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FOREST VEGETATION MANAGEMENT RESEARCH AND DEVELOPMENT

By

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A forest vegetation management project is being conducted within the Canada-Alberta Forest Resource Development Agreement, under Program Activity B, Sub-program B.3 (Forestry Research, Development and Demonstration). It is a joint program of the Northern Forestry centre (CFS), and the Research Branch and Reforestation and Reclamation Branch of the Alberta Forest Service.

The project started in the fall of 1985 pre-treatment data was collected in 1986 and is being followed by scheduled treatments and three years of post-treatment measurements, terminating in 1989-90.

PROJECT TITLE

Silvicultural, economic and environmental impact assessment of selected methods of site preparation and crop release in areas designated for softwood production in Alberta.

Project Location, Layout and Treatments

The test site is located on two separate cut blocks within the Procter & Gamble Forest Management Agreement area, about 21 km south of the Grande Prairie pulpmill, in Improvement District 16 (NTS Big Mountain Creek Sheet). The site is within the mixed wood forest complex of Alberta, and is representative of a significant problem area for softwood

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reforestation. The ecosystem association is white spruce, Viburnum and Aralia. Further details about this ecosystem including its productivity, are available from Corns and Annas (1985).

Treatments are being tested for conifer release (Method I) and site preparation (Method II). The Method I blocks are established on a three-year old aspen cutover and Method I blocks, on a two-year old aspen cutover. Both are regrowi rapidly to a mixture of aspen, poplar, saskatoon, chokecherry, herbs and grasses. Treatments are allocated randomly within blocks and are replicated three times. Treatments are as follows:

Method I (Conifer Release)

	Treatment	Treatment Timing
1.	Control	
2.	Mechanical ROME disc	Spring 1987
3.	Mechanical (TTS Trencher) followed by PRONONE 10 G @ 1 kg ai/ha	Spring 1987 Spring 1989
4.	Mechanical (TTS Trencher) followed by PRONONE 10 G @ 2 kg ai/ha	Spring 1987 Spring 1989
5.	Mechanical (TTS Trencher) followed by manual (brush saw)	Spring 1987 Spring 1989

Method II (Site Preparation)

	Treatment	Timing
1.	PRONONE 10G @ 4 kg ai/ha	Fall 1986
2.	PRONONE 10 G @ 2 kg ai/ha	Fall 1986
3.	PRONONE 10 G @ 4 kg ai/ha followed by mechanical (TTS Trencher)	Fall 1986/ Spring 1987
4.	PRONONE 10 G @ 2 kg ai/ha followed by mechanical (TTS Trencher)	Fall 1986/ Spring 1987
5.	Mechanical - ROME disc	Spring 1987

Both white spruce and lodgepole pine are being tested on the site.

All planting is to be done following mechanical treatments in Spring 1987, on both release and site preparation.

Sample plots are laid out within each treatment plot, and sub-plots within sample plots. All square and circular assessment plots are 25 m^2 in size. Transect plots are 0.5 m x 5 m in size.

The test site was surveyed by Pedology Consultants of Edmonton in August/September 1985; they produced a detailed soils report which was used to locate blocks and treatment plots in the areas with the most homogenous soils (Pedology Consultants 1985). Soils are predominantly moderately well-drained Gleyed Solonetzic Luvisols with a silt-loam surface texture and a clay subsoil texture.

PROJECT COMPONENTS/OBJECTIVES

The project involves research into three aspects of forest vegetation management: 1) silviculture, 2) economic

assessment and 3) environmental impact of herbicides used forest vegetation management, as follows:

A.	Component 1:	Silviculture
B.	Component 2:	Economics
C.	Component 3:	Environmental Impact and Residue Chemistry of Forestr Herbicides.

Objectives for each project component are as follows:

Silviculture Component

CFS:

- To assess the effects of selected manual, mechanical, chemical and combined site preparation and softwood release treatments on the growth and development of the softwood crop on designated mixed-wood sites in Alberta

- To assess the effects of selected manual, mechanical, chemical and combined site preparation and softwood release treatments on the growth and development of competing vegetation, particularly aspen and grass species, on designated mixed-wood sites in Alberta

AFS (FRB):

- To develop strategies to effectively control aspen development in areas designated for softwood production; to develop techniques for suppressing density of aspen suckering and for controlling ingress by seeding-in

Economics Component

- To assess economic aspects of selected manual, mechanical, chemical and combination treatments applied in vegetation management in Alberta to prepare cost-effectiveness and risk-benefit analysis for vegetation management programs. Cost-effectiveness and risk-benefit analyses can be developed from the application costs, treatment effectiveness and product values.

Environmental Impact and Residue Chemistry Component

- To develop environmental impact and residue data on herbicides used operationally for vegetation control in Alberta

- To determine the fate of herbicides in the forest ecosystem, by studying persistence, lateral and downward movement, degradation, and absorption/ desorption characteristics in selected forest soils under field and laboratory conditions

- To evaluate the influence of herbicide application and other silvicultural practices on the structure, composition and dynamics of forest plant communities

- To determine the influence of herbicide application and other silviculture practices on the long-term stability of nutrient balance and the biological (mycorrhizal associates, N-fixation, decomposition) control of tree nutrition

RESEARCH PROCEDURES BY COMPONENT

Silviculture Research and Development

Silviculture R&D is being conducted by the CFS (in-house) and by the Forest Research Branch (AFS) by contract.

CFS research focuses on field assessment of efficacy, cro tolerance and crop growth aspects of the treatments being tested.

AFS research focuses on field and laboratory assessments aspen sucker and seedling density and the impact of treatments on these factors.

CFS: Silviculture Research and Development

CFS research follows protocols established by Herring and Pollack (1985), and accepted by the Expert Committee on Weeds (ECW) Western Silviculture Group. Assessment is bas on 30-25 m^2 sample sub-plots within a given treatment. There are 450 sub-plots for silvicultural assessment on Method I, and 540 on Method II, for a total of 990 overall

Buffer strips between treatment sample plots average 40 m.

Assessments for herbaceous, woody and crop species were conducted for all sub-plots in the summer of 1986 to obtai baseline (pre-treatment) data, and will be repeated after 1,2,3 and 5 growing seasons following treatment.

Data loggers were established in May 1986 to measure air temperature, relative humidity, incident light and rainfal as well as soil moisture and temperature at two depths, within each type of treatment plot on the Method II area f

the 1986 pretreatment season and for five subsequent seasons.

AFS: Silviculture Research and Development

AFS research is aimed at bettering the understanding of aspen suckering processes, particularly factors and conditions which could be used for suppressing density and vigor of suckering. AFS research employs comparable protocols to CFS silviculture research and development for 25 m^2 circular aspen-sucker density-assessment plots as well transect excavation plots (0.5 m x 5 m each) to map and analyze aspen root details for root size and distribution and sucker origin. Pre-treatment assessments were done in 1986 with repeat assessments planned in subsequent years as described/for CFS work.

Economics Component

Economic studies under Component 2 of this project are focussing on site preparation and release treatments not only on the primary test sites but also on satellite plots selected by the AFS for purposes of silviculture R&D testing of treatment equipment, using standard economic analysis techniques such as cost-effectiveness, risk-benefit and marginal cost analysis.

Protocols for this work are based on standard field procedures modified by the experiences gained in conducting similar studies in an agricultural context.

Environmental Impact and Residue Chemistry Component

The procedures used in the environmental impact and residue chemistry component of this project are as follows:

Community (Plant) Changes:

Thirty 5 m x 5 m sub-plots were permanently established in each treatment plot for sampling vegetation. Refer to protocols and ECW standard noted under the heading "Silviculture". The study will investigate the response of all woody and herbaceous species to treatments. The response parameters measured are frequency, density, cover and presence. The sub-plots were sampled before treatment in 1986 and will be resampled 1, 2, 3 and 5 years after application of treatments. The data are being analyzed using standard vegetation analysis techniques.

Residue Sampling in Soils and Vegetation and Water:

Foliage was sampled from two crop species, three target species, three low shrubs and grasses and three ground vegetation species from five sub-plots in each treatment. The sampling was done once before treatment and will be repeated several times after application of the treatment. The foliage is kept frozen until analyzed for herbicide residue by methods developed by the Forest Pest Management Institute (FPMI) of the CFS.

The soils were sampled in five sub-plots in each treatment. The soils profiles were described and separated by horizons up to 30-35 cm depths and collected separately for herbicide residues. The sampling was done in 1986 before and immediately after application of treatments and will be repeated several times after treatment over a span of two

years. The protocols are the same or similar to those developed by FPMI or modified to suit local soil conditions. All soil samples are kept frozen until analyzed for residues. The soils will also be analyzed for texture and nutrient status using standard Northern Forestry Centre laboratory methods.

Surface and ground water will be sampled by Alberta Environment and analyzed by Northern Forestry Centre using standard methods developed by FPMI for specific herbicides. Deposition and drift were assessed and monitored prior to and during herbicide application.

Mycorrhizae and Nutrient Cycling

Effects of PRONONE on growth of five species of mycorrhizae (Hebeloma crustuliniforme, Laccaria laccata, Suillus tomentosus, Thelephora americanum and T. terrestris) were studied under laboratory and field conditions during 1985 and 1986 as part of a PDF program, outside the agreement. The growth of these mycorrhizae in association with lodgepole pine and white spruce was studied in response to application of PRONONE using standard culture methods.

A nutrient-cycling study is being conducted on the herbicide-treated sites as a part of ongoing CFS Research and Development outside this agreement. The work is aimed at determining the influence of herbicide treatments on nutrient balance and on biological and chemical control of tree nutrition, via assessment of N fixation, decomposition, pH changes and cation and anion availability.

Fish and Wildlife:

Impacts on fish were minimized by locating the project and handling materials to prevent such impacts.

Impacts on wildlife, particularly on ungulates will be limited to assessing residues in ungulate browse and forage supplies which will be sampled and analyzed in the course of the environmental impact assessment. The scale of the treatment is too small (a total of 45 ha of which 24 ha will be chemically treated over the life of the project) to provide a meaningful assessment of habitat change for ungulates.

The most meaningful mammal study on the project area be a study of possible toxicity to small mammals, and a study of population impacts of chemical treatment upon small mammals. Such studies are particularly important because of the position of small mammals in the food chain. The plans for a small mammal study include:

1. Update of a literature survey of toxic effects of hexazinone upon mammals

2. Assessment of levels of chemical residues within water, vegetation and soils on the chemically treated area

3. Test for chemical residues in selected tissues (kidneys and livers) of small mammals (mice)

4. A survey of population changes of small mammals as affected by chemical treatments on the project area (acute toxicity and habitat change impacts)

Items (1) and (2) will be accomplished from existing project funding and items (3) and (4) are being addressed by a consultant funded by the Wildlife Toxicology Fund.

REPORTING

Research results for this project will be published following analysis and interpretation of data at intervals over the next 3 or 4 years. Results of mycorrhizal research and development should be published in 1987.

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