Morice & Lakes IFPA

April 2003
Summary No. 20

Morice & Lakes Innovative Forest Practices Agreement

Project Summary

Ecosystem Management

Forest Productivity

Public Involvement

Adaptive Management

Morice & Lakes IFPA projects are exploring ways to enhance forest productivity through a better understanding of factors affecting productivity, through intensive silviculture treatments, by increasing the area of productive forest land, and by improving site productivity estimates.

Problem Forest Type Rehabilitation Trial (2002)

Introduction

This activity summary discusses all activities that occurred during the 2002 field season as related to the first-year post-treatment measurements of an experimental research trial involving rehabilitation (complete removal of tree cover) as compared to other operational treatments in a Problem Forest Type (PFT) stand.

In the Morice & Lakes IFPA area there are approximately 185,351 ha of PFT stands (PFT and low productivity stands) that have been removed from the timber harvesting landbase (THLB) in the latest Timber Supply Review process recently completed in both districts (Ministry of Forests, 2001). For the purposes of this report and project, PFTs are defined as stands which are excluded from the THLB in the timber supply analysis in the Lakes and Morice TSAs for reasons of: a) having species that are not currently being utilized; b) marginal timber value (i.e. low sites); or, c) have non-merchantable value (i.e. owing to species or quality of wood). This project builds on definitions and other information generated from a problem analysis report prepared for the Morice & Lakes IFPA entitled "Forest Management Opportunities for Problem Forest Types in the Lakes and Morice IFPA" (Yole, 2001a). In addition, details of the rationale for study site selection and objectives of this research project, the reader should refer to the working plan (Yole, 2001b).

Specifically, this project is interested in studying the response of a young, very poor-growing 18 year-old lodgepole pine stand to imposed forest management activities. It is the belief of members of the IFPA's Forest Productivity Subcommittee that the site index (SI) of some of these poor growing conifer stands, classified as PFTs, may have been underestimated by the current vegetation inventory label used in the Timber Supply Analysis. The subcommittee required a long-term, replicated plot research study that would help forest practitioners understand what site factors were limiting on a commonly found PFT category in these districts.

Objectives

The main objectives in this study include:

- Establishing long-term experimental plots which will help forest practitioners understand what site factors are limiting on PFTs (Problem Forest Types) and whether there are management interventions that may help practitioners better achieve forest management objectives including improved timber supply.
- Determining how effective subsoiling treatments are in an area previously logged in the net area to be reforested (NAR).
- Determining stand response (height, diameter) to four treatment options including control

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(untreated stand), rehabilitation (complete removal of conifer cover), rehabilitation plus site preparation (alleviate dense soil conditions through subsoiling) and juvenile spacing in a very dense, 18-year old PFT pine stand (SI = 6.6 m), that in time would likely revert into the low height PFT category (Yole, 2001a).

- Determining which treatment option produces the best growth response and whether that response improves forest productivity and site growing conditions to a level where the stand is no longer classified as a PFT or non-merchantable owing to very high stand density
- Determining what site and stand factors are most limiting growth in a repressed lodgepole pine stand (i.e. tree density, root restricting layer).
- Establishing small demonstration areas of rehabilitation and subsoil treatments in roads, landings, and larger contiguous NAR areas relative to the small research test plots.

A demonstrated improvement in forest productivity in such poor growing PFT stands to a merchantable level may be justification for a potential increase in the merchantable forested land base (THLB) in the IFPA area once these PFT stands are treated. This could lead to a re-allocation of the Allowable Annual Cut (AAC) by the Chief Forester if significant areas of PFTs are impacted.

It is expected that the results of this project will provide the Forest Productivity Subcommittee with a more accurate estimate of the responsiveness of PFTs to imposed forest management treatments. Further to this goal, this research will examine improved opportunities for increasing timber supply following traditional (i.e. juvenile spacing) and innovative (rehabilitation and subsoiling) treatments of a PFT stand.

Methods

Details on methods and experimental design are detailed in the establishment report for this project (Yole, 2002) and not presented here except where deviations from that plan are reported. Both tree growth and soil parameters are being monitored in response to the four treatment options.

As the cleared (rehabilitated) and subsoiled plots were summer planted with pine (i.e. July) in 2002, growth had essentially been completed for the year at the time of planting and no measurement of incremental height growth was available for treatment comparison. This will be completed in the 2003 field season. Initial height and seedling calipers were recorded for all trees in the experiment in 2002.

A completely randomized design was used on a 5 ha site with four treatments and three replicates of each treatment. The 12 plots were placed in relatively uniform ecosystem and soil conditions. Analysis of variance was used to assess pre- and post-treatment mean effects with 95% probability.

The study site is a relatively high elevation (~1050 m) site in the Swiss Fire approximately 40 kilometres southwest of Houston, BC. The site conditions are mesic to slightly moister (SBSmc2/01 and /05; Banner et. al, 1983) and growth would appear to be limited by one or more of the following: dense subsurface horizons, perched water tables in the spring, or extremes in tree density (and associated nutrient competition). The current site includes an 18 year-old, short (1.6 m average) and very dense (20,000-100,000 sph) stand of natural pine. The site was originally harvested for snags after the wildfire and then windrowed in 1983/84.

Treatments and Results

To briefly recap the treatments that were completed in 2001, rehabilitation treatments were conducted with a D7 cat fitted with a brush blade. Soil conditions were dry and clearing away of trees went well (>90% stems removed). Any remaining lodgepole pine stems (<10-20%) were removed with brush saws while the juvenile spacing crew was onsite. Owing to small tree size, (<2 m height) clearing with the cat was most successful by lowering the blade at, or just below, the surface. The site in question had very high compaction hazard, thus rehabilitation treatments were conducted under dry soil conditions to minimize damage.

Considerable countable soil disturbance occurred as a result of the rehab and subsoiling treatments as shown in Table 1. Wheel track ruts (T) and wide scalps (W) were considerable on the rehabilitation-only and subsoil plots, respectively. Total counted soil disturbance measured to be 36.1% and 15.0% on the rehabilitation-only and subsoiled plots treatment, respectively. Subsoiling decreased the countable disturbance by approximately 50% relative to the rehabilitation-only treatment. Soil disturbance was well above acceptable FPC disturbance levels (i.e. 5%) for such a clay-rich site.

The juvenile spacing (JS) treatment resulted in 1600 sph healthy trees remaining in each of the three JS plots. All diseased trees were removed and healthy dominant or co-dominant trees were selected in a 2.5 m grid pattern.

New seedlings were summer planted (Seedlot 39649, 415B,

Table 1. Soil disturbance survey tallies of countable disturbance in 6 rehabilitated sites.

Treatment	T (FF gone)	T (FF intact)	E	G	W	S	FF Displ.	Total counted
% counted Rehab	15.5[1]	15.5	1.1	1.1	-	2.8	33.9	36.1
% counted Rehab+SS	1.7	-	-	-	7.8	5.5	55.5	15.0

[1] *Per cent countable disturbance = total observations of counted disturbance out of 180 possible observation points.*

summer plant) in July, 2002 in the rehabilitation and subsoiled plots (6 plots in total). A total of 169 seedlings were planted at each plot (1600 sph or 2.5m grid spacing) with 49 permanent sample trees located in the center 7x7 rows for long-term measurement. Initial heights and calipers were measured in all 12 plots in Sept., 2002 but height increment comparisons (cm/year) between all treatments cannot be made until the end of the 2003 growing season owing to the summer planted seedlings in 6 of the 12 plots. Initial health of newly planted seedlings was only fair going into the winter, perhaps owing to an early frost at the site. This will be assessed in 2003 to determine whether replanting or transplanting trees is necessary.

One season after treatments were completed, bulk density was re-measured using the methods described previously (Yole, 2002) to see whether soil compaction had occurred. Figure 1 details some significant treatment effects for fine fraction bulk density (Bd<2mm) (p=0.05) in the 0-10 cm layers. The rehab+subsoil (RSS) (0.62 g/cm^3) treatment mean value was significantly less than untreated bulk density (0.89 g/cm3). Total bulk density (i.e. with coarse fragments) changes were less dramatic between RSS and other treatments, although similar trends occurred (Figure1). This result suggests the subsoiling treatment had a significant effect on loosening surface soil horizons in the immediate vicinity of the new seedling roots, at least in the short-term. It remains to be seen whether this soil loosening will equate to improved soil aeration and growth performance of seedlings.

One year after site preparation treatments, soil nutrients in 0-10 cm mineral and forest floor layers were re-sampled in each of the 12 plots. Detailed results and discussion of nutrient changes can be viewed in the first year summary report for this project (Yole, 2003). Important findings included the following:

- The lowest forest floor Min-N and total N concentrations occurred in the subsoiling treatment, suggesting likely greater mineralization of available forms of N from the forest floor and the associated loss of organic matter.
- Percent total C was significantly lower in the RSS treatment confirming this trend of organic material loss during mineralization.
- Total N (%) concentration in forest floor materials was significantly (p=0.0081) higher in the juvenile spacing treatment versus the rehab (R) and rehab+subsoil (RSS) treatment.
- Mineralizable-N (p=0.0400), available P (non-significant) and Mg (p=0.0468) were also higher one season after spacing, relative to the other three treatments.
- There was a significant increase in Min-N concentration (p=0.0415) in the 0-10 mineral soil layer when subsoiling is compared to the control treatment.

Measurements Planned for 2003

Owing to late field initiation in 2002, soil aeration and water table depth assessment was not formally done in 2002. It is proposed that metal rods be installed in early May to determine depth of water table by measuring the depth of rust on the inserted rod as an index of how well aerated the surface soil layers are. It is believed poor soil aeration and perched water tables may be slowing early season seedling growth in the untreated soils. Subsoiling should help alleviate this condition.

Seedling height and caliper needs to be re-assessed in fall 2003 to compare 1-year height increment for each of the treatments.

Following measurements in 2003, the trial can sit for 3-5 years before a mid-term assessment is made. Ideally this trial would continue for a minimum of 10 years in order to obtain the desired response data.

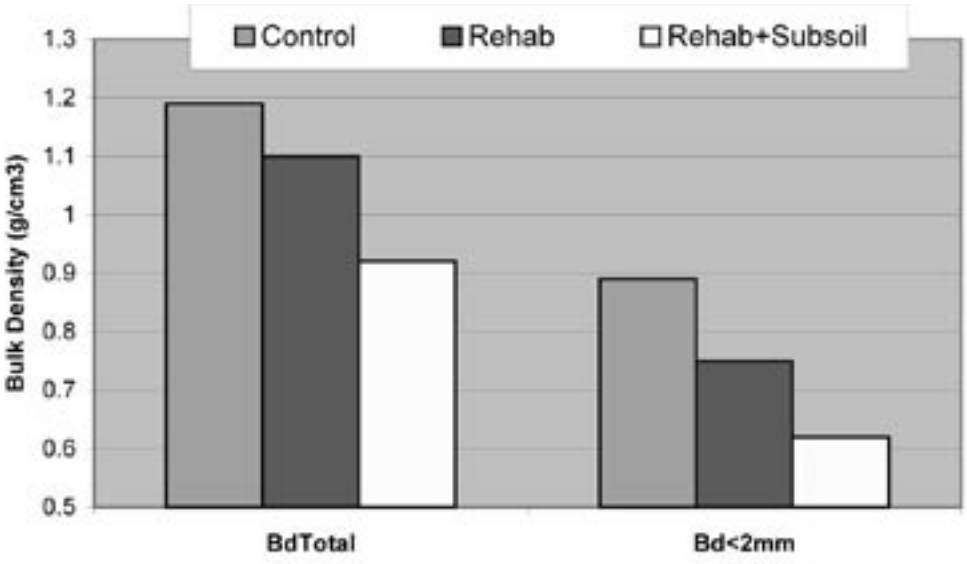

Figure 1. Total and CF free bulk density (<2 mm) one season after treatments in 2002..

Management Summary

Based on the operational activity and measurement of variables that have occurred thus far in the implementation of this project, some preliminary conclusions and comments may be useful in monitoring this trial or to help facilitate other operational rehabilitation or subsoiling work.

1. Subsoiling works well as a treatment in NAR portions of a cutblock to loosen dense soil layers in moist Luvisols. This was evidenced by significantly lower bulk density in the surface 0-10cm layer of subsoiled versus control plots. The treatment effectiveness would have been improved if soil moisture was not as dry as present in this trial. The operator of the subsoiler advised that treating dense and compact soils when slightly moist (i.e. slightly drier than field capacity) results in maximum penetration of the fins and improved shattering of subsoil layers down to an 80 cm soil depth. In this trial, subsoil penetration was limited to about 25-50 cm on average. Since there is a common root-restricting layer at about 30-35 cm, soil shattering benefits may not have been maximized.
2. The early results of this trial would suggest that the subsoiling treatment appears to have soil density and nutritional improvements (significant increase Min-N in mineral) as compared to the other treatments, at least in the short term. A comparison of one-year height increment growth can be made after the 2003 growing season.
3. Soil aeration and drainage are believed to be one of the key limiting variables at this moist, fine textured site and this can be better assessed after measuring water table depth in the various treatments over the 2003 growing season.
4. Once height increment response from this trial is obtained in 2003/2004, further recommendations can be made to operationally treat (i.e.subsoil) dense PFT stands. Current cost estimates to rehab only are $340/ha while subsoiling and clearing costs would be double that or $730/ha. There are other non-merchantable stands in the Marilla Burn and Alvin Lake FSR area that would likely benefit from such rehabilitation or subsoiling treatments in order to convert a PFT stand into a productive one that could contribute to the THLB.

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Acknowledgements

Several persons assisted in this year's measurements and project coordination. John Brockley was the contract administrator and provided advice throughout the year. Larry McCulloch and Marty Kranabetter provided technical review, and along with Bill Chapman, provided useful comments during the field tour. Bill Bristol of CanFor helped with coordinating tree planting and provided the seedlings trees for the trial. Marcel Lavigne helped with tree measurements, re-establishing plot boundaries and soil density sampling in the field. Amanda Nemec of Victoria BC provided statistical analysis services for the project.

Layout, editing and typesetting by Ritchie Morrison of Tetrad Communications.