REHABILITATION OF NON-PRODUCTIVE FOREST STANDS IN BRITISH COLUMBIA

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ABSTRACT

The rehabilitation of forest stands that do not support commercial crop vegetation is necessitated by the fact that competing non-crop vegetation suppresses or kills desirable crop species. These stands occupy some of the most productive forest sites. Reforestation failures are the result of intense brush competition and in the absence of some measure of control, these stands will be lost for forest production.

To alleviate the problem, management of non-crop vegetation is mandatory to re-convert these stands to the level of productivity. Otherwise well-established regeneration will become suppressed or the stand will further degenerate to the non-satisfactorily restocked state, increasing backlog.

Vegetation management is also the strategy to address the problem of re-conversion and to release established but suppressed conifer crop regeneration to become free-growing.

This paper discusses the magnitude of the problem, the Ministry Policy to provide the logistical framework, some of the operational techniques, current plans and projections for future planning of vegetation management on Crown Lands.

INTRODUCTION

The total area of old growth forest denuded annually amounts to nearly 200,000 hectares (Cuthbert, 1986). This area must be reforested with acceptable commercial species within a reasonable period of time. Failing to do so, the consequence will be a significant reduction of the future allowable annual cut (AAC). This in turn, can have a detrimental effect on the forest industry and the economy.

Efforts to reforest denuded areas have not always been successful. To a great extent, failure of reforestation is attributed to non-crop vegetation competition especially on the most productive forest lands. Competing vegetation suppress well-established regeneration on some of the valuable growing sites which are classified as brushed-in satisfactorily restocked (SR) areas. Others revert to the level of the non-satisfactorily restocked (NSR) classification, covered by a variety of vegetation complexes. Rehabilitation of these forest stands which occupy productive sites is carried out in the manner of vegetation management. The purpose of vegetation management is the manipulation of non-crop vegetation to assist crop trees to establish and grow freely. Vegetation management is an integral part of the silvicultural process, needed to protect the reforestation investment (Cuthbert, 1986).

The administrative framework to accomplish this task is rooted in the Forest Act (MOF Act, 1979), and the Policy of the Ministry of Forests, (MOF Policy, Site Rehab., 1984). A variety of alternative techniques are available to manipulate non-crop vegetation. The choice depends on the classification of the stand to be treated and the feasibility of the particular technique. Special emphasis is placed on the rehabilitation of non-productive stands in the current five-year forestry program and in the years ahead (MOF, 1984).

THE SCOPE OF THE BRUSH PROBLEM

A sizeable proportion of forest land which was logged or lost to fire, insects and disease is planted, or, where applicable, left to natural regeneration. Reforestation is a joint effort of the Ministry of Forests and the forest industry. At last, the basic planting requirements are closely approaching the projected goals. In 1985, 130 million seedlings were projected to be planted in the province. This figure has been increased to 200 million seedlings for 1987. More than one billion seedlings have been planted on more than one million hectares since 1939 when planting started. The number of seedlings to be planted during the next five years will be only slightly under one billion, according to the recently released Five-Year Forest and Range Resource Program for 1986-1991 (MOF, 1984).

A large proportion of restocked forest land, especially on the most productive sites was invaded by non-crop vegetation. Some valuable land was reduced to the "non-satisfactorily restocked" class, or it degenerated to the "non-commercial brush"

category. This result can be attributed partly to the lack of awareness of and concern about non-crop vegetation and its effects on conifer establishment and development in the past.

Tables 1, 2 and 3 refer to productive sites which were restocked and now are dominated by brush vegetation (Boateng, 1984; Cuthbert, 1986). Figures shown in Tables 1 and 2 are not identical to those in the Forest and Range Resource Analysis. The "NSR" figures in the latter have been reduced because some of the area was restocked since the NSR areas were surveyed. Only gross figures are shown in Tables 1 and 2 as brush problems still may exist even if the areas are considered stocked. Table 1 shows all categories of brush areas on British Columbia crown lands. The priority areas are included in the first four categories, with a total of about 1,061,000 hectares. The Prince George Forest Region contains 56 percent of the total. The backlog and current non-satisfactorily restocked land comprises about 500,000 hectares that require some vegetation control. A total of 237,000 hectares require immediate vegetation management on lands which are not satisfactorily restocked but are brushed-in. In the absence of control, the conifer regeneration will be lost.

If all these brushed-in areas, NSR, NCBr and SR Brush can be treated, an estimated total of 3.4 million m^3 can be gained in allowable annual cut at culmination age. Conversely, if no treatment is applied, 3.4 million m^3 is lost from the AAC. The equivalent gain (or loss) for the Prince George Forest Region alone will be 1.5 million m^3 annually (Boateng, 1984; Cuthbert, 1986).

In addition to all these losses, approximately 49,000 hectares are added annually to the already existing non-productive problem areas in the province at a rate of 200,000 hectares of annual denudation, if proper vegetation management is not implemented. This figure represents about 25% of the annually denuded area (Boateng, 1984; Cuthbert, 1986).

Deciduous stands of brush areas of British Columbia Crown lands amount to 1.8 million hectares (Table 3). The Prince George Forest Region contains 76 percent of this total. These forest areas are stocked but are either excluded from the AAC calculations or are not utilized to their full potential. Utilization and marketing of deciduous species is expected in the near future. For this reason brush treatment in these stands is not planned (Boateng, 1984; Cuthbert, 1986).

POLICY FOR THE IMPLEMENTATION OF REHABILITATION

The scope and magnitude of the brush problem suggests the necessity of an administrative framework to achieve the desired goals. This framework is provided by the Ministry of Forests Act and Ministry Policy.

Section 4 (a) of the Forest Act (MOF Act, 1979) states that a purpose and function of the Ministry "is to encourage maximum productivity of the forest and range resources in the Province". The Five-Year Forest and Range Resource Program includes the

Table 1: Brush Areas of British Columbia Crown Lands (Good and Medium Sites Only). (Boateng, 1984; Cuthbert, 1986).

BRUSH GROUP	HECTARES
Backlog NSR	342,000
Current NSR	160,000
NC Brush	321,000
Brushed-in SR	237,000
Deciduous	1,140,000
Deciduous/Coniferous	553,000
Coniferous/Deciduous	134,000
Total Area	2,887,000

Abbreviations: NSR = non-satisfactorily restocked
NC = non-commercial
SR = satisfactorily restocked

Table 2: Brush Areas in Hectares: NSR, NC Brush and SR (Crown Lands, Good and Medium Sites) (Boateng, 1984; Cuthbert, 1986)

BRUSH GROUP	PROVINCE	PRINCE GEORGE
NSR	502,250	284,770
NC Brush	321,290	209,480
Brushed-in SR	237,410	94,980
Total	1,060,950	589,320
% of Total		56

Abbreviations: NSR = non-satisfactorily restocked
NC = non-commercial
SR = satisfactorily restocked

Table 3: Areas Covered by Deciduous Vegetation in Hectares (Crown Lands, Good and Medium Sites) (Boateng, 1984; Cuthbert, 1986).

GROUP	PROVINCE	PRINCE GEORGE
Deciduous	1,139,890	889,920
Deciduous/Coniferous	553,000	392,230
Coniferous/Deciduous	133,790	109,010
Total	1,826,680	1,391,160
% of Total		76

Table 4: Brushing and Weeding, Conifer Release Five-year Estimates, in Hectares (Cuthbert, 1986).

YEAR	B & W*	CR*	TOTAL
1985/86	14,000	0	14,000
1986/87	22,000	1,000	23,000
1987/88	32,000	2,000	34,000
1988/89	38,000	3,500	41,500
1989/90	43,000	3,500	46,500
Total	149,000	10,000	159,000

* Includes Forest Renewal Development Agreement

silviculture goals for site rehabilitation (MOF, 1984).

The Ministry Policy (MOF Policy, 1983) statement is as follows:

"Site Rehabilitation will be planned and implemented within the Regions and will be included in Regional Five-Year Forest and Range Resource Programs and budgets under Intensive Silviculture - Site Rehabilitation; whenever economically feasible the on-site material will be utilized; a site rehabilitation plan will be developed for each project, when the proposal is submitted. This Policy Statement provides direction for the planning and implementation of site rehabilitation projects, over conversion stands where commercial values are considered to exist."

For the sake of clarity, certain terms used in this Policy should be defined. "Site Rehabilitation" is the conversion of the existing unsatisfactory cover on highly productive forest sites to a condition appropriate to establishing a crop of commercially valuable species to obtain maximum productivity.

"Conversion Stands" are those stands which are excluded or netted down from the yield analysis and include the following types of forest cover:

a. Non-commercial brush and weed species
b. Interior wet belt decadent hemlock-cedar
c. Interior true fir stands which are poor quality or decadent
d. Interior and coastal stagnant lodgepole pine stands
e. Coastal decadent cedar-yellow cedar-hemlock stands
f. Hardwood stands with or without minor amounts of coniferous species

"Section 52" is a set of provisions under Section 52(a) (MOF Act, 1979) of the Forest Act to increase the Allowable Annual Cut of Forest Licences or major Timber Sale Licences for intensive silviculture treatments carried out by a licensee, in addition to those required under the licence.

"Minor Timber Sale Licence" is a short-term, non-replaceable harvesting agreement.

"Site Rehabilitation Plan" is a schedule of proposed treatments including cost estimates which must be developed for any rehabilitation project from removal of existing cover to the establishment of desired species and successful attainment of "free growing" condition. Trafficability, soils, ecological capability, etc., are all accounted for in treatment plans.

Three conditions are applicable to this Policy:

a) First consideration is given to areas that do not contain timber that can be utilized.
b) Projects should be not less than 10 hectares in size, to complement future forest management regimes.
c) The possibility of future use of on-site material will

not preclude the consideration of projects.

Responsibilities to administer this Policy are divided, according to their functions, between the Directors of the Silviculture and Timber Management Branches, Regional Managers and District Managers. Procedures of the administration of this Policy are specified for Timber Supply Areas according to four stand conditions and for Tree Farm Licences according to three stand conditions. Stand conditions are defined by the value of recoverable timber, such as:

a) no timber values
b) minor values, uneconomical to harvest
c) economics of harvesting are uncertain
d) substantial timber values, such as (b), (c) and (e) types of conversion stands, listed previously.

Present and Future Plans

Forest vegetation management is given special attention in the current five-year forestry program and in the years ahead. Past experiences suggest that vegetation management must be an integral part of the silvicultural process in order to secure future wood supplies. In every problem treatment, the most logical and effective approach is the prevention of escalation of existing difficulties to costly or unmanageable proportions. To manage the brush problem effectively, the first stage is to improve stand establishment procedures that reduce brush encroachment and increase the growth of crop trees (Cuthbert, 1986). The initial fast development of crop trees is enhanced when the sites are well prepared and planted with large, vigorous stock, but brushing and weeding will always remain an integral part of stand management.

Current brushing and weeding and conifer release activities will be increased by 330 percent by the end of this decade. The estimated increases are shown in Table 4 (Cuthbert, 1986). A total of 159,000 hectares to be treated is projected by the end of the five-year period, ending in 1990. This increase of brushing and weeding activities will be made possible by the recently announced forest stand management funds.

Table 5 (Cuthbert, 1986) indicates that brushing and weeding and conifer release will be more than half of major stand tending activities. Additional vegetation management is expected to materialize in association with other silvicultural activities.

The total five-year goals for site preparation and rehabilitation are 625,000 hectares and 171,200 hectares, respectively, as shown in Table 6 (Cuthbert, 1986).

PROCEDURES AND TECHNIQUES FOR REHABILITATION

The actual field operation of rehabilitation is carried out in four phases, based on cruise information data, following a planning proposal and an operational proposal of the rehabilitation project. The planning proposal contains the

Table 5: Major Stand Tending Activities; Five-year Total (1985-90) (Cuthbert, 1986)

ACTIVITY	HECTARES	PERCENT
B & W/CR	159,000	53.2
Fertilization	79,000	26.4
Spacing	61,000	20.4
Total	299,000	100.0

Abbreviations: B & W = brushing and weeding
CR = conifer release

Table 6: Site Preparation - Site Rehabilitation; Five-year Estimates, in Hectares (Cuthbert, 1986).

YEAR	SITE PREPARATION	SITE REHABILITATION
1985/86	110,000	20,000
1986/87	125,000	37,800
1987/88	130,000	37,800
1988/89	130,000	37,800
1989/90	130,000	37,800
Total	625,000	171,200

description of interpretations information and it aids in the construction of a regeneration plan specifying the operations. It also includes pertinent maps, communication records with the Regional Pedologist and the inputs from Ministry Branches and agencies. The operational proposal, referring to Sections 52 and 88 of the Forest Act, has input from the Timber Management, Protection, Engineering and Silviculture Branches. It includes the synopsis and Cut Incentive Calculations. Based on cruise information that determines the "site condition" of the area to be rehabilitated (reference is made to Ministry Policy, Procedures, Chapter: SIL, Section 005), the four phases of rehabilitation are specified:

1. Slashing and/or logging phase. Standing trees are felled and the salvageable material, if any, is extracted.

2. Herbicide/or mechanical brush removal phase. Depending on access, trafficability or other pertinent characteristics of the site, mechanical or chemical techique is employed. If herbicides are used, this phase is also termed as the "spraying" or "browning phase". Other chemical application methods include stem injection (hack-and-squirt) and stump injection. As an alternative to herbicides, mechanical site preparation techniques can be used to remove slash and vegetation. Mechanical site preparation can be achieved either with tractor-mounted special bulldozer blades, disc trenchers or cultivators with tined wheels, for instance, the Bracke Cultivator and the Leno Scarifier. The essential requirement for brush control is the ability of the machinery to uproot the brush vegetation. Simple cutting of the plant above ground level does not accomplish the desired results as the plant can re-sprout after cutting. The choice between mechanical site preparation and other site preparation methods is dictated by the technical feasiblilty, terrain and soil conditions and associated operating costs.

3. Burning phase. Slash and foliar-killed shrubs are disposed of in the process of a controlled burn to create a plantable site.

4. Planting phase. The prepared site is replanted with large, vigorous stock. Heavy stock type on rehabilitated good and medium growing sites is mandatory to ensure fast seedling growth and the ability of the planted tree to compete with subsequent encroachment of brush vegetation. Contrary to widespread belief, herbicides do not kill all vegetation forever, therefore on most productive forest sites a second pass of herbicide application may be required within a year or two, in order to release developing regeneration from competition. The aim is to assist the planted trees to reach the free-growing stage. The silvicultural process however, continues in the form of conifer release, juvenile spacing, and if applicable, commercial thinning.

THE COST OF STAND REHABILITATION

The cost of operations ranges from $200 to $500 per hectare but it can increase to as much as $1,000 per hectare depending on the method used, the difficulty of the terrain and the severity of the brush problem.

Summarized data provided by the Silviculture Branch in 1986 suggest that provincial cost-per-hectare figures decreased as a result of experience, improved techniques and increase in the size of the area treated. During the 1981/82 period only $261 was spent per hectare on 3,087 hectares. During the subsequent two year period, 1982/83 and 1983/84, treated areas totalled 2,782 and 1,792 hectares only, with increased average costs of $457 and $409 per hectare, respectively. By the 1984/85 period a total of 14,493 hectares were treated with a corresponding average cost of $280 per hectare.

CONCLUSION

The restoration of the brushed-in good and medium forest sites to their former level to support productive forest stands is an indispensable component of silviculture. Logged and burned areas or those damaged by disease and insect attacks which are now overgrown with non-crop vegetation cannot contribute to wood production unless vegetation management is implemented. The current and backlog "non-satisfactorily restocked" stands should be converted to the "satisfactorily restocked" classification. Those areas which have already been satisfactorily restocked but the coniferous regeneration is suppressed by heavy competition must be treated by conifer-release techniques.

The numbers presented in Tables 4, 5 and 6 suggest that the stand rehabilitation program is a formidable undertaking. Knowledge and experience are required to accomplish the projected goals. Continued and sustained joint support is needed from decision-makers at the Federal and Provincial levels of government and the forest industry. Fish and wildlife biologists, ranchers, equipment and chemical manufacturers and educational institutions must co-operate with foresters. All this demands a lot of money but long-range silvicultural programs can be sustained only with continued funding.

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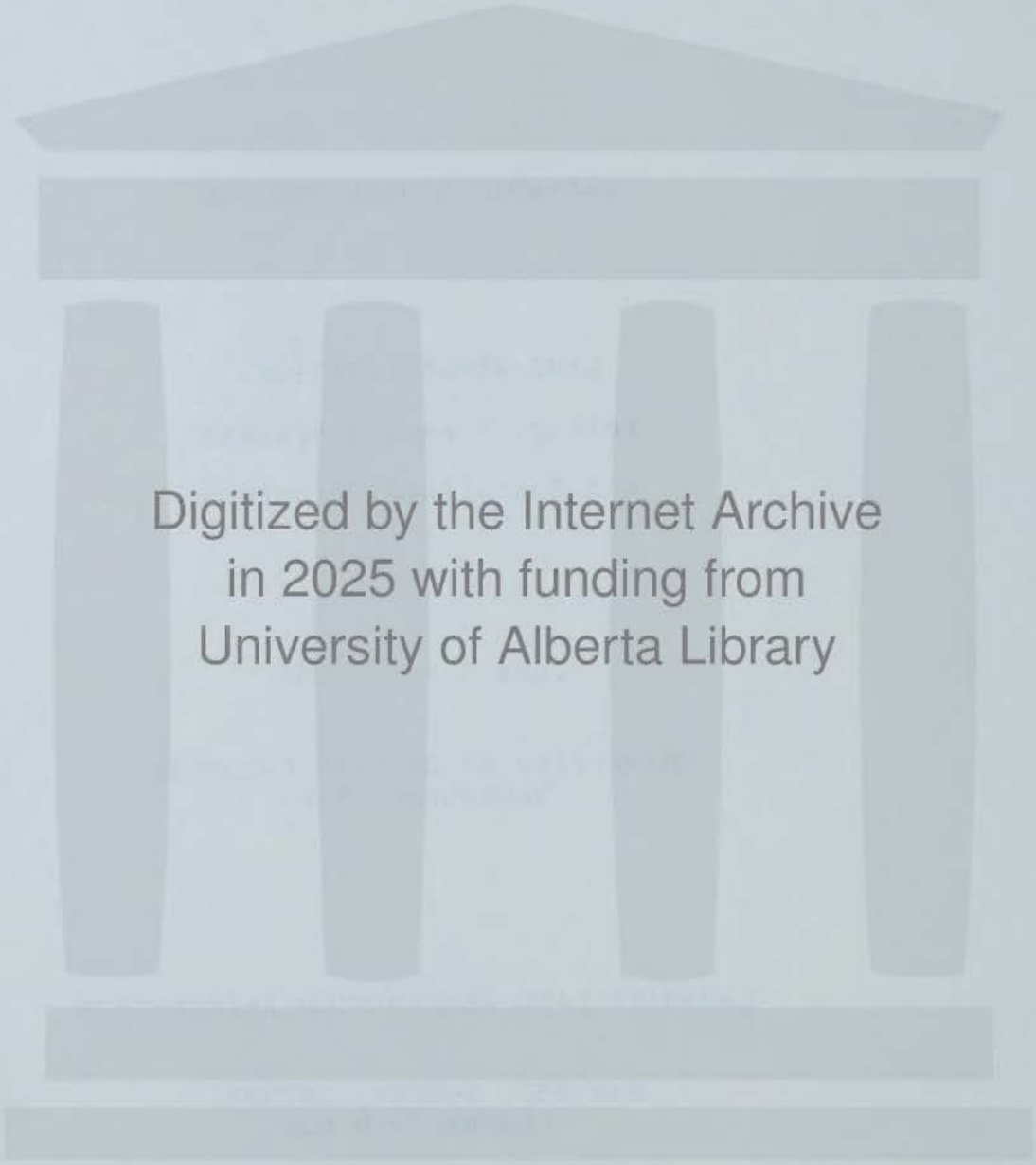

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FOREWORD

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.