REHABILITATION OF DEGRADED FOREST SOIL IN THE PRINCE GEORGE FOREST REGION

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The Prince George Forest Region is the largest of the six forest regions in British Columbia with a total forested landbase comprising 17,718,000 ha or 38% of the overall forested landbase of British Columbia.

Each year there is approximately 57,000 ha logged in this region mainly using the clearcut harvesting system. Studies have shown that 18% of this harvested landbase is affected adversely by a combination of landings, main road and skid trail development (McLeod and Hoffmann, 1984). Landings were found to comprise 4% of the harvested landbase. Thus 2,280 ha/year are being affected by landings in the region (8,657 ha/year on a provincial basis).

Compaction levels on these landings average about 1.5 Mg/m^3, indicating that severe soil compaction is occurring on these landings (McLeod, 1983).

Managers are divided in their opinions that either,

a) unrehabilitated landings are capable of growing a commercial tree thus these areas can be retained in the landbase used to calculate the Allowable Annual Cut or,

b) landings are capable of growing a commercial tree only if landing rehabilitation efforts are initiated.

Regardless of which opinion is valid, the fact remains that failure to maintain these areas as part of the productive forested landbase could result in the reduction of the Allowable Annual Cut available for the forest industry in the region.

Concerns were raised from various quarters that landing rehabilitation would not be successful at a reasonable cost so an ad-hoc committee was struck, whose objective was to develop a realistic landing rehabilitation standard operating procedure which would be adhered to by the forest industry in the region. Below is a portion of the standard operating procedure (S.O.P. 2-1) for landing rehabilitation, issued by the Ministry of Forests, Prince George Forest Region. The intent of this standard operating procedure is to provide a basis for site specific decision making to ensure:

a) that the productive capability of Crown Forest and Range land is maintained.

b) that the total disturbance by landings is minimized.

c) that the location, construction and operation on a landing facilitates its rehabilitation.

d) that fire hazards, fire hangovers and habitat for bark beetle brood development is minimized.

e) that landings are satisfactorily revegetated.

f) that "best opportunity" landings are fully rehabilitated

and reforested with coniferous trees. Best opportunity for the purposes of this standard operating procedure is defined as landings located on flat to rolling terrain, with light to moderate coarse fragments, on moderate to high site ecosystems and not over 100 kilometers away from the conversion facilities.

In order to ensure that the intent of this standard operating procedure is being complied with, seven procedures were developed. These procedures outline what the British Columbia Ministry of Forests, Prince George Forest Region expects industry to adhere to when any landing developments are being initiated. The seven procedures are:

1) Approval

An application for a cutting permit under a harvesting agreement shall include specific details on:

a) the number, dimensions and location of all landings for each cutblock.

b) debris disposal on all landings.

c) rehabilitation category and methods to be employed.

d) erosion control (where required).

e) revegetation plan

No on-site work is to be undertaken until the logging plan is approved by the District Manager.

2) Number and Size

The area disturbed for landings shall not normally exceed 3.5% of the total area of the cutblock, except as may otherwise be approved by the District Manager in consideration of special circumstances.

3) Location

Wherever possible and practical landings shall be a minimum of 40 meters from all cutblock edges, immature timber, lakes, swamps, streams and water courses and from open natural range.

4) Construction

Stumps shall be up-rooted and moved with the least amount of soil. They shall be placed around the periphery of the landing or disposed of with other combustible material.

All combustible debris from the cleared portion of the landing shall be placed in a concentrated cull pile within the confines of the landings. Except for those areas scheduled for broadcast burning, burning permits will not be issued until this requirement is satisfied.

The burying of stumps will only be permitted where in the Pre-harvest Silviculture Prescription the landing is deemed to be Category 1 and the objective is to not grow a future crop of commercial conifer trees.

5) Operations

The cull pile shall contain a minimum accumulation of soil and shall be located so that it is readily accessible for respreading after burning.

All combustible debris which accumulates on the landing shall be placed in the cull pile.

The cull pile shall be surrounded by a mineral soil guard except where the cutblock will be broadcast burned.

6) Slash Disposal

Burning of the cull pile shall be required on all landings and shall be the only approved method of treatment.

All burning shall be carried out in accordance with the District Managers instruction letter and burning permit.

The majority of the combustible debris must be consumed by burning. The level of disposal must be consistent with objectives regarding:

a) reduction of hazard.
b) elimination of hangover fires.
c) bark beetle control.
d) optimizing grazing potential.
e) landing revegetation.
f) recreational and aesthetic values.

7) Rehabilitation

Three separate levels or categories of rehabilitation have been established. Decisions for identifying landing rehabilitation category will be made at the Pre-Harvest Silvicultural Assessment stage but may be fine-tuned after logging.

The category of rehabilitation will be as identified in the appropriate field guide when these are next revised. The actual identifying and interpreting which ecosystem the manager is dealing with and the appropriate category of landing rehabilitation that will be required as a result of this information is in an appendix attached to the standard operating procedure but it is not included in this paper.

For the present where the ecosystem classification has not yet been completed, Category 3 (full rehabilitation) will be carried out on all good and medium sites except where:

a) coarse fragments exceed 30%, or
b) where summer access is impossible, or
c) where slope (where landing occurs) exceeds 30%.

Category 1 - No rehabilitation

The objective will be hazard abatement and any necessary erosion control. The following conditions must be complied with:

a) all woody material must be thoroughly burned
b) construction of waterbars, as required.

Category 2 - Partial rehabilitation

The objective is the same as Category 1 but in addition there is a prime consideration for an aspect other than the growing of a crop of trees (erosion, aesthetics, range and wildlife, etc.). The following conditions must be complied with:

a) requirements of Category 1
b) spread residual ash and remaining woody debris uniformly over the landing area.
c) seed with an inoculated legume (100% alsike) or forest rangeland mix if Range/Wildlife consideration.

Category 3 - Full rehabilitation

The objective is to grow a future crop of commercial conifer trees which may coincidentally provide consideration for other forest resource values. The following conditions must be complied with:

a) requirements of Category 1
b) after burning all residual ash and debris must be uniformly spread over the landing area.
c) ripping of landing now required as follows:

<u>All soil types with up to 30% coarse fragments</u>

Rip with a winged subsoiler to a depth of 1 meter. Specialized pull type equipment should be used. In a second pass, mix in any available ash, topsoil, organic debris with discing type device to a depth of at least 30 centimeters. Work should only be done under conditions of moderate soil moisture.

d) seed with an inoculated legume (100% alsike) if there is range use potential this should be considered in the type of mix.
e) all Category 3 rehabilitated landings should be planted to Lodgepole pine, preferrably one year after seeding.
f) a slow release fertilizer material should be utilized with each seedling planted on a rehabilitated landing to encourage initial growth response.

Concurrent to the implementation of this standard operating procedure, three projects were initiated in the region to further study what status unrehabilitated and rehabiliated landings were

in. The studies initiated were:

a) Historical survey of unrehabilitated landings (McLeod and Carr, 1986).
b) Assessment of landing rehabilitation activities in the Prince George East Forest District (Carr and McLeod, 1986).
c) Evaluation of ripping effectiveness of a winged subsoiler for soil decompaction in the Prince George Forest Region (Carr and McLeod, 1986).

The historical survey indicated that the nutrient pools were very poor on unrehabiliated landings, foliar levels of N, P and K were very deficient for both Lodgepole pine and white spruce, and compaction averaged 1.4 Mg/m^3 or greater regardless of summer or winter construction.

The results of the assessment of landing rehabilitation activities in the Prince George East Forest District, indicated that the rock ripper failed to produce the desired tillage results on either coarse or fine textured landings. The maximum depth of ripping (approximately 17 cm) and the percent of the profile affected (approximately 26%) are far from the desired 30 cm ripping depth and 80 - 100% profile shatter. Even though there was some degree of tillage, there was no significant impact on soil density levels. The lack of soil organic matter has contributed to a reconsolidation of both fine and coarse textured soils. No soils treated possessed the desired well aggregated structure that enhances soil aeration, moisture, and temperature regimes. Even if the ripping operation had successfully achieved the desired effects, forest productivity on the landings would still be greatly impaired by a lack of soil nitrogen, phosphorus, and potassium. On all landings studied, the residual soil concentration of nitrogen, phosphorus, and potassium do not meet the minimum levels for commercial pine establishment as recommended by Monenco (1983).

The results of the winged subsoiler indicated that the winged subsoiler easily accomplished two of the trial objectives, reducing soil density and ripping an average of 30 cm in depth. The degree of profile shatter in Prince George exceeded the results from Oregon (137% versus 80%, respectively) and was vastly superior to results in Prince George obtained using the rock ripper (26%) (Carr and McLeod, 1986). However, problems with soil reconsolidation still occur and can offset any gains from tillage.

As a result of these studies the region has decided to enforce procedure 1 through 6 but opt for operational research trials for procedure 7. A contract has been let to have a winged subsoiler built in Prince George and made available to the forest industry to use. Currently the region is working with the forest industry to set up a good distribution of rehabilitated landings which could be assessed over time to develop a permanent, comprehensive data set to answer the question of whether or not landing rehabilitation is possible on the types of soils present in the region. Initially physical data such as nutrient pool and soil physical properties can be monitored to determine if the

rehabilitation effort is working, but over time the seedlings planted on these sites will also begin showing managers if they can obtain acceptable growth and appropriate piece size. Further research will continue on this important aspect of forest management. Failure to successfully rehabilitate these areas will only result in significant changes to the Allowable Annual Cut or to harvesting methods currently utilized by the forest industry in the Region. No matter how you look at it, additional costs associated with maintaining the productive landbase will need to be borne by the forest industry in order to keep in business.

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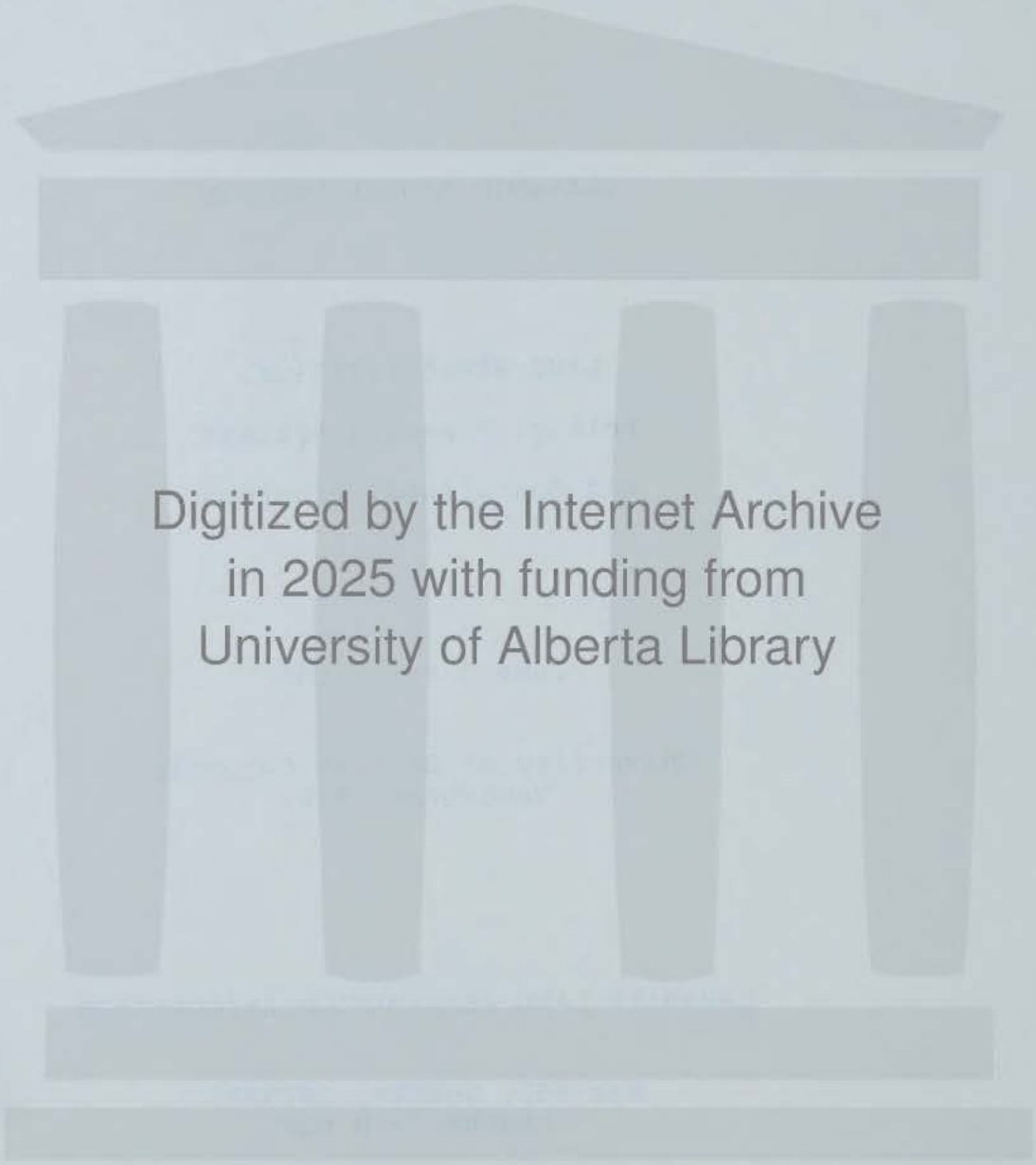

TABLE OF CONTENTS

FOREWORD

The British Columbia Chapter of the Canadian Land Reclamation Association was formed in 1985 to provide a local public forum for the exchange of information and experience in land rehabilitation. Comprised of professionals from a wide range of backgrounds and interests, this organization pulled together quickly to host the 1986 Annual Meeting. The diverse membership in the B.C. Chapter was realized in a program that expanded the scope of the conference to include many fields that have not been represented in past programs. The quality of presentations and range of topics kept audience participation at a spirited level. It is our hope that we have initiated a trend to widen the scope of the annual meetings so as to not focus on traditional mining or energy development issues.

I wish to thank all speakers and attendees for making this first formal function of the B.C. Chapter a success. The enthusiastic support of chapter members in the planning and administration of the conference demonstrated a strong desire for a quality meeting. This drive bodes well for the future of our chapter.

A great deal of effort went into the publication of the proceedings of the 1986 Annual Meeting. Care was taken to accurately reproducce all papers, however minor errors may have escaped the review process. We hope that this will not detract from the information presented by the authors.

May the CLRA and all local chapters continue to grow and function as a focal point for land rehabilitation.