniques created surface soil heterogeneity, which facilitated plant growth, though the Rough and Loose mounding technique was more consistently effective in displacing the mulch. The RipPlow technique was more effective where the mulch was less than 3 inches in depth. In deeper mulch there was a lack of soil exposure, although the surface was more heterogeneous than prior to RipPlow application (Figure 12).

Figure 8 and 9. Vegetation development in the Rough and Loose treatment two growing seasons later.

Figure 10 and 11. Vegetation development in the RipPlow treatment two growing seasons later.
Figure 12. Furrowing (RipPlow) did not effectively displace thick mulch though it created some roughness and surface heterogeneity.

Despite differences in mulch displacement, the microsites created from both site preparation techniques created conditions suitable for natural regeneration of deciduous shrubs (primarily willows [*Salix spp.*]) and deciduous trees (aspen and balsam poplar [*Populus balsamifera*]) (Figure 13) from adjacent seed sources in the surrounding forest. The net result was that there was no consistent difference in effective density of woody vegetation between the two treatments, although there were differences between the study sites, as one was wetter than the other (Table 1).

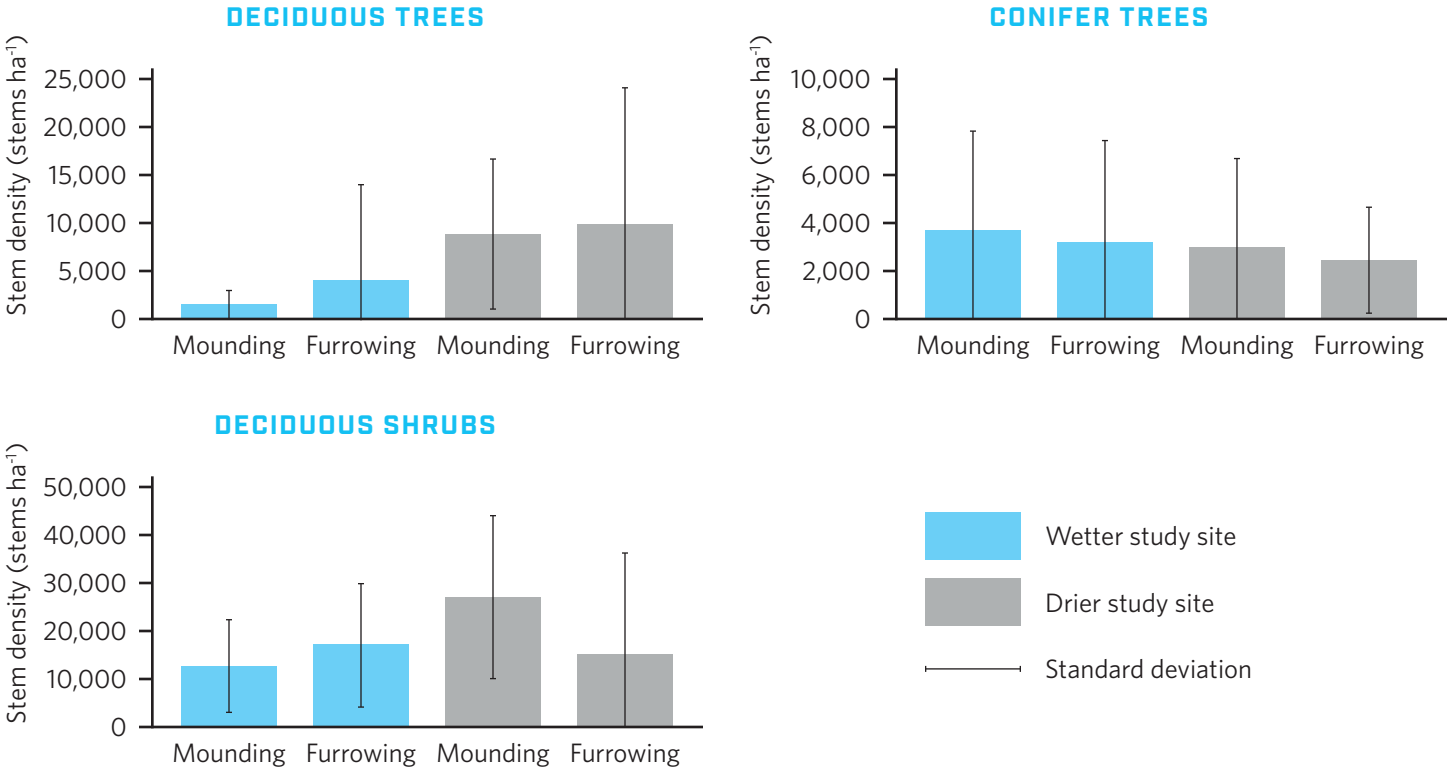


Figure 13. Woody stem density (stems per hectare) of deciduous trees, conifer trees, and deciduous shrubs after two growing seasons. Blue bars represent the wetter study site, and grey bars represent the drier study site. Mounding = Rough and Loose treatment, and Furrowing = RipPlow treatment. Note the different stem density scales.

Table 1. Percent cover of native forbs after two years following site preparation techniques.

SITE	TECHNIQUE	MEAN (%)	STANDARD DEVIATION
Site 1 (less wet)	Rough and Loose	25.9	15.4
	RipPlow	13.6	10.3
Site 2 (wet)	Rough and Loose	9.2	13.5
	RipPlow	11.8	10.5

TAKE AWAY MESSAGE

Although there was not a detected quantifiable difference between the site preparation techniques, we do suggest that supplemental planting may be a good strategy if using the RipPlow treatment in heavy mulch (3 inches or more in thickness), as there was a substantial decrease in natural recovery in the areas of heaviest mulch relative to thinner mulch where soil exposure was evident.

COST COMPARISON

A comparison of costs of the different approaches demonstrated that the RipPlow was by far the most economical approach (approximately 20% of the cost of Rough and Loose treatment) when conducted on wood mulched sites with shallow organic soils (20 to 40 centimeters) overlying mineral soil (Table 2).

NOTE: This only considers the time for conducting the actual treatment activity. Additional costs for transport, accessing the site, clean-up of well centres and consultant supervision are not included. The final column includes a normalized cost comparison which reflects an hourly rate of CAD $210 per hour for use of a 325 excavator versus CAD $270 per hour for a D7 CAT with RipPlow attachment.

Table 2. Summary table of time spent conducting site preparation treatments and per hectare cost of each.

TECHNIQUE	RATE (HOURS PER HECTARE)	COST (CAD$ PER HECTARE)
Rough and Loose	12.5	$2,625.00
RipPlow	1.9	$506.25

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