Morice & Lakes IFPA

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Summary No. 7

Morice & Lakes Innovative Forest Practices Agreement

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.

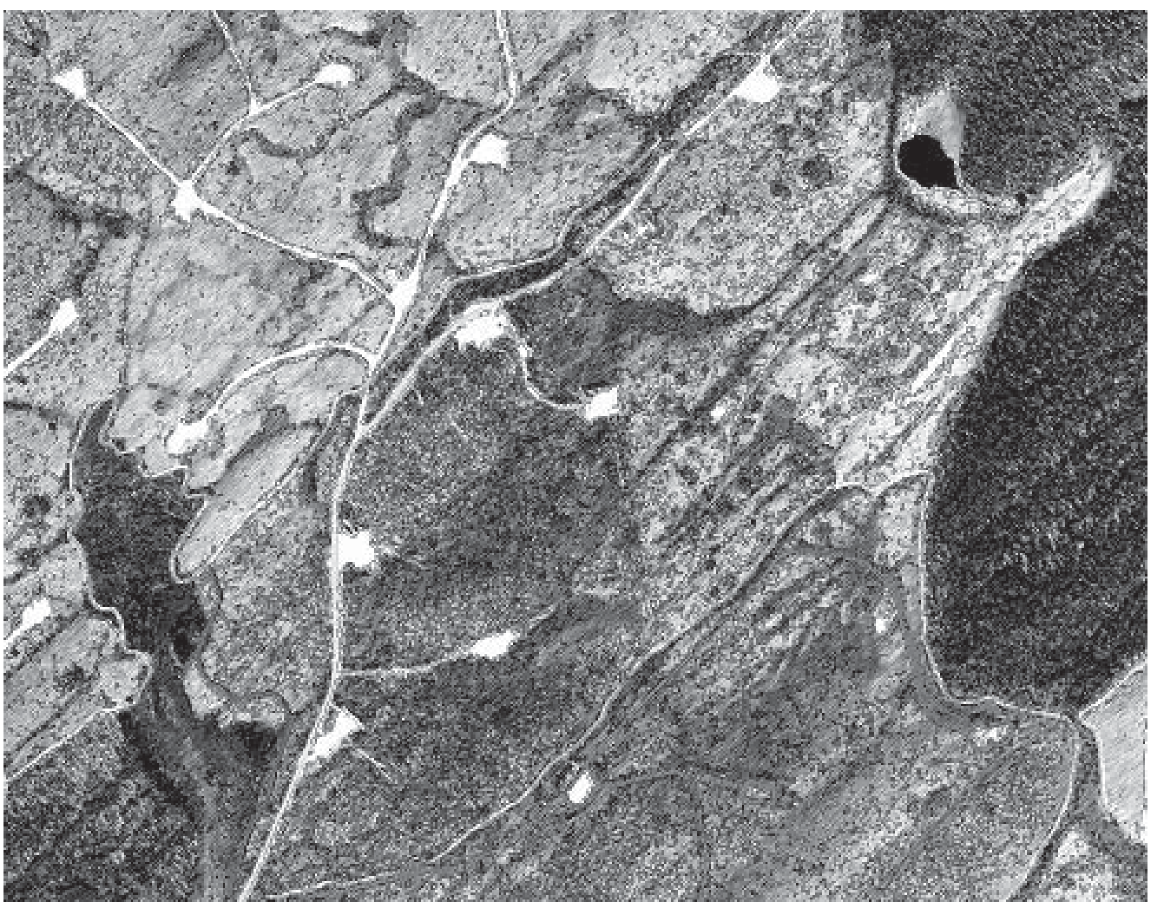
Analysis of Road and Landing Impacts on Timber Supply within the Lakes Forest District

Ecosystem Management

Forest Productivity

Public Involvement

Adaptive Management



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Introduction

The Morice & Lakes Innovative Forestry Practices Agreement (M & L IFPA) is comprised of a number of geographically distinct areas, where various harvesting systems are employed seasonally. The amount of permanent forest loss varies according to cut-block development, harvesting system, local topography, and road building standards. In order to determine the opportunity for minimizing the impacts of roads and landings on the timber harvesting landbase, it is necessary to accurately determine their area and status.

Benefits from a study of this nature include:

- accurate road and landing areas for use in timber supply analysis;
- efficient use of access structures during forest extraction activities;
- defining appropriate targets for road and landing deactivation activities; and
- defining appropriate targets for road and landing rehabilitation activities.

Project Goals

Goals of this project were to quantify the magnitude of roads and landings, identify their location, assess site productivity, assess rehabilitation potential, and classify these structures based on their operational use. The recent Timber Supply Review process (TSR 2) for the Lakes Timber Supply Area used a loss of 5.24% of the timber harvesting land base that is currently less than 40 years old, for existing roads and trails and landings. Estimates of future roads, trails and landings are also approximated in timber supply simulation models by applying this same 5.24 % reduction.

A recent study of roads and landings within Babine Forest Products' Enhanced Forest Management Pilot Project (EFMPP) area concluded that the net down was overestimated. Given these findings, an evaluation of the roads and landings net down within the Lakes Forest District was given priority by the M&L IFPA.

Over or underestimating the area of roads and landings directly impacts the amount of land base available for timber production. Therefore, the determination of long-term forest productivity loss resulting from roads and landings justifies a high level of effort and accurate site evaluation techniques to validate losses and identify those areas that can be targeted for rehabilitation.

Methods

This project utilized a combination of field surveys and office analysis to identify non-productive areas associated with roads and landings within the Lakes Forest District. Eleven mapsheets within the district were randomly selected to confirm and update the locations of all roads and landings, regardless of vintage. Since up-to-date mapping of roads and landings was not available, and funding was limited, a random sample of 11 mapsheets was selected to ensure non-biased, representative results related to forest development activities. These mapsheets were updated using both old and current air photos to ensure the location of roads and landings, which were no longer easily identifiable on the most recent air photographs. Data updates were then loaded into a GIS layer for use in road and landing area determination.

The second step was to field sample the actual non-productive area, quantify site productivity and assess rehabilitation potential on a further random selection of roads and landings. A total of 443 random samples were established: 373 on roads and 70 on landings. To plan for rehabilitation, all roads and landings within the randomly selected mapsheets were classified as long-term permanent (main and branch roads) or temporary access structures. In order to determine site productivity, tree attribute data was collected on all roads and landings that supported commercial tree species.

To provide a reliable and accurate means of determining road and landing areas within the study area, a GIS program was developed to estimate non-productive area. The program aided in the calculation of area associated with forest resource access structures. The inputs for area determination included average widths by road class and stratum (whether the road was inside or outside the block; a main, branch or spur road; and its season of construction—summer or winter), multiplied by the GIS-calculated road length. For landings, the average area by stratum was multiplied by the number of landings present in order to determine area of occupation. This information was then used to calculate the average within-block and outside block, non-productive area associated with roads and landings in the project area.

Results

Survey Results

The data presented within the roads and landings 2001/2002 final report indicates:

- Approximately 26% (40 out of 154) of spur roads sampled had established conifer species, predominantly lodgepole pine (Pl) within the road structure. Of these, 15% (23 roads sampled) were achieving minimum or greater well spaced stocking levels (600 sph) of acceptable conifer species (Pl) having a site index of >7.6*.
- Approximately 86% (60 out of 70) of the landings sampled contained conifer tree species, predominantly Pl, on the landing structure. Of these, 54% (38 landings) were achieving minimum or greater well spaced stocking levels (600 sph) of acceptable conifer species (Pl and Sx) having a site index of >7.6. (Site index of 7.6 is the cut off for problem forest types as per Lakes TSA TSR II.)
- On roads, site index trees previous years annual height growth averaged 46.1 cm for Pl. The average breast height age was 8 years.
- On landings, site index trees previous years annual height growth averaged 42.6 cm for Pl. The average breast height age was 8 years. Sx regeneration was not found in significant enough numbers to report on.
- On roads, previous years average height growth (inclusive of all crown classes) for Pl was 37.5 cm, 21.8 cm for balsam (Bl), and 33.3 cm for Sx.
- On landings previous years average height growth (inclusive of all crown classes) for Pl was 37.5 cm, and 25.2 cm for Sx.
- Stocking levels of well-spaced conifers on the 24% of spur roads supporting acceptable commercial tree species (i.e. Pl) ranged from 0 - 3488 SPH. The remaining 76% of spur roads, which did not support commercial tree species, can be characterized as being recently built and/or as having recent or continual use for forest management or recreation activities.
- Stocking levels of well-spaced conifers on the 86% of landings supporting acceptable commercial tree species (i.e. Pl and Sx) ranged from 0 - 1600 SPH. The remaining 14% of landings, which did not support commercial tree species, can be characterized as being recently built and /or as having recent or continual use for forest management or recreation.
- Data indicates >70% of landings supporting site index trees were achieving a site index of 15 or better.
- Data indicates >90% of roads supporting site index trees were achieving a site index of 15 or better.
- Within the project sample area, 106 km of spur road has been classed as temporary access. A total of 15 sites visited in the field were identified as having rehabilitation potential.

In order to determine the percentage of non-productive area associated with roads and landings within cutblocks, the following procedures were used:

- Within the selected mapsheets harvest blocks were identified and total gross block areas were determined through GIS information.
- Total within-block road lengths and landings were determined by GIS.
- Average road widths and landing areas were applied to the strata present to derive within-block road and landing areas.
- Average non-productive area associated with the strata were applied to derive total non-productive area of roads and landing within blocks.
- Non-productive area was then divided by total gross block area to establish the percentage of non-productive area associated with roads and landings within cutblocks.

In order to determine the percentage of non-productive area associated with roads and landings outside cutblocks, the following procedures were used:

- Within the selected mapsheets, gross productive landbase area was determined by GIS.
- Total outside-block road lengths and landings were determined by GIS.
- Average road widths and landing areas were applied to the strata present to derive total outside-block road and landing areas.
- Average non-productive area associated with the strata were applied to derive total non-productive area of roads and landing outside blocks.
- Non-productive area was then divided by the gross productive landbase area to establish the percentage of non-productive area associated with road and landings outside cutblocks.

This information is presented in tables 1 and 2 on page four.

Table 1. Conventional cutblocks: gross and non-productive area and percent area calculation for roads and landings.

Gross area of conventional cutblocks	4597.62 ha
Gross area of roads and landings within conventional cutblocks	Roads (126.51ha) + landings (110. 73 ha) = 237.24 ha
Percentage of roads and landings within conventional cutblocks	Roads (2.75%) + Landings (2.40%) = 5.15%
Non-productive area associated with roads and landings	Total np area = 155.15 ha • Roads (126.51 ha) - (18.97 ha productive) = 107.54 ha • Landings (110.72 ha) - (63.11 ha productive) = 47.61 ha
Total percent non-productive area	Total % np area = 3.37% • Roads (2.75%) - (0.41% productive) = 2.34% • Landings (2.40%) - (1.37% productive) = 1.03%

Table 2. Roadside cutblocks: gross and non-productive area and percent area calculation for roads and landings.

Gross area of roadside cutblocks	12,079.16 ha
Gross area of roads and landings within roadside cutblocks	Roads (370.95ha) + landings (108.12 ha) = 479.07 ha
Percentage of roads and landings within roadside cutblocks	Roads (3.07%) + Landings (0.9%) = 3.97%
Non-productive area associated with roads and landings	Total np area = 365.05 ha • Roads (370.95 ha) - (55.64 ha productive) = 315.31 ha • Landings (108.12 ha) - (58.38 ha productive) = 49.74 ha
Total percent non-productive area	Total % np area = 3.03% • Roads (3.07%) - (0.46% productive) = 2.61% • Landings (0.9%) - (0.48% productive) = 0.42 %

An analysis of all blocks within the 11 random mapsheets showed a 72/28 ratio between roadside and conventional blocks respectively.

Using this ratio and the percent non-productive area for road-side and conventional blocks a 3.12% reduction for roads and landings was calculated.

Contributing non-productive area of roads and landings outside cutblocks was determined to be 0.6%.

Therefore recommended reduction for roads, trails and landings = 0.6 + 3.12 = 3.72%

Discussion

For the purpose of predicting current and future losses due to roads and landings, outside-cutblock, non-productive area (0.6%) has been added to the within-block, non-productive area (3.12 %) to derive a total non-productive area (3.72%) due to roads and landings.

All landings and roads identified as productive access structures were excluded from the non-productive area, both inside and outside blocks. It was assumed these structures will not be utilized for future forest development activities, and based on site and stand characteristics will positively contribute to timber supply. The 26% of spur roads and 86% of landings found to support conifer species can be characterized as older in nature, on which evidence of recent use was not visible. However, the opposite was generally true of the remaining 74% of roads and 14% of landings, which did not support commercial tree species. These findings indicate a direct relationship exists between conifer regeneration delay and road use.

In order to determine well-spaced conifers a minimum inter-tree spacing of 1.6 m was utilized on both roads and landings. This spacing was nominated because conifer regeneration is often clumpy in nature due to a reduced number of suitable microsites. This is more typical where continued vehicle traffic has compacted mineral soil on portions of the road surface. A 1.6 m inter-tree spacing is lower than that commonly used but is consistent with recommendations within the Forest Practices Code *Siviculture Surveys Guidebook* for assessing areas which do not have even spatial distribution of conifer regeneration.

Site index (SI) on both roads and landings was somewhat variable, however. Calculated SI values for Pl indicate the vast majority of roads and landings supporting suitable site index trees were achieving a site index of >7.6. When examining roads and landings independently, data indicates >70% of landings supporting site index trees were achieving a site index of 15 or better and >90% of roads supporting site index trees were achieving a site index of 15 or better. The proportion of roads and landings having moderate to good site index is important as it gives some insight into site productivity and future timber supply implications. It should be noted that a small percentage of roads and landings supporting conifer species did not contain suitable site index trees and therefore do not have calculated site index values. Given the trend toward moderate to good site index on both roads and landings, samples that do not have a calculated site index value have been prorated to reflect the trend established through collected SI data.

Between individual roads and landings, the stocking patterns differ considerably. This difference lies in the percentage of roads (15%) and landings (54%), which are achieving minimum acceptable well-spaced conifer stocking levels. Given these findings it can be assumed that landings favour conifer establishment when compared to roads. Preliminary field observations showed that landings that tended to have minimal vehicle traffic post-harvest had reduced soil compaction levels and offered a better mosaic of suitable microsites for conifer establishment when compared to roads. The reduced soil compaction typically found on landings has the benefit of providing both Pl and Sx regeneration with suitable site characteristics for achieving acceptable growth. For this reason Sx has been considered an acceptable species on landings and has been included in well-spaced stocking calculations. Sx has not been considered an acceptable conifer species on roads based on poor growth performance on soils significantly compacted from vehicle traffic.This is consistent with data recently collected as part of the roads and landings study within Babine Forest Products' Enhanced Forest Management Pilot Project (EFMPP) area.

The results of this study indicate that temporary access structures left unattended over time will naturally regenerate commercial tree species, and achieve acceptable site productivity and conifer stocking levels. However, it is clear that *optimal* tree growth and stocking levels are not being achieved on a large percentage of roads and landings. Given this trend, rehabilitation measures are worth considering on temporary access structures, as it is an effective tool for alleviating soil compaction, ensuring appropriate stocking of commercial tree species is achieved and maintaining long-term site productivity.

The impact of this data to future timber supply is significant. The assumption that all roads and landings do not naturally regenerate and therefore do not contribute positively to the timber harvesting landbase over time is incorrect.

Recommendations

The project provides the required information for an accurate estimation of current and future forest loss due to roads and landings. Based on project results the following recommendations are provided:

General

- A 3.72% TSR net-down factor should be utilized to estimate current and future losses to the timber harvesting landbase due to roads and landings.
- Given the gross inaccuracy of current road classification within a large portion of the Lakes Forest District, and lack of accurate landing coverage, it is recommended that all roads and landings be spatially corrected and classified. Use of inaccurate data for future TSR analysis will lead to imprecise net-down figures that could significantly impact timber supply. Accurate roads and landings data would allow for an exact TSR net-down calculation, improve operational and sustainable forest management planning and aid in forest certification.
- Proceed with rehabilitation planning and implementation.

Recommendations for minimizing road and landing non productive area

- Harvest in winter when possible: soil compaction is significantly less compared to summer construction and harvest activities. In addition, winter roads were found to have a reduced non-productive road width compared to summer roads.
- Road width and landing area needs should be carefully evaluated prior to construction and contractors informed of specific operational requirements prior to field activities.
- Clearing widths for main and operational roads should be minimized where line of sight and related safety issues are not significant.
- Access structures identified as temporary during forest development planning should have stripped organic material piled separately from coarse woody debris to allow for future retrieval and incorporation into the road or landing mineral soil surface.
- Extremely coarse surfacing material should be avoided on access structures identified as temporary.
- Temporary roads which have not been significantly compacted should be assessed for plantability prior to reforestation activities.
- Spur road cuts, fills, berms and ditch edges created during road construction should be assessed for plantability prior to reforestation activities.
- Seeding of access structures to reduce soil erosion should utilize low-growing legumes to improve soil nitrogen content and reduce the potential for direct competition with conifer species.

Rehabilitation Recommendations

Rehabilitation of temporary access structures can be a useful tool to ensure temporary roads and landings have minimum regeneration delay, appropriate conifer species composition and improved site productivity. When targeting areas for rehabilitation activities, the following recommendations should be reviewed and implemented in order to ensure a cost effective approach and treatment success:

- Ensure that permanent and temporary access structures within the target area are clearly defined prior to field assessment in order to ensure permanent access structures are not assessed and targeted for rehabilitation activities.
- Rehabilitation and road deactivation activities should be carefully coordinated in terms of timing, as conflicts in scheduling can impair the ability to carry out either activity and increase associated operational costs significantly.
- Target areas for treatment that minimize travel between treatment sites.

- Sites targeted for treatment should be evaluated in the field prior to rehabilitation activities in order to identify any potential problem areas such as rock or coarse woody debris concentrations, potential access barriers (deactivated road), drainage structures and areas of poor soil drainage.
- If deep tilling is prescribed, areas that may have road ballast at depth should be avoided or carefully evaluated for rehabilitation suitability.
- Grass seeding is an effective tool for reducing surface soil erosion. This is best conducted just prior to subsoiling or ripping activities when access to the rehabilitation sites are undisturbed and rehabilitation activities will ensure good seed/soil mixing. With topsoil reclamation, seeding activities are best performed after rehabilitation. Seed mix should consist of short growing species, reducing the potential for competition with conifer species planted on the site.
- Areas that may provide difficulty to the operator in terms of rehabilitation should be identified on a large-scale map and marked in the field.
- In order to streamline rehabilitation operations, sites should be clearly marked in the field.
- Rehabilitation activities are best performed during moderately dry soil conditions in order to minimize soil compaction, increase machine productivity, and treatment success.
- When selecting the appropriate machine for treatments, specific reclamation needs and sites planned for treatment must be carefully evaluated in order to ensure cost effectiveness and treatment success.
- Areas containing moderate to coarse textured, well-drained soils are best suited for rehabilitation activities.
- Areas of deep soil compaction (50+ cm depth) are best suited for a tractor crawler/winged subsoiler combination.
- Areas where shallow tilling (30 cm depth) and topsoil recovery are required are best suited to an excavator with a site preparation rake and hydraulic thumb.
- Areas with moderate to heavy concentrations of cobbles and stones should be carefully evaluated as rehabilitation activities and silvicultural success may be impeded due to unfavorable site conditions.
- Tractor crawlers with ripper attachments are better suited to address areas with moderate to heavy concentrations of cobbles and stones.
- Areas with large components of buried coarse woody debris and large boulders are best suited to shallow tilling and topsoil reclamation activities.

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