



PROJECT SUMMARY

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

Introduction

This activity summary discusses all activities that occurred during the 2001 field season as related to the design, layout and initial measurements of an experimental trial involving rehabilitation as compared to other treatments in a Problem Forest Type (PFT) stand.

The Morice & Lakes Innovative Forest Practices Agreement has approximately 185,351 ha of PFT stands (Table 1) that were removed from the Timber Harvesting Land Base (THLB) in the latest Timber Supply Review of both forest districts. For the purposes of this report and project, PFTs are defined as stands that are excluded from the THLB because they either have species that are not currently being utilized, have marginal timber value, or have non-merchantable value. This project builds on definitions and other information generated from a problem analysis report prepared for the IFPA entitled *Forest Management Opportunities for Problem Forest Types in the Lakes and Morice IFPA*.

Specifically, this project studies an 18-year-old very poorly growing conifer stand and its response to imposed forest management activities. It is the belief of members of the IFPA Forest Productivity Subcommittee, that the site index of some of these poorly growing conifer stands, may have been underestimated by the current vegetation inventory label used in the Timber Supply Analysis. The subcommittee required a long-term, long-term

research trial that would help forest practitioners understand what site factors were limiting on a common PFT category in these districts.

Table 1. Extent of the PFT area in the Morice and Lakes TSA as identified in TSR2.

District	Category	TSR2 (ha)
Lakes ¹	PFT	54,978
	Low Site	13,737
Morice ²	Non-Merchantable	46,737
	Low Site	69,899

¹Lakes TSR2 Analysis Report (MoF, March, 2001)

²Morice TSR2 Database Package (MoF, March, 2001)

Objectives

The main objectives in this study include:

- establishing long-term experimental plots to help forest practitioners understand what site factors are limiting on PFTs and whether there are management interventions that may help achieve forest management objectives such as improved timber supply;
- carrying out work in a densely stocked 18-year-old PFT lodgepole pine stand to: 1.) determine how effective subsoiling treatments are in an area previously logged in the Net Area to be Reforested (NAR); 2.) determine stand response (height, diameter) to four treatment options, including control (untreated stand), rehabilitation (complete removal of conifer cover), rehabilita-

Ecosystem
Management

Forest Productivity

Public Involvement

Adaptive
Management

Morice & Lakes IFPA Project Summary

- tion and site preparation (alleviate dense soil conditions through subsoiling and juvenile spacing);
- 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,
- determining what site and stand factors most limit growth in a repressed lodgepole pine stand (i.e. tree density, root restricting layer); and
- 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 justify a potential increase in the harvesting land base. This could lead to a re-allocation of the allowable annual cut if significant areas of PFTs are impacted.

It is expected that the results of this project will provide the IFPA Forest Productivity Subcommittee, in accordance with CSA standard Z809 and B.C. forest legislation, 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 (juvenile spacing) and innovative (rehabilitation and subsoiling) treatments of a PFT stand.

Methods

Details on methods and experimental design are provided in the *Establishment Report* for this project. Both tree growth and soil parameters are being monitored in response to the four treatment options.

A completely randomized design was used with four treatments and three replicates of each treatment at one site. The 12 plots were non-randomly established at the study site in order to

achieve relatively uniform pre-treatment ecosystem and soil conditions. An analysis of variance will be used to assess pre- and post-treatment mean effects with 95 per cent probability.

The study site is at a relatively high elevation (~1050 m) in the Swiss Fire approximately 40 kilometres southwest of Houston, B.C. The site conditions are mesic to slightly moister (SBSmc2/01 and /05) 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 dense (20,000-100,000 stems per hectare) stand of natural lodgepole pine. The site was originally harvested for snags after the wildfire and then windrowed in 1983/84.

Treatments and Early Results

Rehabilitation treatments were conducted with a D7 cat fitted with a brush blade. Soil conditions were dry and tree clearing went well (>90% stems removed) and any remaining stems (<10-20%) were removed by brush saws while the spacing crew was still 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. Some degree of mineral exposure and scalping occurred (<25%). This disturbance will be confirmed in 2002 with soil disturbance surveys.

Subsoil treatments were imposed in an attempt to break up and shatter dense subsoil layers to improve site productivity and increase effective rooting depth. A self-drafting winged subsoiler (Burns Lake Native Logging Ltd.) was pulled behind the same D7 cat. The procedure first involved clearing away the trees, debris piles and windrows followed by subsoiling. Owing to dry soil conditions, the average depth of subsoil trenches was only approximately 40 cm, although a more quantitative assessment of depths will be made in 2002. Considerable mineral soil/forest floor mixing occurred.

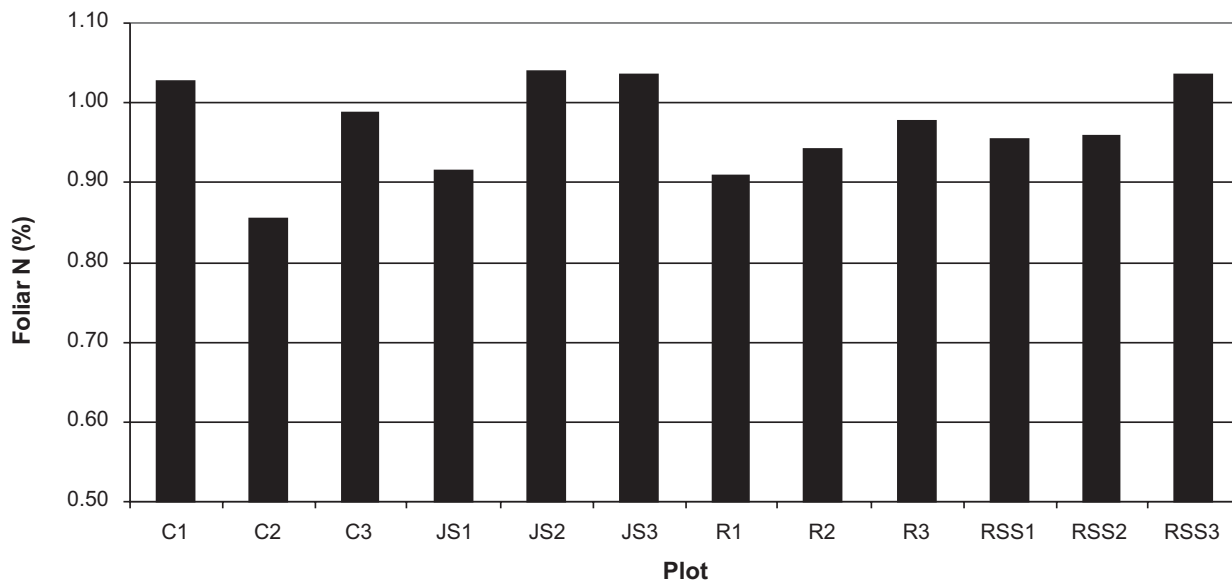


Figure 1. Nitrogen concentrations in foliage at each plot of the Swiss Fire site prior to treatment.

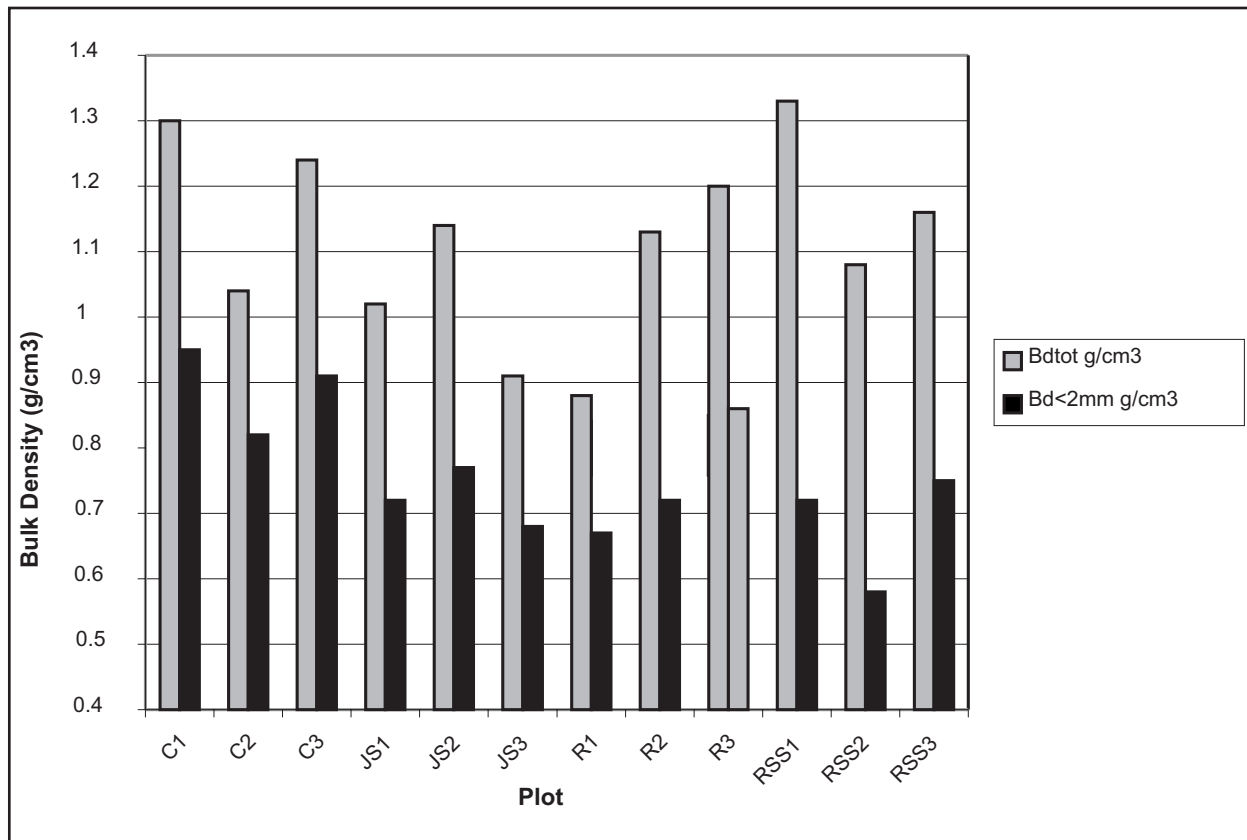


Figure 2. Total and coarse fragment free bulk density (<2 mm) prior to treatments in 2001.

Additional areas were set up to demonstrate operational subsoiling in a larger NAR area (80 x 80 m) relative to the small test plots. Also, a small section of a landing and inactive road was subsoiled near the research area. Both these demonstration areas and the 12 research test plots will be planted in the spring of 2002, pending funding.

Juvenile spacing (JS) treatments resulted in healthy trees with approximately 1,600 stems per hectare remaining in each of the three JS plots. All diseased trees were removed and healthy dominant or co-dominant stems were selected in a 2.5m grid pattern where possible.

Tree response to treatments will involve measuring 49 trees in the center 17.5 m area of each 32.5 m² treatment plot.

Foliar nutrient analysis results revealed a severe deficiency in total nitrogen (N) (Figure 1) (range 0.85-1.04 %) and sulphur (SO₄-S range 28-96 ppm) and are consistent with other nutrient lodgepole pine stands in the interior. This may partially explain the highly chlorotic trees growing at this site.

There were significant treatment effects for coarse fragment (CF) free bulk density (Bd<2mm) ($p=0.05$) in the 0-10 cm layers prior to treatments. From Figure 2, one can see that the mean CF free bulk density of control plots (i.e. "C") was slightly higher than other pre-treatment plot means and likely accounts for the majority of the pre-treatment variation.

Measurements Planned for 2002

Should funding allow, seedlings would be planted and all soil and seedling variables would be re-measured in the summer of 2002 using the same methods outlined in the *Establishment Report*. In addition, estimates of subsoiling depth, aeration index (assessment of soil drainage) and soil disturbance will be measured in 2002.

Management Summary

Based on the operational activities that have occurred thus far in the implementation of this project, a few comments may be useful in subsequent trials or operational work.

1. When subsoiling dense clay-rich luvisolic soils in landings, roads or other productive portions of a block, soil moisture should be close to field capacity or slightly drier. Soil moisture conditions were a little too dry when the treatments were implemented at this site in October. As a result, 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 be as great if soils are moister. The compromise to treating a moist/wet site is that some soil compaction will be caused under tracks of the primary mover when soils are moist.
2. During treatment implementation, some procedures were adjusted to attempt to minimize the amount of mineral soil

Morice & Lakes IFPA Project Summary

scalping that occurred during tree clearing/subsoiling. Pre-cutting of high residual stumps in the NAR didn't affect subsoil performance to a great degree and is not recommended in subsequent trial or operational treatments.

3. As a result of small flexible trees (<2 m) at this site, clearing away of trees during rehab treatments resulted in a fair bit of mineral soil exposure (to be determined in 2002) and soil intermixing. Many of the smallest (0.5-1.0 m) trees remained after the first machine pass. An operational consideration when rehabilitating future young stands would be to treat stands containing larger trees, at least 2-3 m high in the winter months, ideally under frozen conditions. Cold weather should improve the shearing effect, and the second pass clearing by machine (as was common in this study) or by hand would be minimized.
4. Pre-cutting trees by hand in rehabilitated areas and subsoil treatment **did reduce** mineral soil scalping, but at an expense of approximately \$100 per 32 m² plot for brush saw work.
5. Pre-cutting down high stumps by hand ahead of subsoiling **did not** impact subsoiling effectiveness.
6. A greater amount of slash and debris on the ground helps to roll and clear off dense tree canopies, especially in the case of small trees
7. The degree of rot in stumps has an important impact on subsoil treatment effectiveness. Subsoil wings were found to pull right through rotten stumps; otherwise, the implement had to be lifted up and moved ahead of the obstruction. It is possible that selecting **older summer logged areas** requiring rehabilitation and subsoiling may improve treatment effectiveness in terms of pushing over and crushing stumps and debris.

Acknowledgements

The PFT Rehabilitation Trial was conducted by David Yole, research consultant. Field work assistance was provided by Dennis Stoffels of Truffula Tree Ecological Services in Smithers, and Amanda Nemeč of International Statistics and Research Corp. in Victoria carried out the statistical analysis. Wes Bohmer of Burns Lake Native Logging Ltd in Burns Lake coordinated site preparation and juvenile spacing. Thanks to Larry McCulloch, Laing and McCulloch Forest Management Services Ltd. and Bill Chapman, Babine Forest Products Ltd. for technical and administrative advice in the early stages of the project.

This project summary was written by Dave Yole and edited by John Young. Additional editing and layout provided by Ritchie Morrison of Tetrad Consulting.

Forest Renewal BC funded this project summary through the Morice & Lakes Innovative Forest Practices Agreement.

References

- Banner, A., W. MacKenzie, S. Haeussler, S. Thompson, J. Pojar, and R. Trowbridge. 1993. A field guide to site identification and interpretation for the Prince Rupert Forest Region. B.C. Ministry of Forests, Smithers, B.C. Land Management Handbook. 26. 503p.
- Blackwell, B., M.C. Feller, R. Trowbridge. 1995. Conversion of dense lodgepole pine stands in west-central British Columbia into young lodgepole pine plantations using prescribed fire. 2. Effects of burning treatments on tree seedling establishment. Can, J. For. Res. 25: 175-183.
- Brockley, R.P. 2000. Using foliar nutrient levels to predict lodgepole pine fertilization response. Extension Note 47. Ministry of Forests, Kalamalka Research Centre. Vernon, B.C.
- Farnden, C and L. Herring. 2000. Severely repressed lodgepole pine responds to thinning and fertilization: 19-year results. Contract report to Weldwood of Canada Ltd., Hinton, Alberta.
- Klinka, K., R.N. Green, R.L. Trowbridge and L.E. Lowe. 1981. Taxonomic classification of humus forms in ecosystems of British Columbia. B.C. Ministry of Forests, Victoria, B.C. Land Management Report 8. 54p.
- Ministry of Forests. 1995. Forest Fertilization Guidebook. Forest Practices Code of British Columbia.
- Yole, D. 1996. Effect of alternative site preparation treatments on soil chemistry, physical properties, climate and seedling growth on a mesic site in the northern interior of British Columbia. M.Sc. Thesis. University of B.C.
- _____. 2001a. Forest management opportunities in problem forest types in the Lakes and Morice IFPA. Draft. Contract report - Forest Productivity Advisory Committee, Lakes and Morice IFPA.
- _____. 2001b. Working plan for PFT rehabilitation trial. Contract report - Forest Productivity Advisory Committee, Lakes and Morice IFPA. Contract #331.03.
- _____. 2002. Establishment Report for PFT rehabilitation trial. Contract report - Forest Productivity Advisory Committee, Lakes and Morice IFPA. Contract #331.03.

Contacts

David W. Yole, M.Sc., P.Ag., project head, Telkwa B.C.
Phone: (250) 846-9055
E-mail: dyole@bulkley.net

Bill Chapman, project administrator, Babine Forest Products Ltd.
c/o Tweedsmuir Forest Ltd., Prince George
Phone: (250) 692-7177
E-mail: bill_chapman@weldwood.com