

STUDY STATEMENTS

1986-87

NORTHERN FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

5320 - 122 STREET

EDMONTON, ALBERTA

T6H 3S5

MARCH 1986

NORTHERN FORESTRY CENTRE
STUDY STATEMENTS, 1986-87

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FOREST RESOURCE ECONOMICS AND STATISTICS



5. Prepare for review journal article on structure of sawmilling industry in prairie provinces (Williamson).
6. Initiate proposed studies under the Manitoba Agreement.
7. Develop study proposals for consideration under the proposed Saskatchewan research MOU to be funded by the Agreement (Williamson, Daniel).
8. Develop 3 study proposals for consideration under the PRUF program.
9. Continue to provide input for the national economic task force and the evaluation task force, as required (Boylen).
10. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required.
11. Continue to provide reviews/comments of journal articles, reports, proposals and briefings.

Added Goals:

12. Prepare and staff displays for NoFC Open House in May 1985.

10. Accomplishments in 1985-86:

1. The Information Report entitled Production and Consumption of Wood Products and the Relative Socioeconomic impact of the Forest Industry in the Northwest Territories, 1980-81 by R.A. Bohning was reviewed, revised and final report submitted for publishing in September, 1985. Publication date is estimated as summer 1986 (Bohning).
2. The Information Report entitled Forest Economics Research Needs for the West Central Region of Canada by William Phillips, James Beck and Wayne Lamble, University of Alberta was condensed, edited and reviewed by both CFS and U of A systems.

The final report was submitted for publishing by both CFS and U of A in September 1985. Publication date is estimated as spring 1986 (Boylen).

3. A series of meetings were held to discuss the ENFOR 207 project report. It was agreed that the report would be published, with a foreword memo explaining the discrepancies in moisture content, weights and specific gravities. A Forest Management Note focusing on harvesting costs would follow after resolution of the above report condition. These reports were transferred to NOR-4-08, NOR-28-06. (Heit, Boylen, Ondro).
4. Article on Factor Substitution and economies of scale in the Alberta sawmill industry by Banskota, K., Phillips, W. and Williamson, T.B. published in Can. J. of For. Res. (Williamson).

5. Article entitled Production Structure of the Sawmilling Industry in the Prairie Provinces of Canada. Final Report by Kamal Banskota, William Phillips and Timothy Williamson was sent out for review in August, 1985. (Williamson).
6. Two economist positions were staffed in 1985-86. NOR-3-01 provides functional direction/supervision for the Manitoba forest economist, and direct supervision/direction for the Saskatchewan forest economist. (Boylen, Williamson, DeFranceschi)
7. Five of six studies approved under the Manitoba Agreement were initiated by NoFC staff. After 1 June 1985 further development/initiation was the responsibility of the Manitoba economist, in conjunction with NoFC staff (Williamson, DeFranceschi, Bohning, Boylen) (see NOR-36-01-8)
8. Studies under the Saskatchewan agreement were assisted after 1 July 1985. (Williamson, Boylen)
9. Four study proposals were submitted for consideration under the PRUF program. The proposal An Assessment of Non-Market Benefits in a Value-At-Risk Framework for Fire Management by William Phillips and Wiktor Adamowicz was approved and initiated. (Boylen, Williamson).
10. The national economics task force, as such, was disbanded and replaced by one economist from CFS-HQ. One meeting was held with regional economists in June 1985. Several meetings and phone calls have taken place, a Delphi-type exercise completed, and a draft issue paper has been reviewed. (Boylen)
11. The evaluation task force for the Manitoba Agreement contracted, assisted in and received a report Development of an Evaluation Framework for the Canada/Manitoba Agreement on Forest Renewal. This report was intensively reviewed across the CFS and comments received. Recommendations were subsequently presented to the Agreement Management Committee and are now being implemented. (Boylen).

The evaluation task force for the Saskatchewan Agreement has begun preliminary meetings. (Mauch, Boylen).
12. Direct supervision/direction was provided for NOR-3-02. (Boylen)
13. Socio-economic and statistical data, analyses, documentation were provided to CFS, federal and provincial government personnel, and members of the general public as required. Speeches on the forest industry were given to school classes and several adult service clubs in conjunction with the Alberta Forestry Association.
14. Reviews and comments were provided by staff for refereed journal articles, as well as comments on information reports, briefings and research proposals.
15. Displays of forest economics and statistics, wood products, a slide-tape show and a portable sawmill display were prepared and manned by all staff. (Bohning).

11. Goals for 1986-87:

1. Publish article/report entitled Production Structure of the Sawmilling Industry in the Prairie Provinces. Final Report. (Williamson)
2. Publish in association with Forintek, updated versions of Saskatchewan and Manitoba Directory of Wood Using Industries. (Mauch, Steele, Bohning)
3. Publish updated versions of the Saskatchewan and Manitoba Forestry Report series. (Bohning)
4. Assist in the development and implementation of various interdisciplinary forest economic/silvicultural studies to provide operational guidelines for cost-effective use of funds in intensive forest management under the Manitoba and Saskatchewan Agreements. (DeFranceschi, Boylen)
5. Assist in preparation for review, the contract report An Assessment of Non-Market Benefits in a Value-at-Risk Framework for Fire Management. (Williamson)
6. Continue participation on evaluation task forces for the Manitoba and Saskatchewan Agreements. Participate in the interim evaluation of the Manitoba Agreement. Assist in the initiation of an evaluation task force for the Alberta agreement. (Boylen, Mauch, Steele)
7. Continue development and participation in the national economic task force, as required.
8. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required.
9. Continue to provide reviews/comments of journal articles, reports, proposals, and briefings.
10. Provide functional direction for NOR-36-01-8. (Boylen, Williamson, DeFranceschi)
11. Provide direct supervision for NOR-36-03-9. (Boylen)
12. Provide direct supervision for NOR-3-02. (Boylen)

12. Publications 1985-86:

- Banskota, K.; Phillips, W., and Williamson, T.B. 1985. Factor substitution and economies of scale in the Alberta sawmill industry. Can. J. of For. Res. Vol. 15, No. 6, 1025-1030.
- Ondro, W.J., Williamson T.B. 1985. The forest industry in the economy of Saskatchewan, 1979-80. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-268.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Boylen	0.8
	Williamson	0.6
	De Franceschi	0.6
Tech.:	Bohning	1.0
Total:		3.0
Term/Student:		0.0

O & M: \$8,000

Capital:

15. Signatures:

Diane M. Boylen

 Investigator

[Signature]

 Program Director, Development

C. D. [Signature]

 Regional Director General



5. Coordinate updating and expansion of regional data bases.

10. Accomplishments in 1985-86:

1. Participated in the development and implementation of the 1986 national forest inventory component of the Canadian Forest Resource Data Program with FORSTATS counterparts from other regions and FORSTATS PNFI personnel.
2. The Silviculture Statistics for Canada (1975-83) Information Report (changed in 1984-85 from a Forest Management Note) with L. Brace has been completed. Publication date is estimated as March 1986.
3. Use of the criteria and procedures established at the above meetings for actual delivery of the primary data for the 1986 national inventory has begun.
4. Developed a proposal under the Canada-Alberta FRDA to continue with the cataloguing of CFS permanent sample plot data and the standardization of such data. (see NOR-36-02-7)
5. Contributed to development of management information systems e.g., cash flow spread sheets, zone maps.
6. Contributed to silvicultural cost-efficiency studies under the forestry development agreements.
7. Made written recommendations concerning acquisition of computer hardware and software items.

11. Goals for 1986-87:

1. Complete delivery of primary data from Alberta, Saskatchewan, and Manitoba for the 1986 national forest inventory to the FORSTATS program at PNFI.
2. Complete planning and development of a draft report for the landmark 10-year silviculture statistics Information Report.
3. Provide direction and assistance to the permanent sample plot cataloguing contractor. (see NOR-36-02-7)
4. Continue to participate with NOR-36 in the development and implementation of management information systems and evaluation frameworks for the forest renewal agreements.

12. Publications 1985-86:

D.H. Kuhnke and L.G. Brace. Silviculture Statistics for Canada, 1975-83. An Update. Can. For. Serv. Inf. Rep. NOR-X- .

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Kuhnke	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

O & M: \$6,000

Capital:

15. Signatures:

Dieter Kuhnke
Investigator

[Signature]
Program Director, Development

A. D. Hunt
Regional Director General



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 27, 1986

1. Project: Resource Economics and Statistics
2. Title: Interdisciplinary studies in forestry research
3. New: X Cont.:
4. No.: NOR-3-03
5. Study Leader: D.M. Boylen
6. Key Words: Interdisciplinary forest management economics,
cost-effectiveness, benefit:cost, risk:benefit,
decision-making models
7. Location of Work: Prairie provinces and NWT, Ottawa
8. Study Objectives:
 1. To provide socio-economic and statistical data, analyses and documentation for interdisciplinary studies in forest management.
 2. To provide socio-economic and statistical data, analyses and documentation for a regional perspective to national forest economic studies.
9. Goals for 1985-86:
 1. Prepare and publish paper on the economics of thinning for IUFRO conference. (Boylen, De Franceschi)
 2. Publish journal article on the economics for fertilization of lodgepole pine. (Ondro)
 3. Initiation of an interdisciplinary research study proposed in 1984-85. (Ondro)
 4. Review available published/unpublished literature on economics of alternative methods of vegetation management for timber production. Identify and prioritize economic problem analyses. Initial planning with NOR-7 and NOR-10 of the economic components to a regional vegetation management research plan. (Boylen, DeFranceschi)

5. Development of an interdisciplinary research study proposal in fire economics. (Williamson)

Added Goal:

6. Supervision and participation with U of A personnel on a project for Alberta Economic Timber Supply Modelling under the Alberta Agreement. (Boylen, De Franceschi).

10. Accomplishments in 1985-86:

1. Paper entitled Costs and Benefits of Precommercial Thinning. An Overview and Case Study was presented at IUFRO conference and will be published in the Proceedings. (De Franceschi, Boylen)
2. Transferred to NOR-4-08.
3. Transferred to NOR-4-08.
4. The available published literature was researched with the assistance of a U of Helsinki exchange student. Unpublished statistical data has not yet been made available from CFS-HQ. Initial planning is continuing. (Boylen)
5. A combined issue identification, literature review and concept paper entitled Economics of Wildland Fire Management was prepared. (Williamson)
6. Information requests and assistance with regard to 1) damage appraisal, 2) price indices and 3) fire economics terminology were given. (Williamson)
7. Assistance in the development of project design and development proposals. Review of literature from Forest Economics and Policy Analysis project (FEPA). (Boylen, De Franceschi)
8. Development and initiation of various cost studies of intensive silviculture practices. (De Franceschi)

11. Goals for 1986-87:

1. An Information Report will be prepared for review using additional plus case history material (that was used in IUFRO report) on the economics of pre-commercial thinning. (De Franceschi, Boylen)
2. An issue identification, literature review and concept paper on the economics of forest vegetation management will be prepared for review. (Boylen)
3. A methodology for collecting cost data for this years' work program under the Vegetation Management Project will be designed. The data will be collected. (Boylen)

4. Develop a strategy framework for quantification of fire susceptible forest resource values. (Williamson)
5. Develop a fire management input price index for the prairie provinces. (Williamson)
6. Summarize fire economics concept paper and submit to Forestry Chronicle as a non-technical article. (Williamson)
7. Assist in the implementation of the Alberta Economic Timber Supply Modelling project. (Boylen, De Franceschi)
8. Develop a strategy framework for regional co-ordination, development and initiation of silvicultural cost studies by NoFC and agreement personnel. (De Franceschi)

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Boylen	0.2
	De Franceschi	0.4
	Williamson	0.4
Tech.:		0.0
Total:		1.0
Term/Student:		0.0

O & M: \$6,000

15. Signatures:

Diana M. Boylen
Investigator

[Signature]
Program Director, Development

A. D. [Signature]
Regional Director General



NOR-4

STAND PRODUCTIVITY AND FOREST INVENTORY

2. Thinning experiments and some growth monitoring plots in operational thinning trials, have been established in jP, lP, tA, and wS. Remeasurements continue (see summary table). Results are published as became available, and the studies provide important information on managed stand yield.

Thinning equipment performance trials were also conducted, analysed and published.

3. Spacing experiments have been established in jP, rP, lP, and wS. Remeasurements continue (see summary table). Results are published as became available, and the studies provide important information on managed stand yield.
4. At the request of the Alberta Government, intensive short term studies were conducted on regeneration standards, and tree growth response along seismic lines. Results were analysed and published.
5. Over 20 reports and journal articles have been published on growth and yield, on thinning and spacing response and on related problems referred to above for jP, lP, rp, sP, and wS by Bella, I.E. and J.P. DeFranceschi, Cayford, J.H., Jameson, J.S., Johnstone, W.D., Stenecker, G.A., and Wilson, G.M. between 1950 and 1984.

9. Study Objectives:

1. Construct and/or evaluate yield tables for use in natural, unmanaged lodgepole pine, jack pine and aspen stands.
2. Determine the effect of different types and intensities of thinning on subsequent growth and yield of lodgepole pine, jack pine and aspen.
3. Determine growth and development of four indigenous conifer species, Picea glauca, Pinus banksiana, P. resinosa, and P. contorta var. latifolia at various spacings on major site types, so that optimum spacing can be selected for specific management objectives in future planting.

10. Goals for 1985-86:

1. Publish journal article in tree growth response to line clearings in western Alberta. (4-10)
2. Publish journal note on the distribution of the two most important pests by tree size classes in young lP. (4-4)
3. Cooperate in a problem analysis of R & D needs on stand tending, growth and yield in Alberta and Saskatchewan in relation to the upcoming Agreements and MOUs. (4-28)
4. Carry out project leader duties for NOR-4. (4-42)
5. Publish a journal note on logging practices and subsequent development of aspen stands in Saskatchewan. (4-24)

6. Pool all available information on jP thinning in Manitoba and Saskatchewan and prepare an information report as a guide for the forester managing jP. (4-6)
7. Continue to provide advise on mensurational problems including thinning, growth and yield and stand modelling, as well as contribute to technology transfer on related problems as required to the federal-provincial agreements. (4-18 and 4-5MA)
8. Provide functional guidance to P.A. and Winnipeg suboffices as required. (4-41)
9. Review the status of the aspen thinning and pruning study near Swan River, Manitoba, and develop plans for assessment. Discuss pathological aspects with Y. Hiratsuka and R. Wall. (4-22)
10. Direct remeasurement of PSPs in strip-thinned jack pine in SE Manitoba. (4-6)
11. Complete analysis and publish a Forest Management Note on the Teepee Pole Creek 1P spacing study. (4-8)

Added Goals:

12. Participate as a member of the Peer Review Panel for MFC Project MC-32.
 13. Serve on the organizing committee for the international symposium on "Future forests of the mountain west: A stand culture symposium.
 14. Co-author two papers on stem diseases and insect leader damage for the symposium indicated in goal 13.
 15. Direct the remeasurement of R&D plots in Manitoba through staff of the Manitoba District Office.
 16. Prepare a MS on 20 year results of 3 conifer plantations established at different spacings.
11. Accomplishments in 1985-86:
1. A journal article on tree growth response to seismic line clearing in western Alberta has been submitted to the For. Chron. and accepted (Dec. 2, 1985) for publication.
 2. A journal note on the distribution of the two most important pests by tree size classes in young 1P has been published in the CJFR.
 3. Cooperated as required in a problem analysis of R&D needs in stand tending, growth and yield in Alberta and Saskatchewan in relation to the upcoming Agreements and MOUs.
 4. Carried out project leader duties for NOR-04.

5. A journal note on logging practices and subsequent development of aspen stands in Saskatchewan has been submitted to the For. Chron. and conditionally accepted for publication.
6. Information relating to thinning jP in Manitoba and Saskatchewan was reviewed and preparation of a guide in progress.
7. Continued to provide advise on mensurational problems including thinning, growth and yield and stand modelling, as well as contributed to technology transfer on related problems as required to the federal-provincial agreements.
8. Provided functional guidance to P.A. and Winnipeg suboffices as required.
9. The aspen thinning-pruning study near Swan River, Manitoba, has been re-examined with help from the Winnipeg suboffice. Discussions with Y. Hiratsuka and R. Hall suggested pursuing the final assessment of this study with the help of a grad. student as a masters thesis project.
10. Directed the remeasurement of PSPs in strip thinned jP in SE Manitoba, with assistance from the Winnipeg suboffice.
11. The analysis and preparation of a FMN on the Teepee Pole Creek lP spacing was reassigned to, and completed by, R. Yang.

Added Accomplishments:

12. Participated as a peer review board member for project MC-32, Forest productivity, at the MFC, Fredericton, N.B.
 13. Worked as a member of the organizing committee of a International Symposium on "Future forests of the mountain west: A stand culture symposium" to be held in Missoula, Mont., Oct. 1986.
 14. Accepted assignments to co-author two papers for the above symposium on impact on tree growth from stem diseases and insect leader damage. Some field sampling has been conducted in the summer of 1985.
 15. Directed the remeasurement of jP and rP operational thinning monitoring plots in SE Manitoba, with assistance from the Manitoba suboffice and the Manitoba Forestry Service.
 16. Prepared a manuscript on spacing effects 20 years after planting three conifers in Manitoba.
- 12 Goals for 1986-87:
1. Provide project leadership functions to NOR-04 staff and functional guidance to Regional Development staff in Manitoba and Saskatchewan District Offices and to the Alberta and Saskatchewan Agreements' mensurationist; provide advice to colleges and clients on mensurational problems and carry out technology transfer in thinning,

growth and yield and stand modelling; yield forecasting; act as a scientific authority on related contracts as required (4-18, -41, -42, -1AA, 5MA and 2SA).

2. Prepare FMN or Information Report on "Guidelines for spacing lodgepole pine". (4-4, 4-8).
3. Publish FMN or Information Report on "Guidelines for spacing jack pine (4-6).
4. Direct the remeasurement of a replicate of jP strip thinning plots in SE Manitoba, and the LP spacing trials at Gregg Burn. (4-6, 4-32)
5. Direct the remeasurement of tA thinning studies at Turtle and Riding Mountains, Manitoba (4-33).
6. Prepare and present two papers at an international symposium on stand management: (1) impact on tree growth from stem diseases and (2) impact from insect leader damage. (4-70)
7. Co-author a poster paper for the IUFRO Congress, September 1986, on "red belt" impact on the growth of LP. (4-78).
8. Assist and participate in a workshop on stand tending techniques for jP under the Canada-Manitoba agreement. (4-2MA)
9. Publish an Information Report on "Spacing effects 20 years after planting three conifers". (4-35)
10. Act as Scientific Authority (R. Waldron) for a contract involving the review of pre 1970 CFS R&D studies in Alberta and KFES. (4-2MA)

13. Publications 1985-86:

Bella, I.E. 1985. Pest damage incidence in natural and thinned lodgepole pine in Alberta. For. Chron. 61:233-238.

Bella, I.E. 1985. Western gall rust and insect leader damage in relation to tree size in young lodgepole pine in Alberta. Can. J. For. Res. 15:1008-1010.

Bella, I.E. 1985. Tree growth response along seismic line in Alberta. For. Chron.: in press.

Bella, I.E. 1985. Logging practices and subsequent development of aspen stands in east-central Saskatchewan. For. Chron: in press.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.:	Bella	0.8
Tech.:	Vice Kolabinski	1.0
Total:		1.8
Term/Student:		0.3

O & M: \$8,000

Capital:

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1986

Location	Soil and Site	Stand age at establishment	Date of establishment	Date of re-meas.*	No. of plots	Plot size (acres)	Treatment	
							Method	Intensity
Alberta	Varied	Varied	1951 1952 1953	1961 1974 1984 (1994)	100	0.1 0.5	N.A.; these are permanent growth and	
British Columbia	Stratified sand and gravel outwash; moist	15	1952	1957 1962 1967 1971 1977 1983 Spr. (1987 A) (1993 Spr.)	16	0.1	Low selection thinning to specified Stand Density Index every 5 years, except in 1971 & later	Control, no thinning Thinned: to 40%, 50%, 80%, 100% control 9 2 plots e
British Columbia	Medium sand; fresh	40	1958	1963 1968 1973 1978 1983 Spr. (1988 A) (1993 Spr.)	20	0.1	Merchantable Selection thinning, low and crown. Only trees with dbh over 4" were removed.	Control, no thinning Thinned: Heavy low Light low Heavy cro Light cro
British Columbia	a. Sand, fresh Tougas (Rd.)	9	1964	1965 1968 1973 1978 1983 Spr. (1988 Spr.) (1989 Spr.)	15	.002 .007	Mechanical Strip-thinning	Control, Thinned 1-way: Thinned 2-way: 5 p
British Columbia	b. Sand, fresh	11	1967	1969 1976 1981 (1986 A) (1996 A)	5	.002 .007	Mechanical Strip-thinning	Thinned 1-way 5 p

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1986 (continued)

Location	Soil and Site	Stand age at establishment	Date of establishment	Date of reneas.*	No. of plots	Plot size (acres)	Treatment		
							Method	Intensity	
	c. Sand, moist (Central Rd.)	9	1964	1965	15	.002	- Mechanical Strip-thinning	Control:	5 pl
				1968		.007		Thinned 1-way:	5 pl
				1973				Thinned 2-way:	5 pl
				1978					
				1983 Spr. (1988 Spr.) (1998 Spr.)					
di ds, est erve,	d. Sand, moist	11	1967	1969	5	.002	- Mechanical Strip-thinning	Thinned 1-way:	5 pl
				1976		.007			
				1981					
				(1986 A) (1996 A)					
	e. Sandy till, fresh	13	1965	1967	10	.002	- Mechanical Strip-thinning	Control:	5 pl
				1970		.007		Thinned 1-way:	5 pl
				1974					
				1979					
				1984 A (1994 A)					
	f. Sandy till, fresh (west of Piney)	17	1966	1968	10	.002	- Mechanical Strip-thinning	Control:	5 pl
				1970		.007		Thinned 1-way:	5 pl
				1975					
				1980 A 1985 A (1995 A)					
	g. Sand, dry (Badger)	13	1965	1967	10	.002	- Mechanical Strip-thinning	Control:	5 pl
				1970		.007		Thinned 1-way:	5 pl
				1974					
				1979					
				1984 A (1994 A)					
ay, erta	Silt loam to sandy loam	22	1954	1960	16	.20	- Low selection thinning	Control:	3 pl
				1969		.738		1.5m spacing:	3 pl
				1979				1.8m spacing:	3 pl
				(1989)				1.8m spacing: rethi 2.4m spacing: 3 pl 3.7m spacing: 1 pl	

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1986 (continued)

Location	Soil and Site	Stand age at establishment	Date of establishment	Date of re-meas.*	No. of plots	Plot size (acres)	Treatment	
							Method	Intensity
Sandlands, rest serve	Sand, fresh	3 y.o seedlings planted	1963	1973 1978 1983 (1988 A) (1993 A)	32	Variable	49 trees in a 7x7 matrix at 4x4, 10x10 ft. spacing plus a 2-row su Four replications.	
Sandlands	Sand, fresh	3 y.o seedlings planted	1963 1962	1973 1978 1983 A (1988 A) (1993 A)	32	variable	as above	
Gregg Burn	three site types	7	1964	1966 1971 1976 1981 (1986 A) (1991 A)	30	variable	100 trees in a 10x10 matrix at den 400, 800, 1600, 3200 stems/ac.	
Gregg Burn	three site types	27	1984	(1989 Spr.)	24	variable	100 trees in a 10x10 matrix at den 800, 1200, 1600 stems/ac.	
Tepee Pole Creek	three site types	25	1967	1972 1977 1982 (1987 A) (1992 A)	30	variable	100 trees in a 10x10 matrix at den 400, 800, 1600, 3200 stems/ac.	
Sandlands	N/A	N/A	1980	(1985A)	6x4		Control: 20x20m 1. Control, 2. 8' 3. 10'x10' 4. 12'x12' Treated: 30x30m	
Belair	N/A	N/A	1981 (tr) 1982 (co)	(1985A) (1985A)	4	2(20x20 m) 2(10x10 m)		
Hadash.	N/A	N/A	1981	(1985A)		20 x 20 m	3 areas; in each 1 control, 1 thin	

SUMMARY OF ACTIVE THINNING AND OTHER GROWTH STUDIES IN ASPEN
1986

Location	Soil and Site	Stand age at establishment	Date of establishment	Date of reneas.*	No. of plots	Plot size (acres)	Method	Treatment
								Intensity
Littleton, Colorado	Non telluric mesic clay loam till	11	1948	1953 1960 1965 1971 1976 1981 (1986 A)	5	0.2	Regular spacing & alternate strips	Control, no thinning Thinned: 5'x5', 7'x7', & 20' alternate strips 1 plot each
Littleton, Colorado	Non telluric mesic clay loam till	14	1951	1957 1962 1967 1972 1977 1983 Spr. (1988 Spr.)	14	0.2	Thinned to fixed SDI every 5 yrs. except in 1972 & later	Control, no thinning Thinned: to 120, 60, & 50% control plots each
Littleton, Colorado	Non telluric mesic clay loam till	14	1950	1960 1965 1971 1976 1981 (1986 A)	4	0.1	Regular spacing	Control, no thinning Thinned: 8'x8', 12'x12' each
Littleton, Colorado	Telluric mesic silty clay loam till	23	1950	1960 1965 1971 1976 1981 (1986 A)	8	0.2	Regular spacing	Control, no thinning Thinned: 8'x8', 12'x12' each
Littleton, Colorado	Non telluric mesic clay loam till	15	1964	1969 1985 Sp.	24	0.1	Thinning to regular spacing and pruning	Control, no thinning Thinned and Pruned spacing w/ pruning

* measurement years are in brackets.

10. Goals for 1985-86:

1. Prepare information report on "Guidelines for the use of STEMS in the management of lodgepole pine and white spruce". (4-1)
2. Complete Ph.D. thesis entitled "Improved methods of modelling white spruce growth and yield in Alberta. (4-3).
3. Gain familiarization with FORCYTE-11 program which predicts nutrient cycling in aspen stand (in cooperation with Ivor Edwards and Mike Apps). (4-19).
4. Undertake a technology transfer program to promote the use of STEMS for the management of lodgepole pine and white spruce. (4-2).

Added Goals:

5. Visit the North Central Forest Experiment Station at St. Paul Minnesota to discuss STEMS with researchers and to obtain the latest releases of the model.
6. Lecture and provide demonstrations of STEMS to co-workers and clients.
7. Participate in the CFS Modelling workshop and present a paper on modelling work done at NoFC.
8. Review R. Yang's paper "Growth of 25-year old lodgepole pine after juvenile spacing in western Alberta".
9. Set up the latest version of TWIGS (mini-computer version of STEMS) as well as TREEGEN (a program to produce input files for TWIGS using normal, Weibull distributions or individual tree data) on the VAX computer at NoFC.

11. Accomplishments in 1985-86:

1. A first draft of an information report entitled "Guidelines for the use of STEMS in the management of jack pine, aspen and white spruce" was completed.
2. The Ph.D. program was withdrawn because of problems with the thesis. Much time and effort were devoted to the thesis but it was not acceptable to the research committee.
3. Attended a workshop on FORCYTE-11 at the University of British Columbia in February.
4. Technology transfer program was postponed until information report is published.
5. Visited North Central forest Experiment Station at St. Paul, Minnesota to discuss STEMS with researchers and to obtain the latest releases of the model in April.

6. a. Prepared displays and gave demonstrations of STEMS during Open House in May.
- b. Prepared simulation runs of STEMS for the Growth and Yield/Silviculture workshop in Brandon, Manitoba in June.
- c. Prepared and gave a presentation on STEMS at the Growth and Yield Association meeting in Banff in October.
7. Prepared and presented a paper entitled "An overview of modelling work done at Northern Forest Research Centre" at the CFS Modelling Workshop held at Hull, Quebec in June.
8. Reviewed R. Yang's paper "Growth of 25-year-old lodgepole pine after juvenile spacing in western Alberta".
9. Set up the latest version of TWIGS (mini-computer version of STEMS) on the VAX computer. The computer program has 9204 lines and was written in FORTRAN 77 language. TREEGEN (a program to produce input files for TWIGS using normal, Weibull distributions or individual tree data) was also set up on the VAX computer.

12. Goals for 1986-87:

1. Publish an Information Report "Guidelines for the use of STEMS in the management of jack pine, aspen and white spruce". (4-1)
2. Continue to organize demonstrations and workshops on STEMS for the management of wS, tA, lP and bS. (4-2)
3. In co-operation with R. Yang assess growth and yield of wS-tA stands in relation to species mix and other variables (e.g., site, density, etc.). (4-31)
4. Update and publish the Reid Collins bibliography on lodgepole pine. (4-66)
5. Analyze data and publish a FMN on thinning bS-jP in Duck Mountains, MS-7. (4-77)
6. Act as Scientific Authority for an ENFOR study to assess 2-year biomass productivity in aspen cut-overs near Slave Lake. (See study 28-06)
7. Collaborate with M. Apps (Study 12-07) in testing the FORCYTE growth nutrient cycling model using data collected for aspen under the ENFOR program. (12-73)

13. Publications 1985-86:

- Grewal, H. 1985. An overview of modelling work done at NoFRC. Pages 28-38. In G.D. van Raalte, compiler. Proceedings of CFS Modelling Workshop. Research and Technical Services. Canadian Forestry Service. Hull, Quebec.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.: Grewal 0.8
 Bella 0.2

Tech.: 0.0

Total: 1.0

Term/Student: 0.0

O & M: \$3,000

Capital:

16. Signatures:

Harjit S. Grewal
 Investigator

[Signature]
 Program Director, Resources

[Signature]
 Regional Director General

10. Goals for 1985-86:

1. Publish:
 - a. "Nitrogen shifts and content changes in the profiles of two Luvisols following fertilization" in the journal of soil science. (4-17)
 - b. "Response of a podsollic gray Luvisol to urea-N" in a soils journal. (4-62)
2. Continue analyses of lodgepole pine tissues for both studies NOR-4-03 and NOR-4-05. (4-19)
3. Continue soil analyses with reference to essential nutrients and effects on these by various N-fertilizers. Results will again be applicable to both studies 04-03 and 04-05. (4-19)

Some revision of goals 2 and 3 was made September 17, 1985.

2 - discontinue active laboratory involvement but continue in an advisory capacity.

3 - Cease all laboratory analyses and write up results and publish as an Information Report.

11. Accomplishments in 1985-86:

1. This article after review was re-written and re-titled "Effect of fertilization on the nitrogen content in the profiles of two luvisols". Submitted to the Can. J. Soil Sci. for publication.

From the same data a FMN was prepared entitled "Guidelines for fertilizing 30- and 70-year-old Lodgepole pine stands in the foothills area of Alberta".

A paper entitled "Response of a Podsollic Gray Luvisol to urea-Nitrogen" has been submitted to the Can. J. Soil Sci. for publication.

2. Data from goals 2 and 3 were combined in the formation of a paper "The use of nitrogen, sulfur and phosphorus ratios in soil and Lodgepole pine foliage in the detection and correction of imbalances". This has been sent to Soil Science - Rutgers Univ. for publication.
3. Data regarding effects of 3 N-fertilizers on essential nutrients were compiled and written up to be published as an Inf. Report.

"Response in a Podsollic Gray Luvisol (Mercoal) to fertilization with three sources of nitrogen"

12. Goals for 1986-87:

1. Publish Journal Articles on the following:
 - a. Effects of fertilization on nitrogen shifts and content in the profiles of two Luvisols (4-17).
 - b. Response of a Podsollic Gray Luvisol to urea-nitrogen (4-62).
2. Revise until published the following Information Report.
 - a. Response in a Podsollic Gray Luvisol (Mercoal) to fertilization with three sources of nitrogen (4-60).
3. Provide advice on foliar and soil analyses to co-workers and clients as requested.

13. Publications 1985-86:

Nil

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

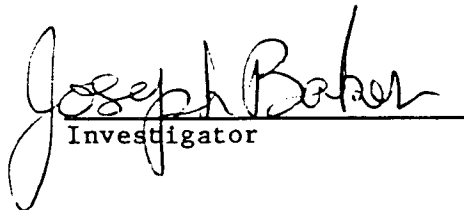
15. Resources 1986-87:

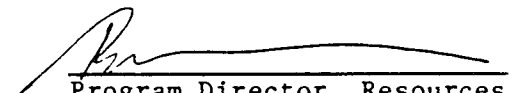
PYs: Prof.:	Baker	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

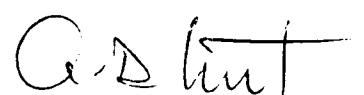
O & M:

Capital:

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

Greenhouse fertilization trials were initiated in 1975 to provide data to examine the characteristics and best analytical methods for the response surface design used in the field experiments.

Plot trees were re-tallied in 1981, 10 years after fertilization, to assess stand responses. In addition to the plot tally, three dominant or codominant trees on each plot were felled for stem analysis to provide tree growth before and after fertilization.

Publications: One journal article and two reports were published.

9. Study Objectives:

1. To assess the growth responses of lodgepole pine to varying levels of N, P, and S fertilization on important soil types and age classes in the lower foothills region of Alberta.
2. To explore means of using foliar content or soil characteristics and their combination as a diagnostic tool for fertilization prescription.

10. Goals for 1985-86:

1. Publish a Forest Management Note entitled "Fertilization improves stand productivity of preharvest lodgepole pine". (Yang and Bella) (4-55)
2. Revise and publish a journal article on effects of fertilization on wood density and tracheid length of 70-year-old lodgepole pine. (Yang, Wang, and Micko, U of A) (4-15)
3. Remeasure and conduct data analysis for fertilization studies in black spruce (The Pas) and jack pine (Saskatchewan). Assess potential of Alberta Interprovincial white spruce fertilization trial and 2 addition fertilization trials in Saskatchewan. (Yang) (4-40)
4. Continue to provide advice and carry out technology transfer on mensurational problems related to forest fertilization. (Yang) (4-18)

11. Accomplishments in 1985-86:

1. The Forest Management Note entitled "Fertilization improves stand productivity of preharvest lodgepole pine" has been internally reviewed.
2. The journal article on effect of fertilization on wood density and tracheid length of 70-year-old lodgepole pine is currently under second review.
3. Growth response data from fertilization studies on black spruce (Manitoba) jack pine (Saskatchewan) and white spruce (Alberta) were obtained. Preliminary analysis indicates plot response varies with stand. Stem analysis data should be used to assessed fertilization effect in combination with plot data.

4. Provide advice on problems related to fertilization as requested.

12. Goals for 1986-87:

Study terminated. Goals 1, 2 and 3 have been transferred to NOR-4-05. Due to resourcing limitations goal 3 will not be carried out until 1988-89.

13. Publications 1985-86:

Nil.

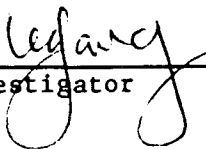
14. Environmental Implications:

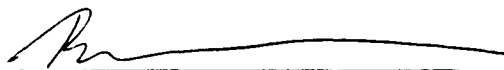
The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

Terminated.

16. Signatures:


Investigator


Program Director, Resources


Regional Director General



3. To develop a diagnostic technique for fertilization prescription of lodgepole pine from the above relationships.
4. To obtain growth response information to fertilization for other regional commercial tree species as warranted by available data sources.

10. Goals for 1985-86:

1. Sample for nutrient content of ground vegetation and soils at various depths before fertilization (Baker, Lux and Yang). (4-19)
2. Apply fertilizer (ammonia nitrate) to plots according to the experimental design (0, 180, 360, and 540 kg/ha of N and 40 kg/ha of P and S for all plots) (Yang and Lux). Prepare an establishment report (Yang). (4-19)
3. Act as a scientific authority in a study to assess existing information in this region on white spruce growth after release from trembling aspen competition (Yang). (4-1MA)
4. Conduct problem analysis of white spruce-aspen mixedwood stands with respect to silvicultural treatments and mensurational responses. (Yang and Waldron). (4-30)
5. Analyze the results from forest soil reactions to three N sources and prepare a manuscript for publication as a journal note (Baker and Yang). (4-60)
6. Complete data analysis on S/N ratio in lodgepole pine tissue and prepare a manuscript for journal publication (Yang and Baker). (4-61)

11. Accomplishments in 1985-86:

1. Soil, ground vegetation, and foliage samples were taken from all 72 plots prior to fertilization for nutrient determination.
2. Fertilizer (N: 0, 180, 360, and 540 kg/ha plus 40 kg/ha of P and S) was applied to plots according to the experimental design. Establishment report has been prepared.
3. A contract to assess existing information in this region on white spruce growth after release from trembling aspen competition has been undertaken by Johnson Forestry Service. (see new study NOR-4-09)
4. A problem analysis of white spruce-aspen mixedwood stands with respect to silvicultural treatments has been undertaken in conjunction with a field re-measurement of MS-153 plots. Plots established in 1950's for studying spruce-aspen competition in prairie provinces have been relocated, re-established, and plot trees measured. (see new study NOR-4-09)
5. The goal to publish a journal note on soil reactions to three N sources has been revised. Results compiled to date will be prepared and published as an Information Report.

6. Analysis of nutrient concentrations in lodgepole pine tissue was completed. A journal note on interrelations of nutrient concentrations in 40-year-old lodgepole pine needles is progress.

12. Goals for 1986-87:

1. Publish a FMN on "Fertilization improves stand productivity of preharvest 1P" (4-55).
2. Publish an article on fertilization effects on wood density and tracheid length of 70-year-old lodgepole pine. (4-15)
3. Complete soil, ground vegetation, and foliar nutrient analyses and conduct statistical analysis to determine changes in nutrient status one year following thinning (4-19).
4. Collect soils, ground vegetation, and foliage samples for determining nutritional and dimensional responses to fertilization and thinning (4-19).
5. Publish a FMN on "Growth of 25-year-old lodgepole pine after juvenile spacing". (4-8)
6. Revise and submit to a journal for publication an article on N, S, and P ratios in 40-year-old lodgepole pine tissues for the purpose of detecting and correcting nutrient imbalances. (4-61)
7. Examine the feasibility of undertaking a professional development leave at an institution with reputation in forest fertilization (4-64).
8. Continue to provide advice and carry out technology transfer on mensurational problems relating to forest fertilization (4-18).

13. Publications 1985-86:

Nil

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of the following clarifications provided by the study leaders, the committee concludes that no further action is required:

1. The treated area is only 1.5 ha.
2. The terrain is flat and there are no creeks in the area. As a result there is no possibility of the fertilizer moving off-sites into nearby water bodies.
3. The fertilizer is applied by manually-operated cyclone spreaders.

15. Resources 1986-87:

PYs: Prof.: Yang 0.6

Tech.: Lux 0.5

Total: 1.1

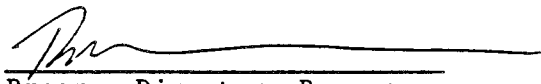
Term/Student: 0.0

O & M: \$3,000

Capital:

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 16, 1986

1. Project: Stand Productivity and Forest Inventory
2. Title: Forest inventory
3. New: Cont.: X 4. No.: NOR-4-06
5. Study Leader: W.C. Moore
6. Key Words: Forest type polygons, geographic information systems (GIS), mapping and analyses of resources system (MARS), biomass inventories, change monitoring, multi-level remote sensing, satellite imagery, aerial photography, large-scale photo (LSP) sampling, photo/imagery interpretation, Alberta Forest Service (AFS), Resource Evaluation and Planning Division (REAP), and Canada Centre for Remote Sensing (CCRS)
7. Location of Work: Alberta, Saskatchewan, Manitoba, Northwest Territories
8. Problem Analysis:

Forest demand, ecological concerns, remote sensing improvements, and GIS developments have all increased in importance in the past decade. Public concerns with the first two factors appear to have generated requirements for the latter two for the efficient management of forest lands in particular. Three of the four political jurisdictions within the Region are at various stages of implementing GIS for this purpose. CFS remote sensing applications R&D is particularly appropriate for determining the optimum means of acquiring traditional map information for GIS data bases, as well as developing new information for the monitoring and appraisal of resources in cooperation with governments, industries and academic institutions.

Progress to 1984

1. Hardware/software of MARS operationally used to manually digitize example forest inventory maps from each of the four jurisdictions within the Region, and appropriate stand and stock tables entered for biomass computations and mapping.
2. Presentation made at Sixth International Symposium on Automated Cartography, 18 October 1983, "Computer mapping for biomass inventories".

3. Completed ENFOR contract supervision for non-inventoried forest land sampling across the Region, and for prairie forest land area determinations with Landsat imagery.
 4. Job creation through participation as a manager in the Environment 2000 Project provided a supervisor and eight assistants to reproduce the Northwest Territories summary forest inventory maps as well as provide manpower assistance for other projects in the AFS and NoFC.
 5. Consultations with PFC provided a review of Yukon ecological mapping activities, and communications with Indian and Northern Affairs Canada provided an indication of the requirements for similar activities in the Northwest Territories based on a GIS capability at NoFC.
 6. Participated as an active member of the Alberta Committee on Remote Sensing.
9. Study Objectives:
1. To provide advice and prescriptions by evaluating, developing, coordinating and applying regionally unique forest inventory and mapping techniques for appraising and monitoring changes in the forest resource, principally through Remote Sensing and Interpretation research, in collaboration with Centre colleagues, federal agencies, provincial governments, educational institutions and industries.
 2. To support growth and yield, Forest Ecology and Soils, silviculture and environmental impacts research and development as appropriate.
10. Goals for 1985-86:
1. Complete Information Report, "A mapping and analysis of resources system application: forest inventories to biomass inventories", under the ENFOR Program (NOR-28-06); submit paper, "Mapping of burned forest land in the Northwest Territories", for journal publication; and, publish Forest Management Note, "Procom-2 mapping technique for forest depletion monitoring.
 2. Review regional objectives for forest inventory data acquisition and mapping through remote sensing applications as they relate to national roles and submit a file report for review.
 3. Complete file reports on multi-level remote sensing and mapping and photo-digitizing forest maps for digital data bases in cooperation with the AFS and the Environment 2000 Program respectively.
 4. Provide additional forest management advice and prescription services to clients and colleagues as required, and particularly as follows:
 - a. provide research and coordination support for forest inventory data bases as required under the Regional Development Agreements;

- b. further develop economic applications for change monitoring and reconnaissance mapping with Alberta and Saskatchewan, and for forest inventories on federal lands with the CFS Development Directorate as required for forest management;
- c. initiate update/acquisition of state-of-the-art GIS/digital image analysis system - if and as funding becomes available; and,
- d. continue as a member of the Alberta Advisory Committee on Remote Sensing and as a member of the organizing committee of the 10th Canadian Symposium on Remote Sensing, in May 1986.

Added Goal:

- e. Serve on the GIS R&D Sub-Committee to the Alberta Energy and National Resources Ministerial Advisory Committee.

11. Accomplishments in 1985-86:

1. Information Report, "A mapping and analysis of resources system application: forest inventories to biomass inventories", completed and forwarded to the editor for publication; reviews completed for paper, "Mapping of burned forest land in the Northwest Territories", and forwarded to the editor for submission to the Canadian Journal of Remote Sensing; and Forest Management Note, Procom-2 mapping technique for forest depletion monitoring", reviewed and submitted to the editor for publication.
2. Participated in CFS workshop on remote sensing policy, minutes containing policy statement reviewed, comments on implementation in Region forwarded to CFS HQ, and file report in preparation.
3. Multi-level remote sensing and mapping has become an Alberta remote sensing and mapping pilot project for the Whitecourt test area in cooperation with PNFI, AFS, REAP, and CCRS. Preliminary planning meetings and field visits have been completed, and progress report being prepared. Also coordinated a test of Lands Directorate color laser photo-digitizer capabilities for automated Alberta Phase III inventory map entry to REAP data bases. Work is as yet incomplete, but it appears to be more expensive than Alberta contractors. Report will be prepared on completion.
4. Provided additional advice and services to clients as follows:
 - a. Reviewed Saskatchewan GIS contractor report.
 - b. Conducted a change monitoring presentation with the Procom-2 in Saskatoon, cooperated with REAP in a burned land monitoring project, and examined improvements with the initial Landsat Thematic Mapper images. Also prepared and demonstrated Procom-2 for NoFC Open House, and made presentations on LSP sampling and Procom-2 equipment for touring Russian Officials.

- c. No funding available for state-of-the-art GIS or digital image analysis systems this year.
- d. Continued as a member of the Alberta Advisory Committee on Remote Sensing and as Publications member of the organizing Committee of the Tenth Canadian Symposium on Remote Sensing in Edmonton, 5-8 May 1986.
- e. Served on the GIS R&D Sub-Committee to the Alberta Energy and Natural Resources Ministerial Advisory Committee, and participated in the preparation of the Final Report.

12. Goals for 1986-87:

- 1. Publish Journal paper, "Mapping of burned forest lands in the Northwest Territories" (4-58); Information Report, "A mapping and analysis of resources system application: forest inventories to biomass inventories" (4-43); and Forest Management Note, "Procom-2 mapping technique for forest depletion monitoring" (4-44).
- 2. Examine Landsat Thematic Mapper spectral band imagery for color composite combinations that best highlight specific forest conditions in the Region for a potential Journal paper. (W. Moore) (4-54)
- 3. Participate with advice and prescriptions in the 5-year Alberta remote sensing and natural resources mapping pilot project for the Whitecourt test area in cooperation with PNFI, AFS, REAP, and CCRS. (W. Moore) (4-57)
- 4. Participation in the interpretation and evaluation of STAR-1 synthetic aperture radar imagery for the Whitecourt test area, and assist as required for the Fort McMurray and Brazeau areas, with the Alberta Remote Sensing Centre, AFS, REAP, and Intera Technologies Limited for the publication of a Forest Management Note. (W. Moore) (4-79)
- 5. Perform Procom-2 interpretation and mapping of areas of cutovers using a HP digitizer and microcomputer combination with existing software for comparison with existing data. (W. Moore & R. Hall) (4-56)
- 6. Prepare a submission for "Forestry Report" on remote sensing for publication in 1987/88. (W. Moore) (4-80)
- 7. Provide additional forest management advice and prescription services in forest inventory, mapping and remote sensing applications to clients and colleagues as required, and particularly as follows (4-51):
 - a. provide research, development and coordination support for GIS and forest inventory data bases within the Region as required under the Development Agreements. (W. Moore & S. Price)
 - b. cooperate as required with CFS HQ for forest inventories on federal lands. (W. Moore)

- c. provide advisory services, seminars and presentations to clients as required on remote sensing applications. (W. Moore & R. Hall) (4-51)
- d. provide Procom-2 and instruction to AFS and REAP for evaluation of cut block, burn and seismic line map updating with Landsat Thematic Mapper imagery. (W. Moore)
- e. assist Manitoba Forestry Branch with updating forest inventories in Pine Falls area for burns. (W. Moore)
- f. continue as a member of the Alberta Advisory Committee on Remote Sensing, and as a member of the Organizing Committee for the Tenth Canadian Symposium on Remote Sensing, 5-8 May 1986. (W. Moore)
- g. act as host for the next workshop of the CFS Remote Sensing Working Group 4-9 May 1986. (W. Moore and R. Hall)

13. Publications 1985-86:

Nil

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.: Moore 1.0

Tech.: 0.0

Total: 1.0

Term/Student: 0.0

O & M: \$5,000

Capital:

16. Signatures:


Investigator


Program Director, Resources


Regional Director General



written and transferred to client agencies upon request. Simple change detection approaches using Landsat for tent caterpillar defoliation has been developed. Image analysis procedures have been devised to facilitate the classification of digital data in the Northwest Territories. There has been participation in numerous seminars, workshops, courses, symposia, and committees to provide advice and technology transfer.

9. Study Objectives:

1. To develop and apply new techniques in the regional application of large-scale photography in acquiring and analyzing resource inventory data.
2. To provide advisory and technology transfer services in the acquisition, uses, and analyses of remote sensing imagery; mapping; and in the operation of interpretation equipment.
3. To design and develop photo acquisition and measurement/interpretation system components as required for regional applications.
4. To maintain an image acquisition and analysis laboratory for cooperative studies.
5. To assess and apply digital image analysis techniques in the interpretation and classification of forest resources in the region.
6. To provide advisory services in survey design, interpretation methods and analyses as required.

10. Goals for 1985-86:

1. Airborne test new computer camera control system in Edmonton. Set up contracts for modification to MOT approvals for Pod and Rack. Continue operational trials in Alberta (REAP) and in the Yukon (INAC) in the 1985 field season depending on status of MOT approval. Complete data analyses, prepare 1 or 2 reports, and submit to review of 1983 + 1984 cooperative applications work with REAP. Collaborate with field work for 1985 projects, and advise on analysis and interpretation of LSP. Prepare descriptive report on camera system depending on status. Depending on available funds, supervise contracts to assemble camera system for INAC-Whitehorse, and incorporate laser altimeter and tip-and-tilt technology. (4-46)
2. Complete final stages of M.Sc. thesis. Prepare and submit a journal paper for review on Thematic Mapper results. Present seminar to INAC-Forest Resources NWT staff in Fort Smith. (4-49)
3. Continue methodology developments for forest renewal. First phase is summarizing the problem of user objectives. Continue discussions with NeFC as required. (4-48)

4. Write, update, and modify microcomputer programs for expanded capabilities and additional application for in-house use and for clients in cooperative projects. (4-47)
5. Provide advisory services in remote sensing and forest inventory to NoFC clients and colleagues as required, particularly as follows:
 - a. To continue as member of REAP-AFS-NoFC LSP Review and Implementation Committee.
 - b. To continue assistance to Parks Canada in Banff on their monitoring program to assess visitor use impact causing damage on alpine vegetation.
 - c. Supervise contracts to publish the Alberta Forest Fire History Maps depending on available funds. (R. Hall and G. Delisle)
 - d. To continue as member of Forestry Working Group of the Canadian Advisory Committee on Remote Sensing (4-50) (4-51)
6. Evaluate HP digitizer and microcomputer combination with PROCOM-2 for rapid area determinations of change from satellite imagery. (R. Hall and W. Moore) (4-56)

11. Accomplishments in 1985-86:

1. New computer camera system was airborne tested, and warranty adjustments and refinements were identified. The latter being performed under a \$2000 contract. Syscomp. is now marketing simpler versions. Phase 2 contracts for the Yukon NAP system were defined, negotiated, and awarded to Wild Leitz (\$14 000), Syscomp (\$42 000), and NWI (\$71 000). Two progress report meetings and copies of all relevant documents were given to Yukon. NWI will build a new pod and rack for both NAP and NoFC (\$36 000) with minor differences due to equipment. Technology transfer to prepare NAP on their camera system and photography was performed using the NoFC camera system, including an aircraft demonstration to NAP management. Reviewed PNFI equipment in storage and arranged for transfer of selected items to serve as back-up and spare parts. Maintenance and overhaul on many items required.

Photography was acquired for a photomensuration refinement project (in preparation for Phase IV) with REAP and Silvacom. Field work was completed in the Whitecourt area and data preparation and analysis is in progress. Data analysis for slash assessment with REAP completed and a m/s entitled "Practical implications of slash assessment in Alberta with large-scale photos" is in preparation with March-April as a goal for completion. Descriptive report on camera system delayed until Yukon NAP system is operational so that both systems can be described in a single report.

2. M.Sc. thesis completed and degree awarded. A 1½ day seminar on Thematic Mapper results was presented in Fort Smith to both Forest Resources and several GNWT resource specialists. Obligatory copies

were provided to INAC and the Canada Centre for Remote Sensing. A manuscript is in preparation with March or April as a goal for completion.

3. Methodology developments for forest renewal have been directed towards consolidating 2 parallel enquires (PAPCO and DPRR) under the Canada-Saskatchewan Agreement. Two meetings with a third slated for February or March have been held for drafting project details for a project to commence Spring, 1986. Agreement in Newfoundland has expired which has presently delayed further work.
4. A HP microcomputer and I/O Expander has been incorporated as the main controller in the photo measurement system. Major effort has been in transferring existing programs from the HP 9825 and modifying them to run on the HP 9816. New versions were completed on slash, LSP, and flight planning. A statistical package on the 9825 for simple and family regression, and t-test with file storage was prepared and given to REAP upon request. Survey Traverse program was transferred to AFS Measurements Section upon request to be used in field PSP calculations. LSP and flight planning updates were transferred to Yukon NAP.
5. Advice and assistance were provided to clients and colleagues on LSP, image analysis, flight planning, statistics, forest inventory, programming, and 5 manuscripts were technically reviewed. Several meetings were held as member of LSP Liaison Committee with REAP and AFS to review projects and provide advice. An in-depth review was made on the Parks Canada monitoring study, and solutions and options were proposed to troubleshoot problem areas. A second draft of the Alberta Forest Fire History Maps publication was completed. Three lectures were presented to 2 forestry courses (201 & 401) at the U of A upon request. Conducted a brief regional study on marketing problems with remote sensing and provided summary report as member of Forestry Working Group of Canadian Advisory Committee on Remote Sensing (CACRS). I did not attend meeting however, due to limited funds. Also contributed 12 potential slides with description for a forestry slide-tape package by CACRS. Provided contribution as member of 10th Canadian Symposium on Remote Sensing Organizing Committee. Contributed to slide-tape package on color and color infrared photography for forestry produced by Silvacon for the Alberta Remote Sensing Centre. Constructed Open House display for forestry week, attended inaugural meeting of CFS Remote Sensing Working Group, and was interviewed by CBC TV news. Provided information to Dr. Frances Akin, visiting Professor to U of A from Univ. of Ibadan, Nigeria.
6. A new version of an area digitizing program was completed to facilitate tabulation of polygons by cover type. Study area selection, images, maps, and AFS area cutover figures has been compiled by W. Moore. Interpretation, digitizing and data analysis will be performed in the next fiscal year. This program has also been used by the Fire Project for area calculations.

12. Goals for 1986-87:

1. Airborne test Yukon NAP Camera system including laser altimeter and make operational adjustments. Complete NAP operations manual under contract and perform training. Airborne test refinements to NoFC

- camera system and continue LSP applications work with REAP. Acquire photography in the Yukon depending on completion date of Yukon system. Submit application paper with REAP to review and prepare paper with Syscomp on camera control system. Acquire tip/tilt indicator if funds available. (4-46)
2. Submit paper to Journal based on Master's thesis on Thematic Mapper in cooperation with U. of A. (4-49)
 3. Initiate LSP project for regeneration assessments in cooperation with PAPCO and DPRR under Canada-Sask. Agreement. (R. Hall and A. Gardner) (4-ISA)
 4. Continue to write, update and modify LSP computer programs for in-house use and for clients in cooperative projects. (Complete LSP volume program with term FO-1 if available) (4-47)
 5. Provide advisory services in remote sensing and forest inventory to NoFC clients and colleagues as required, (4-51) particularly as follows:
 - a. Participate as member of 10th Canadian Symposium on Remote Sensing Organizing Committee - Poster Sessions Manager; Edmonton 5-8 May, 1986.
 - b. Continue as member of REAP-AFS-NoFC LSP Liaison Committee.
 - c. Complete text for and publish "Alberta Forest Fire History Maps 1931-83" (R. Hall and G. Delisle). (4-50) (see also NOR-5-03)
 - d. Technical Advisor to Timberline Canada-BC Agreement project on the modification to the BC 70-mm Boom system for silvicultural survey application.
 - e. Continue as member of CFS Remote Sensing Working Group.
 6. Perform interpretation and compile data for analysis on areas of cutovers using HP digitizer and microcomputer combination with Procom-2. (Interpretation and digitizing to be done by term FO-1 if available) (R. Hall and W. Moore) (4-56)
 7. Compile and organize papers as Coordinator of Forestry Report on Remote Sensing for publication in 87/88. (4-73)
 8. Submit LSP review paper with Spencer (PRUF) on the status of LSP in Canada to journal. (4-74)
 9. Analyze MEISS-II scanner data for forestry at PNFI as required under REAP-CCRS-PNFI-NoFC project in the Whitecourt area. (R. Hall and D. Leckie/PNFI) (4-75)

13. Publications 1985-86:

Hall, R.J., 1985. An analysis of simulated Thematic Mapper digital data for forest and land cover classification in the Northwest Territories. University of Alberta, M.Sc. thesis. 107 pp.

Hall, R.J., D.J. Morgan, and R.H. Bowlby. 1985. Application of large-scale photography to forest resource inventories: what are the options? pp. 643-652 in Proc. 9th Canadian Symposium on Remote Sensing.

Hall, R.J. 1985. Practical considerations of 240-mm (9" x 9") and 70-mm formats for large-scale photography. Proc. of CIF Remote Sensing Seminar. 12 pp.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.: Hall 1.0

Tech.: Walsh 1.0

Total: 2.0

Term/Student: 0.3

O & M: \$14,000

Capital: \$30,000 for gyro and attitude indication with annotation on photographs.

16. Signatures:

Ronald Hall
Investigator

[Signature]
Program Director, Resources

[Signature]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 16, 1986

1. Project: Stand Productivity and Forest Inventory2. Title: Economic evaluation of intensive management practices3. New: XCont.:4. No.: NOR-4-085. Study Leader: W. Ondro6. Key Words: Economic returns, financial and marginal analyses, costs, benefits, financing, investment, decisions, cost effectiveness, pruning, spacing, conifer release, thinning, fertilization7. Location of Work: Northern Forestry Centre, Edmonton, Alberta, Saskatchewan and Manitoba8. Problem Analysis:

Biological responses to intensive forest management practices are fairly well documented and understood, but we are lagging behind in economic analyses of such treatments. This study is to fill that gap.

9. Study Objectives:

1. Determine economic returns from increased growth after spacing, fertilization and other intensive management practices.

2. Evaluate cost-effectiveness of different intensity, mix and sequence of forest management treatments.

10. Goals for 1985-86:

1. Complete analysis and prepare manuscript on economic returns from fertilizing in 70- and 30-year-old lodgepole pine.

11. Accomplishments in 1985-86:

1. Manuscript on economic returns from fertilizing in 70- and 30-year-old lodgepole pine was prepared.

12. Goals for 1986-87:

1. Complete review and publish information report on economic returns from fertilizing 70- and 30-year-old lodgepole pine. (4-68)
2. Prepare problem analysis on the economics of spacing in overdense lodgepole pine and jack pine. (4-69)
3. Prepare a preliminary problem analyses and develop a plan for carrying out time studies for a variety of different silvicultural techniques used in releasing white spruce from trembling aspen competition. (4-3MA)

13. Publications 1985-86:

Nil - new study.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leaders, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.: Ondro 1.0
 Tech.: 0.0
 Total: 1.0
 Term/Student: 0.0

O & M: \$2,000

Capital:

16. Signatures:

Tom ...
 Investigator

 Program Director, Resources

 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 16, 1986

1. Project: Stand Productivity and Forest Inventory
2. Title: Stand tending techniques in the Mixedwood Forest Section
3. New: X Cont.: 4. No.: NOR-4-09
5. Study Leader: R.C. Yang
6. Key Words: B.18a, aspen white spruce, competition, competition index, whipping, suppression
7. Location of Work: Manitoba, Saskatchewan and Alberta
8. Problem Analysis:

Spruce-aspen is one of the most important cover type in the Mixedwood Forest Section (B.18a) of the Boreal Forest Region. Aspen, a vigorous pioneer species, usually forms the upper canopy for at least the first 50 to 60 years of the life of the stand. Often the spruce in the understorey is subjected to severe suppression, and mechanical injury from the dominating aspen. The aspen competition results in reductions of height and diameter growths of the white spruce and losses in volume production.

Foresters have long realized the impact of aspen on white spruce growth. Experimental improvement cuttings to favor the white spruce in mixedwood stands in Manitoba were first carried out in 1936 (Duck Mountain). A series of experimental release cuttings were made in 1951-54 in 15- to 60-year-old stands in Manitoba and Saskatchewan (MS-153), to determine the effects of partial and complete removal of aspen upon the development of white spruce. A similar experiment was also carried out in Slave Lake area, Alberta (A-13).

Progress to 1984:

This study is based on data from earlier experiments on releasing white spruce from aspen competition in Manitoba and Saskatchewan (MS-153) and Alberta (A-13) established in early 1950's. Plots were remeasured 5 and 10 years following establishment. Four reports were published.

9. Study Objectives:

1. To prepare silvicultural prescriptions for releasing white spruce from trembling aspen in mixedwood stands based on ecological factors and mensurational growth responses derived from experiments and operational trials carried out in this region.
2. To assess the impact of the release treatments in terms of potential increases in wood production on mixedwood forests in this region.

10. Goals for 1985-86:

Nil - new study.

11. Accomplishments in 1985-86:

Nil - new study.

12. Goals for 1986-87:

1. Locate A-13 study plots established in 1954 in the Slave Lake Forests and re-measure plot trees to assess single tree response to releasing from aspen competition. (4-72)
2. Complete analysis and publish an Information Report on white spruce tree and stand growth following removal of aspen competition in mixedwood forests. (MS-153, MS-8) using suitable stand growth models. (4-63)
3. Review R&D contract (Johnson Forestry Services) on the biological response of releasing wS from tA. (Waldron) (4-1MA)
4. Assess growth and yield of wS-tA stands in relation to species mix and other variables (e.g., site, density, etc). (4-31).

13. Publications 1985-86:

Nil - new study.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leaders, the committee has concluded that these activities are not potentially detrimental to the environment.

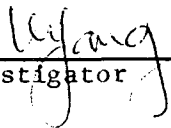
15. Resources 1986-87:


PYs: Prof.: Yang 0.4
Tech.: Lux 0.5
Total: 0.9
Term/Student: 0.0

O & M: \$4,000

Capital:

16. Signatures:


Investigator


Program Director, Resources


Regional Director General



NOR-5

FIRE MANAGEMENT SYSTEMS AND GUIDELINES

4. Prepare and submit for publication "Jack pine regeneration by the use of controlled burning and a seed-tree system in central Saskatchewan". (5-42)
 5. Prepare and submit for publication "Postburn establishment and growth of jack pine plantations on clear-cut areas in central Saskatchewan". (5-43)
 6. Compute, prepare, and submit for publication "Correlations between the standard fuel moisture codes and the actual moisture contents of dimensionally categorized fuels on jack pine cutovers in central Saskatchewan". (5-8)
 7. Survey jack pine growth in postburn plantations and on seed-tree burns in central Saskatchewan. (5-42, 5-43)
 8. Provide advisory services as required. (5-26)
10. Accomplishments in 1985-86:
1. The paper on "Foliar moisture-content variations in four coniferous tree species of central Alberta" was revised, resubmitted and accepted for publication.
 2. The paper on "Foliar heat-content variations in four coniferous tree species of central Alberta" was revised, resubmitted and accepted for publication.
 3. Data analysis was completed and an Information Report on "Fire behavior and effects in a semi-mature jack pine stand, central Alberta" is in preparation.
 4. The journal paper on "Jack pine regeneration by the use of controlled burning and a seed-tree system in central Saskatchewan" was prepared and is ready for review.
 5. An Information Report on "Postburn establishment and growth of jack pine plantations on clear-cut areas in central Saskatchewan" is in preparation.
 6. Data analysis was completed and the journal paper on "Correlations between the standard fuel moisture codes and the actual moisture contents of dimensionally categorized fuels on jack pine cutovers in central Saskatchewan" is in preparation.
 7. Jack pine growth in postburn plantations and on seed-tree burns was measured in central Saskatchewan as planned, and the data were computed.
 8. On request, provided advisory services, and also critically reviewed papers for publication by various authors (four manuscripts).

11. Goals for 1986-87:

1. Conclude publication of an Information Report on "Fire behavior and effects in semi-mature jack pine stands, central Alberta". (5-7)
2. Conclude publication of a journal article on "Jack pine regeneration by the use of controlled burning and a seed-tree system in central Saskatchewan". (5-42)
3. Conclude publication of an Information Report on "Postburn establishment of jack pine stands on seeded and planted clear-cut areas in central Saskatchewan". (5-43)
4. Conclude publication of a journal article on "Correlations between the standard fuel moisture codes and the actual moisture contents of dimensionally categorized fuels on jack pine cutovers in central Saskatchewan". (5-8)
5. Prepare and submit for review a journal article on "Dimensional classification and dry-weight regression equations in jack pine biomass studies, central Alberta". (5-3)
6. Prepare and submit for review a journal article on "Dry-weight regression equations for dimensionally categorized biomass of six understory shrub species, central Alberta". (5-4)
7. Prepare and submit for review a journal article on "Correlations between the standard fuel moisture codes and the actual moisture contents of dimensionally categorized fuels in undisturbed stands of four different types, central Alberta". (5-44)
8. Analyze microclimatic differences between the open and four undisturbed forest types in central Alberta. (5-54)
9. If time permits, provide advisory services as required. (5-26)

12. Publications 1985-86:

1. Chrosciewicz, Z. 1986. Foliar moisture-content variations in four coniferous tree species of central Alberta. Can. J. For. Res. (in press).
2. Chrosciewicz, Z. 1986. Foliar heat-content variations in four coniferous tree species of central Alberta. Can. J. For. Res. (in press).

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

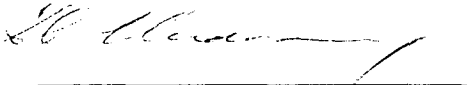
14. Resources 1986-87:

PYs: Prof.: Chrosciewicz 1.0
Tech.: 0.0
Total: 1.0
Term/Student: 0.0

O & M: \$500

Capital: Nil

15. Signatures:


Investigator


Program Director, Extension

Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 28, 1986

1. Project: Fire Management Systems and Guidelines
2. Title: Evaluation and development of fire detection-suppression technology
3. New: Cont.: X 4. No.: NOR-5-02
5. Study Leader: C.J. Ogilvie and R.J. Barney
6. Key Words: Aerial patrols, lookouts, detection, storm tracking, wildfire mapping, remote sensing, retardants, combustion lab, air tankers, suppression, fire control, fire planning
7. Location of Work: Throughout region
8. Study Objectives:
 1. Develop techniques for wildfire surveillance and mapping.
 2. Identify the most advantageous primary detection medium for given conditions.
 3. Develop techniques to evaluate fire retardants and determine the optimum application required to inhibit fire spread in different fuels under varying burning conditions.
 4. Develop fire suppression production information for a variety of methods and conditions.
 5. Develop fire management planning and operational procedures and guidelines.
 6. To analyze and disseminate information to fire management agencies through technical assistance, consultation, and training.
9. Goals for 1985-86:
 1. Develop statistically-sound test matrix and continue comparative evaluations on selected retardants in the combustion laboratory. Prepare a report on the results to date for distribution to client agencies. [C.O.] (5-58)

2. Continue to collect lightning fire origin data. [C.O.] (5-17)
3. Complete compilation of fire weather and fire report data for calibration and performance of the CFWI in Saskatchewan. [C.O.] (5-51)
4. Finish report on use of infrared and LLP system for improved fire detection. [C.O.] (5-15)
5. Continue assessment of procedures to map large wildfires. [C.O.] (5-18)
6. Provide technical services and training to client agencies and in-house guidance to Saskatchewan Agreement Fire Specialist. [C.O.] (5-56, 5-26)
7. Compile Information Report: "Annotated bibliography of CFS fire research in the prairie provinces and N.W.T.". [vice Newstead, M.E.A.] (5-75)

Added Goal

8. Some responsibilities of the new Project Leader were added in July and are reported here. [R.J.B.]
10. Accomplishments in 1985-86:
1. A complete report on the results to date from the retardant evaluations in the combustion laboratory has been distributed. The weight-loss over time curves included in the report indicate that the thickened retardants do not penetrate the test fuel (excelsior) as well as the unthickened and water which results in restricted effectiveness.

A test matrix is being developed at present with the assistance of W. Chow and a term position has been requested to assist in running the tests.
 2. Collected lightning fire origin data on one fire in Saskatchewan. Only one fire was documented because of the slow fire season in Saskatchewan and a time commitment made to the Alberta Forest Service. This data is obtained by accompanying the initial attack crew stationed at La Ronge. This crew is to be on fires as quickly as possible so travelling with them affords a unique opportunity to gather data very soon after the "fire arrival". The data collected in the field includes representative moisture content and bulk density samples taken at 3 levels in the duff near the point of ignition, as well as notes and pictures on fuel location, type arrangement, etc. FWI and LLP information pertaining to each fire is collected after the fact. A report was written on 10 of the fires documented so far and sent to K. Gorham in Saskatchewan and P. Kourtz in PNFI.

3. This goal has been transferred to study NOR-05-04.
4. This report has been completed and will be distributed to the client agencies. The report documents the efforts made from 1979 to 1984 to develop methods of finding holdover fires using infrared and an automatic lightning detection system (ALDS). The report concludes that while the hardware necessary to find holdover fires is now or will be shortly available what lacks is a solid lightning fire occurrence prediction method. It is hoped that goal 2 will supply basic data for a lightning fire prediction method.
5. Due to the lack of large fires throughout the region only some background work in the form of a literature review and personal communication with the U.S. fire mapping team was done. It is believed that procedures can be developed to use FLIR scanners from helicopters to map and obtain rates of spread for on-going fires through smoke.
6. Provide technical services and liaison to client agencies and guidance to the Saskatchewan Agreement Fire Specialist as follows:
 - a. Developed methods for and co-conducted a test of a Daedalus infrared line scanner. The scanner is mounted in a Beech King Air that is owned by the National Safety Council of Australia. The scanner was leased by the Alberta Forest Service, the B.C. Ministry of Forests, and Conair Aviation. The tests were run in the Swan Hills area of Alberta and were designed to evaluate the equipment as to its potential for detecting hold-over fires.
 - b. First authored a report on the Daedalus line scanner tests. 100 copies of the report have been printed and distributed by the Alberta Forest Service and the report is under consideration as an NoFC Information Report.
 - c. Along with W. De Groot (Saskatchewan Agreement Fire Specialist) assisted in the installation of a number of the new Saskatchewan fire weather stations.
 - d. Made plans and arrangements to conduct a controlled burn at C.E. Lee Nature Sanctuary, but due to wet weather it was cancelled.
 - e. Made a reconnaissance flight in an attempt to locate an alternate site for the Saskatchewan DPRR Beauval fire tower. No suitable site was found.
 - f. Conducted the field work for relocating Saskatchewan DPRR Holbein tower. A suitable location was found and a set of panoramic photos were taken.
 - g. Made the burning laboratory available and provided aid to G. Cummins of the University of Alberta.
 - h. Provided advice and information on a number of occasions to the Saskatchewan Agreement Fire Specialist.

7. Goal transferred to NOR-05-06 and reported under item 10.5.
8.
 - a. Attended fall fire conference of AFS and gave a short presentation on fire research program.
 - b. Attended Saskatchewan Regional Director and Supervisors meeting in Prince Albert. Gave a presentation on the fire research program.
 - c. Attended the IFC meeting on fire equipment in Boise, ID at the Boise Interagency Fire Center.
 - d. Attended SAF meeting in Fort Collins and meetings of the Forest Science Board and the fire working group.
 - e. Renewed regional programs with fire personnel in NWT, Alberta, Sask. and Manitoba. These meetings were in lieu of the regular regional fire research technical meetings.
 - f. Attended CCFFM meeting in Ottawa.
 - g. Met with U of Alberta Forestry officials on several occasions to establish cooperative relationships.

11. Goals for 1986-87:

1. With the help of a graduate student do comparative evaluations of retardants in the combustion laboratory. [C.O.] (5-58)
2. Continue to collect lightning fire origin data to be used for supporting the lightning fire prediction model. [C.O.] (5-17)
3. Continue to assess methods and procedures to map wildfires and determine rates of spread with FLIR scanners, line scanners and visible light cameras. C.O. (5-18)
4. Monitor and assess new developments and technological breakthroughs on infrared systems. [C.O.] (5-16)
5. Supply two articles for the upcoming "Forestry Report" on Remote Sensing, a) Scanner trials conducted in 1985, b) Procedures used for obtaining and using panoramic photographs from proposed fire tower locations. [C.O.] (5-96)
6. Be involved in a critique of the Saskatchewan forest fire detection system. [C.O.] (5-97)
7. Plan and co-conduct with the Alberta Forest Service field tests of an updated Daedalus line scanner (model 1268) and compare it to the scan extender. [C.O.] (5-98)
8. Provide technical services and training to client agencies. [C.O., R.B.] (5-56, 5-26)

9. Supervise and coordinate the regional fire research program. [R.B.] (5-59)
 10. Continue to provide technology transfer, participation on committees, task forces etc. aimed at improving the protection and use of Canada's forests through efficient fire management. [R.B. and others] (5-26)
 11. Prepare regional fire research strategy, including integration of studies under the Forestry Development Agreements and Memorandums of Understanding. [R.B.] (5-78)
 12. Conduct regional fire research technical subcommittee meeting. [R.B.] (5-79)
 13. Participate, as federal representative on N.W.T. Fire Management Committee. [R.B.] (5-80)
 14. Develop cooperative relationships and studies with University of Alberta and other Canadian universities as appropriate. [R.B.] (5-99)
 15. Make presentations at academic institutions throughout the year as appropriate. [R.B. and others] (5-99)
12. Publications 1985-86:
- Ogilvie, C.J. 1985. Comparative evaluations of selected retardants in the NoFRC combustion laboratory ... A progress report. Govt. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. Study NOR-5-02. File Rep. No. 5.
- Ogilvie, C.J.; Skrenek, J.; Young, R.W. 1985. Daedalus line scanner trials in Alberta, 1985. Govt. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. Study NOR-5-02. File Rep. No. 6.
- Ogilvie, C.J. 1985. Finding holdover fires in Saskatchewan 1979-84. Govt. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. Study NOR-5-02. File Rep. No. 7.
13. Environmental Implications

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Barney 0.9

Tech.: Ogilvie 1.0 (0.1 in Agreements NOR-36-01-3,
0.1 in NOR-36-03-4)

Total: 1.9

Term/Student: 0.5

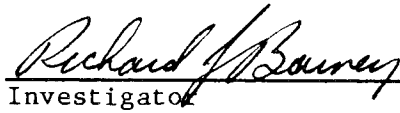
O & M: \$9,000

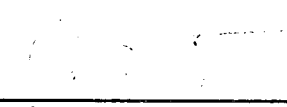
Capital: Nil

15. Signatures:


Investigator


Program Director, Extension


Investigator


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 28, 1986

1. Project: Fire Management Systems and Guidelines
2. Title: Evaluation of the role of fire in forest and intermingled vegetation in the prairie provinces, Rocky Mountains, and far north
3. New: Cont.: X
4. No.: NOR-5-03
5. Study Leader: G. Delisle and R.J. Barney
6. Key Words: Fire ecology, fire history, fire cycle, fire type, fire climax, fire scar rating
7. Location of Work: Region wide
8. Study Objectives:
 1. To develop and implement fire management programs in designated national parks.
 2. To define the needs and priorities of client agencies in the area of fire impact assessments.
9. Goals for 1985-86:
 1. Analyze data and complete M.Sc. thesis, U of A, entitled "Fuels in the forested stands around Jasper townsite, Jasper National Park, Alberta" and present progress report to Parks Canada. [G.D.] (5-63)
 2. Provide advisory services to National Parks with emphasis on fire management guidelines. [G.D.] (5-61)
 3. Publish fire history atlas for Alberta. [G.D.] (5-27)
 4. Prepare summary data reports for Nahanni and Wood Buffalo National Park fire history study. [G.D.] (5-38)
 5. Complete analysis and reports on Pukaskwa National Park Fire History and Ecology Study. [M.E.A.] (5-24)

6. Supervise and coordinate the regional fire research program. [Project Leader] (5-59)
 7. Continue to provide technology transfer, participation on committees, task forces etc. aimed at improving the protection and use of Canada's forests through efficient fire management. [Project Leader and others] (5-26)
 8. Prepare regional fire research strategy, including integration of studies under the Forestry Development Agreements and Memorandums of Understanding. [Project Leader] (5-78)
 9. Conduct regional fire research technical subcommittee meeting. [Project Leader] (5-79)
 10. Participate, as federal representative on N.W.T. Fire Management Committee. [Project Leader] (5-80)
10. Accomplishments in 1985-86:
1. Master's thesis oral defence will be performed at the latest by the end of April 1986. Last year's accomplishments regarding this project include:
 - a. Development of biomass regression equations for dwarf shrub, shrub and seedling spp. found in the study area.
 - b. Completion of four parts of the thesis: Introduction, objectives, description of the study area and methods.
 - c. Compilation of all the biomass data per sampling plot.
 - d. The result section of the thesis is in progress.
 2.
 - a. Technical advices were provided to Jasper National Park managers in regard to the Henry House prescribed burn planned for September/October 1985. The project aborted due to the unavailability of the right weather conditions.
 - b. Met with Provincial Parks people to discuss fuel sampling techniques.
 3. Statistics from Nahanni National Park fire history study, from Dennis Dubé were compiled and sent to Nahanni National Park headquarters.
 4. The expanded text related to "Forest fire history maps of Alberta: 1931-1983" is currently under review.
 5. Very little progress to report due to Study NOR-5-05, activities (e.g., Big Lake Project) and miscellaneous duties resulting from departure of Project Leader (e.g., Agreement positions -- interviews, guidance).

6. Upon signing of the exchange agreement in early July began the role of Project Leader providing supervision and coordination of the project's activities [R.J.B.]. Prior to appointment role of project leader carried out by Program Director with input from M.E.A. and other study leaders.
7. Met with all top management fire personnel throughout the region and NWT. Project members were involved in various forms of participation and technology transfer throughout the project area of responsibilities.
8. Began investigative efforts in preparation of a regional fire research strategy including Forestry Development Agreements and Memorandums of Understanding commitments.
9. A regional fire research technical subcommittee meeting was not held this year. In lieu of this meeting the project leader went to each province and the NWT to both familiarize himself of the local situation and gain input for the research program development.
10. No NWT Fire Management Committee meetings were held since the new project leader came on board.
11. Goals for 1986-87:
 1. Complete all requirements for M.Sc. For. theses and prepare and submit a paper on forest fuels physical properties (quadratic mean diameter and specific gravity) for Jasper National Park, related to the Master's thesis for a journal publication (e.g., Canadian Journal of Botany). [G.D.] (5-63)
 2. Publish Forest Fire History Maps of Alberta: 1931-1983. [G.D.] (5-27)
 3. Present a paper entitled: "Forest fire history maps of Alberta: 1931-1983" to the "IV International Congress of Ecology" in Syracuse, N.Y., 10-16 August, 1986. [G.D.] (5-27)
 4. Provide advisory services to National Parks with emphasis on the management guidelines. [G.D., R.B.] (5-61)
 5. Prepare summary data reports for Nahanni National Park fire history study. [G.D.] (5-38)
 6. Complete analysis and reports on Pukaskwa National Park fire history and ecology study. [M.E.A.] (5-24)
12. Publications 1985-86:

Alexander, M.E.; Delisle, G.D. 1986. Références bibliographiques sur la methode Canadienne d'Evaluation des Dangers d'Incendie de Forêt: 1969-1985. Govt. Can., Can. For. Serv., West and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-191 (NOR-5-191) File Rep. No. 12F.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Delisle 0.9
Barney 0.1

Tech.: 0.0


Total: 1.0

Term/Student: 0.0


O & M: \$2,000

Capital:

15. Signatures:


Investigator


Program Director, Extension


Investigator

Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 28, 1986

1. Project: Fire Management Systems and Guidelines
2. Title: Decision-aid models for use in fire management
3. New: Cont.: X 4. No.: NOR-5-04
5. Study Leader: B.S. Lee
6. Key Words: Fire behavior, fuels, fireline production, fire statistics, fire effects, decision models, fire management, computer systems
7. Location of Work: Regional
8. Study Objectives:
 1. To identify the key factors relating to the occurrence, behavior, and effect of wildfires on the cost-effectiveness of fire control decisions.
 2. To build, test, and operate relevant decision-aid models designed to assist fire management agencies in optimizing the allocation and use of available resources during demanding or multiple fire occurrence situations.
 3. To develop and maintain regional data bases on fire weather, fire occurrence, fire environments and fire management activities for use in fire research and fire management activities.
9. Goals for 1985-86:
 1. Develop a decision framework of data and information needs for a regional fire data library, including information from fire weather records, fire reports, and daily fire situation reports. This will include the continued development of FIREWXBASE and the preparation of a draft user's guide. [B.L.] (5-23)
 2. Submit a problem analysis report in operations research and prepare a multi-year research study plan. [B.L.] (5-66)

3. Publish an Information Report on the development and application of the initial-attack planning model, incorporating fire-line productivity, rate-of-spread, fuels, and other related information. [B.L. & R.N.] (5-40)
 4. Participate as the CFS member on the CCFFM Working Subcommittee to Revise the Glossary of Forest Fire Management Terms. [B.L.] (5-90)
 5. Act as NoFRC representative to the "Subprogram 9 - Electronic Systems for Enhanced Fire Protection" advisory committee under the Canada-Manitoba Forest Renewal Agreement (see NOR-36-01-3). [B.L.]
 6. Continue to provide technology transfer services with respect to fire management systems, computer modelling, and decision-aid models as required. [B.L.] (5-88)
 7. Commence development leave to obtain a Master's degree in fire operations research. [B.L.] (5-87)
 8. Complete analysis of recent fire history for Wood Buffalo National Park and prepare a report. [B.L.] (5-91)
 9. Publish Information Report on the status of all airtanker/retardant drop pattern data compiled to date. [R.N.] (5-41)
 10. Publish Proceedings of the 1983 Intermountain Fire Council meeting. [D.D.] (5-46)
10. Accomplishments in 1985-86:

1. Development on the Western and Northern Region Fire Weather Data Library (FIREWXBASE) continued. Achievements include:
 - a. Development of the Western and Northern Region Fire Weather Stations Data Base. This data base includes relevant information on 313 fire weather stations located in the Western and Northern Region. The structure of the file is described in a report entitled, "Western and Northern Region Fire Weather Station Retrieval System". The report also serves as a user guide for those who wish to run queries on the data base or generate stock and custom reports using DATATRIEVE on the NoFC VAX 11/750 computer.
 - b. The data entry, verification and processing of fire weather data for FIREWXBASE continued as follows:

<u>Agency</u>	<u>No. of Stations</u>	<u>No. of Years</u>
NWT	20	132
Saskatchewan	40	200
Manitoba	26	52
Parks Canada	18	90
Alberta Parks	<u>1</u>	<u>11</u>
	105	485

- c. Two utility programs were written for FIREWXBASE:
- HISTO - a program to provide single or multi year histogram displays of data in the data library. The program provides for both batch and interactive data processing as well as both screen or laser printer graphics.
 - A consistency check program that checks for coding errors, missing observations, etc. was written to hasten the processing of fire weather data was prepared.
2. A problem analysis and multi-year research plan for Study NOR-05-04 was prepared.
 3. An Information Report on the development and application of the NoFC Initial-Attack Planning Model, incorporating fire-line productivity, rates-of-spread, fuels, and other related information was taken to the "under review" stage.
 4. Participated as one of two (MEA and myself) CFS members on the CCFFM Working Subcommittee to revise the Glossary of Forest Fire Management Terms.
 5. Developed a micro-computer program (FWI/PC) Beta 1 Version to calculate, report on and archive Canadian Forest Fire Weather Index System data for the Province of Manitoba. This program was developed as part of NoFC's commitments under Subprogram 9 - Electronic Systems for Enhanced Fire Protection of the Canada-Manitoba FRDA and develop two video tape presentations for FWI/PC.
 6. Technology transfer services with respect to fire management systems, computer modelling and decision-aid models were provided to client agencies on an ongoing basis:
 - a. A micro-computer program to implement the NoFC Forest Fire Initial-Attack Planning Model on the IBM PC, using both numerical and graphics output, was prepared.
 - b. The Ontario fire weather index program for the Apple III micro-computer was modified for use in the Northwest Territories by the INAC Northern Affairs Program.
 - c. The FWI/PC micro-computer program was modified to run on the Wang PC for the BC Ministry of Forests (BC Forest Service) in consultations with and approval of PFC.
 7. Development leave (for B. Lee) to obtain a Master's degree in fire operations research from the University of Washington (Seattle) was commenced in January 1986.
 8. A fire occurrence data base for Wood Buffalo National Park was prepared which summarizes approximately 500 wildfire reports for the park for the period 1972 to 1983. The structure of the file is described in a report entitled, "Wood Buffalo National Park Fire

Occurrence Data Base and User's Guide". The report also serves as a user guide for those who wish to run queries on the data base or generate stock and custom reports using DATATRIEVE on the NoFC VAX 11/750 computer.

9. An Information Report on the status of all airtanker/retardant drop pattern data compiled to date at NoFC was published (Inf. Rep. NOR-X-273).
10. The Proceedings of the Intermountain Fire Council 1983 Fire Management Workshop was published (Inf. Rep. NOR-X-271).
11. Goals for 1986-87:
 1. To continue the development of the Western and Northern Fire Weather Data Library by: [B.L.] (5-23)
 - a. Processing the following fire weather data:
 - 40 AES stations for the period of 1953 to present.
 - 40 Saskatchewan Stations for the period 1978 to present.
 - 20 NWT stations for the period 1977 to present.
 - 26 Manitoba stations ???? to present.
 - b. Prepare two additional utility programs to support FIREWXBASE.
 - c. Prepare a draft user's guide for FIREWXBASE.
 2. Prepare for review and publish an Information Report on the development and application of the NoFC Initial-Attack Planning Model, incorporating a user guide for the companion micro-computer program. [B.L.] (5-40)
 3. Publish a Forest Management Note announcing the availability of the FWI/PC micro-computer program. [B.L.] (5-88)
 4. Prepare an Information Report entitled, "A user's guide to FWI/PC: a computer program to calculate, report on and archive Canadian Forest Fire Weather Index (FWI) System data". [B.L.] (5-88)
 5. Prepare a report on the recent fire history of Wood Buffalo National Park. [B.L.] (5-91)
 6. Continue development leave at the University of Washington to obtain a Master's degree in fire operations research. [B.L.] (5-87)
12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Lee 1.0 (on Developmental Leave;
0.1 in Agreement NOR-36-01-3)

Tech.: Smith 1.0

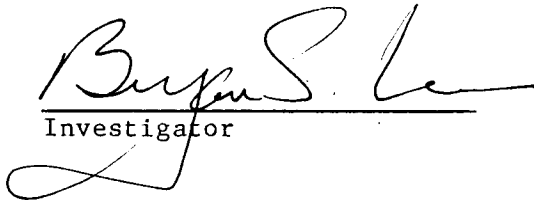
Total: 2.0

Term/Student: 0.0

O & M: \$2,000.00

Capital: Nil

15. Signatures:


Investigator


Program Director, Extension

Regional Director General



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 28, 1986

1. Project: Fire Management Systems and Guidelines
2. Title: Fire danger and behavior rating in forest and rangeland environments
3. New: Cont.: X
4. No.: NOR-5-05
5. Study Leaders: M.E. Alexander and R.S. McAlpine
6. Key Words: Canadian Forest Fire Danger Rating System, wildfire case histories and studies, fire behavior estimation, fire environment
7. Location of Work: Regional
8. Study Objectives:
 1. To develop, evaluate, interpret, and apply the Canadian Forest Fire Danger Rating System.
 2. To improve the assessment and prediction of wildfire behavior in terms and by methods which are useful to fire management agencies.
9. Goals for 1985-86:
 1. Prepare and submit manuscript "Fire behavior in the black spruce-lichen woodland fuel complex: the Porter Lake Project, N.W.T." for publication as an NoFRC Information Report (co-authored with B.D. Lawson, B.J. Stocks, and C.E. Van Wagner). [M.E.A.] (5-31)
 2. Coordinate national CFS inter-establishment documentation team effort associated with an experimental burning project in the black spruce-Labrador tea-Cladonia fuel type. [M.E.A.] (5-72)
 3. Prepare and submit manuscript "Spring fires in a semi-mature trembling aspen stand, central Alberta" for publication as an NoFRC Information Report (co-authored with D. Quintilio and R.L. Ponto). [M.E.A.] (5-67)

4. Prepare and submit manuscript on the relationship between the Fine Fuel Moisture Code and Cladonia Fire Hazard Index for publication as an NoFRC Forest Management Note (co-authored with K.G. Hirsch). [M.E.A.] (5-29)
5. Continue to participate in cooperative projects of the CFS Fire Danger Group associated with the research, development, and application of the Canadian Forest Fire Danger Rating System. [M.E.A.] (5-30)
6. Continue to provide advice and services with respect to fire danger and behavior rating as required, including serving on the Central and Western Region Fire Weather Committees. [M.E.A.] (5-32)

Added Goals:

7. Develop a slide-rule device for calculating forest fire growth based on the FBP System. [R.S.M.]
8. Develop micro computer programs for the Nec PC 8201 lap top computer to calculate components of the FWI System and FBP System. [R.S.M.]

10. Accomplishments in 1985-86:

1. File report on Porter Lake project which documents all the basic data collected, etc. nearing completion. Detailed outline of Inf. Rep. prepared with B.J. Stocks and B.D. Lawson in March. Group worked on draft Inf. Rep. during December. Intend to submit review draft in early February.
2. Actual field work covered periods July 4-24 and Aug. 9-21. Other permanent members of NoFC fire research project involved include: R.S. McAlpine, B.S. Lee, M.E. Maffey, G.P. Delisle, R.M. Smith, and W.J. De Groot (Sask. District Office).

Completed remaining preburn fuels inventory (i.e., organic layer, lesser vegetation, dead and down roundwood, crown foliage and branchwood). Continued fuel moisture sampling and 1.4-m stand vs. 10-m open wind relationship measurements. Conducted and documented six successful experimental fires plus two abortive attempts; this leaves at least 14 more plots left to burn.

3. No progress to report.
4. Draft manuscript completed for review.
5.
 - a. Attended two working sessions of the CFS Fire Danger Group in 1985. To work on various matters relating to the Canadian Forest Fire Danger Rating System (CFFDRS): Mar. 10-14, CIFFC, Winnipeg and Dec. 9-15, Sault Ste. Marie.
 - b. Co-authored paper on the 1984 interim edition of the Canadian Forest Fire Behavior Prediction (FBP) System for Eight Conference on Fire and Forest Meteorology (see Lawson, Stocks, Alexander, and Van Wagner 1985).

- c. Prepared and presented paper at the Eight Conference on Fire and Forest Meteorology on the fire growth aspects (area & perimeter length) of the FBP System (see Alexander 1985a).
 - d. Produced English and French versions of bibliography dealing with references on the CFFDRS released between 1969 and 1985 (see Alexander 1986 and Alexander & Delisle 1986). Production of these two file reports greatly facilitated by earlier progress on this task.
 - e. Served as representative for the Group to coordinate review of fire danger, fire behavior, and fire-weather related terms/definitions to be included 4th edition of the Canadian Committee on Forest Fire Management's (CCFFM) "Glossary of Forest Fire Management Terms" (see Canadian Committee on Forest Fire Management 1986). Also attended portions of two glossary committee meetings held in Edmonton (June 11 and Sept. 11-12).
 - f. Developed prototype FBP System frontal fire intensity component nomogram/table for presentation at 1986 CCFFM annual meeting.
- 6.
- a. Served as an instructor at the AFS "Keeping Current A Fire Management Workshop" held Feb. 11-15 at the Forest Technology School (FTS) in Hinton. Made two presentations (physics of forest fires and CFFDRS) and led a practical exercise on fire behavior prediction using the 1968 Lesser Slave Lake Fire as an example.
 - b. Presented an overview of CFS fire research activities (i.e., fire behavior, fire ecology, fire suppression, and prescribed fire) on Feb. 21 to students taking the fire management course at FTS Hinton.
 - c. Presentation on Feb. 22 dealing with fire weather and fire danger rating made by K.G. Hirsch (FO-1 term) to students taking the fire control course at the Kelsey Institute of Applied Arts & Sciences in Saskatoon.
 - d. Organized and chaired the annual business meeting of the Western Region Fire Weather Committee (WRFWC) held Mar. 15 at NoFC. Compiled and distributed minutes to WRFWC member agencies.
 - e. Presentation on the FBP System at the AFS Bow/Crow Forest Spring Ranger Meeting in Calgary on Mar. 18.
 - f. Co-hosted fourth annual Advance Fire Behavior Course held at FTS Hinton on Apr. 1-4 (with D. Quintilio).
 - g. Presentation on CFFDRS overview by K.G. Hirsch at Alberta Provincial Parks resource management meeting on fire management held Apr. 10-11 in Edmonton.
 - h. Organized and presented 1-day information sessions on the FBP System for provincial fire management and Parks Canada staff at Prince Albert (Apr. 15) and Winnipeg (Apr. 16).

- i. Organized and chaired the second technical and scientific seminar of the Central Region Fire Weather Committee (CRFWC) held in Winnipeg on Apr. 17. Compiled and edited proceedings for distribution to CRFWC member agencies and others (see Alexander 1985b). Attended CRFWC Technical Subcommittee meeting held at same time. Attended CRFWC 11th annual business meeting held in Winnipeg on Jan. 17.
- j. Distributed to AFS and INAC, a preliminary set of dew-point temperature tables prepared for fire weather stations with ventilated thermometers (three elevation ranges), analogous in format to the present FWI System RH tables.
- k. Provided advice on SI/metric units on U.S. Forest Service fire behavior prediction program for HP-71 calculator at request of R.E. Burgan of Intermountain Fire Sciences Laboratory, Missoula, MT.
- l. Met with A.N. Cooper (Chief Fire Control Officer, New Zealand Forest Service, Wellington) and B.D. Lawson (CFS-PFC) at Victoria on Sept. 3 to discuss fire research in New Zealand with particular reference to CFFDRS applications.
- m. Acted as external reviewer on the following unsolicited manuscripts:
 - A Comparison of Fire-Weather Severity in Northern Alberta During the 1980 and 1981 Fire Seasons (For. Chron.) by D.A. Harvey and B. Janz [Note: authors have included the Study leader as the second author -- see Harvey, Alexander, and Janz 1986].
 - The 500 mb Anomaly Chart -- A Useful Fire Management Tool (Proc. 8th Conf. Fire & For. Meteorol.) by B. Janz and N. Nimchuk.
 - Soil Moisture Reduces Soil Temperature Under Burning Fuel Piles (Can. J. For. Res.) by W.H. Frandsen and K.C. Ryan.
 - Forest Fire History Maps of Alberta: 1931-1983 (NoFC publ.) by G.P. Delisle and R.J. Hall (NoFC review board chairman).
 - Methods/Procedures for Prescribed Fire Assessments in British Columbia (BCMF Res. Rep./Land Manage. Handb.) by R. Trowbridge, B. Hawkes, A. Macadam, and J. Parminter.
 - The Index to Fire Incidence as a Relative Measure of the Natural Role of Fire in Mixed Forest Communities (Can. J. For. Res.) by P.A. Quinby.
 - Estimating Downed-Dead Roundwood Fuel Volumes in Central Alberta Forest Cover Types (NoFC Inf. Rep.) by T. Singh.
 - Synoptic Weather Conditions During the Porter Lake Experimental Fire Project (Climatol. Bull.) by M.D. Flannigan and J.B. Harrington (PNFI).

- n. Served as scientific authority on PRUF-sponsored research project "Climatology of Atmospheric Conditions Related to Extreme Forest Fire Behavior in West-central and Northern Canada" being undertaken by the Meteorology Division, Dept. of Geography, University of Alberta.
 - o. Worked on a paper for the 18th IUFRO World Congress (Sept. 1986) dealing with the adaptation of the FWI System in Alberta as a case study in technology transfer (w/ A.D. Kiil and D. Quintilio).
7. Constructed a Prototype Fire Growth Calculator (MK1) and submitted companion manuscript for review as a NoFC Forest Management Note.
 8. Developed interim versions of Nec FWI and Nec FBP.
11. Goals for 1986-87:
1. Publish FMN on relationship between FFMC and Cladonia Fire Hazard Index. [M.E.A., K.G.H.] (5-29)
 2. Continue to participate in cooperative projects of the CRFS National Fire Danger Working Group associated with the maintenance and development of the CFFDRS. [M.E.A., R.S.M.] (5-30)
 3. Complete for publication an Information Report on fire behavior in the black spruce-lichen woodland fuel complex: the Porter Lake project, N.W.T. [M.E.A.] (5-31)
 4. Continue to provide advice and services with respect to fire danger and behavior rating as required, including serving on the Central and Western Region fire weather committees. [M.E.A., R.S.M.] (5-32)
 5. Complete and publish Information Report on spring fires in a semi-mature trembling aspen stand. [M.E.A.] (5-67)
 6. Coordinate national CFS/AFS inter-establishment documentation team effort associated with an experimental burning project in the lowland black spruce fuel type. [M.E.A.] (5-72). Initiate investigation into the acceleration of point source fires to obtain data for potential M.Sc. thesis project. [R.S.M.] (5-92)
 7. Complete preparation of Information Report "Annotated bibliography of CFS fire research in the prairie provinces and N.W.T. [R.S.M., M.E.A.] (5-75)
 8. Publish NoFC Forest Management Note "Slide Rule Estimates of Forest Fire Growth" and train agency personnel in use. [R.S.M.] (5-95)
 9. Publish NoFC Forest Management Note announcing the availability of the Nec FWI and Nec FBP computer programs. [R.S.M.] (5-000)

12. Publications 1985-86:

- Alexander, M.E. 1985a. Estimating the length-to-breadth ratio of elliptical forest fire patterns. Pages 287-304 in Proc. Eight Conf. on Fire and For. Meteorol. (Apr. 29-May 2, Detroit, Mich.). Soc. Amer. For., Bethesda, Md.
- Alexander, M.E. (compiler & editor). 1985b. Proceedings of the second Central Region Fire Weather Committee technical and scientific seminar (Apr. 17, Winnipeg, Man.). Govt. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 11. 31 p.
- Alexander, M.E. 1986. Bibliography on the Canadian Forest Fire Danger Rating System: 1969-1985. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 12.
- Alexander, M.E.; Delisle, G.P. 1986. Références bibliographiques sur la Méthode Canadienne d'Evaluation des Dangers d'Incendie de Forêt: 1969-1985. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-191 (NOR-5-191) File Rep. No. 12F.
- Canadian Committee on Forest Fire Management. 1986. Glossary of forest fire management terms. Natl. Res. Counc. Can., Ottawa, Ont. Publ. NRCC No. 15520 (in press).
- Harvey, D.A.; Alexander, M.E.; Janz, B. 1986. A comparison of fire-weather severity in northern Alberta during the 1980 and 1981 fire seasons. For. Chron. 62: (in press).
- Lawson, B.D.; Stocks, B.J.; Alexander, M.E.; Van Wagner, C.E. 1985. A system for predicting fire behavior in Canadian forests. Pages 6-16 in Proc. Eight Conf. on Fire and For. Meteorol. (Apr. 29-May 2, Detroit, Mich.). Soc. Amer. For., Bethesda, Md.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Alexander	1.0	
	McAlpine	0.5	
	Tech.:	Maffey	1.0
Total:		2.5	
Term/Student:		0.3	



is also felt that a handbook outlining fuel inventory methods, suitable for the unique situations in the region, would be of value. Prospects for the findings from this study being put to practical use are excellent since the study will be based on user needs.

9. Study Objectives:

1. To determine fire use applications, problems and considerations for an array of management objectives and vegetative situations in the region.
2. To develop information and establish guidelines for the use of prescribed fire in various fuel types within the region.
3. To assess fire spread and intensity under various weather conditions for major fuel complexes appropriate for prescribed burning.

10. Goals for 1985-86:

Nil (New Study - see Accomplishments below).

11. Accomplishments in 1985-86:

1. Attended course entitled "Advanced Fire Behavior" in Hinton, Alberta, sponsored by the Alberta Forest Service (Apr. 1-4).
2. Attended Central Region Fire Weather Committee meeting on April 17, 1985 in Winnipeg, Manitoba.
3. Participated in Big Fish Lake experimental burning project in northern Alberta (May-August 1985). (5-72)
4. Goal transferred from NOR-5-02, Item 11.7. Continued work on Information Report: "Annotated bibliography of CFS fire research in the prairie provinces and N.W.T.". Completed 68 annotations. (5-75)
5. Attended seminar "Prescribed Fire - Behavior and Use" in Duncan, British Columbia on November 6, 7, 1985.

12. Goals for 1986-87:

1. Initiate a problem analysis on prescribed fire in the region to establish research needs of the client agencies. [R.S.M., G.P.D.] (5-93)
2. Begin work on a handbook, similar to McRae et al., (1979, CFS Report O-X-287) to document prescribed fire sites, both pre and post burn, and to present possible aides to prescription planning for the prairie provinces and N.W.T. [R.S.M., G.P.D.] (5-94)
3. Participate in cooperative projects of the ad-hoc CFS Prescribed Fire--Fire Effects Working group. [R.S.M., G.P.D.] (5-101)

4. Provide advice and services with respect to prescribed fire. [R.S.M., G.P.D.] (5-26)

13. Publications 1985-86:

McAlpine, R.S.; Eiber, T.G. 1985. The Canadian Forest Fire Weather Index System as a predictor of total soil moisture content as estimated by the Thornthwaite water balance. Can. J. For. Res. 15:1194-1195.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof: McAlpine 0.5
Delisle 0.1

Tech: 0.0

Total: 0.6

Term/Student: 0.0

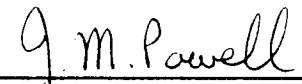
O & M: \$2,000


Capital: Nil

16. Signatures:


Investigator


Investigator


Program Director, Extension


Regional Director General

NOR-7

ENVIRONMENTAL EFFECTS OF TOXIC SUBSTANCES
AND VEGETATION MANAGEMENT



2. Prepare and submit for review a paper on spatial, temporal, and vertical variability of pollutants and other elements in forest soils. (Maynard, Addison, carried over from 1984-85)
3. Prepare and submit for review a journal article on the effects of pollutant deposition on soil chemistry. (Maynard, Addison)
4. Continue to determine the factors that control the mobility and form of pollutants and other elements in forest soils. (Maynard)
5. Publish a journal article on the influence of soil chemistry on the population of Thiobacillus in contaminated soils. (Maynard, Addison)
6. Complete the study on the impact of low pH and high conductivity on the moss Pleurozium and prepare a manuscript for review. (Addison)
7. Publish a journal article on the deposition of pollutants from sour gas processing as measured by lichen and moss elemental content. (Addison)
8. Re-examine biomonitoring plots in the vicinity of sour gas processing in west-central Alberta. (Maynard, Addison)
9. Consult with and assist NoFC FIDS staff to carry out their responsibility to CFS AR-NEWS program in the region. (Sidhu, vice Addison, Maynard)
10. Publish a journal article on the effects of concentration and duration of exposure to SO₂ on the lichen Evernia mesomorpha. (Addison, from NOR-7-02)
11. Complete and publish a journal article on the distribution of SO₂ in forest canopies. (Addison, carried over from NOR-7-02)
12. Prepare and publish results of SO₂ intermittent fumigation effects on aspen photosynthesis and growth. (Addison, from NOR-7-02)
13. Prepare and submit to the Research Management Division of Alberta Environment an annual report on the research accomplishments in 1984-85. (Addison, Maynard, from NOR-7-02)
14. Publish a paper entitled "Effects of SO₂ on leaf conductance, xylem tension, fructose, and sulphur levels in jack pine seedlings". (Addison, from NOR-7-02)
15. Complete and submit a paper on the distribution and effects of smelter emissions in the Thompson, Manitoba area. (Carried over from 1983-84 Hogan at GLFC, from NOR-7-02)
16. Prepare and submit for review a journal article on the influence of elemental S dust on the vascular plant communities in the foothills of Alberta. (Addison, carried over from 1984-85)

17. Complete study to determine the influence of elemental S dust on the growth and elemental content of the upper crown of lodgepole pine. (Addison)
18. Complete preparation and submit for review an Information Report on uranium mining and milling and radionuclides in the terrestrial environment. (Apps, carried over from 1983-84)
19. Publish a journal note on the colorimetric determination of elemental S in forest litter. (Maynard, Addison)
20. Continue to participate in the DOE Regional Screening and Coordinating Committee and to participate in environmental assessment through regional technical subcommittees of RSCC. (Zoltai)

Added Goals:

21. Publish a journal article on the sulfur constituents in soils and streams of a watershed in the Rocky Mountains of Alberta in collaboration with other researchers. (Maynard)
22. Present a seminar at the Canterra Annual Environmental Review on the five years of research carried out by CFS around the Strachan and Ram River sour gas plants. (Maynard)
23. Participate and present a paper at a Soil pH Monitoring Workshop sponsored by the Research Management Division of Alberta Environment. (Maynard)
24. Prepare and submit for review a journal article on some considerations of visual estimates of vegetation for biomonitoring. (Addison)
25. Prepare and submit for review a journal article on fission track mapping of uranium in black spruce twigs. (Apps)
26. Review NoFC studies to fulfill mandate of the NoFC Environmental Screening Committee. (Sidhu, Maynard, Zoltai)

10. Accomplishments in 1985-86:

1. Consultative and advisory services have been rendered to a variety of government (federal and provincial) agencies, industry (both energy and consulting companies) and university researchers and managers. In addition, there was involvement with a M.Sc. advisory committee and several papers for national and international journal articles were reviewed. Contributed to the standardization of field and laboratory methods for AR-NEWS.
2. The first draft of the paper on the variability is being prepared presently. The complexity of this subject along with the importance of variability in monitoring for acid deposition has resulted in more data and time required than was originally anticipated. Additional data on three sites looking at the effect of bulk density and depth of the organic surface horizons were collected and analyzed this summer.

A portion of this data may be presented at the acid forming emissions workshop in Calgary in May 1986.

3. The statistical analysis of the soils data was completed this fall. Collation and statistical analysis is being done on the deposition and lysimeter data at present. However, a portion of this work was being done by Paul Addison and it has been delayed because of his transfer. Publication of this data by itself may not be possible because of the large variability problems. Some of this may have to be incorporated into publications in goal #2 and #3 for 1986-87.
4. A growth chamber study looking at the effects of nutrients and inoculum at four rates of elemental S was completed. All the data has been collected and the statistics done on most of the data. This study was done in cooperation with Dr. Jim Germida from the University of Saskatchewan. Dr. Germida was responsible for measuring the microbial elemental sulfur oxidizing populations.
5. A paper entitled "Effect of elemental sulfur on selected chemical and biological properties in forest soils" by D.G. Maynard, J.J. Germida and P.A. Addison was submitted to the Canadian Journal of Forest Research.
6. Technical problems with the growth chamber and gas analyzer (IRGA) and extra time needed in the field to complete the re-examining of the biomonitoring plots delayed the start of the experiment.
7. The paper has been written and reviewed within project. It is presently with the senior author being revised. The progress of the paper has been delayed by the author's transfer to Ottawa.
8. The field collection of the soil and plant material and the reassessment of the vegetation was completed June through October. Problems were encountered in sampling the pine trees that resulted in more time than was originally expected. In addition the re-examination of the plots took 1 month instead of ten days due to poor weather. Chemical analysis has been started on the soil and plant material and should be completed by February. Growth measurement (i.e., needle counts, weights, etc.) have to be done and will start when a term position is filled. The assessment of the vegetation cover is being collated at present.
9. Discussions have taken place with: Alberta and Manitoba environment on the criteria for setting up of AR-NEWS plots and FIDS and analytical laboratory staff at NoFC and PFC for the collection and preparation of samples for chemical analysis. Assisted in the setting up of 9 of 11 AR-NEWS plots in the prairie region. Collected data on minor vegetation on 90 sub-plots in addition to the AR-NEWS protocols (FIDS). Initiated a contract for the digest preparation and analyses of the soil and plant samples from the AR-NEWS plots in B.C. and this region.

10. A journal article "The effect of sulphur dioxide on net CO₂ assimilation in the lichen Evernia mesomorpha Nyl." by D. Huebert, S. L'Hirondelle and P.A. Addison has been published in the New Phytologist 100:643-651.
11. The data for the paper has been collected but the manuscript has not been written. Other commitments owing to Paul Addison's transfer and the low priority assigned to this goal have not allowed for its completion.
12. An article entitled "Growth and physiological responses to aspen and jack pine to intermittent SO₂ fumigation episodes" by S. L'Hirondelle, P.A. Addison, and D. Huebert was submitted to the Canadian Journal of Botany in August 1985 and has been accepted and is under revision.
13. The 1984-85 fiscal year was the final year of the contract with the Research Management Division of Alberta Environment and ended 10 years of cooperative work with CFS and Alberta Environment on air pollution. It was decided that a more comprehensive report reviewing the 10 years of CFS involvement with Alberta Environment was needed. Therefore, a more extensive document to be published as an Information Report was prepared. The manuscript has been reviewed internally and by three members of the RMD of Alberta Environment and has been accepted. The paper has been submitted to the editorial staff of NoFC.
14. A paper entitled "Effect of SO₂ on leaf conductance, xylem tension, fructose and sulphur levels on jack pine seedlings" by S. L'Hirondelle and P.A. Addison has been published by Environmental Pollution Series A 39: 373-386.
15. The first draft has been completed and is with the senior author at GLFC. Additional analysis on sulfate adsorption is being carried out and the second draft is being prepared.
16. The first draft of the paper entitled "Effect of elemental sulfur on vegetation" by K.A. Kennedy, P.A. Addison, and D.G. Maynard has been reviewed within the group. Considerable reworking of the paper was required and a second draft has been completed. Final revision and submission of the article to Water, Air and Soil Pollution will be completed by March.
17. The sampling of the 7 age classes of pine at 4 sites down a gradient from the Strachan sour gas plant has been completed. Sampling was done every 2 months throughout last winter and every month during the frost free period. The last sampling was completed in September. Chemical analysis of all the pine tissue has been completed.
18. The first draft of an Information Report on uranium mining and milling is in the final stages of preparation and should be completed in February, 1986. Sections of the draft have been reviewed within the group.

19. A journal article entitled "Extraction and determination of elemental sulfur in organic horizons of forest soils" by D.G. Maynard and P.A. Addison has been published in the Canadian Journal of Soil Science 65: 811-813.
 20. Participated in five DOE regional Screening and Coordinating Committee meetings. Participated as members for four subcommittees and was chairperson for one of these subcommittees.
 21. A paper entitled "Sulfur constituents in soils and streams of a watershed in the Rocky Mountains of Alberta" by M.J. Mitchell, M.B. David, D.G. Maynard and S.E. Telang has been accepted for publication in the Canadian Journal of Forestry Research and will appear in the April 1986 issue. This paper reported data on the Marmot Creek Watershed.
 22. Presented a review on our 5 years research around the Strachan and Ram River sour gas plants at the Canterra Annual Environmental Review, October 16, 1985.
 23. Presented a paper entitled "Alternatives to soil pH monitoring: Total and elemental sulfur analysis" at the Soil pH Workshop, November 8, 1985. The workshop was sponsored by the Research Management Division of Alberta Environment to assess their soil monitoring program around sour gas plants in Alberta. The paper was well received and the final recommendations of the workshop participants was that a total S or elemental S analysis be included in any revision of the current monitoring workshop.
 24. A paper entitled "Some considerations for the use of visual estimates of plant cover in biomonitoring" by K.A. Kennedy and P.A. Addison has been accepted for publication in the Journal of Ecology.
 25. A paper entitled "Fission track mapping of uranium in black spruce (*Picea mariana*) twigs" by M.J. Apps, M.J.M. Duke, and B.V. Turner was accepted for publication in the Journal of Radioanalytical and Nuclear Chemistry.
 26. Reviewed NoFC studies to fulfill mandate of the NoFC Environmental Screening Committee.
11. Goals for 1986-87:
1. Provide consultative and advisory services and undertake studies to resolve problems related to industrial development in natural areas as needs and opportunities arise in consultation with the Program Director. Continue to participate in departmental and interdepartmental committees as required, including the NoFC Environmental Screening Committee. Attend workshops and symposia. (Maynard, Sidhu, Apps, Zoltai, Feng, vice Addison)
 2. Prepare and submit for review a paper on the sources of variability of pollutants and other elements in forest soils. A portion of this data will be presented at a workshop on acid deposition in Calgary, May 1986. (Carried over from 1985-86, Maynard)

3. Publish a journal article entitled "Effect of elemental sulfur on some chemical and biological properties of forest soils". (Carried over from 1984-85, Maynard)
 4. Prepare and submit for review a journal article on the interaction of Thiobacillus populations and soil chemistry in elemental sulfur contaminated soils. (Maynard)
 5. Publish a journal article on "Elemental content of Hypogymnia physodes and Pleurozium schreberi near sour gas processing in Alberta". (Addison)
 6. Prepare and submit the final report on ecological changes of a forest system caused by sour gas processing. (Maynard)
 7. Contribute to AR-NEWS program in a consultative and advisory role. Establish two AR-NEWS plots and collect vegetation and soils in addition to the FIDS requirements in 30 subplots. Complete soil sampling to make up deficiencies in the plots set up in 1985. Complete the soil and vegetation analyses for 1985 and samples collected in 1986. Submit results to FIDS. (Sidhu, Maynard)
 8. Complete and submit a paper on the distribution and effects of smelter emissions in the Thompson, Manitoba area. (Carried over from 1984-85, Hogan; Maynard will be the NoFC contact)
 9. Publish a journal article on "The effects of particulate elemental sulfur on vegetation". (Maynard)
 10. Prepare and submit for review an article on the seasonal variation in elemental concentrations of Pinus contorta in polluted and non-polluted areas. (Maynard)
 11. Complete and publish Information Reports on the uranium mining and milling and radionuclides in the terrestrial environment. (Apps)
 12. Publish an Information Report on the Effect of Oil Sands emissions on the boreal forest (Maynard).
 13. Prepare and submit a journal article on the influence of elemental sulfur on soil animals. (Maynard, PRUF contract report)
 14. Initiate study to determine the physiological response of forest trees to acidic soils. (vice Addison)
 15. Determine the relative sensitivities of forest species to acidic soil conditions and initiate a study to determine the physiological basis for sensitivity. (vice Addison)
12. Publications 1985-86:
- Apps, M.J., M.J.M. Duke, and B.V. Turner. 1986. Fission track mapping of black spruce (Picea mariana) twigs. Journal of Radioanalytical and Nuclear Chemistry. (in press)

- Huebert, D., S.J. L'Hirondelle, and P.A. Addison. 1985. Growth and physiological response on net CO₂ assimilation in the lichen Evernia mesomorpha Nyl. *New Phytologist* 100:643-651.
- Kennedy, K.A. and P.A. Addison. 1986. Some considerations for the use of visual estimates of plant cover in biomonitoring. *Journal of Ecology*. (in press)
- Kennedy, K.A., P.A. Addison, and D.G. Maynard. 1985. Effects of particulate elemental sulphur on moss. *Environmental Pollution Series A* 39:71-77.
- L'Hirondelle, S.J. and P.A. Addison. 1985. Effect of SO₂ on leaf conductance, xylem tension, fructose and sulphur levels on jack pine seedlings. *Environmental Pollution Series A* 39:343-386.
- Maynard, D.G. and P.A. Addison. 1985. Extraction and determination of elemental sulfur in organic horizons of forest soils. *Canadian Journal of Soil Science* 65:811-813.
- Maynard, D.G., J.W.B. Stewart, and J.R. Bettany. 1985. The effects of plants on soil sulfur transformations. *Soil Biology and Biochemistry* 17:127-134.
- Mitchell, M.J., M.B. David, D.G. Maynard, and S.A. Telang. 1986. Sulfur constituents in soils and streams of a watershed in the Rocky Mountains of Alberta. *Canadian Journal of Forest Research*. (in press, April 1986)

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs:	Prof.:	Apps	0.2
		Feng	0.1
		Maynard	0.6
		Sidhu	0.3
		Zoltai	0.1
		Vice Addison	0.7
	Tech.:	Radford	0.6
		Ridgway	0.7
		Fairbarns	0.3
	Total:		3.9
	Term/Student:		0.3

O & M: 12 K

Capital: 7 K (autosampler ICP-AES)

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 23, 1986

1. Project: Environmental Effects of Toxic Substances and Vegetation Management
2. Title: Environmental impact and residue chemistry of forestry herbicides
3. New: Cont.: X 4. No.: NOR-7-04
5. Study Leader: S.S. Sidhu, J. Feng,
6. Key Words: Herbicides, forest system, persistence, degradation, adsorption, desorption, environmental impact, residue chemistry
7. Location of Work: Region wide
8. Problem Analysis:

Herbicides, as well as nonchemical methods of weed control such as site scarification, prescribed burning, mechanical and manual treatments provide a wide range of options for forest weed management. Even though the effectiveness of herbicides for control of weed species in forestry has been recognized since the introduction of the phenoxy herbicides, their use in forestry has lagged far behind that of agriculture. At present, forestry use of herbicides in Canada is less than 0.5% of the total used in agriculture. The limitation in the use of herbicides as a silvicultural tool is to some extent a result of the lack of information available on the environmental effects of these compounds in the natural environment. While various herbicides have been tested by CFS over the last several decades, herbicide studies have never constituted a top priority in forest management research activities. In addition, the agrochemical industry has never had a research and development program of any duration for forestry use of herbicides in Canada.

Currently, the Forest Pest Management Institute (FPMI) of CFS, as a National Institute, has the mandate to conduct herbicide research for forest resource management in Canada. The aims of FPMI's Herbicide Research Project are to accelerate the development of new herbicides, to refine and improve methods of utilizing existing products, and to improve application technology and formulation characteristics to enhance effectiveness of the herbicides while minimizing the impact on the forest ecosystem.

One of the major areas of concern, with significant data gaps, is the fate of herbicides entering the forest ecosystems. Available information on residue chemistry and environmental impact of forest herbicides under Canadian climatic conditions, particularly in the boreal forest, is very limited. Therefore, NoFC proposes to carry out research, relevant to the Western and Northern Region, on the persistence, mobility, degradation, and fate of forest herbicides and their metabolites in the terrestrial environment. In addition, attempts will be made to assess the impact of herbicide application on the plant community as a whole to evaluate the influence of this silvicultural practice on plant community structure and forest productivity. These studies are essential if sufficient information is to be generated to make informed decisions regarding the use of herbicides in this region.

In order to avoid fragmentation of environmental impact and residue research studies, NoFC will ensure that the data collected is available to FPMI, provincial governments, and the public. Also, the information obtained from this study will be integrated into vegetation management guidelines/prescriptions to be developed through a parallel study on "Field Testing and Evaluation of Forestry Herbicides" in NOR-10. Initially, three major herbicides, namely Roundup, Velpar, and Garlon, will be investigated.

9. Study Objectives:

1. Determine the fate of herbicides in the forest ecosystems, by studying persistence, lateral and downward movement, degradation, and adsorption/desorption characteristics in regionally important forest soils under laboratory and field conditions.
2. Evaluate the impact of herbicides on the structure, composition, and dynamics of forest plant communities, including mycorrhizal aspects.
3. Provide federal, provincial, and industrial resource managers in the region with advice on the environmental effects of the use of herbicides in forestry applications.

10. Goals for 1985-86:

1. Review available published and unpublished literature on the use of herbicides in forestry applications. (Sidhu)
2. Set up liaison with scientists at FPMI, universities and provincial institutions who are involved in herbicide research. (Sidhu)
 - a. Review available literature on current techniques in the analysis of herbicides and herbicide residues.
 - b. Review and develop field sampling design and procedures to sample vegetation and soils.
 - c. Review and develop the capability of NoFC to analyze for proposed herbicides and herbicide residues.

3. Prepare detailed plan of the study to determine the direct environmental effects of herbicide applications in natural forested areas for implementation. (Sidhu)
4. Collaborate with Manitoba Environment's herbicide project which is part of Canada-Manitoba Forest Renewal Agreement. (Sidhu)

Added Goals: Goals 5-7 with the arrival of a PDF (Chakravarty) in August, 1985.

5. Review literature on the effect of hexazinone (Velpar and Pronone), glyphosate (Roundup), and Trichlopyr (Garlon) on mycorrhizae. (Sidhu, Chakravarty)
 6. Prepare a research proposal for the study of effects of herbicides on mycorrhizae associated with white spruce and lodgepole pine in controlled and field conditions. (Sidhu, Chakravarty)
 7. Isolate and culture common mycorrhizae associated with Pinus contorta and Picea glauca. (Chakravarty)
 8. Initiate experiments on the effect of hexazinone on in vitro and in vivo growth of mycorrhizae associated with Pinus contorta and Picea glauca. (Chakravarty)
 9. Establish field plots on an aspen cutover site selected for the study of environmental impact of mechanical, manual, chemical silviculture site preparation methods. (Sidhu)
 10. Contribute to workshops on "Toxic chemicals: Management in the prairie region". (Sidhu)
 11. Prepare plans for an interdisciplinary research on vegetation management under the Canada/Alberta Agreement. (Sidhu)
 12. Prepare draft of publication as Information Report prepared under a PRUF contract. (Malik and VanderBorn)
11. Accomplishments in 1985-86:
1. Reviewed available published and unpublished literature on use of herbicides in forestry applications.
 2. Established liaison with scientists at FPMI, EPS, AFS, BCMF, University of Alberta, Alberta Environment, University of Guelph, University of Toronto, Canadian Forestry Centres at MFC, GLFC, and NeFC and industry.
 - a. Reviewed available literature on current techniques in the analysis of Roundup and Velpar.
 - b. Reviewed and developed field sampling design and procedures for vegetation and soils.

3. Prepared a detailed plan of a benchmark study to determine direct environmental effects of vegetation management techniques (chemical herbicides, mechanical, manual) in natural forested areas.
 4. Collaborated with Manitoba Environment in herbicide project which is a part of Canada-Manitoba Forestry Renewal Agreement. Provided liaison to FPMI, provided methods to sample vegetation, soils, and air for herbicide deposits and herbicide residues.
 5. Reviewed literature on the effects of herbicides including hexazinone (Velpar and Pronone), glyphosate (Roundup), and Trichlopyr (Garlon) on mycorrhizae.
 6. Prepared a research proposal for the study of effects of selected herbicides on mycorrhizae associated with lodgepole pine and white spruce.
 7. Isolated and cultured common mycorrhizae (Hebeloma crustuliniforme, Laccaria laccata, Suillus tomentosus, Thelephora amanicanum and T. terrestris) associated with Pinus contorta and Picea glauca.
 8. Initiated experiments to study the effects of hexazinone on in vitro and in vivo growth of mycorrhizae associated with 2 tree species (see 7).
 9. Established field plots on an aspen cutover, the site of a benchmark study, for the study of environmental impacts of mechanical, manual, and chemical methods of vegetation management. Initiated sampling vegetation for pretreatment assessments.
 10. Contributed to 3 workshops on Toxic Chemical Management. The results would be used in formulating DOE integrated policy and setting priorities for managing toxic chemicals in the prairie region.
 11. Prepared detailed plans for an interdisciplinary research for vegetation management under the Canada-Alberta Forest Resource Agreement in cooperation with NOR-10 and AFS.
 12. Prepared a publication draft for an Information Report entitled "The need for herbicides in forest resource management". The report has been reviewed and is with the editor. The publication is based on a report produced under a PRUF grant to the University of Alberta.
12. Goals for 1986-87:
1. Establish field vegetation sample plots on Procter & Gamble FMA southwest of Grande Prairie in cooperation with NOR-10 for Methods-I and Method-II in the benchmark study area. (Sidhu)
 2. Sample vegetation and soils for pre-treatment application data for Methods-II and possibly Method-I. (Sidhu, Feng)
 3. Sample vegetation and soil (and possibly water) for pre-herbicide application for herbicide residue analysis for Method-II. (Sidhu, Feng)

4. Sample vegetation and soils from post-treatment data for Method-II plots and possibly for Method-I plots. (Sidhu, Feng)
 5. Sample vegetation, soils, water, and deposition plates for pest-herbicide application and residue data. (Sidhu, Feng)
 6. Develop and establish herbicide residue chemical laboratory, streamline analytical methods for hexazinone and initiate analyses of samples collected during summer 1986. (Feng)
 7. Continue to provide federal, provincial, and industrial resource managers in the region on the environmental effects of the use of herbicides in forestry application. (Sidhu, Feng)
 8. Continue to participate in ECW and CFS Weed Management Coordinating Committee. (Sidhu, Feng)
 9. Complete experiments on the effects of hexazinone and Roundup on in vitro growth of 5 species of mycorrhizae and prepare draft manuscript for publication by March 1986. (Sidhu, Chakravarty)
 10. Complete experiments on the effects of hexazinone on plant growth and survival of naturally occurring and artificially inoculated mycorrhizae associated with P. contorta and Picea glauca. (Chakravarty)
 11. Prepare a draft for publication of results of experiment in No. 10 (January 1987). (Sidhu, Chakravarty)
 12. Plan and initiate experiments on the effect of hexazinone of mycorrhizae in pine and spruce seedlings under aseptic conditions. (Sidhu, Chakravarty)
 13. Plan for experiments to study the effects of hexazinone on microflora populations in control plots and plots treated with hexazinone. (Chakravarty)
13. Publications 1985-86:
- Nil
14. Environmental Implications:
- The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment. (For Environmental Implications of herbicide application, also see NOR-10 & NOR-36-02-01).
15. Resources 1986-87:
- | | | | |
|------|--------|----------|-----|
| PYs: | Prof.: | Sidhu | 0.7 |
| | | Feng, J. | 0.8 |

Tech.: Fairbarns 0.7
Milward 1.0
Feng, C. 1.0

Total: 4.2 (In addition a PDF (Chakravarty) contributes to this study).

Term/Student: 1.8 (0.6 from Agreement)

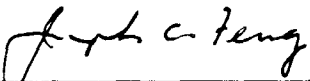
O & M: 10 K (+40 K from NOR-36-02)

Capital: 100 K (Agreement see NOR-36-02-01B)

16. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

Investigator

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 23, 1986

1. Project: Environmental Effects of Toxic Substances and Vegetation Management
2. Title: Nutrient cycling and dynamics, tree growth, and physiology in relation to environmental pollutants and silvicultural practices.
3. New: Cont.: X
4. No.: NOR-7-05
5. Study Leader: D.G. Maynard, vice Addison
6. Key Words: Nutrient cycling, nutrient uptake, tree growth and physiology, ecosystem stability, herbicides
7. Location of Work: Region wide, emphasis on Alberta
8. Study Objectives:
 1. Determine the influence of acid deposition, herbicide application, and other silvicultural practices on the long-term stability of nutrient balance and the biological (e.g., mycorrhizal associates, N-fixation, decomposition) and chemical (pH change, cation, and anion availability) control of tree nutrition.
 2. Provide federal, provincial, and industrial resource managers with advice on the environmental effects of the use of various silvicultural practices.
9. Goals for 1985-86:
 1. Review available literature on the influence of herbicide applications and other silvicultural practices on the nutrient dynamics of forest systems. (Maynard, Addison)
 2. Plan and design the experimental procedure to determine the effect of proposed silvicultural practices on forest nutrient cycling. (Maynard, Addison)

10. Accomplishments in 1985-86:

The initial start-up of this study was delayed until 1986-87 for several reasons. Other commitments to NOR-7-01 (LRTAP related duties) did not allow sufficient time to adequately start this study. In addition, P.A. Addison, co-study leader was transferred to Ottawa in early October.

11. Goals for 1986-87:

1. Review available literature on nutrient cycling and dynamics in a boreal forest. Review the literature on the influence of herbicide applications, other silvicultural practices and acid deposition on the nutrient dynamics of forest systems. (Maynard, Feng)
2. Plan and design growth chamber experiments to study nutrient cycling processes in natural systems and to look at the effect of proposed silvicultural practices (e.g., herbicide applications, mechanical treatments) and acid deposition on forest nutrient cycling. (Maynard, vice Addison)
3. Collect samples to monitor nutrient status prior to treatments in the field. (Maynard)

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs:	Prof.:	Maynard	0.3
		Vice Addison	0.3
		Feng (J.)	0.1
	Tech.:	Radford	0.2
		Ridgway	0.3
	Total:		1.2
	Term/Student:		0.0

O & M: 3.0 K

Capital:

15. Signatures:

Doug Maynard
Investigator

Small
Program Director, Protection

Joseph C. Long
Investigator

C. D. Trent
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 23, 1986

1. Project: Environmental Effects of Toxic Substances and Vegetation Management
2. Title: Analytical Services Laboratory
3. New: Cont.: X
4. No.: NOR-7-06
5. Study Leader: Y.P. Kalra, D.G. Maynard
6. Key Words: Analysis, soils, vegetation, water
7. Location of Work: Northern Forestry Centre
8. Study Objectives:
 1. Maintain a high quality analytical laboratory suitable to support ongoing research studies by providing precise analyses of soil, vegetation, and water samples.
 2. Provide an efficient analytical service commensurate with budget-equipment allocations.
 3. Develop analytical techniques as required by user request and as time permits.
9. Goals for 1985-86:
 1. Provide analytical services to research scientists and cooperators. (Kalra)
 2. Provide assistance to staff from other projects who wish to use the facilities of the Analytical Services Laboratory. (Kalra)
 3. Prepare a File Report of the work performed in the laboratory during 1984-85. (Kalra)
 4. Set up auto-analyzer system and digestion apparatus to replace macro-Kjeldahl digestion and distillation system for the analysis of ammonium in natural materials. (Kalra, Maynard)
 5. Prepare and submit for review a journal article on the effectiveness of selected soil extractants for the determination of available cations and anions. (Maynard, Kalra)

6. Update safety procedures in the Analytical Services Laboratory and ensure that those using the laboratory do so in an acceptably safe manner. (Kalra)

Added Goals:

7. Continue involvement with the Western Enviro-Agricultural Laboratory Association. (Kalra)
8. Participate in an inter-laboratory study on soil analysis being conducted by the International Soil Reference and Information Centre, Wageningen, The Netherlands. (Kalra)
9. Set up the Kjeltec Auto 1030 Analyzer Tecator system. (Kalra)
10. Provide consultative and advisory services regarding soil and vegetation analysis for the ENFOR and AR-NEWS programs. In addition coordinate and schedule analysis of samples for ENFOR and AR-NEWS. (Kalra, Maynard)

10. Accomplishments in 1985-86:

1. Provided analytical services to research scientists and cooperators, in particular NOR-1, 4, 7, 10, and 12.
2. Provided assistance to staff from other projects using the facilities of the Analytical Services Laboratory.
3. Prepared a File Report of work performed in the laboratory during 1985-86.
4. Replaced the macro-Kjeldahl digestion and distillation system with block digestion apparatus and auto-analyzer system. Both digestion and distillation systems are functional.
5. Prepared and submitted a journal article entitled "Extraction and determination of sulfate and total extractable sulfur in organic horizons of forest soils" by D.G. Maynard, Y.P. Kalra, and F.G. Radford to the Soil Science Society of America Journal.
6. Updated safety procedures in the laboratory by attending a J.T. Baker safety course and by presenting a safety seminar to summer students.
7. Maintained an active role in the activities of Western Enviro-Agricultural Laboratory Association by attending bi-annual meetings.
8. Participated in an inter-laboratory study on soil analysis coordinated by the International Soil Reference and Information Centre, Wageningen, The Netherlands. Fifteen soils were analyzed for a number of parameters (e.g., CEC, exchangeable cations, pH, particle size) and the results sent to The Netherlands. Preliminary results indicate that the analyses done by the Analytical Services Laboratory are comparable to other laboratories throughout the world.

9. The Kjeltec Auto 1030 Analyzer Tecator system for the determination of ammonium in natural materials was set up in M041. The unit is functional and many analyses have been carried out.
10. Assisted the contract person for the ENFOR project on the organization of samples prior to preparation for analysis. Coordinated the analyses of the samples by ICP-AES and autoanalyzer. Coordinated the organization and preparation of the AR-NEWS samples for digestion and analyses, including samples from the Pacific Forestry Centre.
11. Goals for 1986-87:
 1. Provide analytical services to research scientists and cooperators. (Kalra)
 2. Provide assistance to staff from other projects using the facilities of the laboratory. (Kalra)
 3. Prepare a File Report of the work performed during 1985-86. (Kalra)
 4. Prepare and submit for review a journal article on the determination of ammonium for cation exchange capacity by three different techniques. (Kalra, Maynard)
 5. Publish a journal article entitled "Extraction and determination of sulfate and total extractable sulfur in organic horizons of forest soils". (Maynard, Kalra)
 6. Prepare for review an Information Report on methods used in the Analytical Services Laboratory. (Kalra, Maynard)
 7. Maintain an active role in the activities of the Western Environmental Agricultural Laboratory Association. (Kalra)
 8. Participate in the inter-laboratory study on soil analysis coordinated by the International Soil Reference and Information Centre, Wageningen, The Netherlands. (Kalra)
 9. Collect soil and foliage samples to be used as long-term reference samples for the Analytical Services Laboratory. (Kalra)
 10. Provide the coordination for the preparation and analysis of the ENFOR and AR-NEWS samples to staff and contract persons working on the AR-NEWS project. (Kalra)
 11. Management and disposal of old chemicals. Organization of a chemical spill response team. (Kalra)
12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment. The old unwanted chemicals are disposed of twice a year. They are picked up from NoFC by the Chemistry Department, University of Alberta and disposed of according to the U of A guidelines.

14. Resources 1986-87:

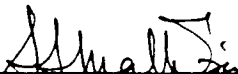
PYs: Prof.:	Kalra	1.0
	Maynard	0.1
Tech.:	Shuya	1.0
	Radford	0.2
Total:		2.3
Term/Student:		0.6

O & M: 15 K

Capital: 20 K (dilutor, plant sample grinder, microwave digester)

15. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

NOR-10

REGENERATION AND PLANTATION MANAGEMENT

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1986

1. Project: Regeneration and Plantation Management
2. Title: Silvicultural investigations
3. New: Cont.: X 4. No.: NOR-10-03
5. Study Leader: L.G. Brace
6. Key Words: Silvicultural prescriptions, mechanization, guidelines, planning, computer data bank
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta
8. Study Objectives:
 1. To coordinate all NOR-10 studies with other NoFC projects.
 2. To promote the development and dissemination of silvicultural knowledge through work with national, regional, and local committees, development of data bank criteria, establishment of the silvicultural component of a data bank (to include stock performance and silviculture mechanization components) and cataloging and assessment of silviculture guidelines and decision models.
 3. To publish scientific and technical reports of silvicultural interest, regionally and nationally, stressing regeneration silviculture.
 4. To provide liaison and input as required to relevant regional and national programs, including the Canadian Forest Resource Data Program, and the Mechanization of Silviculture Program.
 5. Supervise research contracts and develop in-house research studies as an outgrowth of contracts where appropriate.
9. Goals for 1985-86:
 1. Prepare a vegetation management project overview and analysis and develop and coordinate forest vegetation management project at NoFRC in conjunction with NOR-3 (Economics) and NOR-7 (Environment). (10-56)

2. Participate in problem analysis on research priorities in MOUs for Saskatchewan and Alberta. (10-51)
3. Continue as project leader and coordinator of NOR-10 and act as chairman of Regional Reforestation Technical Committee (RRTC) and member of National Committee on Mechanization of Silviculture (NACMEC). Also coordinate Wood Buffalo IEE review. (10-14 and 10-3MA) (P-314)
4. Cooperate with Edwards (NOR-12) in drawing up contract for extension of ENFOR P-205 for 1984-85 through 1986-87. (10-55)
5. Act as regional contributor to IUFRO meeting in Jasper, October 1985. Includes presentation of report on use of color video in equipment evaluation. (10-57)
6. Cooperate with Economics project (NOR-3) in updating CFRDP National Silviculture Data bank and prepare publication. (10-15)
7. Continue inventory and equipment evaluation work on mechanization of silviculture program. Make GLFC inventory operational on NoFRC system during 1985-86. Plan workshop for 1986-87. (10-17)
8. Continue as member of Canada/USA LP/MPB Committee. (10-38)
9. Supervise the development and application of a forest site classification for Manitoba utilizing a term PY under the Canada-Manitoba Forest Renewal Agreement. (Waldron) (10-2MA)
10. Provide functional guidance to technician (N.W.) establishing silviculture demonstrations under the Canada-Manitoba Forest Renewal Agreement. (Waldron) (10-5MA)

Added Goals:

11. Develop a work program for A. Radvanyi - assessment of hare impact on regional forests and development of hare control strategies - and supervise the work during 1985-86.
 12. Undertake silviculture R&D field plot establishment on primary test site for forest vegetation management project under Canada-Alberta Forest Resource Development Agreement (FRDA).
 13. Co-operate with S. Navratil on the preparation and review of a report on planting stock quality monitoring.
10. Accomplishments in 1985-86:
1. Outline of a regional problem analysis and project plan for forest vegetation management developed. Problem analysis carried out with co-operation of Regional Reforestation Technical Committee and a draft prepared for use as background to project plans. Status of vegetation management R&D reviewed with Saskatchewan and Manitoba regional offices. Detailed work plan prepared for a baseline study on forest

vegetation management under the Canada-Alberta FRDA co-ordinating efforts of NOR-3 (Economics) and NOR-7 (Environment) staff at NoFC in both planning and field phases.

2. Participated in problem analysis on MOU research priorities in Saskatchewan and Alberta.
3. Continued as project leader and co-ordinator of NOR-10. Organized and held RRTC meeting in Manitoba in June, 1985. Represented at the NACMEC meeting in November 1985 by R. Gorman. No action on Wood Buffalo Park IEE.
4. Co-operated with I. Edwards in drafting contract for extension of ENFOR P205 work up to 1986-87. Contract is currently underway, supervised by Edwards. (P-314)
5. R. Gorman acted as regional contributor to IUFRO meeting in Jasper primarily in areas of field tour organization and supervision. Work completed successfully .
6. Updating of report on national silviculture statistics completed and prepared for publication in co-operation with NOR-3 (Economics).
7. Inventory and equipment evaluation for mechanization of silviculture program continued and reported to NACMEC meeting in November 1985. GLFC inventory obtained but not yet operational Initial planning for 1986-87 workshop underway.
8. Continued on Canada/USA LP/MPB Committee by review of program documents.
9. Not completed. The goal transferred to NOR-10-06 for 1986-87.
10. Functional guidance provided.

Added Accomplishments:

11. A. Radvanyi prepared a draft report on snowshoe hares and forest plantations, which includes sections on impact and control strategies. The work continues until March 31, 1986, then terminate.
 12. Completed layout of research blocks on primary test site for forest vegetation management research at Grande Prairie, and the layout of all sub-plots for treatment assessment on half the test area. Work done August to November 1985.
 13. Completed review of stock quantity monitoring manuscript and submitted for final editing and publication.
11. Goals for 1986-87:
1. Continue as project leader and co-ordinator of NOR-10, including technology transfer work via the Regional Reforestation Technical Committee (RRTC) (organize, co-ordinate, report 1986 meeting) and participate in CPPA Logging Committee (LOG) and National Committee on mechanization of silviculture (NACMEC). (10-14)

2. Co-operate with Regional Resource Data Specialist in updating CFRDP National Silviculture Report. Publish FMN on 10-year results (1975-85). (10-15)
3. Continue inventory and data bank maintenance for mechanization of silviculture study - co-operate with GLFC in machine evaluations. Conduct workshop in Manitoba or Saskatchewan and report proceedings. (Brace/Gorman) (10-17)
4. Continue measurement of cooperative field performance trials at Grande Prairie. Prepare annual status report for AFS. Prepare and publish FMN on 3-year results, in cooperation with AFS (Navratil). (10-21)
5. Continue to contribute as member of Canada/USA, LP/MPB committee. (10-38)
6. Coordinate regional forest vegetation management project composed of inputs from NOR-10, NOR-7 (environmental impact) and NOR-3 (forest economics). (10-56)
7. Agreement related:
 - a. Hold silviculture workshops in fall of 1986 in Saskatchewan (RRTC) emphasizing topics of current priority. (10-3MA)
 - b. Undertake silviculture R.D. required on Grande Prairie benchmark site for forest vegetation management project under the Canada-Alberta FRDA. (10-1AA).
 - c. Act as scientific authority for a study on the control of aspen suckers and seedlings (Navratil - AFS). (10-2AA).
 - d. Act as scientific authority for intensive forest management project at Weberville and Jumping Pound. (10-3AA)
 - e. Co-ordinate regional equipment demonstrations of Donaren Disc Trencher, Sinkkula & TTS Delta Disc Trencher. (10-4AA)
 - f. Provide advise on forest vegetation management and silviculture investigations R&D in Saskatchewan. (10-1SA, 10-2SA)
 - g. Provide functional guidance to technician (N.W.) establishing silviculture demonstrations under the Canada-Manitoba Forest Renewal Agreement (Waldron). (10-5MA)
8. Visit Abitibi-Price, Pine Falls, and advise on reforestation problems; design field trials if required--work to be undertaken by Manitoba District Office staff (J.B.). (10-79)
9. Publish Information Report on "Planting stock quality monitoring". (10-81)

12. Publications 1985-86:

Gorman, J.R., compiler. 1985. Proceedings of the 1984 Mechanized Silviculture Workshop. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-272.

Radvanyi, A. 1985. Snowshoe hares and forest plantations in a literature review and problem analysis. Can. For. Serv., North. For. Cent., Edmonton, Alberta. File Rep.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Brace 1.0 + vice Ball 1.0

Tech.: Gorman 1.0 + vice Walker 1.0

Total: 4.0

Term/Student: 0.3 (Finnish student)

O & M: \$16,000

Capital:

15. Signatures:

H. Grace

Investigator

[Signature]
Program Director, Resources

[Signature]
Regional Director General



- b. possibilities of sex-attractant development for shoot pine terminal weevils.
- 4. Continue with strong support from /with FPMI, ECW, ECPUA and as Summarizer and Chairman for Silviculture Section (ECW Western).

Added Goals:

- 5. Assist on Grande Prairie vegetation management project.
 - 6. Herbicide tours - demonstrations with AFS.
 - 7. Calling Lake vegetation assessments with Dupont.
 - 8. Review, edit publications by Malik/Van DenBorn/Radvanyi/Hiratsuka.
 - 9. Perform duties as President of Entomological Society of Alberta.
10. Accomplishments in 1985-86:
- 1. Continued assessments, monitoring, final measurements of established herbicide plots in Alberta using guidelines/techniques of 1, 2, 3-5 year measurements established by ECW (Western). Continued with field tests of Velpar "L" with exact-delivery spot gun application at Grande Prairie, Economy Tower Supplemental on May 6. (10-69)
 - 2. Due to general policy directive - all aerial applications in the province were cancelled in the spring. Proposed test w/Garlon (triclopyr) at Grande Prairie was cancelled on agreement with FPMI priorities. A large aerial trial at Calling lake with Pronone 10/5 G was rescheduled for ground application (Pfizer Canada) on June 10-15. Assisted Pfizer with Pronone 10/5 G w(hexazinone) trial applied June 10-11 at 1, 2 and 4 kg a.i./ha, replicated 3x, w/control for each dosage. Plot size was 2 ha (100 x 200) (21 plots) including 4-50 x 100 m plots, with 20 subplots, crop tree centered, circular at 2 m radius, centre staked. Crop trees were tagged sampled measured, recorded as per ECW protocols/guidelines. Prevegetation assessment taken June 11-15 while crop response/efficacy were assessed Aug. 25. Preliminary results indicate good to excellent controls at 1 and 2 kg a.i./ha (10-69).
 - 3. Continued evaluation of pheromones with National Research Council at Saskatoon with Dr. E.W. Underhill, Dr. H.R. Wong and C. Rentz on Petrova metallica to complete biology, as well as biology on Proteoteras spp. feeding on Manitoba Maple seeds and laterals in Alberta and monitoring of the pine shoot moth Rhyacionia buoliana with sex attractant recently developed by T.G. Gray (PFC, Victoria) and on the larch casebearer Coleophora laricella. No pine shoot moth were recovered in Alberta and Manitoba. No larch casebearer recovered in in Alberta. In Manitoba, large numbers (1114) of what was tentatively identified as larch case bearer adults. We are awaiting positive identification from Ottawa. (Reports on P. metallica and Proteoteras spp. will follow shortly) indicating spread/distribution has not occurred in either Manitoba and Alberta - both from USA or Ontario/B.C.

- a. Monitor spread/distribution of R. buoliana - pine shoot moth 4 @ Porcupine Hills, 4 @ Belly River, Alberta and Piney, Manitoba - No adults recovered - Report to follow. (10-67)
 - b. Monitored spread/distribution & field test attractants for larch Casebearer, (C. laricella). 6 @ Castle Mountain, Alberta, 6 @ Sprague, Manitoba - No adults recovered in Alberta. Large numbers of adults were tentatively identified as casebearer from Sprague - no positive identification from Ottawa to date.
 - c. Monitored peak emergence of P. metallica (pitchnodule maker) at Hinton to complete biology by obtaining mated adult-egg laying and emergence (6 traps) - Report to follow. (10-66)
 - d. Monitored emergence of Proteoteras acsculana on M-maple to obtain eggs and biology as well as unknown seed feeding Proteoteras spp. Report to follow.
 - e. Collected, identified, reared and obtained distributions of Pissodes terminalis on pines in Saskatchewan/Manitoba/Alberta to obtain parasitism, distribution and damage estimates in Alberta - report to follow on pine terminal weevil. (10-68)
4. Continued close ties with FPMI, as Chairman and Summarizer for Expert Committee on Weeds, Silviculture Section (Western). Organized, chaired a meeting of representatives (industry, governments, federal/provincial, chemical companies) to ECW Silviculture on July 9 for prairies and B.C.: main topic protocols/guidelines for herbicide research in western regions; and technical papers session at December 2-5 ECW meeting 1985, need for more abstracts - agenda proposals, Feed, food and fibre registration. As member of planning/organization committee attended 5 meetings as Forestry representative set up agendas, set up registration of silviculture group, maintained strong ties w/ECPUA, Agric. Canada registrations.

Continued as Forestry representative for Western Committee on Crop Pests for the Western Forum, as Sub Committee Chairman for berry crops Greenhouse Ornamental shade shelterbelts, house and home greenhouse plants, as well as seasonal wood and timber structures.

Added Accomplishments:

5. Assisted L. Brace, Coordinator on top priority Vegetation Management Project at Grande Prairie starting in August with work plan objectives experimental design, personnel lists and materials required, permits and draft design. In September assisted in field baseline layout of blocks, lines and sub-plot layout, forms for vegetative assessment of the entire primary test site by September 30, including 936 sub-plots located/marked. Pre-treatment assessment to continue before chemical treatment by fall 1986. This project superceded planned monitoring or proposed herbicide work at Grande Prairie/Slave Lake/Calling Lake.
6. Conducted tours (2) talks/demonstration on herbicides w/D. Paver, Slave Lake, Alberta Forest Service re-controls, dosages, timing,

efficacy, ECW protocols, spot-gun applications at strawberry Creek and Faust plots, as well as Swan Hills (AFS aerial sprays) on August 26, September 5 and July 11, to Forestry, Industry and Chemical companies.

7. Assisted Dupont on tour at Calling Lake Velpar "L", G ground and aerial applications, for industry, governments, private, and AFS personnel.
 8. Reviewed, edited, publications/reports on Herbicides (Malik - VanderBorn), Hare control (Radvanyi), Vegetation Management Industrial (Alberta Environment), pest leaflets on Silverleaf and Rusts.
 9. As president Entomological Society of Alberta, organized, conducted three executive meetings and one annual meeting in Lethbridge with proceedings for the presentation of papers by members of the Society.
11. Goals for 1986-87:
1. Summarize and publish the results of efficacy and crop tolerance experiments established in Alberta and Manitoba since 1980. (10-75)
 2. Prepare final report on use of pheromones for assessing populations of Petrova metallica. (10-66).
 3. Prepare file report on distribution and spread of pine shoot moth (Rhyacionia buoliana). (10-67) (Completed Jan. 6/86)
 4. Obtain additional data for Saskatchewan and Manitoba. Include jP terminal weevil in both cases. Prepare report for prairie region on abundance and control possibilities for wP weevil, root collar weevil and terminal weevil. (10-68) (Completed Jan. 14/86)
 5. Conduct small scale screening trials for efficacy and crop tolerance on FPMI priority-rated herbicides. (10-69)
 6. Maintain strong contact with FPMI and participation in ECW, ECPVA, and WCCP re herbicides. (10-70)
 7. Continue field evaluation of herbicides for site preparation and conifer release at the Grande Prairie benchmark site and for conifer release at the Calling Lake site (Co-op AFS, Dupont - Pfizer). (10-71).
 8. Complete studies of biology and taxonomy of seed eating Proteoteras spp. Prepare final report. (10-65)

12. Publications 1985-86:

Drouin, J.A. 1985. Expert Committee on Weeds Research Report Vol. 3 Western Canada Section, Edmonton pp. 215-242.

Drouin, J.A. 1985. Annual revision of insect pests and controls on berry crop. In WCCP Report (1985). 5 pp.

Cerezke, H.F., J.A. Drouin, and B. Neill. 1985. Annual revision of insects pests and controls on shelterbelts, ornamentals and shrubs. In WCCP Report (1985). 15 pp.

Cerezke, H.F. and J.A. Drouin. 1985. Insect pests and controls in seasoned wood and timber structures. In WCCP Report (1985). 3 pp.

Soehngen, U., M. Steiner, and J.A. Drouin. 1985. Annual revision of insect pests and controls on houseplants and on greenhouse woody ornamentals and crops. In WCCP Report (1985). 17 pp.

Drouin, J.A. 1985. Expert Committee on Weeds proposed recommendations 1985. ECW (Western Canada), Edmonton, pp. 303-309.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of the following clarifications provided by the study and project leaders, the committee concludes that no further screening action is required:

1. All experimental herbicide applications have been done under permits issued by Alberta Environment, Environmental Protection Services (Pollution Control Division), and the studies are registered with FICP.
2. Experimental plots are very small (1/10 acre).
3. Either the plots are distant from any water bodies or there was a buffer zone of 30-50 m between the plots and a water body.
4. No federal funding was involved in herbicide applications or in locating the plots.
5. Plots are being monitored over long term to assess the effects of herbicide application on vegetation and forest crop species.
6. Methods of application included back pack spray, spot-gun spray or as grid balls. As a result, no aerial drift of herbicides was expected or observed.

14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.: Drouin	1.0
Total:	1.0
Term/Student:	0.0

O & M:

Capital:

15. Signatures:


Investigator


Program Director, Resources


Regional Director General

2. a. Publish:

- FMN "Fertilization improves red pine seed production". (Dyck) (10-44)
- IR "Field performance of jack pine and white spruce container and bare-root stock on prepared burns in central Saskatchewan". (10-18).
- FMN "Cold frame growth of white spruce and lodgepole pine in 40 and 55-cm containers, Alberta". (10-18).

b. Prepare:

- FMN Seeding and planting on shallow, rocky soil sites, Abitibi Price Limits, Manitoba (MS-238). (10-53).
- FMN "Field performance of jack pine and white spruce container and bare-root stock on prepared burns in Saskatchewan--10 year results". (10-18).
- IR Planting and seeding white spruce under aspen--30 case histories. (MS 226, 227, 190, Alta.). (10-40).

3. Assess usefulness of existing silvicultural research projects in Manitoba (Waldron, Ball) for remeasurement and supervise NOR-36-07-1 study leader (Kolabinski) developing guidelines for management of white and black spruce (MS 182, MS 216, MS 211, MS 228 etc.). (10-41, 10-4MA).
4. Perform liaison and technology transfer function with Manitoba clientele. (10-42).
5. Remeasure MS-69 (one plot); cooperate with the National Park in regenerating the triploid clone and prepare a File Report--contingent upon RMNP cooperation. (10-54).

Added Goal:

6. Remeasure MS-232, plantation 7-16 and 20-16, NOR-4-01, and 1980 red pine thinning plots.

10. Accomplishments in 1985-86:

1. Candidate areas for a vegetation management trial in the Western Region were selected in 1985. However (following meetings with Dupont, DNR, Manitoba Environment and NoFC), provincial approval for the aerial application of Velpar L was not forthcoming and goal 10-58 was dropped.

Field performance data from herbicided and control plots (MS 226) at Riding Mountain have been collected and are being compiled.

Day-Bell PRUF contract work involving a glyphosate in the Western Region was monitored from Winnipeg; a seminar on this and greenhouse toxicology experiments (at Lakehead University) is planned for Edmonton in March.

2. a. The FMN "Fertilization improves red pine seed production" Dyck (10-44) remained unchanged with the editor between September 1984 and August 1985. A few revisions were made in August 1985.

The IR "Field performance of jack pine and white spruce container and bare-root stock on prepared burns in central Saskatchewan (10-18) has been with the editor since August 1985.

A file report "Cold frame growth of white spruce and lodgepole pine in 40 and 55-cm³ containers, Alberta" was released in October 1985.
- b. Data on MS-238 are being compiled and a report on seeding and planting on shallow rocky soil sites near Pine Falls will be prepared.
- c. Ten year field performance results of jack pine and white spruce container and bare-root stock are being compiled. (10-18)
- d. Data on MS 226, 227 190 (30 case histories involving planting and seding white spruce) are being compiled. (10-40)
3. Silvicultural research projects (MS-182, MS-211, MS-216 and MS-228) were assessed for developing guideliknes for managemnt of white and black spruce: study NOR-36-07-01 was supervised.
4. Contacts were made with provincial and industrial foresters through work on HAMPCO, CIF executive and Manitoba Forestry Week Committees. Attended the National CIF meeting (Winnipeg), Regional Reforestation Technical Committee meeting (Spruce Woods), Vegetation Management Committee (Edmonton) and CIF scction meetings at The Pas and Winnipeg. CFS displays were assembled and manned for Scouts Day, Forestry Week and the National CIF meeting. Assistance was provided at the CFS booth at the Red River Exhibition.
5. Assisted U of Winnipeg (Mike Pidwirny and student Pat Reimer) regarding triploid aspen clone mapping and collection of apical buds. Reimer is preparing a report for Parks Canada and we have collected some video on the clone.
6. a. Remeasured MS-232 (Incidence of decay on thinned and pruned aspen, Porcupine Mountain).
- b. Remeasured plantations 7-16, 20-16 (thinned and unthinned jack pine plantations at Shilo).
- c. Assisted Walker and Witt with remeasurement of MS-134 mechanical strip thinning at Badger and Woodridge.

- d. Remeasured and retagged 1980 Red Pine thinning (6 plots) in the Sandilands (with Walker, Witt and Kolabinski).

New tally sheets were prepared and checked; all data were photocopied and sent to Bella. Pictures of spacing trials at Moody were taken and sent to Bella.

11. Goals for 1986-87:

1. Publish:

- a. FMN "Fertilization improves red pine seed production". (Dyck) (10-44)
- b. IR "Five year field performance of jack pine and white spruce container and bare-root stock on prepared burns in central Saskatchewan". (10-18)
- c. IR planting and seeding white spruce (30 case histories - MS 226, 227, 190). (10-40)
- d. FMN "Growth and survival of container seedlings after 10 years". (Walker and Ball) (10-18)

2. Prepare:

- a. FMN on seeding and planting on shallow, rocky soil sites, Pine Falls, Manitoba (MS-238). (10-53)
 - b. FMN on the effect of three methods of soil treatment on the survival and growth of white spruce transplants (MS-229). (10-18)
- 3. Supervise Study Leaders for NOR-36-01-4 and NOR-36-01-3 under the Canada-Manitoba Forest Renewal Agreement. (10-4MA)
 - 4. Cooperate with regional economist in the collection of historical economics data from a variety of vegetation management projects (manual, mechanical and chemical). (10-58)
 - 5. Perform liaison and technology transfer function with Manitoba and NoFC clientele. (10-42). E.g. A field trip to Pine Falls in May to assess plantation survival problems is planned. (10-79)

12. Publications 1985-86:

Ball, W.J. and N. Walker. 1985. Cold frame growth of white spruce and lodgepole pine in 40- and 55-cm³ containers, Alberta. NoFC; Manitoba District Office; Winnipeg, Manitoba. File Report.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of the following clarifications given by the study and project leaders, the committee concludes that no further action is required:

1. The goal in question referred to a proposed provincial project which was subject to screening by Manitoba Environment, and there was no direct CFS concern. This project has since been cancelled as the proponent company did not satisfy Manitoba Environment or environmental assessment.

14. Resources 1986-87:

PYs: Prof.: Ball 1.0

Tech.: Dyck 1.0

Total: 2.0

Term/Student: 0.0

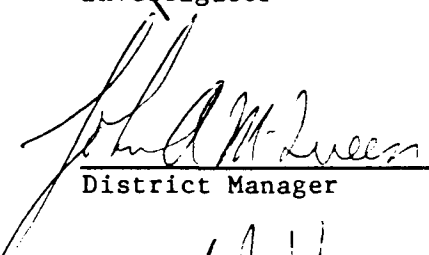
O & M: \$7,000

Capital:

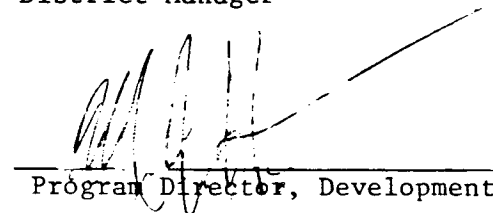
15. Signatures:


Investigator


Program Director, Resources


District Manager


Regional Director General


Program Director, Development

9. Goals for 1985-86:

1. Complete "Common forest plants of Alberta" and ecological classification field guide for publication. (10-34)
2. Prepare draft report for review on forest succession 24 years after clearcutting (Edson Forest). (10-25)
3. Continue data evaluation and plot selection for analysis and characterization of highly productive forest sites in the region, with objective of determining potentially manageable chemical and physical factors (including several micronutrients). Existing data plus new plot data are required. Sampling in Saskatchewan and Manitoba is planned for 1985. (10-22)
4. Continue study of effects of soil modification during logging and site preparation. Calibration of bulk density equipment to be completed. (10-35)
5. Prepare and present paper on effects of logging and site preparation equipment on soil compaction and subsequent tree growth, at IUFRO meeting in Jasper, Sept. 29 - Oct 3, 1985. (10-35)
6. Continue to act as scientific authority on CFS-PRUF contract to Drs. G.H. LaRoi and D.J. Pluth of U. of A. project deals with "Development of lodgepole pine and white spruce site index curves and productivity-site relationships from ecologically classified permanent sample plots" in western Alberta. (10-61)

Added Goals:

7. Prepare and present paper "Ecological classification of Alberta forests and its application in forest management" to COJFRC Symposium "Site classification in relation to forest management" August 27-29, 1985, Timmins, Ontario.
8. Prepare and present review paper "Forest site classification in the western and northern region at CFS Site Classification and Land Evaluation meeting, Fredericton, New Brunswick, October 6, 1985.
9. Serve on Alberta Fish and Wildlife Division steering committee overseeing a habitat district classification and mapping contract in the Wapiti map area, west-central Alberta.

10. Accomplishments in 1985-86:

1. The ecological classification field guide "Forest ecosystems of west-central Alberta" has gone through two reviews and revisions, was integrated with the "common forest plants" manuscript and is now with the editor in preparation for publication as an information report, to be published with funds from the Canada-Alberta Forest Resource Development Agreement.
2. No progress due to other activities.

3. Further plot selection and sampling for analysis and characterization of highly productive sites in Saskatchewan (6) and Manitoba (3) was undertaken. Stem analysis is complete and data is in computer. Foliar and soil analysis in progress. No further plot sampling is planned.
 4. Some additional plot sampling and machine calibration was done during 1985. A greenhouse study of wS and LP seedling growth on several soils reconstructed to three bulk density levels was completed.
 5. Presented paper "Compaction by logging and site preparation equipment and effects on seedling growth on four soil types in west-central Alberta, Canada" to IUFRO Symposium on the Equipment/Silviculture Interface in Stand Establishment Research and Operations, September 29-October 3, 1985, Jasper, Alberta, which is to be published in a Proceedings prepared by GLFC.
 6. Continued to act as scientific authority on CFS-PRUF contract to Drs. G.H. LaRoi and D.J. Pluth of U. of A.
 7. Prepared and presented paper "Ecological classification of Alberta forests and its application in forest management" to COJFRC Symposium "Site classification in relation to forest management" August 27-29, 1985, Timmins, Ontario, which is to be published in the Proceedings by GLFC.
 8. Prepared and presented review paper "Forest site classification in the western and northern region" at CFS Site Classification and Land Evaluation (SCALE) meeting, Fredericton, New Brunswick, October 6, 1985, which is to be published by NoFC.
 9. Served on Alberta Fish and Wildlife Division steering committee overseeing a habitat district classification and mapping contract for the Wapiti map area, west-central Alberta. Contract work was completed and reviewed in October 1985.
11. Goals for 1986-87:
1. Publish "Forest ecosystems of west-central Alberta" field guide and conduct field workshop(s) or other extension-related activities on use of field guide, following its publication. (10-34)
 2. Prepare draft report for review on forest succession 24 years after clearcutting (Edson forest). (10-25)
 3. Continue data evaluation, analysis and characterization of highly productive sites in the region. (10-22)
 4. Continue data analysis and prepare journal article for review and publication for study on forest soil compaction effects. (10-35)
 5. Continue to supervise PRUF contract on development of site productivity relationships in lodgepole pine and white spruce which is to be completed in August. Terminate. (10-61)

6. Initiate site classification of NOR-10-08 1P stand development plots at Hinton. (10-77)
7. Supervise (vacant) the development and application of a forest site classification for Manitoba. (10-2MA)
8. Serve on the organizing committee for the IUFRO Working Party on Silviculture at High Latitudes meeting, Grande Prairie and Dawson Creek, Aug. 23-26, 1986. (10-80)

12. Publications 1985-86:

- Achuff, P.L. and I.G.W. Corns. 1985. Plants new to Alberta from Banff and Jasper National Parks. Canadian Field-Naturalist 99:94-98
- Corns, I.G.W. 1985. Interpretation of site factors for mechanized site preparation. In J.R. Gorman, compiler, Proceedings of the 1984 mechanized silviculture workshop. Inf. Rep. NOR-X-277. p. 40-41.
- Corns, I.G.W. and R.M. Annas. 1984. Ecological classification of Alberta forests and its application for forest management. In M. Murray (ed.) Forest classification at High Latitudes as an Aid to Regeneration. USDA Forest Service Gen. Tech. Rep. PNW-177. Proc. 5th International Workshop. Fairbanks, Alaska. August 15-17, 1983. p. 40-52.
- Corns, I.G.W. and R.M. Annas. (in press) Ecological classification of Alberta forests and its application to forest management. Proc. COJFRC Symposium, site classification in relation to forest management. Aug. 27-29, 1985, Timmins, Ont. Great Lakes Forestry Centre. (in press)
- Corns, I.G.W. (1985) Forest site classification in the western and northern region. Proc. CFS Site classification and land evaluation meeting. Oct. 6, 1985, Fredericton, New Brunswick.
- Corns, I.G.W. (in press) Compaction by logging and site preparation equipment and effects on seedling growth on four soil types in west-central Alberta, Canada. Proc. IUFRO Symposium on the equipment/silviculture interface in stand establishment and research and operations, Sept. 29 - Oct. 3, 1985, Jasper, Alberta. Great Lakes Forestry Centre. (in press)

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of the following clarifications given by the study and project leaders, the committee concludes that no further screening action is required:

With respect to goal 4 for 1985/86 (soil modification during logging and site preparation) the study indicates that summer logging on several soil types in west-central Alberta has resulted in long lasting (24 hours) soil bulk density increases (up to 48%). Seedlings grown in the greenhouse upon soils reconstructed to field bulk density levels showed significantly

reduced growth compared to growth on soils with bulk densities approximately uncut controls. The study was reviewed by the NoFC environmental screening committee.

14. Resources 1986-87:

PYs: Prof.: Corns 1.0

Tech.: Allan 1.0

Total: 2.0


Term/Student: 0.0

O & M: \$3,000

Capital: \$1,500 (camera)

15. Signatures:


Investigator


Program Director, Resources


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1986

1. Project: Regeneration and Plantation Management
2. Title: Evaluation of mortality in stands of young trees in plantations and scarified areas
3. New: Cont.: X 4. No.: NOR-10-08
5. Study Leader: W.G.H. Ives and C.L. Rentz
6. Key Words: Jack pine, Pinus banksiana Lamb., lodgepole pine, Pinus contorta Dougl., white spruce, Picea glauca (Moench) Voss, insect damage, tree diseases, stocking standards, site classes, reforestation, browsing, rodent damage

7. Location of Work: Prairie provinces and Edmonton

8. Study Objectives:

To determine whether or not pine tree survival from establishment to age 35 years is related to site conditions, and if so, to prepare a set of survival curves for each site class.

9. Goals for 1985-86:

1. Assess third-year mortality in jack pine plots in the Sandilands Provincial Forest, Manitoba and prepare File Report. (10-64)
2. Assess fourth-year mortality in lodgepole pine plots near Hinton, Alberta and prepare File Report. (10-63)
3. Collaborate with Dr. Wong (NOR-1-04) in the preparation of illustrations and text for "A pictorial guide to the forest and shade tree insects of the prairie provinces". (10-72)

Added Goals for 1985-86

4. Measure d.b.h. of subsample of trees in jack pine plots in Manitoba. (10-64)
5. Measure d.b.h. of subsample of trees in lodgepole pine plots near Hinton, Alberta. (10-63)

10. Accomplishments in 1985-86:

1. Third-year mortality in jack pine plots in the Sandilands Provincial Forest, Manitoba was assessed. Data has been coded and entered into computer. File Report will be prepared early in 1986.
2. Fourth-year mortality in lodgepole pine plots near Hinton, Alberta was assessed. Data has been coded and is being entered into computer. File Report outlining 1982-83 and 1983-84 mortality was prepared. File Report outlining 1984-85 mortality will be prepared in early 1986.
3. Progress in preparing illustrations and text for "A pictorial guide to the forest and shade tree insects of the Prairie Provinces" was reported in more detail under NOR-11-04. Most of required photographs have been obtained and about one-third of text has been prepared.
4. The dbh of one-half of the trees in jack pine plots in Manitoba was measured and entered into computer.
5. The dbh of one-half of the trees in lodgepole pine plots near Hinton, Alberta was measured. Data are being entered into computer.

11. Goals for 1986-87:

1. Measure height of subsample of trees in jack pine plots in the Sandilands Provincial Forest, Manitoba and prepare File Report on 3 years of mortality. (10-64)
2. Assess fifth-year mortality in lodgepole pine plots near Hinton, Alberta and prepare File Report outlining 1984-85 mortality. (10-63)
3. Measure height of subsample of trees in lodgepole pine plots near Hinton, Alberta and prepare File Report. (10-63)
4. Collaborate with Dr. I. Corns in the preparation of site classifications for the lodgepole pine plots near Hinton, Alberta. (10-77)
5. Collaborate with Dr. Wong (NOR-11-04) in the preparation of illustrations and text for "A pictorial guide to the forest and shade tree insects of the prairie provinces". (10-72)

12. Publications 1985-86:

- Ives, W.G.H.; Rentz, C.L. 1985. Growth and survival of young lodgepole pine regeneration in west-central Alberta. III. 1982-83 and 1983-84 survival. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. File Rep. Study NOR-10-08 (NOR-9-181).

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Ives 0.5

Tech.: Rentz 1.0

Total: 1.5

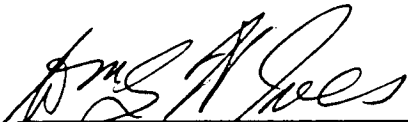
Term/Student: 0.6

Note: Achievement of stated goals will require a minimum of three students plus a full-time term position.

O & M: \$27,000

Capital:

15. Signatures:


Investigator


Program Director, Resources


Investigator


Regional Director General



A recent problem analysis indicates that in the period 1975-85, approximately \$92 MM was invested in site preparation and planting of 240,000 ha to white spruce or competition prone spruce sites in the region. If this investment is to be maintained some form of follow-up vegetation management - manual, mechanical, chemical or combinations of these - is essential. Failure to do so could result in softwood yield losses of 30 to 40 percent on these areas.

Recently there has been considerable emphasis on herbicides as a tool for site preparation and stand maintenance. National groups like the Canadian Confederation of Professional Foresters' Association (of which the CIF is a member) and the CPPA have issued policy statements emphasizing the need for herbicide use in forestry. The CCREM formed a special committee in 1981 to increase the number of herbicides available for forestry use and to shorten the period required for registration of herbicides. A recent PRUF contract report prepared for the NoFRC, entitled "Herbicide Use in Forestry: A literature survey and assessment of its environmental impact and its future potential for forest management in the prairie provinces of Canada" documents the need for increased herbicide use in forestry. In 1984, a national tree nursery herbicide committee was formed to promote the registration of more herbicides for nursery use.

CFS has responded to the need for more herbicide research by initiating a National Forest Weeds Program with a Herbicide Sub-Program and a Forest Weeds Planning and Coordinating Committee. This Committee functions in a policy/coordinating role for CFS. The recent CFS policy on forest pest management which addresses herbicides - is a major step forward in supporting vegetation management R&D in the CFS.

The NoFC has recently increased its regional forest vegetation management R&D which began in 1980 with small scale rate and timing trials of selected herbicides in support of the herbicide registration program at FPMI (see study NOR-10-04). This work is now being extended through a combined program of R&D involving both A-base and Agreement related programs in the region to include larger scale experiments. The project is multi-disciplinary, involving work on silvicultural, environmental and economic aspects of a range of alternation vegetation management tools, including manual, mechanical, chemical and fire. The role of the regional program with aspect to FPMI can be illustrated as follows:

FPMI

Selection and prescreening of new herbicides and conduct of experiments in support of registration needs

NoFC

Small scale efficacy tests in support of FPMI preregistration requirements

Registration Process:

Large-scale (benchmark) multi-factor studies of vegetation management alternatives in regional context. Studies include silvicultural, environmental and economic aspects.

The forest vegetation management project at NoFC is developing using A-base resources as a primary source of personnel and lab support and agreement resources for financial support. Both elements are critical to program success.

This project was subjected to national peer review in January 1985 and November 1985.

9. Study Objectives:

1. Co-ordinate the development of a regional forest vegetation management R&D project plan and components incorporating. A-base and federal/Provincial Agreement resources (3 provinces, NoFC and regional offices in Saskatchewan and Manitoba). The plan should incorporate components of project NOR-10 (Regeneration and Plantation Management), NOR-7 (Environmental Impact and Residue Chemistry) and NOR-3 (Forest Resource Economics).
2. Conduct the silviculture R&D component of the forest vegetation management project plan, emphasizing efficacy, crop tolerance and crop growth aspects of alternative vegetation management techniques.
3. Maintain liaison with other related CFS projects, national (FPMI) and regional, as well as related provincial and industrial projects (ECW, etc.).
4. Co-operate with other agencies in developing public consultation on herbicide use in forestry, contributing to procedural as well as factual aspects in this process.

10. Goals for 1985-86:

1. Develop a problem analysis and research plan for forest vegetation management in Alberta as a component of the regional coordinated forest vegetation management research plan. This will require consultation and cooperation with economics (NOR-3) and environment (NOR-7) staff. (10-62)
2. Collect and analyze available cost effectiveness data for various vegetation management techniques in Alberta. (10-62)
3. Continue measurement of cooperative field performance trial (with AFS) at Grande Prairie (transferred from 10-07). (10-21)

11. Accomplishments in 1985-86:

1. A regional problem analysis and a work plan for vegetation management R&D under the Canada-Alberta Forest Resource Development Agreement were developed. The work plan incorporates components of projects NOR-10, NOR-7, and NOR-3. The status of forest vegetation management in Saskatchewan and Manitoba was reviewed and assessed.
2. No cost effectiveness data were collected under this study.

3. The co-operative field performance trial was remeasured and a status report is being prepared. (Transfer to NOR-10-03 for 1986/87)

12. Goals for 1986-87:

1. Coordinate preparation of a regional forest vegetation management R&D plan incorporating components of projects NOR-10 (Silviculture) NOR-7 (Environmental Impact) and NOR-3 (Forest Economics). (Brace) (Reference goal 10-56, study NOR-10-03)
2. Coordinate completion of the work plan for forest vegetation management R&D under the Canada-Alberta Forest Resource Development Agreement (FRDA). This includes participation on a project facilitation team comprised of senior managers from the AFS and industry. (Brace) (Reference goal 10-56, study NOR-10-03) (Also reference work plan for Alberta Agreement Project)
3. Maintain liaison with CFS, other federal departments, provincial agencies and companies involved in vegetation management projects in the region. (Brace, New F.O.; Drouin, Gardner; Ball) (Reference goal 10-14, study NOR-10-03, goal 10-70, study NOR-10-04, goal 10-42, study NOR-10-05)
4. Conduct small scale screening trials for efficacy and crop tolerance on FPMI priority related herbicides. (Drouin) (Reference goal 10-69 and goal 10-70, study NOR-10-04)
5. Continue field evaluation of Velpar and Pronone trials at Calling Lake taking lead role in 3rd year assessment, (Co-op, AFS, Dupont - Pfizer) and assist in pre-assessment work on silviculture plots on benchmark site at Grande Prairie. (Drouin) (Reference goal 10-71, study NOR-10-04)
6. Summarize and publish the results of efficacy and crop tolerance experiments established in Alberta and Manitoba since 1980. (Drouin) (Reference goal 10-75, study NOR-10-04)
7. Publish report on long-term silvicultural effects on herbicide (2,4-D) released treatment on white spruce in Manitoba (MS-266). (Ball) (Reference goal 10-40, study NOR-10-05)
8. Supervise PRUF contract on glyphosate release trials, undertaken in Manitoba by Lakehead University staff. (Ball) (Study NOR-10-05)
9. Initiate silviculture R&D in forest vegetation management in Manitoba. Prepare study proposals. (Ball) (Reference goal 10-58, study NOR-10-05)
10. Agreement related:
 - a. Conduct silviculture R&D required on Grande Prairie benchmark site for vegetation management project under Canada-Alberta FRDA. (Brace) (Reference goal 10-1AA, study NOR-10-03 and see study NOR-36-02-1)

- b. Act as scientific authority for a study on the autecology of aspen - Navratil - AFS. (Brace) (Reference goal 10-2AA, study NOR-10-03 and see study NOR-36-02-1)
- c. Provide advice on forest vegetation management R&D in Saskatchewan - Gardner. (Brace) (Reference goal 10-1SA and see study NOR-36-03-5 and 6).

13. Publications 1985-86:

Nil

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of the following clarifications provided by the study and project leaders the committee concludes that no further screening action is required.

1. Field performance refers to the survival and growth of planted seedlings. It has no specific environmental impact implication. The Alberta project, on the Grande Prairie benchmark site, has been reviewed by Technical advisory Committee of the Alberta Environment Centre and by the Pesticides Chemical Branch of Alberta Environment. The project will require a permit from Alberta Environment before proceeding, so will be scrutinized again in early 1986. All other aspects of the study were screened under the studies in which they originated.

15. Resources 1986-87:

PYs: Prof.: (See individual studies)

Tech.:

Total:

Term/Student:

O & M:

Capital:

16. Signatures:

15/8/86
Investigator
R. K. Brown
A. J. Ball

J. A. M. Luce
[Signature]
Program Director, Resources

G. R. Hunt
Regional Director General



- b. Vegetation variables--including ground cover species.
- c. Regeneration results--including competing vegetation, species survival and regeneration growth rates.
- d. Variation of machine operator skills--e.g., training and experience, speed of machine operations, spacing of machine operations.

Background:

Most silvicultural treatments have been concerned with manipulation of the biological resource component. Trials have included spacing, thinning, planting positions, planting stock improvement, species suitability, survival and growth studies, and forest fertilization. Site preparation for physical manipulation of sites by chopping, harrowing, blading, scalping, rotoraking, plowing, bedding, prescribed burning, and use of herbicides are discussed by Smith (1962) and Pritchett (1979). Site preparation techniques are designed to improve conditions for seeding or planting that result in increased germination or seedling survival and tree growth rates. Goals are exposure of mineral soil, elimination of competing vegetation, and improvement of soil-plant water relationships.

Rennie (1958 and personal communication 1984), Taylor (1971), and others report on a range of site preparation techniques throughout the world. Little of this work has been done in Canada (Mechanization of Silviculture Unit, 1984) where the prime objective of site preparation, even in southern Canadian conditions of soil and climate, is to provide an increased supply of soil moisture and heat, in line with the goals listed earlier. Forest managers recognize that to achieve improved forest regeneration success in this region forest managers must develop a sequence of site preparation techniques that begins with physical site treatments (scarification, plowing, etc.) followed by chemical treatments (herbicides, fertilizers) and silvicultural treatments (spacing, thinning, stand tending, etc.). An immediate requirement is to assess present site preparation methods and to improve them where possible.

Study objective 2:

In the boreal forest, approximately 50% of most map sheets have soils developed on hard, compact glacial till that has been compressed by ice approaching one mile in thickness. Since deglaciation, these materials have weathered slowly and have developed soils with shallow rooting depths (hence low rooting volume for plants). Fine, clayey textured soils developed on glaciolacustrine deposits bring the amount of soil that may benefit from physical amelioration to 60-70% of most map sheets.

In addition, the environmental factors of soil formation in the boreal forest cause many of these soils to develop luvisolic profiles (C.S.S.C. 1978b). The pedogenic results are Gray Luvisols, identified by eluvial Ae and illuvial Bt horizons, signifying presence of downwardly translocated clay. Agronomically and silviculturally, this pedogenic result is interpreted as surface mineral soil horizons that form hard crusts on exposure, with dense compact subsoil horizons that inhibit root

penetration and development. These features are the basis of the subclass "D" limitation (a physical restriction to rooting by dense or consolidated layers other than bedrock) that was used for classifying the Land Capability for Forestry portion of the Canada Land Inventory (Whitecourt 83J, 1968).

Many of the forest soils in this region fall below the wilting point during the growing season (Duffy 1967). Clayton et al. (1977) described the temperature classes of the soil climate in the boreal forests as cool to moderately cool. Thus, in order to attempt improved forest regeneration and increased forest growth rates, a fundamental requirement is amelioration of the soil in order to provide greater availability of soil moisture to plants (increased rooting volume) and higher soil temperatures.

To change the soil climate and to achieve the soil amelioration objective listed above requires solution of the following sequence of problems:

- a. Identify soils likely to benefit by specified treatments (i.e., limitations that may be overcome by ameliorative treatment).
- b. Development of soil ameliorative techniques and equipment to use on those soils selected as most likely to respond to treatment. Suggested techniques are subsoil ripping, vibrating deep-soiler, and deep ploughing.

Questions to be answered for treatment of Gray Luvisols and some Brunisols (i.e., those containing fragipans), are:

- What is the optimum depth of soil disturbance; i.e., does the entire Bt horizon have to be loosened?
- How important is the conservation of surface soil horizons? The LFH, or litter surface, of forest soils contains most of the nutrients, and together with the Ae horizon, contains most of the microflora and mesofauna. How are these upper soil horizons best managed? Does it matter if they become covered, as in deep ploughing?
- What is the effect of soil amelioration on acidic subhorizons; i.e., low pH Bt horizons of Gray Luvisols? Will they become more acid or less acid?
- What is the effect of soil amelioration on aluminum toxicity; particularly in soils with bisequa morphologies, classified as Brunisolic Gray Luvisols, and occurring on the more stable landscape segments of western Alberta?
- How is a lower bulk density of soil maintained; i.e., how does one prevent luvisolic subsoils from recompacting?
- What is the optimum mixing of subsoil and parent material, i.e., does lime from the C horizon improve the acidic Bt horizon?

- Will amelioration techniques destroy or deplete soil organic matter, in particular organic nitrogen?
 - What are the most effective ameliorative techniques for soils of mixed morphology (e.g., sandy soil over silt or clay are among our most productive forest soils at the present time)? Will deep ploughing harm these soils or improve them? How should shallow peat over mineral soils and poorly drained soils be ameliorated?
 - What happens to soil moisture as a result of subsoil amelioration? Does internal soil drainage improve? Can moisture storage be increased? Is more moisture available for roots?
 - What happens to soil temperatures as a result of subsoil amelioration?
- c. Field testing the impact of soil amelioration on specific sites to determine:
- the effect of timing of operations.
 - costs of site preparation.
 - the response of aspen and competing vegetation species.
 - regeneration and growth response to silvicultural treatments following soil amelioration.

Background

Extensive literature is available on soil amelioration techniques such as deep ploughing, mostly in Europe (see list of references). Many of the tests have been done on soils used for agriculture and on poorly drained marine clays near the Baltic Sea; e.g., Denmark, Germany, Poland, Finland. Work in forested soils in Sweden has been primarily with highly developed podzols derived from granitic materials. British work has occurred mostly on fen and moor areas with poorly drained organic soils, many of them with thin ortstein iron pans.

Rennie (1958, 1984) emphasizes the importance of planting position where surface roughness has been developed or a cloisonné type of ploughing has been done. Work on luvisolic soils on glacial till materials, with conditions more similar to ours, has apparently been carried out in southern France and southern Germany (Hellum 1983). Deep ploughing efforts have been carried out in the U.S.S.R. and Czechoslovakia, but translations are slow and difficult to obtain. United States experience appears to be more concerned with compaction caused by machinery working in the forest (Andruse and Froehlich, 1982).

In Canada, some soil amelioration by deep ploughing has been done on deep peats in Newfoundland (Wilton 1970), and on solonchic soils in Alberta (Harker 1975, Peters 1982, Hermans 1983). In the Mayerthorpe area, some soil amelioration work on luvisolic soils has been done by a vibrating deep-soiler recently imported from Germany (Preugchas 1984). The first

experiment with soil amelioration (deep ploughing, vibrating deep-soiler) after forest harvest is presently in progress on luvisolic soils in the Whitecourt area, and is being done by the Soil Science Department, University of Alberta, through a PRUF contract to D.J. Pluth.

The functions of ploughing for the improvement of tree growth by alteration of the site are summarized by Taylor (1971) as follows:

- regulating water movement.
- improving soil aeration.
- reducing compaction.
- mobilizing nutrients, particularly nitrogen.
- reducing competition from natural vegetation.
- providing a favorable planting position.

The principal advantage of ploughing in our region is to change some adverse soil feature (soil limitation) in order to increase rooting volume and soil heat to improve forest regeneration and forest growth rates. Anticipated additional advantages of deep ploughing in our region are:

- increased rooting volume, water availability, and soil heat.
- more uniform distribution of soil water.
- improved soil drainage.
- less slash burning required, i.e. atmospheric pollution is reduced.

Restraints:

A number of issues appear to prevent development and testing of site preparation and soil amelioration techniques for forest regeneration purposes:

1. Costs--Many forest companies are inhibited by costs of machinery and the expensiveness of field operations (Gorman 1984). Hence trials are limited and results are few, preventing the development of adequate silvicultural prescriptions. Government expenditure is required to test machinery, modify it where necessary, and demonstrate its use. A large number of trials are necessary in order to develop silvicultural prescriptions over a range of field conditions.
2. Slash disposal--Excessive slash that is left over as a result of forest harvesting activity is a restraint to site preparation because it precludes easy operation of S.M. Machinery may clog with debris, or is prevented from contact with the soil, and may even be broken by excessive amounts of slash. Huge amounts of slash may become a fire hazard in this region. Pritchett (1979) points out the gradual increase of public objection to smoke because of slash disposal by

burning. Heavy equipment may be used for slash disposal, but is costly and may reduce exposure of mineral soil. An inexpensive method of slash disposal by incorporation of site organic matter into mineral soil is still needed.

3. Stumps--Remnants from cutover natural forests, stumps are an obstacle to use of some kinds of silvicultural machinery. An economic method of removal, burial, or incorporation into the mineral soil is needed.
4. Aspen roots in cutover areas--Disturbance of aspen trees by cutting or site preparation activity usually results in unwanted aspen suckering. Techniques are required to prevent aspen suckering in areas where it is an unwanted species in the next rotation.

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- I. Introduction and early developments.
 - II. Historical review of ploughing on wet soils.
 - III. Historical review of ploughing on drier soils. Scottish Forestry 30:1-15, 90-111, 253-274.

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9. Study Objectives:

1. To evaluate silvicultural machinery for forest site preparation in terms of impact on soils and vegetation and subsequent seedling survival and growth rates.
2. To develop methods that will ameliorate the physical condition of boreal forest soils in order to improve regeneration success and forest growth rates.
3. To disseminate knowledge of forest soils by writing and by providing soil advisory services.

10. Goals for 1985-86:

1. Prepare a critique of the existing CFS equipment evaluation methodology and report to NACMEC. Develop and pilot test a modified evaluation (after receiving feed back from NACMEC) which incorporates increased emphasis on soils. (10-60)
2. Prepare user's manual on Forest Soils of the Prairie provinces, which defines and describes forest soils and presents guidance for their use. (10-73)
3. Provide advisory services on forest soils as requested, eg.
 - a. Selection of seed orchard sites re: Canada-Manitoba Forest Renewal Agreement.
 - b. Site descriptions for NOR-10-08. (10-74)
4. Continue consultations aimed at assessing the potential of subsoilers:
 - a. Dr. H. Schulte-Karring, Provincial Teaching & Research in Vineyards, Gardening and Agriculture, Walporzheimerstr. 48, 5483 Bad Neuenahr-Ahrweiler, Federal Republic of Germany.
 - b. Carl Kaelble u. Gmeinder GmbH & Co.¹, Postf. 1260, D-6950 Mosbach, Federal Republic of Germany.
 - c. Dr. Peter Bullock, Rothamsted Experimental Station, Harpenden, England.

¹(Manufacturer of agricultural machinery).

The purpose of the above contacts is to obtain advice for the best method of subsoiler operation (e.g. depth, speed, time, and intensity of operation, special problems, available soil and yield data, costs, etc.). (10-59)

Contingent upon the availability of a vibrating deep-soiler, carry out a field trial for site improvement in over-dense lodgepole pine stands and in juvenile spruce stands.

5. Continue PRUF contract with U of A, Department of Soil Science. (10-59)

Added Goals:

3. c. To act as chairman of the CFS Site Classification (SCALE) Working Group.
- d. To act as scientific authority for the J.D. Irving PILP contract in New Brunswick.
- e. Prepare and present paper "Ecological land classification in Banff and Jasper National Parks" to the COJFRC symposium "Site classification in relation to forest management" August 27-29, 1985, Timmins, Ontario.
- f. Provision of advisory services to the Technical Committee of the Waterton Biosphere Reserve, as requested.

11. Accomplishments in 1985-86:

1. The critique was written and presented to GLFC. Further follow-up does not appear to be warranted.
2. A revised format outline of the user's manual on Forest Soils in the Prairie Provinces was prepared for comment.
3. Advisory service on forest soils was provided as follows:
 - a. Field examination of forest soils was conducted in northern Manitoba (the Pas area) to assist Al Nanka in the selection of seed orchard sites under the Canada-Manitoba Forest Renewal Agreement.
 - b. No work was done this year on site descriptions for NOR-10-08. Goal moved to NOR-10-06.
 - c. A meeting of the CFS SCALE Working Group was held in Fredericton on Oct. 6, 1985, with 24 people attending. A proceedings of the meeting is in preparation through funding from Headquarters.
 - d. A meeting was held with J.D Irving representatives in Fredericton in July. Their plantations were briefly examined in October during an IUFRO tour. This PILP contract is in abeyance for about one year.

- e. Prepared and presented paper "Ecological land classification in Banff and Jasper national parks" to the COJFRC symposium "Site classification in relation to forest management" August 27-29, 1985, Timmins, Ontario.
 - f. A meeting of the Technical Committee of the Waterton Biosphere Reserve was attended in Lethbridge in May.
4. Correspondence, mostly with the U.S.A., has provided further papers and information on subsoilers and rippers.
 5. The field work for the PRUF contract (DSS file No. 01SG.KH505-3-0105) with the U of A Department of Soil Science is complete and the final report is in preparation. The project report "Amelioration of subsurface horizons of Luvisolic soils through mechanical disruption" was due on December 1, 1985. Follow-up work is required in order to monitor seedling survival and growth, and soil moisture and soil temperature changes.
12. Goals for 1986-87:
1. Continuation of advisory service on forest soil as requested; e.g.
 - a. As national chairman of SCALE:
 - to complete the 1985 meeting proceedings.
 - to convene a spring or summer meeting of the CFS Working Group.
 - to prepare a report for Headquarters by December/86 outlining recommendations of the CFS Working Group in site classification (SCALE). (10-76)
 - b. Act as scientific authority for J.D. Irving PILP contract in New Brunswick. (10-74)
 - c. As requested e.g.
 1. Technical Committee, Waterton Biosphere Reserve.
 2. Advisory Committee, Vermilion College. (10-74)
 - d. Assist Adam Kosowan and Glen Padbury to present a soils course for Saskatchewan Foresters in 1986. (10-74)
 2. Act as scientific authority for PRUF contract with U of A Department of Soil Science. Prepare a report on literature review of subsoiler machinery, including additional results of the PRUF study northwest of Whitecourt, Alberta; i.e. seedling survival and growth, and soil temperature and soil moisture values. (10-59)
 3. Solicit support for preparation of a user manual entitled "Forest soils of the prairie provinces", the goals being to collect, describe, correlate, and interpret use of the provincial forest soils in the NoFC region. (10-73)

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

Deep tillage should permit increased storage of water in the soil. It should also permit easier movement of water through the soil, hence more uniformity of water values. However, there is little problem expected unless vast areas are treated. The current project is not large enough to impact the environment to any major degree (there are 15 plots, each approximately 1.5 ha, on 1 block of 80 hectares). Water storage and movement is being monitored in the project.

14. Publications 1985-86:

Holland, W.D. 1985. SCALE - Proceedings of Canadian Forestry Service Working Group on Site Classification - Fredericton meeting, October 6, 1985.

Holland, W.D. (In press). Ecological land classification of Banff and Jasper national parks. In COJFRC proceedings of symposium on "Site classification in relation to forest management", August 27-29, 1985, Timmins, Ontario.

15. Resources 1986-87:

PYs: Prof.:	Holland	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

O & M: \$3,000

Capital:

16. Signatures:

W.D. Holland

Investigator

[Signature]
Program Director, Resources

[Signature]
Regional Director General

NOR-11

FOREST INSECT AND DISEASE SURVEY
AND MANAGEMENT SYSTEMS

2. Conduct special surveys for particular pests or of designated areas. (Moody, Cerezke).
 3. Compile and publish an Information Report on the forest pest situations in the region for 1984 and make predictions for 1985. Draft copy of the report will be sent to FIDS coordinator in Ottawa for national compilations. (Moody, Cerezke).
 4. Provide pest extension service and technology transfer to various client agencies and general public. (Moody, Cerezke, FIDS staff)
 5. Represent NoFC and CFS on various provincial, regional, and national forest insect and disease committees and advisory groups. (Moody, Cerezke)
 6. Organize and conduct annual interagency FIDS review and planning meeting with representatives (contact persons) from three prairie provinces, the Northwest Territories and Parks Canada (Prairie and Western Region). (Moody, Cerezke)
 7. Publish Forestry Report on FIDS. (Moody, Cerezke)
 8. Publish Forest Management Notes on forest pest conditions and forecast for each of the prairie provinces and the NWT. (Moody)
 9. Complete and submit first draft of a standard survey methodology manual suitable for the region. (Moody)
 10. Collaborate with Bill Ives and Dick Wong and provide assistance with photography and insect collection for the pictorial guide to forest and shade tree insects of the prairie provinces. (Moody).
 11. Establish plots to contribute the national program to detect early signs of acid rain (pollutants) damage to the forests. (Moody)
 12. Provide functional guidance for NOR-36-04 Forest pest management and damage appraisal (Manitoba), Development Agreement for surveys of forest pest conditions and their damage, and in providing pest control advisory services and technology transfer. (Moody)
10. Accomplishments in 1985-86:
1. Aerial and ground surveys were conducted and areas of tree mortality or moderate-to-severe infestations were mapped of major forest pests (spruce budworm, mountain pine beetle, spruce beetle, forest tent caterpillar, and jack pine budworm) in the three prairie provinces and the Northwest Territories. Aircraft time for surveys is largely provided by outside agencies.
 2. Many special surveys for particular pests or of designated areas were conducted and reports prepared. Examples are as follows:

- a. Special surveys were conducted for overwinter survival and brood-gallery development of mountain pine beetle in southwestern Alberta, and several national parks.
 - b. Conducted field experiments to test spruce budworm pheromones in two types of traps (Pherocon 1CP and Multipher traps) for use in monitoring budworm populations.
 - c. Surveys to detect new or introduced pests also included baited traps for possible introduction of gypsy moth and the European pine shoot moth. One male gypsy moth was trapped in Sherwood Park in 1984 but none in 1985. Elm bark beetle surveys were conducted with Alberta Environment and Alberta Agriculture but beetles were not detected in Alberta.
 - d. Special pest surveys were conducted in three forest nurseries, jack pine regeneration, white spruce plantations, and jack pine seed orchard in Saskatchewan and pine plantations in Manitoba.
 - e. Nematode infested logs were collected in Manitoba and sent for identification of the Pinewood nematode. Report prepared for Ottawa.
3. Compiled and published Information Report on the forest pest situations in the region for 1984 and made predictions for 1985. Draft copy of the report was sent to Ottawa for FIDS national report.
 4. Pest extension services were provided and about 2000 inquiries were processed. Information booths on tree pests were displayed to the general public, on numerous occasions, and pest leaflets and other material were distributed.
 - a. Workshops, lectures, and talks on forest pests were presented on 30 occasions, e.g. to Parks Canada staff, courses sponsored by Alberta Agriculture, staff of tree nurseries, AFS staff, Parks and Recreation, etc.
 - b. T.V., radio, and newspaper interviews were given on pest problems.
 - c. Open House displays and advice on pests.
 5. Represented NoFC and CFS on various committees and advisory groups:
 - a. Representation and report prepared for the Alberta Pest Control Advisory Council.
 - b. Representation and two reports prepared for the Forest Pest Control Forum (Ottawa).
 - c. Also provided representation and reports for:
 - Manitoba DED Advisory Committee
 - Saskatchewan Advisory Council - Plant Disease (Saskatoon)

- Saskatchewan Advisory Council - Insect Control (Saskatoon)
 - DED Advisory Council - Saskatchewan (Regina)
 - Alberta Horticultural Environment Subcommittee (Edmonton).
Herb Cerezke served as secretary 1985.
 - Alberta Extension Horticultural Committee (Red Deer)
 - Western Forest Insect Work Conference (Colorado)
Ben Moody served as Secretary/Treasurer
6. Annual interagency FIDS review and planning meeting was conducted in March 1985 at NoFC with representations from three prairie provinces, the Northwest Territories and Parks Canada.
 7. First draft of Forestry Report almost completed.
 8. The forest pest conditions and forecast for each of the prairie provinces and the NWT were distributed in the form of File Reports.
 9. First draft of a standard survey methodology is being prepared.
 10. Collaborated with Bill Ives and Dick Wong and provided assistance with photography and insect collections for the illustrated report "A pictorial guide to the forest and shade tree insects of the prairie provinces".
 11. Established and sampled 10 permanent plots under the acid rain national early warning system (ARNEWS) and foliage and soil samples are being chemically analyzed through NOR-7. These plots are distributed as follows: 4 in Manitoba, 2 in Saskatchewan and 4 in Alberta.
 12. Provided functional guidance to FIDS projects under the Canada-Manitoba Forest Renewal Agreement (NOR-36-04), and assistance by the transfer of FIDS Ranger, Mike Grandmaison to Winnipeg.

Added Accomplishments:

13. Formulated and wrote Insect and Disease Projects under the Canada-Alberta and Canada-Saskatchewan Forest Resource Development Agreements.
11. Goals for 1986-87:
1. Survey, map, and report on major forest pests of the region, i.e. mountain pine beetle, spruce beetle, forest tent caterpillar, spruce budworm, jack pine budworm, dwarf mistletoe, and needle cast or needle rust. (Cerezke and FIDS technical staff)
 2. Conduct special surveys for particular pests or of designated areas. (Cerezke, Moody, and FIDS technical staff)
 3. Compile and publish an Information Report on the forest pest situations in the region for 1986 and make predictions for 1987. Draft copy of the report will be sent to FIDS coordinator in Ottawa for national compilations. (Cerezke, Moody,)

4. Provide pest extension service and technology transfer to various client agencies and the general public. (Cerezke, Moody, FIDS staff)
 5. Represent NoFC and CFS on various provincial, regional, and national forest insect and disease committees and advisory groups. (Cerezke, Moody, and FIDS staff)
 6. Organize and conduct annual interagency FIDS review and planning meeting in March with representatives (contact persons) from three prairie provinces, the Northwest Territories and Parks Canada (Prairie and Western Region). (Cerezke, Moody,)
 7. Complete material for review and publish Forestry Report on FIDS. (Moody, Cerezke)
 8. Complete and submit first draft of a standard survey methodology manual suitable for the region. (Moody)
 9. Survey plots established under the national program to detect early signs of acid rain (ARNEWS) (pollutants) damage to the forests with NOR-7. (Cerezke, Moody and FIDS technical staff)
 10. Provide functional guidance for I & D projects under the 3 FRDA Agreements in the prairie provinces. (Cerezke)
12. Publications 1985-86:

Moody, B.H. and H.F. Cerezke. 1985. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba and the Northwest Territories in 1984 and predictions for 1985. Inf. Rep. NOR-X-269.

Moody, B.H. and H.F. Cerezke. 1985. Contribution In: Forest Insect and Disease Conditions in Canada. 1984. Compiled by E.S. Kondo and R.G. Taylor. Environ. Can., Can. For. Serv., Ottawa.

Cerezke, H.F. and other members of TULC. 1985. Trees in the Urban Landscape. Alta. Agric. Publ. 40 p.

Unpublished Reports:

Cerezke, H.F. 1985. Report to Environmental Committee of Alberta Horticultural Advisory Committee.

Cerezke, H.F., Drouin, J., Neill. 1985. Revisions for 1986 Western Committee Crop Pests publication.

Cerezke, H.F. 1985. Mountain pine beetle outbreak in Alberta and Saskatchewan, 1976-1985.

Emond, F.J. 1985. Pest extension report. File Report.

Emond, F.J. 1985. Insect and disease surveys of provincial tree nurseries. File Report.

- Emond, F.J. 1985. Insect and disease conditions in Waterton, Banff, Jasper, Kootenay, Yoho and Elk Island national parks, 1985. File Report.
- Gates, H. 1985. 1985 Spruce budworm pheromone trapping and larval wash for 1986 forecast. File Report.
- Gates, H. 1985. Forest pest conditions in the Northwest Territories, 1985. File Report.
- Gates, H. 1985. Forest insect and disease surveys in Wood Buffalo and Nahanni national parks, 1985. File Report.
- Grandmaison, M. 1985. Pest conditions in Riding Mountain National Park, 1985. File Report.
- Moody, B.H. 1985. Report on the spruce budworms in the prairie provinces and the Northwest Territories 1985. Report prepared for the 12th Annual Forest Pest Control Forum, Ottawa.
- Moody, B.H. 1985. Report on the status and control of other pests in the prairie provinces, 1985. Report prepared for the 12th Annual Forest Pest Control Forum, Ottawa.
- Moody, B.H. 1985. Status of major forest insects and diseases in the prairie provinces and the NWT, 1984-85. Contribution to report to working group on forest insect and diseases, North American forestry Commission, October 1985.
- Moody, B.H. 1985. Highlights of forest insect and disease research in the prairie region. Contribution to the Canadian report to the North American Forestry Commission, October 1985.
- Still, G.N. 1985. Microcomputer mapping program for forest pests infestation. Program.
- Still, G.N. 1985. Insect and disease conditions in Alberta, 1985. File Report.
- Tidsbury, C. 1985. Spruce budworm in Saskatchewan, 1985 and forecast for 1986. File Report.
- Tidsbury, C. 1985. Jack pine budworm in Saskatchewan, 1985 and forecast for 1986. File Report.
- Tidsbury, C. 1985. Forest tent caterpillar infestations, 1985 and defoliation forecasts for 1986. File Report.
- Tidsbury, C. 1985. Insect and disease conditions in Prince Albert National Park, 1985. File Report.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Cerezke	0.5	
	Moody	0.3	
Tech.:	Emond	1.0	
	Still	1.0	
	Grandmaison	1.0	(Manitoba District Office)
	Tidsbury	0.7	
	Gates	1.0	
Total:		5.5	
Term/Student:		1.2	

O & M: \$37,000

Capital:

15. Signatures:

A. F. Cerezke
Investigator

Shwalee D...
Program Director, Protection

B. L. Moody
Investigator

C. D. Hunt
Regional Director General



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 7, 1986

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Sawfly systematics
3. New: Cont.: X
4. No.: NOR-11-02
5. Study Leader: H.R. Wong
6. Key Words: Tenthredinoidea, Nearctic Region, distribution, hosts, keys, life history, morphology, new genera, new species, biogeography, revision, Symphyta, evolution, phylogeny
7. Location of Work: Edmonton, Alberta
8. Study Objectives:
 1. To maintain taxonomic expertise on sawflies of Canada at the national and international level.
 2. To study morphology, evolution and biogeography of the economically more important sawfly genera which may ultimately lead to their revision in North America.
9. Goals for 1985-86:
 1. Identify larval and adult sawflies for research personnel, institutions, and laboratories.
 2. Review for the Canadian Entomologist, a manuscript of nearly 400 pages submitted for publication.
 3. Complete review and submit for publication "Larvae of the North American genera of Diprionidae (Hymenoptera: Symphyta)" for review by the technical board.
 4. Continue supervising the research of the visiting scholar from the Forest Research Institute, Chinese Academy of Forestry, Beijing, People's Republic of China.

10. Accomplishments in 1985-86:

1. Identified over 1000 larval and adult sawflies for regional clients and reviewed 2 manuscripts for the Proc. Entomological Society of Washington.
2. Reviewed a monograph of nearly 400 pages for publication in the Memoirs of the Entomological Society of Canada.
3. The manuscript "Larvae of the North American genera of Diprionidae (Hymenoptera: Symphyta)", has been reviewed by the technical board and two outside reviewers and has been submitted to Can. Ent.
4. A paper with the visiting scholar from the Forest Research Institute, Chinese Academy of Forestry, Beijing, People's Republic of China entitled "Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae in Hinton, Alberta" was presented at the 33rd Annual Meeting of the Entomological Society of Alberta.

11. Goals for 1986-87:

1. Identify larval and adult sawflies for research personnel, institutions, and laboratories.
2. Publish "Larvae of the North American genera of Diprionidae (Hymenoptera: Symphyta)".
3. Identify 250 specimens of Pristiphora for the Systematic Entomology Laboratory, USDA, Washington, D.C. and prepare a report on any new species.
4. Supervise the research of the visiting scholar from the Chinese Academy of Forestry, Beijing, People's Republic of China until departure in August.
5. Prepare and submit for review a paper on the "Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae) in Hinton, Alberta".

12. Publications 1985-86:

Wong, H.R. 1985. Observations on the life history and habits of Nematus calais Kirby (Hymenoptera: Tenthredinidae) defoliating willows in Alberta (Abst.). Proc. Ent. Soc. Alberta 32:9.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Wong 0.3

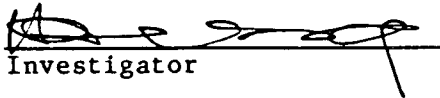
Tech.: 0.0

Total: 0.3

Term/Student: 0.3

O & M: \$1,000

Capital:

15. Signatures:
Investigator
Program Director, Protection
Regional Director General

4. Prepare final reports of the following three studies:
 - a. Impact studies of the jack pine budworm in the Nisbet Prov. Forest, Saskatchewan (For. Management Note or short journal publication).
 - b. Surveys of the spruce budworm populations and damage in Riding Mt. National Park (Inf. Rep.).
 - c. Control studies of seed and cone insects in mature white spruce trees with carbofuran near Grande Prairie, Alberta (journal publication).
 5. Continue cooperative field studies with Drs. Wieser and Dixon at Univ. Calgary and Alberta Forest Service on MPB pheromone testing and applications.
 6. Provide consultory and technology transfer services to clientele as requested.
 7. Summarize data and prepare first draft report of MPB studies with co-workers Drs. H. Wieser and E. Dixon, Univ. Calgary, titled: "Mountain pine beetle attack density pattern on semiochemical-baited and unbaited lodgepole pine in southwest Alberta".
10. Accomplishments in 1985-86:
1. a. Attended and reported at a MPB Technical Committee review meeting in Cranbrook, B.C., September, 1985
 - b. Participated in a field tour in Idaho/Montana to view Lp/MPB management strategies July 1985; organized under Can/US MPB Action Plan.
 2. All measurements of MPB trapped in 1984 were completed and statistical analyses were completed on most 1983 and 1984 data. Some tables and graphs were prepared with co-workers at Univ. Calgary and a first draft manuscript was started titled: "Attractiveness of structural analogs of brevicomin to MPB in field bioassay studies in southwest Alberta, 1982-1984. (Co-authors: Wieser, Dixon, Ibrahim and Cerezke).
 3. Analyses were completed on all data but no separate report was prepared. Instead the data will likely be combined with results from a similar study that compared MPB attraction to three pine hosts: lodgepole, jack and limber pines. Results of the latter study were summarized and presented at the Ann. meeting of the Entomological Soc. Alta, Oct./85. Paper titled: "Attack pattern and brood productivity of the MPB on three pine hosts".
 4. a. Report on jack pine budworm impact studies was re-written for presentation at Jack Pine Budworm Workshop to be held Jan. 14-15, 1986 in Winnipeg. Paper titled: "Impact studies of the jack pine budworm, Choristoneura pinus pinus, in Nisbet Provincial Forest, Saskatchewan".

- b. Revisions for report on spruce budworm studies in Riding Mt. National Park are underway.
 - c. Paper on control studies of seed and cone insects was reviewed, revised, and now with editor in final draft form for Inf. Report.
5. In cooperation with Drs. H. Wieser and E. Dixon, U. of C. (funded by Alberta Forest Research Dev. Funds), four field experiments were attempted with pheromone tests, three on MPB and one with spruce beetle:
- a. Several chemical compounds tested for attraction to MPB as bait in traps; trap catch data are likely too low to yield useful results because of declining populations overall.
 - b. Two "best" compounds were field-tested at three different release rates to determine field response to MPB; again trap catch may be too low to provide meaningful results.
 - c. Several pheromone blends were tested in limber pine stands for attraction to MPB in three replicated plots and four sampling periods. Data measurements are incomplete and not summarized. Catches of MPB are adequate to yield meaningful results.
 - d. Known pheromone bait formulations were field-tested as bait in traps for spruce beetle attraction in a latin square design north of Manning, Alberta. Catch results were very low for one of several reasons; placed out in field too late for beetle flight, poor response to existing pheromone, or population too low.
6. Important consultory and technology transfer services have included: provided information and advise on woodborers in export lumber for major company; participated in MPB training session to Jasper Park warden staff; participated in two review meetings on MPB with Alberta For. Ser.; gave lecture on seed and cone insects to U. of A. forestry students; participated in two seminars on major forest insects for Manitoba and Saskatchewan forestry staff; assembled an open-house display on MPB pheromones; served on advisory committee for U. of A. graduate student; provided information (spruce beetle, spruce budworm, decays, blowdown) to consulting forester to incorporate into a long-term management plan of overmature Sw along lower Liard R., NWT; and jointly prepared on outline with B. Miyagawa (AFS) of proposed MPB review publication for Alberta.
7. Prepared first draft of proposed journal article titled: "Mountain pine beetle attack density pattern on semiochemical-baited and unbaited lodgepole pine in southwest Alberta", by H. Cerezke, H. Wieser and E. Dixon.
8. Accepted responsibility as an Associate Editor of the Canadian Entomologist.

11. Goals for 1986-87:

1. Complete final draft copies of the following in publishable format:
 - a. Impact studies of jack pine budworm in the Nisbet Provincial Forest, Saskatchewan; to be presented at Jack Pine Budworm Workshop Jan. 14-15, 1986 in Winnipeg and likely printed in a Proceedings of the workshop.
 - b. Surveys of spruce budworm populations and damage impact in Riding Mt. National Park, 1979-80; Inf. Rep.
 - c. Control studies of seed and cone insects in mature white spruce trees with carbofuran near Grande Prairie; Inf. Rep.
2. Complete first draft copies and submit for review the following manuscripts; first three are proposed journal articles; d) will be presented as a paper by E. Dixon at Canadian Chemical Conference, June 1986 in Saskatoon, Sask. Likely author/co-authorship are indicated.
 - a. Mountain pine beetle attack density pattern on semiochemical-baited and unbaited lodgepole pine in southwest Alberta. (Cerezke, Wieser, Dixon)
 - b. Attractiveness of structural analogs of brevicomin to MPB in field bioassay studies in southwest Alberta. (Wieser, Dixon, Ibrahim, Cerezke)
 - c. Attack pattern and brood productivity of the MPB on three pine hosts. (Cerezke)
 - d. Probing the receptor site for the aggregation pheromone exo-brevicomin in MPB (Dixon, Ibrahim, Castro, Wieser, Cerezke)
3. Continue representation on MPB Technical Committee and provide input into CAN/US MPB Action Plan as required. Attend MPB/Lodgepole pine field trip in Okanagan area of BC in 1986 as a planned tour of the Action Plan.
4. Complete measurements and analyses of 1985 MPB pheromone data.
5. In cooperation with co-workers, Wieser and Dixon at U of C, conduct three field trials for attractiveness of pheromone compounds to MPB and to spruce beetle, to evaluate these materials for detection/monitoring tools.
 - a. Test and compare the effectiveness of two bait formulations in traps for MPB detection and monitoring at low population levels.
 - b. Test attractiveness to MPB of several lure formulations in traps. This goal is contingent upon securing two suitable MPB infestation sites in eastern B.C. for testing with cooperation of B.C. Forest Service.

- c. Conduct a repeat of the 1985 field test of pheromone compounds for attractiveness to the spruce beetle.
6. Contribute to proposed Alta. Forest Service publication: "Mountain pine beetle in Alberta--a decade of infestation, 1977-1986".
7. Provide technology transfer and information services to clientele as requested, and carry out duties required for an Associate Editor of Can. Entomol.
12. Publications 1984-85:

Unpublished Reports:

Cerezke, H.F. 1985. Report to Technical Committee on mountain pine beetle.

Cerezke, H.F. 1985. Attack pattern and brood productivity of the MPB on three pine hosts. Paper presented at annual meeting of the Entomological Society of Alberta, Lethbridge, Oct. 1985. Abstract to be printed in 1985 Proceedings.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Cerezke	0.5
	Tech.:	0.0
	Total:	0.5
	Term/Student:	0.3

O & M: \$6,000

Capital:

15. Signatures:

H. F. Cerezke
Investigator

A. Matheson
Program Director, Protection

C. D. Kent
Regional Director General

4. Determine the spread of introduced insects in the Canadian prairies. (Wong)
 5. Determine the species of ants attacking lodgepole pine stumps in the Hinton area of Alberta. (Wong)
 6. Continue the preparation of the pictorial guide to the forest and shade tree insects of the Canadian prairies by:
 - a. Identifying immature and mature insects and obtaining the necessary photographs.
 - b. Conducting a literature review of the forest insects of this region.
 - c. Prepare text and figures for the guide. (Ives, Wong)
 7. Prepare for publication a manuscript on Petrova albicapitana (Busck) and Petrova metallica (Busck) (Lepidoptera: Tortricidae) in Pinus contorta stands of Alberta with J.A. Drouin and C.L. Rentz. (Wong, Drouin)
 8. Prepare for publication a Forest Management Note on the major insects attacking poplar stooling beds in the nurseries of the Canadian prairies. (Wong, Emond)
10. Accomplishments in 1985-86:
1. Determined several thousand insect specimens in the mature and/or immature stages submitted to the Northern Forestry Centre and handled over a thousand enquiries from in-service personnel, clients, outside agencies, and scientists.
 2.
 - a. Over two hundred specimens determined by specialists in Ottawa and by myself have been incorporated into the insect reference collection.
 - b. Over four hundred specimens collected by personnel of the Insect and Disease Survey were reared, in which over one hundred and fifty were overwintered to obtain biological information and specimens for the reference collections.
 - c. Over 1000 specimens were pinned, spread, labelled, or preserved for the reference collection.
 3. Biological information and/or specimens were provided to:
Dr. Ichiji Togashi, The Ishakawa Ag. College, Japan.
Dr. I.D. Lafontaine, Biosystematic Res. Institute, Ottawa.
 4.
 - a. A survey was made in 1985 for the following introduced insects, which have entered southeastern Manitoba in recent years.
 - The distribution of the introduced pine sawfly, which was first collected in 1983, has not extended its range beyond Bird's Hill Provincial Park near Winnipeg, Manitoba.

- The European spruce sawfly present since 1969, has been collected as far north as Silver Falls, Manitoba.
 - Larvae of larch casebearer, present since 1965, was not collected in 1985 in Manitoba. Pheromone traps placed in the Sprague area of Manitoba, however collected a number of adults, which appear to be the larch casebearer. These were sent to Ottawa for confirmation.
 - The mountain ash sawfly collected at Falcon Lake, Manitoba in 1984 was absent in this area in 1985.
 - A single male of the Gypsy moth was captured in a pheromone trap in Sherwood Park, Alberta in 1984. Numerous pheromone traps set out in this area in 1985 failed to collect any males of this species in this area in 1985.
- b. The European pine shoot moth present in Ontario and British Columbia is still absent in Alberta.
5. Ten species of ants were observed colonizing lodgepole pine stumps in the Hinton area, Alberta. The species Myrmica incompleta Provancher, Formica subnuda Emery, and Camponotus herculeanus (Linnaeus) were the dominant species. The slave species were Formica neorufibarbis Emery and Formica fusca (Linnaeus). The species Formica dakotensis Emery was a temporary parasite of Leptothorax muscorum (Nylander). The other species were Formica obscuriventris Mayr, Formica opaciventris Emery and Formica cinerea Mayr.
 6. Accomplishments in the pictorial guide to the forest and shade tree insects of the Canadian prairies are as follows: (1) identifying and rearing of over 4500 specimens, (2) preparation of over 2000 specimens for photographing, (3) overwintering of over 1000 specimens, (4) preparation of over 3500 slides of insects and their damage, (5) preparation of additional 40 color plates and the improvement of the many previous 60 plates, and (6) preparation of the text for an additional 30 plates making an approximate total of 60 completions.
 7. The manuscript "Petrova albicapitana (Busck) and Petrova metallica (Busck) (Lepidoptera: Tortricidae) in Pinus contorta stands of Alberta" has been accepted for publication in the Canadian Entomologist.
 8. Figures for the note on the major insects attacking poplar stooling beds in nurseries of the Canadian prairies has been prepared and the text is being written.
11. Goals for 1986-87:
1. Provide diagnostic and biosystematic services for the more difficult determinations on mature and immature insects damaging forest and shade trees. (Wong)

2. Maintain and improve reference collection of insects and mites. (Wong)
3. Provide information and specimens to scientists engaged in taxonomic and biological studies. (Wong)
4. Determine the spread of introduced insects in the Canadian prairies. (Wong)
5. Continue the preparation of the pictorial guide to the forest and shade tree insects of the Canadian prairies by:
 - a. Collecting and identifying immature and mature insects required to complete the guide and obtaining the necessary photographs.
 - b. Conducting a literature review of the forest insects of the region for sections not yet written.
 - c. Prepare most of the remaining text and figures for the guide. (Ives, Wong)
 - d. Rearing insects collected in 1985 and 1986 for positive identification. (Ives, Wong)
 - e. Submit majority of write-ups for review. (Ives, Wong)
 - f. Begin preparing camera-ready plates for pictorial guide during winter of 1986-87. (Ives, Wong)

12. Publications 1985-86:

Wong, H.R.; Drouin, J.A.; Rentz, C.L. 1986. Petrova albicapitana (Busck) and Petrova metallica (Busck) (Lepidoptera: Tortricidae) in Pinus contorta stands of Alberta. Can. Ent.117:1463-1470.

Drouin, J.A.; Wong, H.R. 1985. Life history and distribution of Petrova metallica (Lepidoptera: Tortricidae) in Alberta. (Abst.) Proc. Ent. Soc. Alberta 32:8.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Wong 0.7
 Ives 0.5

Tech.: 0.0

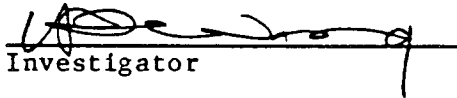
Total: 1.2

Term/Student: 1.3


O & M: \$3,000

Capital:

15. Signatures:


Investigator


Investigator


Program Director, Protection


Regional Director General



- c. Reassess dwarf mistletoe impact plots in Saskatchewan and establish additional plots if required.
 - 4. Continue to investigate the use of remote sensing techniques as a tool to assess pest damage in cooperation with project NOR-4 and FIDS project at Petawawa.
 - 5. Continue to develop effective working relationships with officials of provincial and industrial forest resource management agencies.
10. Accomplishments in 1985-86:
- 1. Tree condition was re-assessed for the fifth year on 37 impact plots for damage caused by the mountain pine beetle in pine stands in the national parks (Yoho (6), Kootenay (6), Waterton (25)). The outbreak has collapsed in many stands and a report is in progress.
 - 2. Work on the first draft of a literature review of the effects of major forest pests on tree mortality and growth in the forests of the region has been slow, and the draft should be completed in 1986.
 - 3. a. Defoliation and tree mortality caused by the spruce budworm were assessed on 13 impact plots located in white spruce/balsam fir stands on Hecla Island and in the Whiteshell provincial forest, Manitoba. The budworm outbreak is declining and a report is being prepared.
 - b. Assessed for the third year damage caused by the jack pine budworm in 10 permanent plots near Grand Rapids, Manitoba. The data are being analyzed. This is in collaboration with the Forestry Branch, MDNR.
 - c. Reassessed five dwarf mistletoe impact plots in the Nisbet Provincial Forest, Saskatchewan.
 - 4. Continued to give support to work on the use of remote sensing for pest damage surveys being conducted at PNFI, Petawawa and at the Canada Centre for Remote Sensing.
 - 5. Participated in several meetings with regional forestry personnel to discuss enhancement of pest depletion loss figures and damage assessment.

Added Accomplishments:

- 6. Two computer programs: 1) A MPB Hazard Rating System; 2) FIDS damage surveys; developed in the U.S. have been adapted and modified to meet local climatic, environmental, and pest conditions.
- 7. Prepared report on jack pine budworm outbreak history, impact, and damage, and FIDS sampling and predictive methods for Manitoba proceedings on jack pine budworm, Jan. 14, 1986.

8. Most of the data on the spruce budworm damage assessment during the 1955-69 Namew Lake, Manitoba outbreak have been received, sorted, and are being analyzed.

11. Goals for 1986-87:

1. Remeasure 37 impact plots and assess damage by the mountain pine beetle in the national parks and write report. Collect data on seed viability and availability. Establish additional plots if required. (Moody)
2. Complete draft of a literature review and submit for review on the effects of major forest pests on tree mortality and growth in the forests of the region (Inf. Rep.). (Moody)
3. a. Remeasure 13 spruce budworm impact plots in Manitoba, assess data, and write report. (Moody)
 - b. Assess for the fourth year damage caused by the jack pine budworm in 10 permanent plots in Manitoba and complete report. (Moody,)
 - c. Reassess dwarf mistletoe impact plots in Saskatchewan and establish additional plots if required and prepare a Forest Management Note. (Moody)
4. Provide functional guidance and supervision on studies initiated under the Federal-Provincial Forest Resources Development Agreements in the Western and Northern Region and provide input for the FIDS annual report, as required. (Volney, Moody)
5. Continue to investigate the use of remote sensing techniques as a tool to assess pest-caused damage to the forests; in cooperation with project NOR-4 and FIDS project at Petawawa. (Moody)
6. Continue to develop effective working relationships with officials of provincial and industrial forest resource management agencies. (Volney, Moody)
7. Participate in studies to provide a quantitative description of the relationship between major insect pest populations and stand volume losses. (Volney)
8. Participate in studies which will permit the design of a pest management system for the jack pine budworm. (Volney)

12. Publications 1985-86:

Unpublished Reports:

- Moody, B.H. 1984. Computer and statistical analysis of the mountain pine beetle damage data from the Rocky Mountain National Parks. File Rep.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Volney 0.5
Moody 0.5

Tech.: Szlabey 1.0


Total: 1.8

Term/Student: 0.3

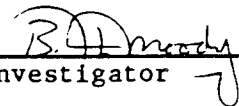
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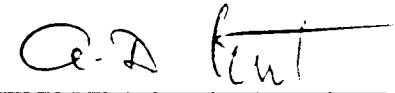
Capital:

15. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

- b. The following publications will be prepared:
 - Western gall rust (Information Report)
 - Histopathology of western gall rust (journal paper)
 - Resistant reactions of two Asian hard pines to western gall rust (journal paper)
 - Inhibition of spore germination of Endocronartium harknessii by four fungicides (journal paper)
 - c. Attempt to establish genetically identical young plants of lodgepole and jack pines by: tissue culture plantlets, rooted hypocotyl, or excised embryo methods to test existence of western gall rust races.
 - d. Tissue culture of lodgepole and jack pines will be established for the study of host-parasite interactions.
 - e. Axenic cultures of western gall rust will be established for future studies.
2. Examine pine stem rust samples collected during the professional development leave (1983-84). Two journal papers will be prepared on morphology and cytology of Asian pine stem rusts.
 3. Complete an Information Report entitled "Impact of pine stem rusts of hard pines in Alberta and the Northwest Territories--10 year plot study" with Drs. Powell and van Sickle.
10. Accomplishments for 1985-86:
1. Western gall rust study in conjunction with the genetic improvement program of lodgepole and jack pine. This work is partly supported by the fund made available by the Alberta Forest Service (Forest Research Branch) through the University of Alberta.
 - a. A total of 320 graftlings from scions obtained from 80 trees in 4 Alberta locations (Hinton, Jasper, Grand Prairie, Nojack) were planted in the field at NoFC for future investigation. Half (40) of the original trees were field resistant (no gall), and the other half were susceptible (multiple galls). They will be used for future investigations.
 - b. Publications listed in 9-1.b. are in different stages of preparation.
 - c. Excised embryo method to propagate genetically identical lodgepole pine plantlets was tried successfully.
 - d. Several tissue cultures originated from young lodgepole pine seedling tissues were started.

- e. First round of attempts to obtain axenic cultures of western gall rust failed.
 2. Pine stem rust samples collected during the professional development leave (1983-84) were examined. A journal paper on the cytology of an autoecious species (Peridermium yamabense) was prepared and accepted in Mycologia. A paper on morphology of several Asian pine stem rusts requires more information to be completed.
 3. An Information Report entitled "Impact of pine stem rusts of hard pines in Alberta and the Northwest Territories--10 year plot study" with Drs. Powell and van Sickle is in an advanced stage of preparation.
11. Goals for 1986-87:
- A. Western gall rust study
 1. Continue investigation of early infection symptoms in relation to resistant symptoms and gall formation with lodgepole and jack pines.
 2. Complete an Information Report on western gall rust for publication.
 3. Continue to improve methods to vegetatively propagate lodgepole and other hard pines.
 4. Continue to explore sure and easy techniques to establish and maintain tissue cultures of lodgepole and jack pines.
 5. More attempts will be made to establish axenic cultures of western gall rust and other pine stem rusts.
 - B. Taxonomy and biology of forest tree rusts
 6. Publish an Information Report entitled "Impact of pine stem rusts of hard pines in Alberta and the Northwest Territories - 10 year plot study" with Drs. Powell and van Sickle.
 7. Examine and identify a pine stem rust from Mexico.
 8. A short term (2 weeks) field trip to the People's Republic of China to collect and examine pine stem rusts will be planned if outside financial assistance (NSERC) is available.
 9. Start organizing IUFRO "Rusts of Hard Pines" Working Party meeting to be held in Alberta in 1989 as the chairman of the organizing committee.

12. Publications 1985-86:

Allen, E. 1985. Infection of young seedlings of lodgepole pine by Endocronartium harknessii. (M.Sc. Thesis, University of Alberta, supervised by Y. Hiratsuka).

Allen, E.; Hiratsuka, Y. 1985. Infection of young lodgepole pine seedlings with Endocronartium harknessii. (Abst.) Am. Phytopath. Soc. Ann. Meet., Aug. 1985, Reno, Nevada. Phytopathology 75:1279.

Hiratsuka, Y. 1985. Cytology of an autoecious soft pine blister rust (Peridermium yamahense) in Japan. (Abst.) Am. Phytopath. Soc. Ann. Meet., Aug. 1985, Reno, Nevada. Phytopathology 75:1279.

Hiratsuka, Y. Cytology of an autoecious soft pine blister rust (Peridermium yamabense) in Japan. Mycologia (In press).

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

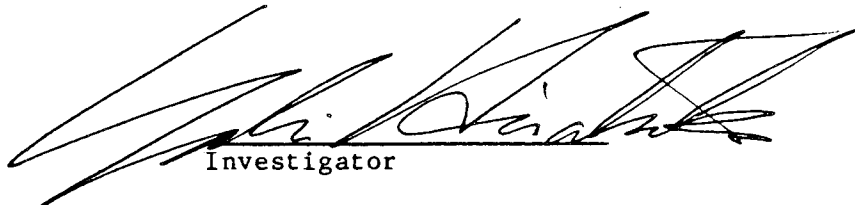
14. Resources 1986-87:

PYs: Prof.:	Hiratsuka	0.7
Tech.:	Maruyama	0.7
Total:		1.4
Term/Student:		0.3

O & M: \$5,000

Capital:

15. Signatures:


Investigator


Program Director, Protection


Regional Director General

investigate water relationships of mountain pine beetle-attacked trees with possible cooperations of Drs. Swanson, Addison, and Dymock (NoFC) as well as Drs. Ayer and Higginbotham (U of A).

10. Accomplishments for 1985-86:

1. Significant progress has been made to produce the first draft of the book. Several sample pages and plates have been reviewed by the outside agencies and specialists for making the final decisions on format and contents.
2. Armillaria root rot study
 - a. Sporophores (mushrooms) were produced abundantly in the field in 1985, and as a result, we were able to compare their morphology and evaluate the taxonomy of forms found in Alberta and other provinces in western Canada. The main type of mushrooms associated with mortality of young conifers was confirmed as Armillaria ostoyae (Romagn) Herink (= Armillaria obscura (Pers.) Herink). This species probably corresponds to two of the "biological species" (I and "foothill type") recognized in Alberta. Another common type of mushroom mainly associated with broadleaf trees seems to match with the description of A. borealis Marxmuller et Korhonen. At least one and probably two more morphologically distinct groups of mushrooms, possibly representing separate taxonomic species, were also collected.
 - b. During 1985 season, about 150 diploid and more than 100 haploid cultures were obtained from Alberta, Saskatchewan, and Manitoba for cultural, pathological and genetic studies to further delineate biological and taxonomic species that exist in the prairie provinces.
 - c. A journal paper on a new detection technique (trap log method) is in press (Can. J. For. Res.) and another journal paper on the nature of black line between different biological species has been submitted (Can. J. Bot.).
 - d. Following papers on Armillaria root rot were presented at scientific meetings:
 - Mallett, K.I.; Hiratsuka, Y. 1985. Pathogenicity of Alberta isolates of the Armillaria mellea complex. Am. Phytopath. Soc., Reno, Nevada.
 - Suzuki, K.; Mallett, K.I.; Hiratsuka, Y. 1985. Changes in water potential components in lodgepole pine seedlings inoculated with Armillaria mellea. Am. Phytopath. Soc., Reno, Nevada.
 - Hiratsuka, Y.; Mallett, K.I.; Maruyama, P.J.; Hwang, S.F.; Mugala, M. 1985. Taxonomy and nomenclature of Armillaria mellea complex in Alberta. Pl. Path. Soc. Alta., Lethbridge, Alta.

3. Microbiological and pathological investigation of trees attacked by mountain pine beetle.

- a. To monitor physiological changes in trees after beetle attack, heat-pulse velocity equipment (Dr. R. Swanson) and Scholander pressure bomb (for pressure-volume curves) (Dr. K. Suzuki) were used. Eight unattacked trees (four trees in each of two locations) were selected. Two trees in each location were baited with a commercially prepared mountain pine beetle pheromone lure (Phero-Tech, Vancouver) supplied by Dr. H. Cerezke of the Canadian Forestry Service. One tree in each location was caged up to 2.5 m to prevent beetle attack, and one tree in each location was untreated. Three sets of probes were implanted in each tree, and xylem sap flow was monitored from July 16 to September 27. Branch samples were collected four times (July 16, August 1, September 4, and October 3) and pressure-volume curves were obtained.

No attack occurred on four trees in one location, but two pheromone-baited trees in another location were selectively attacked (about 200 and 60 attacks, respectively) around July 31 to August 2.

Results of the heat-pulse velocity readings and pressure-volume curves indicated that definite physiological changes occurred within 2 to 3 weeks after beetle attack. This period corresponds to the beginning of visible blue stain symptoms in the water-conducting sapwood of the attacked trees.

The results were presented at the Phytopathological Society of Alberta meeting. Suzuki, K.; Swanson, R.H.; Maruyama, P.J.; Hiratsuka, Y. 1985. Pathophysiological investigations of trees attacked by mountain pine beetle.

- b. Metabolites isolated from blue stain fungi and other fungi were bioassayed to detect possible pathotoxin(s) involved in the mortality of trees attacked by mountain pine beetle.

11. Goals for 1986-87:

1. Publication of an illustrated book of the tree diseases of the prairie provinces.
- a. Final decisions on the format, selection of diseases, photographic processes etc. will be decided.
- b. Rough draft of the book will be prepared by May 1986 for review.
- c. Final camera ready manuscript with color balanced plates will be produced by 1 December 1986 for the publication before the end of 1986-87 fiscal year.

2. Disease identification and taxonomic service.

- a. Provide diagnostic and identification service of tree and shrub diseases.
- b. Maintain and upgrade the Mycological Herbarium and a fungus culture collection.

3. *Armillaria* root rot investigation.

- a. Initiate a collaborative research on epidemiology and damage impact assessment with Dr. P. Blenis of the University of Alberta.
- b. Continue inoculation experiments to determine pathogenicity and host preference of main biological species identified in the region.
- c. Conduct extensive mating tests using haploid cultures obtained from the field and known haploid tester cultures sent by experts to determine biological species exist in the region.
- d. Conduct morphological examinations of sporophores (mushrooms), rhizomorphs, hyphae etc. to determine taxonomic species of *Armillaria mellea* complex exist in this region.
- e. Conduct cytological examinations of various diploid and haploid isolates to clarify nuclear cycle of the group.

4. Microbiological and pathological investigation of trees attacked by mountain pine beetle.

- a. Continue investigation of metabolites produced by main blue stain fungi for possible pathotoxin involvement (with Dr. W. Ayer, Dept. of Chemistry, University of Alberta).
- b. Continue monitoring physiological status of beetle attacked trees observed 1985 season during the spring of 1986 (2 attacked and 2 un-attacked trees). Heat pulse velocity measurements (with Dr. R. Swanson) and examination of microflora (associated with trees attacked by mountain pine beetle) will be conducted.

12. Publications 1985-86:

Mallet, K.I.; Hiratsuka, Y. 1985. Pathogenicity of Alberta isolates of the *Armillaria mellea* complex. Am. Phytopath. Soc. Ann. Meet., Reno, Nevada (Abst.). Phytopathology 75:1278.

Mallett, K.I.; Hiratsuka, Y. 1985. "Trap log" method to survey the distribution of *Armillaria mellea* in forest soils. Can. J. For. Res. (In press).

Suzuki, K.; Mallett, K.I.; Hiratsuka, Y. 1985. Changes in water potential components in lodgepole pine seedlings inoculated with Armillaria mellea. Am. Phytopath. Soc. Ann. Meet., Reno, Nevada (Abst.). Phytopathology 75:1339.

Tsuneda, A.; Mallock, D.; Hiratsuka, Y. 1985. Ascospore morphology and germination in Scopinella species. Trans. Mycol. Soc. Japan. 26:221-229.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the study proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

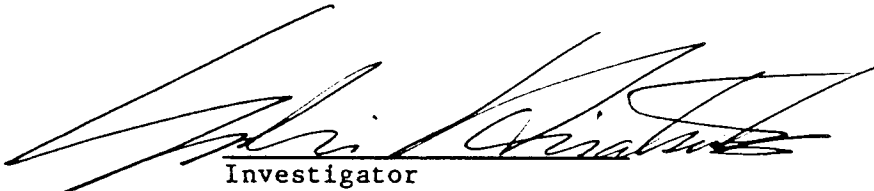
14. Resources 1985-86:

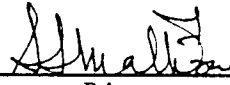
PYs: Prof.:	Hiratsuka	0.3
	Tech.:	Maruyama 0.3
	Total:	0.6
	Term/Student:	0.0

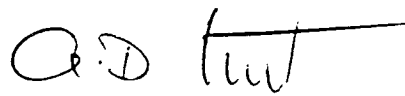
O & M: \$8,000

Capital:

15. Signatures:


Investigator


Program Director, Protection


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 7, 1986

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Effects of ice-nucleating agents on canker, dieback, and mortality of juvenile forest trees and amenity species
3. New: Cont.: X 4. No.: NOR-11-08
5. Study Leader: H. Zalasky
6. Key Words: Canker, dieback, mortality, juvenile trees, amenity species, ice nucleating agents, frost, frost damage, fungal succession, remedial measures, technical transfer
7. Location of Work: Northern Forestry Centre, Edmonton, intensively managed forest stands, provincial nurseries, and homeowners in our region
8. Study Objectives:
 1. To determine the effects of INA and microclimate on cold tolerance of seedlings and juvenile trees and use knowledge gained to develop more effective overwintering guidelines and to enhance field performance.
 2. Investigate the use of non INA agents or competition to control populations of INA on the phylloplane of trees and neutralize their mediation in frost.
 3. Assemble photos and photograph trees and parts of trees to illustrate the effects of frost damage and demonstrate how to diagnose symptoms even though they have been initiated in past years to aid in remedial measures of growth problems, undesirable multileading or stunting.
 4. To investigate red belt symptoms, winter browning, bark discoloration, and subsequent severe defoliation and changes in refoliation patterns.
9. Goals for 1985-86:
 1. Prepare and submit for review a draft of "Bacterial ice nucleating patterns, chemical, morphological, and INA changes".

2. Prepare and submit for review illustrative and text material for a frost damage diagnostic report.
 3. To initiate a manuscript on "the effects of INA bacteria, yeast, and fungi on conifer seedling mortality".
 4. To initiate a manuscript on "the effects of INA organic substances on conifer seedling mortality".
 5. Identify control factors for INA organisms.
 6. Determine bio-control measures for specific INA organisms.
 7. Advisory and consulting services on the health of trees and shrubs, identification, and professional service.
 8. Publish abstract and present poster session paper on "Bud defects in winter damaged Colorado spruce" at Olympia Washington International Forest Disease Work Conference and at Lethbridge, Alberta, Alberta Plant Pathology Work Conference.
10. Accomplishments for 1985-86:
1. "Bacterial ice nucleating patterns, chemical, morphological, and INA changes" with the author.
 2. "Diagnosis and recognition of winter damage in trees" typed and reviewed once.
 3. "The effects of INA bacteria, yeast, and fungi on conifer seedling mortality" was not initiated.
 4. "The effects of INA organic substances on conifer seedling mortality" was not initiated.
 5. Control factors for INA microorganisms were studied by a screening method of non-INA microorganisms and amino acids. Seventy-six non-INA microorganisms and 91 combinations of non-INA and INA microorganisms were tested on containerized lodgepole pine and white spruce seedlings stored for 9 wk at -1°C. In addition 7 non-INA amino acids and 189 combinations of non-INA amino acids (1% solution, 1/10 dil, and 1/100 dil) and INA microorganisms were tested on stored seedlings. The non-INA control factors identified were species and strains of microorganisms and three types of amino acids.
 6. Non-INA strains of Corynebacterium flaccumfasciens controlled 5 out of 6 INA bacteria, fungi, and yeast. C. flaccumfasciens had 21 Non-INA strains rated 1:3 as very good to good in the control of INA storage microorganisms: Corynebacterium poinsettiae, Fusarium oxysporum var. redolans, Fusarium solani, Hansenula mrackii, and Pichia fermentans. Pediococcus bacteria and 1/100 dil of tyrosine were highly specific for the control of INA Botrytis cinerea. The ratio of Non-INA to INA activity in strains of Corynebacterium flaccumfasciens, C. poinsettiae and Hansenula mrackii was 1:1 and usually dropped to 1:3 when paired with INA storage microorganisms. Pairing strains of

Non-INA C. flaccumfasciens with storage Botrytis cinerea resulted in 100% INA.

7. Processed 24 homeowner calls, 21 nursery calls, 26 technological calls affecting various government and industrial agencies outside and within the region, and 8 scientific consultations, and reviewed 5 scientific papers.

11. Goals for 1986-87:

1. Complete review processes for diagnosis and recognition of winter damage in trees.
2. Attempt to document results of experiments in 5 and 6. File Report.
3. Terminate study.

12. Publications 1985-86:

Zalasky, H. Bud defects in winter damaged Colorado spruce. Proceedings of the thirty-third annual International Forest Disease Work Conference, Olympia, Washington, September 24-27, 1985. p. 110.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Zalasky	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

O & M:

Capital:

15. Signatures:

Investigator



Program Director, Protection



Regional Director General

NOR-12

NURSERY MANAGEMENT AND TREE IMPROVEMENT

4. Performs the duties of a seed analyst for certification of forest reproductive material moving in international trade.
9. Goals for 1985-86:
1. Seedling physiological research. (12-49, 12-51, 12-60)
 - a. Produce 1985 stock in sufficient numbers for all study requirements under NOR-12-01.
 - b. Complete weekly and bi-weekly cold hardiness tests on 1984 bS, lP, wS, and rP.
 - c. Complete weekly and bi-weekly dormancy tests on 1984 bS, lP, wS, and rP.
 - d. Incorporate 1984-85 data on cold hardiness and dormancy testing of overwintering 1984 bS and lP with 1983-84 data. Complete data entry and analysis. Prepare draft journal report (Can. J. Forest Res.) on cold hardiness and dormancy testing of overwintering bS and lP for manuscript review. Prepare a poster session research paper on "Overwintering physiology of bS and lP in a cold temperate climate" for presentation at the joint meeting of the Canadian and American Societies of Plant Physiology, June 23-27, 1985 at Brown University, Providence, Rhode Island, U.S.A. Initiate further supplementary cold hardiness and dormancy testing of 1985 bS and lP, including cooperative DTA/cold hardiness testing by Steve Wallner (Colorado State University) on NOR-12-192 samples.
 - e. Evaluate 1984-85 data on cold hardiness and dormancy testing of 1984 wS and rP. Initiate supplementary cold hardiness (including DTA) and dormancy testing of 1985 wS and rP.
 - f. Initiate complete cold hardiness (including DTA) and dormancy testing of 1985 jP and collect, preserve and store replicates of jP material for analysis of selected endogenous cellular metabolites during 1986-87.
 - g. Continue methods/bioassays development for studying the role of endogenous cellular metabolites of interest in tree seedling physiology.
 - h. Continue biochemical analysis of selected endogenous cellular metabolites of stored 1983 bS and lP seedlings proposed to have roles in regulating cold hardiness, dormancy, and overwintering capabilities. Initiate similar analyses of stored 1984 wS and rP seedlings.
 2. Cone and seed physiological research. (12-62, 12-66)
 - a. Promotion of early flowering in conifers.
 - Complete data analysis of growth parameters of 1984 study of the effects of photoperiod, light types, and growth regulator

applications on lP. Prepare/present an oral research paper at the Western Regional Meeting of the Canadian Society of Plant Physiologists February 17-18, 1985 at the University of Calgary on "Influence of extended photoperiod and different light regimes on early growth of Lodgepole Pine". Assess overwintering survival and subsequent growth of outplanted lP during 1985. Prepare and present a poster session research paper on "The influence of growth regulators, photoperiod and supplemental light on growth and survival of Lodgepole pine" at the 12th International Conference on Plant Growth Substances at Heidelberg, West Germany, August 26-31, 1985. Prepare a draft manuscript for review (Can. J. Forest Res.) on the same topic.

- Continue study on the influence of photoperiod, light types, and growth regulator applications on accelerating growth and promoting early flowering of wS. Initiate bi-weekly growth regular applications January 25, 1985 and bi-weekly measurements of growth parameters February 1, 1985. Initiate hardening off of material for outplanting June 1, 1985. Destructively sample representative trees from each treatment. Outplant 12 trees per treatment in the NoFC nursery starting July 12, 1985. Evaluate growth parameter data on accelerated wS.
 - Initiate third part of study on the promotion of early flowering in conifers using bS or jP in November 1985.
- b. Ecophysiology of seed maturation in lodgepole pine in Alberta Foothills (Cooperative study with Dr. A.K. Hellum., Dept. of Forest Science, University of Alberta).
- Complete tree aging and growth analysis (IDJ). Complete germination testing +/- stratification and after-ripening tests. Complete analysis of X-rayed seed/tree/site. Complete seed weight analyses and germination/moisture content tests (AKH).
 - Contribute to the preparation of a paper on results of 1984 collection and analyses for presentation by AKH at a symposium on: Conifer Tree Seed in the Inland Mountain West, August 5-9, 1985, Missoula, Montana, U.S.A. Paper to be co-authored by AKH and IJD. Topic of presentation will be related to the effect of seed maturity requirements for cold stratification in lodgepole pine in the Alberta Foothills.
 - Continue study for a second field season, subject to the availability of funds for AKH through: PRUF, AFDRTF, AERTF, CFS/U. of A. block grant, or provincial or federal employment programs (i.e. STEP, PEP, Alberta Environmental Employment Program; Environment 2000 or its equivalent, etc.). CFS participation for 1985 is restricted to scientific/technical advisory roles for Dymock/Dendwick respectively. CFS will make available those facilities utilized during 1984 for personnel working as assistants to Hellum (U. of A.). Instruction in the use of laboratory facilities, and in field work requirements will be provided on request.

3. Provide consultative services to NoFRC staff and CFS regional clients concerning tree physiology and cone and seed production. (12-57)
 4. Perform seed analyst duties as may be required. (12-52)
 5. Perform duties as supervisor of research support staff (Dymock).
 - Complete writing of PAS for Tree Physiology Research Technician for classification review.
 - Perform duties as supervisor of one technical support person.
 - Perform duties as supervisor of four Environment 2000 lab assistants to March 29, 1985.
 - Perform duties as supervisor of COSEP (or its equivalent) summer students from May to September 1985.
10. Accomplishments for 1985-86:
1. Seedling physiological research. (NOR-12-01, Dymock)
 - a. Production of 1985 seedling research material for NOR-12-01.
 - Produced 450 trays (31,500 seedling) of jP and 81 trays (5,670 seedlings) each of lP, bS, wS and lP, in Spencer-Lemaire (Five) containers for 1985-86 overwintering studies.
 - Produced 720 jP seedlings in 5.4 litre square pots for accelerated growth/promotion of flowering studies in native conifer species.
 - Produced 105 seedlings each of wS, lP and jP in 1.0 gallon round pots for assessing hormone toxicity in support of accelerated growth/promotion of flowering studies.
 - b. 1984-85 cold hardiness testing of bS, lP, wS and rP.
 - Completed weekly freezing tolerance/oscilloscope-SWD/survival testing of 1984 wS and rP at +20°C, -5°C, -10°C, and -15°C for durations of 6.0, 24.0 and 168.0 hours on 85.05.09.
 - Completed bi-weekly freezing tolerance/conductivity/survival testing of 1984 lP, bS, wS and rP at +20°C, -5°C, -10°C and -15°C for 24.0 hours duration on 85.05.09.
 - c. 1984-85 dormancy testing of bS, lP, wS, and rP.
 - Completed weekly oscilloscope-SWD testing, root growth capacity testing, time to bud break testing, and collection and preservation of bud and root tip samples for mitotic index determinations on 1984 lP, bS, wS and rP seedlings on 85.05.09.
 - d. Evaluation of 1984-85 lP and bS data, report preparation, and further research.

- collated and key-punched data into VAX computer files. Summarizing and analysis of data completed.
 - Prepared a poster session report titled "Overwintering physiology of black spruce and lodgepole pine in a cold temperate climate" based on 1983-85 LP and BS data, co-authored by I.J. Dymock and F.M. Dendwick. Report presented by IJD at the quadrennial joint annual meeting of the Canadian and American Societies of Plant Physiologists, June 23-27, 1985, Brown University, Providence, Rhode Islands, USA.
 - All relevant 1982-85 data on LP and BS organized into tables and figures for manuscript preparation. No further progress on report preparation.
 - Initiated an additional (third) season of bi-weekly cold hardiness and dormancy testing of LP and BS 85.08.12. Severe mortality of 1984 LP and BS during 1984-85 necessitated initiation of an additional year of testing. No collaborative DTA/cold hardiness testing of 1985 LP and BS samples (with Steve Wallner, Colorado State University) was initiated due to delayed bud set and scheduling difficulties.
- e. Evaluation of 1984-85 wS and rP data.
- Collated and key-punched data into VAX computer files. Summarizing and analysis of first year results completed. Figures and tables of 1984-85 wS and rP results prepared.
 - Initiated second year of bi-weekly cold hardiness and dormancy testing of 1985 wS and rP 85.08.12. No collaborative DTA/cold hardiness testing of 1985 wS and rP samples (with Steve Wallner, Colorado State University) was initiated due to delayed bud set and scheduling difficulties.
- f. 1985-86 cold hardiness and dormancy testing of jP.
- Initiated weekly freezing tolerance/oscilloscope-SWD/survival testing of 1985 jP at +5°C, -5°C, -10°C and -15°C for durations of 6.0, 24.0, and 168.0 hours on 85.08.12.
 - Initiated bi-weekly freezing tolerance/conductivity/survival testing of 1985 jP at +5°C, -5°C, -10°C, and -15°C for 24.0 hours duration.
 - Initiated weekly dormancy testing of 1985 jP using oscilloscope/SWD testing, root growth capacity testing, time to bud break testing, and collection and preservation of bud and root tip samples for mitotic index determinations.
 - Initiated weekly assessment of growth and winter damage of 1985 jP seedlings, and weekly collection and storage of replicate samples of jP shoots and roots for biochemical analyses of selected endogenous cellular metabolites of interest in overwintering.

- g. Methods/bioassays development.
- Continued evaluating methods for analysing abscissic acid, phenols, flavonoids, and auxins that are compatible with NoFC HPLC and GLC equipment.
- h. Role of selected endogenous cellular metabolites in cold hardening, dormancy and overwintering capabilities of conifer seedlings.
- Freezing and lyophilizing of lP, bS, wS, and rP samples completed. Dry matter estimates completed as well as water content of shoots and roots. Grinding of samples and sub-sampling initiated. Purchased two new rotary evaporators for extractions. Pigment and phenolic analyses will continue with delivery of rotary evaporators. Freezing and lyophilizing of 1985 jP seedlings and additional replicates of 1985 lP, bS, wS and rP continues. Analyses will continue as time permits.
2. Cone and seed physiological research. (12-62)
- a. Promotion of early flowering in conifers.
- Continued study on lP. Completed entry and analyses of 1984 lP data. Prepared and presented a report, co-authored with F.M. Dendwick, titled "Influence of extended photoperiod and different light regimes on early growth of lodgepole pine", at the Western Region Meeting of the Canadian Society of Plant Physiologists. February 17-18, 1985 at the University of Calgary. Monitored survival winter damage and growth of 300 outplanted accelerated growth lP in NoFC nursery. Prepared and presented a poster session report, co-authored with F.M. Dendwick, B.A. Thomson and J.L. Macen, titled "Influence of growth regulators, supplemental lights, and photoperiod on early growth of lodgepole pine". The report was presented by IJD at the 12th International Conference on Plant Growth Substances, August 25-30, 1985 in Heidelberg, West Germany. Collated, key-punched and began analysis of 1985 outplanted lP data. Prepared tables and figures on analysed data for manuscript preparation. Final data analysis and manuscript preparation continues.
 - Continued study on wS. Initiated bi-weekly growth regulator treatments 85.01.25, and bi-weekly growth measurements 85.02.01. Initiating hardening off of wS 85.06.01. Outplanted 390 wS trees in NoFC nursery 85.07.10. Sacrificed all remaining trees for analysis of dry matter distribution. Measured monthly growth of 390 outplanted wS until 85.10.01. Began data collation and key-punch entry into VAX computer files.
 - Initiated and completed study on optimum application rates and toxicity levels of hormones for use with accelerated growth lP, wS, and jP under sodium lamps with an 18 hour day length. Results to be incorporated in each respective manuscript.

- Initiated study on jP. Seeded 36 trays of Spencer-Lemaire (Five) trays with jP on 85.11.07. Transplanted 720 fastest growing jP seedlings to 5.4 litre square pots 85.12.19, and transferred to light and photoperiod treatments. Bi-weekly growth regulator applications and growth measurements will commence 86.01.30.
- b. Ecophysiology of seed maturation in lodgepole pine (Cooperative study with Dr. A.K. Hellum, Forest Science Dept., University of Alberta).
- Completed all laboratory work on 1984 1P cones/seed (with AKH).
 - Prepared a symposium paper with AKH titled "Cold stratification requirements of lodgepole pine seed". AKH presented the paper at the Symposium on Conifer Tree Seed in the Inland Mountain West, August 5-7, 1985 in Missoula, Montana, U.S.A. Manuscript to be published in the proceedings.
 - Acted as scientific/technical advisors (IJD/FMD) for second field season of study in Grande Prairie area.
3. Consultative services. (NOR-12-01, Dymock)
- a. Provided consultative services to CFS, CWS, and EPS personnel at NoFC as requested on matters related to plant/tree physiology, cone and seed production, use and purchase of analytical equipment, and methods development for their respective needs.
 - b. Provided similar consultative services to AFS Research Branch staff, University of Alberta and University of Calgary researchers in the departments of Botany, Plant Science, Forest Science and Biology.
 - c. Presented a two-hour lecture on "Stock conditioning relative to planting" in Forest Science 517-Advanced Silviculture for Dr. A.K. Hellum, Univ. of Alberta Forest Science Dept., and participated as seminar leader for a discussion of the same topic, March 19 and 21, 1985 respectively.
 - d. Acted as NOR-12 coordinator for the May 1985 Open House at NoFC. With Dendwick, I prepared a display on accelerated growth in conifers, showing results obtained to-date with 1P and wS. I was subsequently interviewed by CBC Evening News (Edmonton) and a feature story on my work on accelerated growth and its uses for forestry was broadcast on 85.09.20 at 1800 hours.
 - e. Acted as a member of the NoFC Safety and Energy Committee during 1985.
 - f. Provided consultative services as a scientific reviewer and review board chairperson for manuscript reviews, AFDRTF and PRUF proposals, and one NSERC strategic grant proposal.

- g. Assisted in the development and writing of two PRUF proposals from two university researchers (Dr. R.P. Pharis, Biology Dept., Univ. of Calgary; Dr. A.K. Hellum, Forest Science Dept., Univ. of Alberta). The RRP/U of C proposal was funded through PNFI for 1985-86.
 - h. Advised and assisted Ms. B.A. Thomson in the preparation and submission of a Job Development proposal for a Forest Biotechnology Training Project to operate at NoFC. Approval is pending review by CEIC and NoFC administration.
4. Seed analyst duties (NOR-12-01, Dymock).
- No requests were received for seed analysis in 1985. I have been appointed acting seed inspector in the absence of Harvey (maternity leave as of 85.10.01). No activities have been carried out under either aspect of this goal in 1985.
5. Supervisor of research support staff (NOR-12-01, Dymock)
- Performed duties of supervisor of one technical support staff member (Dendwick, F.M., EG-ESS-06) for the year (1.0 PY). Re-writing of PAS for Tree Physiology Research Technician will continue when revised EG-ESS standards for Agriculture Canada/CFS are issued. No progress to-date.
 - Performed duties as supervisor of one COSEP staff (B. Thomson) and one contract staff member (J. Macen) during the summer of 1984 (0.66 PY).
 - Performed duties as a supervisor of four Environment 2000 laboratory/greenhouse assistants (C. Robertson, A. Nigam, R. Nigam and C. Moore) from 85.01.01 to 85.03.29 (1.0 PY).

Added Goal:

- 6. Coordinator of growth chamber/growth room use at NoFC (NOR-12-01, Dymock).
 - a. Recommended for the appointment this position with the transfer of Dr. Paul Addison to CFS Headquarters in Ottawa in September 1985. Accepted. Handled two requests for growth chamber space.
11. Goals for 1986-87:
- 1. Seedling physiological research (12-49, 12-51, 12-60)
 - a. Produce 1986 stock in sufficient numbers for all study requirements under NOR-12-01.
 - b. Complete weekly (jP) and bi-weekly (lP, bS, wS, rP) cold hardiness testing of 1985 container stock. Compile and analyse data.

- c. Complete weekly (jP) and bi-weekly (lP, bS, wS, rP) dormancy testing of 1985 container stock. Compile and analyse data.
 - d. Complete analysis, summary and organization of 1983-86 data on cold hardiness and dormancy testing of overwintered bS and lP. Prepare manuscripts for review as an information report and/or journal submissions.
 - e. Compile and complete analysis of 1984-86 data on cold hardiness and dormancy testing of overwinterized wS and rP. Prepare poster report for 1986 CSPP annual meeting in Saskatoon, Sask. Initiate third and final year of weekly cold hardiness and dormancy testing of wS and rP.
 - f. Compile and complete analysis of 1985-86 data on cold hardiness and dormancy testing of overwintered jP. Initiate second year of bi-weekly cold hardiness and dormancy testing of jP.
 - g. Complete methods development for studying the role of endogenous cellular metabolites of interest. Review and test radioimmunoassays and enzyme-linked hormone specific assays for plant hormones.
 - h. Continue study of role of selected endogenous cellular metabolites on overwintering physiology of conifer seedlings. Complete biochemical analysis of lP and bS samples. Prepare manuscript(s) on lP and bS for review. Continue biochemical analysis of wS and rP. Initiate analysis of jP samples.
2. Cone and seed physiological research. (12-62)
- a. Promotion of early flowering in conifers.
 - Continue study on lP. Complete manuscript on first year lP results and submit for interval review. Publish. Monitor second year of growth, flowering, cone and seed production of 300 accelerated growth lP outplanted in the NoFC nursery in 1984.
 - Continue study on wS. Monitor survival and first year of growth, flowering, cone and seed production of 390 accelerated growth wS outplanted in the NoFC nursery in 1985. Prepare manuscript on first year wS results for review.
 - Continue study on jP. Initiate growth regulator treatments on 86.01.30. Initiate hardening fertilizer treatments 86.06.12 and move outdoors to shade-frames. Outplant 390 accelerated growth jP in NoFC nursery 86.07.07. Sacrifice all remaining trees for assessment of dry matter distribution. Initiate monthly growth assessment of outplanted jP on 86.07.23.

- Initiate study on bS. Seed 36 trays of Spencer-Lemaire (Five) trays with bS on 86.09.25. Transplant 720 fastest growers to 5.4 litre square pots 86.11.06. Initiate light and photoperiod treatments 86.11.07. Initiate growth regulator applications and growth measurements 86.12.19.
- b. Ecophysiology of seed maturation in lodgepole pine.
- Review progress to date on study. Evaluate data with Dr. A.K. Hellum. Establish any further publication goals and need for further cooperation.
 - Continue acting as scientific/technical advisers only (Dymock/Dendwick) if further field work required.
3. Provide consultative services to NoFC staff and CFS regional clients concerning tree physiology and cone and seed production. (12-57)
 4. Perform duties as seed analyst as may be required. Perform duties as acting/OECD seed inspector (for Harvey) to 86.03.31. (12-52)
 5. Perform duties as coordinator of growth chamber/growth room facilities at NoFC.
 6. Perform duties as supervisor of research support staff. (Dymock)
 - Complete writing of PAS for Tree Physiology Research Technician when revised Agriculture Canada/Forestry EG-ESS standards become available.
 - Perform duties as supervisor of one technical support person. (Dendwick, F.M., EG-ESS-06)
 - Perform duties as supervisor of 1-3 COSEP (or its equivalent) summer students from May to September, 1985.
 - Perform duties as NoFC coordinator/supervisor of job development project - Forest Biotechnology Training Program with project sponsor, Dr. John Hoddinott, Botany Dept., U. of A. and project manager Ms. B.A Thomson for up to 22 weeks (subject to approval/funding through C.E.I.C.).

12. Publications 1985-86:

Dymock, I.J. and F.M. Dendwick. 1985. Overwintering physiology of lodgepole pine and black spruce in a cold temperate climate. Plant Physiology (Supplement) 77(4):99. Published abstract only.

Hellum, A.K. and I.J. Dymock. 1985. Cold stratification for lodgepole pine seed. In: Proceedings of the Symposium on Conifer Tree Seed in the Inland Mountain West. August 5-7, 1985. Missoula, Montana, U.S.A. 7 pp. In press.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

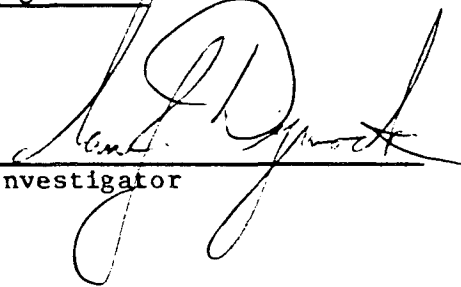
14. Resources 1986-87:

PYs: Prof.: Dymock 1.0
 Tech.: Dendwick 1.0
 Total: 2.0
 Term/Student: (Job Creation if approved)

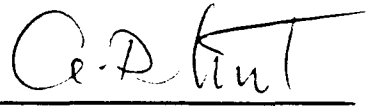
O & M: \$11,000

- Capital:
1. Shelving/cupboards up-grading in MI32 (capital replacement) \$4600
 2. Freeze dryer system - capital replacement \$38,000.00
 3. ELISA photometer/microplate reader (new-capital) - \$10,000.00 to \$32,100.00
 4. Liquid scintillation counter (spectrometer) system (capital replacement) - \$33,000 to \$55,000

15. Signatures


 Investigator


 Program Director, Resources


 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 15, 1986

1. Project: Nursery Management and Tree Improvement
2. Title: Provenance tests for coniferous species
 - Experiment a. (Formerly MS187) Provenance experiments with the white spruce of Manitoba and Saskatchewan.
 - Experiment b. (Formerly MS089) Red Pine (Pinus resinosa) provenance experiment.
 - Experiment c. (Formerly MS088) Scots pine (Pinus sylvestris) provenance experiment.
 - Experiment d. (Formerly MS234) A test of twelve Norway spruce provenances from northern Europe and Siberia -- Riding Mountain Research Area.
 - Experiment e. (Formerly MS019) All-range jack pine provenance experiment, Manitoba-Saskatchewan sub-experiment.
 - Experiment f. (new) Geographic variation in black spruce, Northern Region component.
3. New: Cont.: X 4. No.: NOR-12-02
5. Study Leader: J.I. Klein
6. Key Words: Geographic variation, seed sources, seed zones, Alberta, Manitoba, Saskatchewan, exotic species, Picea abies, Picea glauca, Picea mariana, Pinus banksiana, Pinus resinosa, Pinus sylvestris
7. Location of Work: Wasagaming, Vassar, Piney, Mafeking, Lonesand and Carberry, Manitoba; Holbein, Indian Head, and P.A. Pulp Camp 6, Saskatchewan; Reno, Alberta

8. Study Objectives:

1. To screen populations of conifer species for possible usefulness for planting in various areas within the Northern Region.
2. To obtain an indication of the probable usefulness of further provenance testing or similar research with the species under trial and to guide the planning of such research.
3. To obtain information on patterns of geographic variation in the species under trial.
4. To identify adapted genotypes among the introduced populations for further breeding uses.

9. Goals for 1985-86:

1. Review the status of all experiments in this study, and write an evaluative report recommending maintenance or discontinuance of each experiment. (12-37)
2. Complete measurement of the black spruce test plantations with assistance from incremental staffing under Federal/Provincial Forest Development Agreements. (12-10)

Goal added:

Summarize the 10-year measurement of the black spruce test and provide source means to the coordinator of the range-wide study. (12-10).

10. Accomplishments in 1985-86:

1. Review of the status of all experiments in this study, and writing of an evaluative report on each experiment, have not yet been done, owing to lack of sufficient time. (12-37)
2. The black spruce test plantations were measured under the leadership of the Tree Improvement Specialist in the Manitoba District Office. (12-10)
3. Black spruce source means at 10 years were provided to the coordinator of the range-wide study. (12-10).

11. Goals for 1986-87:

1. Review the status of all experiments in this study, and write an evaluative report recommending maintenance or discontinuance of each experiment. (12-37)

Red Pine:

1. Prepare a draft report on the 25-year results. (12-11).

Jack Pine:

1. Measure the plantation at Lonesand, Manitoba at 15 years. (12-29)

Black Spruce:

1. Carry out brush control and other required tending in the Alberta plantation. (12-10)

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof: Klein	0.1
Tech: Chapman	0.1
Total:	0.2
Term/Student:	0.0

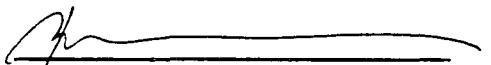
O & M: \$2,000

Capital:

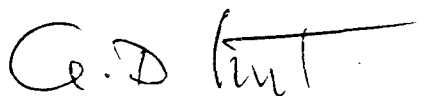
15. Signatures:



 Investigator



 Program Director, Resources



 Regional Director General

4. Develop tree improvement programs under the Saskatchewan and Alberta memorandums of understanding. (12-30)
 5. Harvest cones from the mass selection seed orchard at Birds Hill for a yield test. (12-15)
 6. Measure the central breeding district family test at 10 years from planting, with assistance from incremental staffing under the Manitoba and Saskatchewan Agreements. (12-19)
 7. Promote, coordinate, and enhance greater use of tree improvement technology in this region, and act as regional contact for the national tree improvement program. (12-6, 12-7)
 8. Plant 649 grafts and tend more than 3100 clone bank grafts to increase clone bank stocking to 2800 positions of 3185 required, and to maintain the inventory of grafts required for clone bank completion at close to 3100. (12-1)
 9. Publish the manuscript entitled "Development of a jack pine seed orchard by mass selection" in the Forestry Chronicle. (12-4)
 10. Conduct a workshop on tree improvement techniques under the Canada-Manitoba Forest Renewal Agreement. (12-1MA)
10. Accomplishments in 1985-86:
1. Functional guidance was provided for development of jack pine seed orchards under the Canada-Manitoba Forest Renewal Agreement. This guidance included a detailed Draft Plan for the seed orchard program plus correspondence and consultations.
 2. There was no time available to initiate writing of a Forest Management Note on the 10-year results of the western breeding district family test.
 3. The special report of maps and source lists for the breeding program has not been completed owing to lack of sufficient time. There was progress early in 1985 and completion is expected early in 1986.
 4. Tree improvement programs have not been developed under the Saskatchewan and Alberta memorandums of agreement, because no mandate or commitment of resources has been provided for this goal.
 5. Cones have been harvested from the mass selection seed orchard at Oakbank by Manitoba Forestry Branch staff. Seed acquisition for a CFS gain test of the seed orchard has not yet been done.
 6. The central breeding district family test was measured at 10 years with assistance from the Saskatchewan and Manitoba District Offices.
 7. Use of tree improvement technology in this region was promoted and advanced by providing scions of selected jack pine families for a study on genetics of western gall rust, by inviting the Canadian Tree

Improvement Association to meet in Edmonton in 1989, and by collaborating with W. Ondro on an economic analysis of a planned seed orchard. For the national tree improvement program, input was provided at the Petawawa tree breeding project review, and a tour was arranged of black spruce range-wide provenance experiment plantations for the study's coordinator.

8. More than 300 grafts were planted in the clone bank, of 679 identified in May 1985 as plantable. Additional graft planting and tending of grafts planted in the clone bank, (other than mowing) were not accomplished owing to insufficiency of support staffing. Grafts in pots or lined out at NoFC were tended, understocks for 1986 grafting were reared, and the records management system for the clone bank was refined. Because there was not time to tally the clone bank in 1985, the current inventory of grafts required for completion is not known.
9. The manuscript entitled "Development of a jack pine seed orchard by mass selection" has been accepted for publication in the Forestry Chronicle.
10. A proposed agenda for a technical workshop on growing trees in containers for tree improvement plantations has been mailed to prospective participants. Tentative dates are February 18-20, 1986.
11. Goals for 1986-87:
 1. Provide functional guidance for development of jack pine seed orchards in Manitoba under the Canada Manitoba Forest Renewal Agreement. (12-6MA)
 2. Publish a journal paper on the 10-year results of the eastern breeding district family test. (12-12)
 3. Under the Canada-Manitoba Forest Renewal Agreement, produce a special report of maps and source lists for the breeding program. (12-2MA)
 4. Prepare planting sites and begin rearing planting stock for a gain test of the mass selection seed orchard at Oakbank. (12-15)
 5. Measure the eastern breeding district family test at 15 years from planting. (12-25)
 6. Promote, coordinate, and enhance greater use of tree improvement technology in this region, and act as regional contact for the national tree improvement program. (12-6, 12-7)
 7. Provide advice for the first year of a two-year research contract on vegetative propagation of jack pine, white spruce, and black spruce (12-3MA).
 8. Graft, plant, and tend grafts to increase clone bank stocking to 2900 of 3185 required, and to maintain the inventory of grafts required for clone bank completion at close to 3100. (12-1)

9. Conduct the 1985-86 workshop on rearing trees in containers for forest genetics plantations, under the Canada-Manitoba Forest Renewal Agreement. (12-1MA)
10. Attend the IUFRO Joint Meeting of Working parties on Breeding Theory, Progeny Testing and Seed Orchards and the post-conference tour, in October 1986, and present a voluntary paper. (12-75).
11. Select central breeding district families best at 10 years. (12-19)
12. Publish the manuscript entitled "Establishment of a jack pine seed orchard by mass selection" in The Forestry Chronicle. (12-4)

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Klein	0.9
	Tech.:	Chapman 0.9
	Total:	1.8
	Term/Student:	0.3 + (Job Creation if approved)

O & M: \$8,000

Capital:

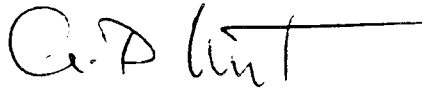
14. Signatures:



 Investigator



 Program Director, Resources



 Regional Director General

and survival are often a result of cultural problems in the nursery. Plantation failure usually necessitates costly re-scarification, site preparation and planting.

Size standards for suitable planting stock are lacking in the region. It is important to determine desirable morphological qualities that will enable stock to establish on particular sites. Stock that has certain morphological characteristics may be more suited to a particular site than stock with differing morphological characteristics. Field performance of various size classes of nursery stock several years after outplanting is the best test of the effectiveness of any size class standards.

In addition to knowing the size class of stock that is planted, it is also important to continually monitor the quality of the stock. Material attributes such as bud dormancy, water status, mineral nutrition, carbohydrate status and morphology as well as performance attributes such as vigor tests, root growth potential and frost hardiness should be closely monitored. The prairie region is behind some of the other regions, for example, British Columbia, Ontario and Oregon, in evaluating the quality of nursery stock. Some of the techniques from these regions should be adopted and modified for conditions specific to the prairie region. The predictive abilities of these techniques should be quantified by outplanting trials.

Size classes and stock quality are largely influenced by seedbed density in the nursery. High density may result in poor root system, poor top form and high top/root ratio. Low density may result in lower productivity and therefore higher cost of seedling production. Root culturing treatments such as root pruning and wrenching have been used in adequately spaced beds in order to improve root system fibrosity, increase root regeneration potential, decrease top/root ratio, and improve seedling growth and survival in stressful conditions in the field. Proper seedbed spacing and root culturing treatments may be used to improve the size class and stock quality of nursery stock in the prairie region.

Weed control is an ongoing problem at all bareroot nurseries and at some container nurseries where seedlings are placed outside the greenhouses for a 'hardening off' period. Weeds compete for valuable water and nutrients and may cause a serious reduction in nursery stock quality. Due to the rising cost of labor and the danger of damaging small seedlings, hand weeding is often not a viable method of weed control. There is an extreme shortage of herbicides registered for use in forest tree nurseries in Canada. As of January 1984, the only herbicides registered for use in nurseries were dazomet and methyl bromide (soil fumigants) and dacthal and simazine (pre-emergent herbicides). Presently, there are several herbicides that are registered in Canada that have potential for minor use in forest nurseries. Relevant data on crop tolerance and efficacy are needed for these minor use registrations. In July 1984, a Tree Nursery Weed Control Committee (Ron Hallet, CFS, Fredericton; Eileen Harvey, CFS, Edmonton; John Maxwell, B.C.F.S., Surrey; Bruce Neill, C.D.A., Indian Head; and Charles Waywell, O.M.N.R., Guelph) was formed to set

priorities on choice of herbicides and species for submission for minor use registration and to establish a standard testing and reporting procedure for herbicide testing in nurseries.

9. Study Objectives:

1. To conduct laboratory, greenhouse, and field research into seedling production, handling, storage problems, size class standards and stock quality monitoring.
2. To improve general nursery practices, including seedling handling, disease control, weed control, cultural operations, and innovations for seedbed treatments.
3. To advise on containerized and bareroot production of seedlings.
4. Maintain liaison between NoFRC and regional nursery facilities.
5. To conduct OECD seed inspections as required.

10. Progress to Date:

- Various problems in the regional nurseries have been investigated.
- A study for Parks Canada on their Native Plant program was completed and advice was given to Parks Canada on regeneration and reclamation.
- An inventory and monitoring program for nursery stock was developed.
- Site investigations for nurseries in Alberta and Saskatchewan were carried out.
- Simpson Timber (Alberta) Ltd. was given cultural advice on the start up of their container program.
- Two workshops (one in Edmonton and one in Prince Albert) on Basics of Fertilization, Insects and Diseases Common to Nurseries and Greenhouses were organized; a workshop on forest seed was held at NoFRC and Pine Ridge Forest Nursery; the 1981 Intermountain Nurserymen's Association Meeting was held in Edmonton.
- A monitoring program for soil and foliage from regional bareroot nurseries was developed.
- Conducted the regional nurserymen's meeting at NoFC.
- Completed white spruce/jack pine spacing study that was established at Pineland Nursery by R. Huber.

11. Goals for 1985-86:

1. Investigate greenhouse and nursery problems and provide routine advisory service and technology transfer to regional nurseries. (12-40)

2. Monitor soil fertility and seedling nutrition in bareroot nurseries in the region; maintain monitoring program already underway and provide appropriate recommendations to nursery managers on soil fertility management. (12-65)
 3. Publish the proceedings of the 1984 Regional Nurserymen's Meeting as an Information Report. (12-56)
 4. Complete a File Report, "Recommendations for Improving the Quality of Seed Sown at Saskatchewan Forest Nurseries" and submit to the Province. (12-40)
 5. Prepare and submit for peer review a plan to study the establishment of size class standards and methods of monitoring stock quality in the region. (12-55)
 6. Prepare and submit for peer review a plan for continuation of Huber's study, incorporating root pruning and wrenching as operational factors. (12-68)
 7. Participate on the National Tree Nursery Weed Control Committee as required, collect relevant data on crop tolerance and efficacy for minor use registrations. (12-69)
 8. Conduct OECD seed inspections as required. (12-44)
12. Accomplishments in 1985-86:
1. Provided technology transfer and advised regional nurserymen of any workshops or publications which might be of benefit to them. Tested and advised Clearwater Nursery, The Pas, Manitoba on peat quality from Carrot River, Sask. Examined stock and site quality problems with Clearwater and Pineland Stock that was planted at Pine Falls and The Pas Manitoba and wrote a joint file report with I.K. Edwards regarding this. Advised Pineland Nursery about light levels in their greenhouses and shadehouses. Advised Pineland Nursery about Aluminum toxicity in beds. Completed a file report on quality of Saskatchewan seed. Examined snow blight problems at Big River and Chitek Lake nursery and advised on this. Examined problem of premature bud set in white spruce at Prairie Sun Greenhouses, Joffre and provided advice on this. Examined overwintering problem at St. Regis greenhouses, Hinton and wrote a joint file report with I.K. Edwards regarding this. Wrote up an experimental design for a snow making machine experiment for St. Regis nursery, Hinton. Assisted Saskatchewan in inviting people to the regional nurserymen's meeting. Advised Whitecourt Mt. seeding nursery on use of herbicides in their container stock. Hosted a seminar on the use of a porometer designed for use on coniferous nursery stock, plant moisture stress measurements using a pressure bomb and the use of the Licor Photosynthetic system.
 2. Monitored soil fertility and seedling nutrition in bareroot nurseries in the region; maintained monitoring program already underway. Provided appropriate recommendations to nursery managers on soil fertility management.

3. The proceedings of the 1984 meeting have not, as yet, been edited.
 4. Completed the File Report: "X-ray and germination results of Saskatchewan Nursery Seed before and after cleaning with a South Dakota seed cleaner and separator at the Northern Forestry Centre and submitted this to the province.
 5. Prepared and submitted for peer review a plan to study the establishment of size class standards and methods of monitoring stock quality in the region. Initiated the study in Saskatchewan by collecting samples from each seedlot grown at each of the four nurseries in the province and conducting morphological and physiological measurements.
 6. Prepared and submitted for peer review a plan for continuation of Huber's study, incorporating root pruning and wrenching as operational factors. This plan was approved, but due to time constraints, the work was not initiated.
 7. Participated on the National Tree Nursery Weed Control Committee by reviewing the "National survey of weed control practices in forest tree nurseries" questionnaire.
 8. Sent 'Request to Present Collections Plans' letter to Reid Collins Nurseries Ltd. asking them to contact Dr. Ian Dymock in my absence on maternity leave.
13. Goals for 1986-87:
1. Investigate greenhouse and nursery problems and provide routine advisory service and technology transfer to regional nurseries. (12-40).
 2. Monitor soil fertility and seedling nutrition in bareroot nurseries in the region; maintain monitoring program already underway and provide appropriate recommendations to nursery managers on soil fertility management. (12-65)
 3. Continue the study on the establishment of size class standards and methods of monitoring stock quality in the region, working primarily in Saskatchewan. Present progress report at regional nurserymen's meeting. (12-55)
 4. Participate on the National Tree Nursery Weed Control Committee as required by cooperating in the national Goal (oxyfluorfen) trial. (12-69).
 5. Act as lead NoFC contact in cooperating with organizers of regional nurserymen's meeting. (12-56)
 6. Conduct OECD seed inspections as required. (12-44)
 7. Visit Abitibi-Price Pine Falls and advise on reforestation problems; design field trials if required. (12-74)

8. Act as Scientific Authority for R & D contract to conduct nursery investigations under Canada-Saskatchewan FRDA. (12-1SA)
9. Publish the Proceedings of the 1984 Regional Nurserymen's meeting as an Information Report. (12-56)

14. Publications 1985-86:

Harvey, E.M. and I.K. Edwards. 1985. Morphological and physiological attributes of lodgepole pine (Pinus contorta Dougl.) grown at St. Regis (Alta.) Ltd. greenhouses in Hinton, Alberta. File Report.

Harvey, E.M. 1985. X-ray and germination results of Saskatchewan nursery seed before and after cleaning with a South Dakota seed cleaner and separator at the Northern Forestry Centre. File Report.

Harvey, E.M. and I.K. Edwards. 1985. Investigation of decline in outplanted black spruce seedlings at Pine Falls and The Pas, Manitoba. File Report NOR-12-04.

15. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.


16. Resources 1986-87:


PYs: Prof.:	Harvey	0.8
Tech.:		0.0
Total:		0.8
Term/Student:		0.3

O & M: \$7,000

Capital:

17. Signatures:


Investigator


Program Director, Resources


Regional Director General

11. Accomplishments in 1985-86:

1. Routine administration was carried out. Fans were installed in all of the greenhouse compartments in order to distribute the heat more evenly. The problem of high energy consumption in the greenhouse was examined and recommendations were made to combat this. A filler/shaker machine and an automatic sulphuric acid dispenser were installed. A high pressure washer was purchased to wash the greenhouse windows.
2. The NoFC nursery facilities plan was finalized. The triploid aspen were planted in the southwest corner of the nursery complex. The remaining FIDS trees were removed from the nursery and planted around the grounds. Colorado blue spruce were planted in the south, east and north windrows.
3. 50,000 Colorado blue spruce were grown for distribution during National Forest Week and at NoFC public information displays.
4. Bedding plants were started for the NoFC outdoor beds and tropicals were grown and maintained in the reception area.

12. Goals for 1986-87:

1. Administer the NoFC greenhouse and nursery facilities. (12-42)
2. Finalize the implementation of the NoFC nursery facilities plan by having the depressions in the complex filled in and installing an irrigation system. (12-70)
3. Grow and maintain bedding plants and tropicals for NoFC if there is sufficient greenhouse space.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Publications 1985-86:

Nil

15. Resources 1986-87:

PYs: Prof.:	Harvey	0.2
	Tech.:	0.0
	Total:	0.2
	Term/Student:	Mills 0.5

O & M:

Capital: \$24.0 K

15. Signatures:

Eileen M. Kelly
Investigator

[Signature]
Program Director, Resources

C. D. [Signature]
Regional Director General



2. Act as project leader and coordinator of NOR-12. Participate in development of research priorities in MOU's for Saskatchewan and Alberta. (12-67)
3. Set up plot instrumentation and act as Scientific Authority for contract project (P-314) to determine rate of nutrient cycling in aspen and gather data for calibration of FORCYTE growth simulation model. Develop, with the assistance of M. Apps and H. Grewal, application of project data to the FORCYTE model. (12-59)
4. Draft report for review on nutrient requirements for hardening of wS and lP. Initiate study on nutrient requirements for hardening of bS and jP. (12-58)
5. Review contractor's report on ENFOR P-205 and undertake added analysis as needed. Original contract terminated before report completed. New contract (P-323) will do additional analysis and prepare report on ENFOR P-205. To act as Scientific Authority for this latter contract. (12-64)
6. Continue experiment on effects of residual soil fertility on succeeding crop of bareroot seedlings. (12-48)
7. Provide advisory service, investigate problems, and offer recommendations on soil fertility and tree nutrition as requested by industry and government agencies. (12-54)

Added Goals:

8. Prepare summary paper on bareroot nursery fertilization and act as chairman of the fertilization session at the annual meeting of the Intermountain Nurserymen's Association in Fort Collins, Colorado.
 9. Prepare and present a paper on "Fertilization of containerized seedlings: problems and solutions" at a containerized seedling technology workshop held in Fredericton, N.B.
 10. Represented NoFC at the annual Prairie Nurserymen's meeting in Prince Albert and presented a summary of project activities for 1985.
 11. Present a paper on "Salt effects on vegetation" by invitation at a workshop on Gel and Saline Drilling Wastes and sponsored by the Reclamation Research Technical Advisory Committee (RRTAC) of Alberta Energy and Natural Resources.
10. Accomplishments in 1985-86:
1. a. Erodibility index for forest land (IR).
This report was reviewed twice, revised, and submitted for final editing by the Editor.
 - b. Soil fertility and site productivity (IR).
The report was revised and is ready for typing prior to the second review.

c. Fertilization and conifer seed production (FMN).

The report was revised following the necessary reviews and submitted for final editing by the Editor.

2. Acted as project leader and coordinator of NOR-12. Attended meeting in Prince Albert to review proposals for nursery research submitted under the Canada-Saskatchewan Forest Research and Development Agreement.
3. Set up plot instrumentation and acted as Scientific Authority for three contracts under ENFOR project P-314. Two contracts related to the collection and transportation of water and litter samples from Kinuso and Calling Lake to Edmonton. The third contract was for preparation and chemical analysis of the samples that were collected.

Attended (with M. Apps and H. Grewal) a workshop at Vancouver on the FORCYTE model that is being developed by J. Kimmins for aspen. Publication of a manual for the model by Kimmins is expected. It would assist in the application of the analytical data to the model.
4. The report on nutrient requirements for hardening of wS and lP was not drafted. The study on nutrient requirements for hardening bS and jP was initiated late in the year when the term employee was hired.
5. Reviewed contractor's report on ENFOR P-205. Revision of regression equations and the format for presentation of the literature review was requested. New regression equations for small trees were developed by T. Singh for use by the contractor. A proposal for the new contract, an extension of P-314, has been submitted. Acted as Scientific Authority for P-205 and P-323.
6. Collected soil and foliage samples from the four fields under study at Prince Albert. The final sampling will be in 1986 following lifting. The samples are being analysed chemically.
7. Provided advisory service, investigated problems, and provided recommendations as requested.
 - assisted E. Harvey to assess results of chemical analyses of soil and seedlings collected from all nurseries in the region under the routine sampling program;
 - conducted soil water studies in the laboratory re outplanting failure of bS near Pine Falls, Manitoba. Cooperated with E. Harvey in preparing a report on the problem;
 - advised D. Roddy re soil problems at PAPCO Seed Orchard, Henribourg, Sask.;
 - Advised Y. Beaubien and D. Gillis re tree seedling nutrition at Pineland Nursery, Manitoba.

8. By invitation, acted as session chairman at INA meeting in Ft. Collins, Colorado, led discussion through prepared questions and submitted a summary of the theme - Increasing efficiency of fertilizers in bareroot nurseries.
 9. Attended containerized seedling workshop in Fredericton and presented a paper on fertilization of container seedlings: problems and solutions.
 10. Attended Prairie Nurserymen's meeting in Prince Albert as the only representation of NoFC and presented a summary of project NOR-12 activities during 1985.
 11. Presented a paper on "Salinity effects and salt interactions in forest vegetation at a workshop sponsored by RRTAC, and Alberta Energy and Natural Resources.
11. Goals for 1986-87:
1. a. Publish Information Reports on Soil fertility and site productivity, and
 - b. Erodibility index and its application.
 - c. Publish FMN on Fertilization and conifer production.
 - d. Prepare draft report on uptake of soil phosphorus. (12-45)
 2. Complete experiment on effects of residual fertility on bareroot seedlings and initiate data analysis. (12-48)
 3. Provided advisory services, investigate problems and offer recommendations on soil fertility and tree nutrition as requested by industry and government agencies. (12-54)
 4. Draft an internal report on nutrient requirements for hardening off wS and lP seedlings. Complete a similar study on bS and jP. (12-58)
 5. Act as project leader and coordinator of NOR-12. (12-67)
 6. Visit Pine Falls, Manitoba to advise on reforestation problems. (12-74)
 7. Organize workshop to address Manitoba nursery management needs. (12-4MA)
 8. Provide technical advice to Manitoba Forestry Branch to grow large high quality stock. (12-5MA)
12. Publications 1985-86:
- Harvey, E.M. and I.K. Edwards. 1985. Investigation of decline in outplanted black spruce seedlings at Pine Falls and The Pas, Manitoba. File Report NOR-12-04.

Edwards, I.K. 1985. Salt effects on vegetation. Proceedings of RRTAC-sponsored Workshop on Gels and Saline Drilling Wastes held in Edmonton April 23-24, 1985.

Edwards, I.K. 1985. Fertilization of containerized seedlings: problems and solutions. Proceedings of Containerized Seedling Technology Workshop in Fredericton, N.B. July 17, 1985.

Edwards, I.K. 1985. How to maximize efficiency of fertilizers in a forest tree nursery. Proceedings of the annual meeting of the Intermountain Nursery Association in Ft. Collins, Colorado, August 13-15, 1985.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Edwards	0.8
Tech.:	Van Dyk	1.0
Total:		1.8
Term/Student:		0.3

O & M: \$8,000

Capital:

15. Signatures:

I.K. Edwards
Investigator

[Signature]
Program Director, Resources

C.D. Tut
Regional Director General



Over the past 7 years, certain data have been collected (under the ENFOR program) partly with a view to calibrating the FORCYTE model for application to aspen. Although it is not certain how well or completely this data set will fit the input requirements of the model (both for the reasons mentioned above and other factors associated with the collection of this data set), it should provide a good starting point and work has begun (under contract) to evaluate any holes in the existing data base.

Finally it must be recognized that the FORCYTE models are (for the same reasons as given above) largely untested, at least within Canada. Before they can be considered for client use (clients could conceivably include both government agencies and the forest industry), considerable research must be performed to ensure the validity of their predictions. Assuming they prove valid, future development work will be required to make the model more accessible to the end user.

The purpose of this study is to strengthen existing NoFC expertise in ecosystem modelling. This will be accomplished initially by developing specific expertise with the FORCYTE series of models and evaluation of their applicability to the needs of the region, with particular reference to aspen. Depending on the conclusions reached, implementation of the model in a specific environment (probably aspen oriented) will be undertaken and a series of validation and sensitivity analysis tests designed. Because ecosystem modelling is largely interdisciplinary, attempts will be made to solicit constructive criticism by other NoFC scientists working in related areas by keeping them informed by such mechanisms as workshops and seminars as appropriate.

9. Study Objectives:

1. To develop expertise in forest ecosystem modelling, assess applicability of existing ecosystem models to regional needs, and assist regional clients in forest ecosystem management through the use of models.

10. Goals for 1985-86:

New study. See accomplishments below.

11. Accomplishments in 1985-86:

1. Attended introductory FORCYTE workshop at UBC.
2. Participated in CFS Modelling Workshop, Ottawa, June 1985.
3. Participated in planning meetings of U of A Integrated Forestry Research working group.

12. Goals for 1986-87:

1. Arrange installation of FORCYTE models on NoFC computing facilities. Where feasible, install on microcomputer for greater eventual end user access.
2. Develop working knowledge of FORCYTE models and its potential to meet regional needs by:

- a. arrange FORCYTE workshop and seminar;
 - b. establish contact with other FORCYTE users;
 - c. visit study sites of existing Alberta data base (reference ENFOR P314).
3. Evaluate requirements to make FORCYTE operational for regional aspen needs by:
- a. assess the available data and ascertain additional data needed to drive the model in collaboration with ENFOR P314.
 - b. perform trial model runs with existing data to make preliminary assessment of validity of the model. (Apps, Grewal)
 - c. plan, in collaboration with Dr. Kimmins and contractor, program of model validation. (Apps, Grewal) (12-73)
13. Publications 1985-86:

Nil, new study.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986/87:

PYs:	Prof.:	Apps	0.7
		Grewal	0.2

Tech.:	0.0
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Total:	0.9
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Term/Student:


O & M: \$2,000

Capital: \$20,000 (IBM microcomputer)

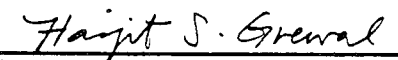
16. Signatures:



 Investigator



 Program Director, Resources



 Investigator



 Regional Director, General



NOR-13

FOREST HYDROLOGY AND MICROCLIMATE RESEARCH

9. Goals for 1985-86: (All Swanson unless otherwise indicated)

1. Publications:

- a. Publish "The hydrological effects of timber harvest at Marmot Creek and Streeter watershed, Alberta". (Swanson, Golding, Rothwell, Bernier) (13-13)
- b. Publish Forestry Report (Marmot-Streeter results, Mount Allan snow). (Swanson, Bernier) (13-14)
- c. Prepare for review Information Report on the Streeter Basin project. (Swanson, Golding, Hillman, Singh, Telfer) (13-16)

2. Interaction with provincial clients:

- a. Convene Steering Committee, Alberta Watershed Research Program. (13-8)
- b. Provide assistance to the Watershed Management Section, Alberta Forest Service, regarding application of research findings to management problems and the operation of the Tri Creeks watershed project. (13-8)
- c. Provide Canadian Forestry Service input to the ad hoc committee formed to evaluate the potential of watershed management in water supply via a pilot watershed management project. (Swanson, Bernier) (13-7)

3. Provision of data:

- a. Continue to assist in use of the Mount Allan snow data. Advise as requested in formation of master plan for the Mt. Allan-Marmot basin Olympic and recreational ski development. (13-1)
- b. Assume responsibility (from Swanson) for the operation and maintenance of the automated weather stations on Marmot Watershed. Transfer data for 1982-1984 to files on NoFC computer. Prepare format for compilation and ready access to these data in computer format. (Hurdle) (13-1)

4. Interaction with outside agencies and other NoFC staff:

- a. Attend annual meeting of the Associate Committee on Hydrology as CFS member, St. Johns, Newfoundland, May or June 1985. Also attend normally scheduled meeting of Research Priorities sub-committee at this time. (13-9)
- b. Prepare program for International Symposium on Forest Hydrology and Watershed Management for Vancouver, August 9-22, 1987. (For meeting of convenors during July-August 1985 in Vancouver). (13-9)
- c. Make preliminary arrangements for Canadian Hydrology Symposium 1988 at Banff and/or Kananaskis. (13-9)

Added goal:

- d. Participate in MSc thesis examination of John Berry, University of Alberta. Re: snow ablation study conducted at James River microclimate site in 1983-84. (Swanson) (13-4)

10. Accomplishments in 1985-86:

1. Publications:

- a. A paper entitled "The hydrologic effects of clear-cutting at Marmot Creek and Streeter watersheds, Alberta", has been reviewed, edited and submitted to the Canadian Water Resources Journal, but was considered too long by the journal and is now to be published as an Information Report. (13-13)
- b. The Forestry Report on Marmot-Streeter results is in editing for final graphs, figures and layout. (13-14)
- c. The Information Report on Streeter basin is about 90% complete. (13-16)

2. Interaction with provincial clients:

- a. The Steering Committee, Alberta Watershed Research Program met in Calgary on 21 June 1985. A field trip to view the Marmot Creek project was held in the afternoon. (13-8)
- b. Helped Alberta Forest Service researcher Al Nip prepare a paper on snow distribution on Tri Creeks for presentation at a workshop on snow measurements at Lake Louise. Also considerable informal consultations with respect to this study. (13-8)
- c. Continued to provide CFS input into this committee. Reviewed and participated in preparation of report to Alberta ministers of Environment and Energy-Natural Resources on the selection of an area, estimated water yield increase, and rough costs associated with this pilot project. Requested Bernier to prepare a WRENSS program that could be used with AFS timber inventory data to estimate water yield from each of 411 forest units identifiable on the Grease Creek Watershed recommended for this pilot project.

Conducted a workshop/planning session for AFS and Fish and Wildlife personnel at Kananaskis to derive the operation plan for this pilot study. (Bernier) (13-7)

4. Provision of data:

- a. Requests for data were handled routinely by either Fisera at Kananaskis or Hurdle at Edmonton. (13-1)
- b. All of the data from the micrologger climate stations at Marmot are now on disk files compatible with the IBM PC. They are also archived on the NoFC VAX under user ID AWRP, and have been permitted to full read-only access by any inhouse or outside user.

Hurdle has assumed full responsibility for the maintenance, operation and data reduction for the Marmot micrologger stations. The microcomputer for this work has been upgraded from CPM to IBM PC-compatible standard to allow direct translation of field data to disks compatible with the LOTUS 123 spreadsheet program operating on Hyperion and IBM PCs or to a VAX format for use by outside agencies. Hard copies of all Marmot micrologged data are archived at NoFC. (13-1)

5. Interraction with outside agencies and other NoFC staff:

- a. Attended annual meeting of research priorities subcommittee and Associate Committee on Hydrology in St. Johns, Newfoundland, 26-28 June. The research priorities subcommittee encouraged the submission of Bernier's microwave review (and any others commissioned by this subcommittee) to CMOS for publication. The main committee approved our proposed topic for the CHS-88 symposium at Banff and authorized the payment of a \$500 deposit to the Banff Centre to hold both the CHS-88 dates and those for the annual meeting of the Associate Committee (CHS-88: 9-11 May, ACH-88-1: 12-13 May 1988). (13-9)
- b. Prepared program for an International Symposium on Forest Hydrology and Watershed Management to be held in Vancouver, 9-22 August 1987. The program was approved at a meeting of convenors 18 November 1985. Dr. P.Y. Bernier and I are to serve as co-editors of the proceedings of this symposium which will be prepublished and made available to an expected 300-400 participants in August 1987. A first call for papers/posters is to be issued in January 1986. Final papers are due 30 November 1986. (13-9)
- c. The Banff Centre has been booked and confirmed for 9-11 May 1988. Program and local arrangements committees will be formed and their names presented for approval at the ACH meeting in Regina in June 1986. (13-9)
- d. Participated in MSc exam for John Barry, University of Alberta, as principal scientific questioner on his committee. (13-4)

11. Goals for 1986-87:

1. Publications:

- a. Submit for review and publication:
 1. Information Report: The Hydrologic Effects of Clear-cutting at Marmot Creek and Streeter Watersheds. (Swanson, Golding Rothwell, Bernier) (13-13).
 2. Journal article: The Hydrologic Effects of Clear-cutting in Alberta's Eastern Slopes Watershed. (Swanson, Bernier) 13-13).

3. Forestry Report on Marmot-Streeter results, Mount Allan snow. (Swanson, Bernier) (13-14).
 4. Management note: Water yield improvement harvesting prescriptions for Alberta's Eastern Slopes subalpine forests. (Swanson, Bernier) (13-7)
 5. Management note: Enhancing snow retention and local water supply in the Aspen-Grassland type. (Swanson) (13-7)
 6. Conference proceedings - Canadian Hydrology Symposium (CHS-86): The potential for increasing water supply in the Saskatchewan River system by forest harvesting. (Swanson, Bernier) (13-7)
 7. Conference proceedings - Western Snow Conference: A watershed management pilot project in Alberta. (Bernier, Swanson, Swan-Alberta Forest Service) (13-7)
 8. Conference panel paper - Canadian Institute of Forestry annual meeting, Victoria: Altering stand microclimate for increased growth and/or water yield. (Swanson) (13-4)
 9. Information report: The Streeter Basin Aspen-Grassland Watershed Experiment. (Swanson, Golding, Singh, Hillman, Telfer-CWS) (13-16)
2. Interaction with provincial clients:
 - a. Convene Steering Committee, Alberta Watershed Research Program. Make arrangements for final closing down of Marmot Experimental Watershed. (Swanson) (13-8)
 - b. Provide assistance to Alberta Forest Service in conduct of Tri Creeks watershed study. Participate in study of evapotranspiration if requested. (Swanson) (13-8)
 - c. Provide CFS input into pilot watershed management program with province. (Swanson, Bernier) (13-7)
 3. Provision of data:
 - a. Continue to assist in the use of Mount Allan (Marmot) data. Compile and archive data from microloggers. Supply data in machine readable or printed form upon requested. (Hurdle) (13-1)
 4. Interaction with outside agencies and NoFC staff:
 - a. Attend annual meeting of the Associate Committee on Hydrology as the CFS member. Continue to provide forestry input into research priorities subcommittee of the ACH. (Swanson) (13-9)

- b. Continue as lead convenor of IAHS symposium on Forest Hydrology and Watershed Management for August 1987. Send out call for papers, coordinate reviews by program chairmen, notify authors of acceptance or rejection, coordinate and participate in reviews of accepted papers, start editing and preparing papers for publication. (Swanson, Bernier - editing only) (13-9)
- c. Continue preparations for Canadian Hydrology Symposium-88 on Results from small basin research, at Banff, May 1988. Appoint program committee, local arrangements committee. Contact authors of invited papers on results from Canadian research basins. Prepare a general call for volunteer submissions. (Swanson) (13-9)

12. Publications 1985-86:

Swanson, R.H. 1985. Managing lodgepole ecosystems as watersheds. In: Proceedings, Lodgepole Pine Symposium: the species and its management, May 8-10, 1984, Spokane, Washington, and May 14-16, 1984, Vancouver, B.C. pp. 305-313.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

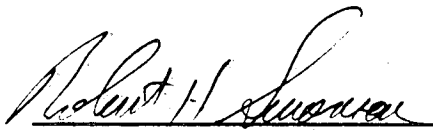
14. Resources 1986-87:

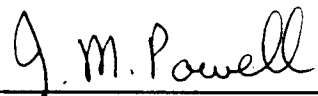
PYs:	Prof.:	Swanson	0.8
		Bernier	0.4
	Tech.:	Fisera	1.0
	Total:		2.2
	Term/Student:		0.0

O & M: \$6,000

Capital:

15. Signatures:


Investigator


Program Director, Extension


Regional Director General

relatively predictable increase in annual water yield, plus an increase in stormflow response which is especially marked when storms occur during low flow periods. In snow dominated regions, the effect is not so easily explained. Snow lies on the ground for weeks or months and in some clear-cutting situations, the modification of the near-ground microclimate could influence the evaporation of snow to the point of negating the increases in water yield induced by the removal of trees.

The evaporation process is affected by wind speed, temperature, and vapour concentration gradient. Work in Wyoming has shown that air-borne snow particles will evaporate within 3000 m of their point of origin. We do not know the importance of air-borne evaporation in the large clear-cuts of the Alberta foothills.

Evaporation also occurs from snow on the ground, even at temperatures below 0°. This is thought to be an especially important type of evaporation in Chinook areas, (such as southern Alberta) where the air temperatures often exceed 0°C for extended periods. Here, evaporation from the winter's snowpack has been thought sufficient to reduce summer streamflow, and the Alberta Forest Service has had its logging practices challenged in court on this basis.

The essence of the problem is that evaporation under either situation is very likely affected to an unknown degree by the influence of clear-cut size on surface wind speed and turbulence. Until the magnitude of the problem is known, we do not know what steps to take to evaluate it under the variety of field situations that exist in the southern Alberta foothills.

The tools available to either researchers and forest managers for evaluating or predicting the effects of harvesting practices on water yield are hydrologic land use models. To be useful in the solution of the current problem, a model must allow the input of local wind speed, air temperature, and vapour concentration. The use of such models is currently beyond the capabilities of either ourselves or Alberta Forest Service personnel because of a lack of suitable site-specific data on either actual evaporation or that on wind-temperature-humidity.

This study is thus being conducted in two phases. Phase I is to determine the magnitude of evaporation from snow under chinook and non chinook conditions. This is being carried out in the James River microclimate study site near Sundre. Both large and a number of replicated small clearings are available at this site. Normal patterns of snowpack accumulation and ablation have been well documented during previous studies. If the magnitude of evaporation from snow is large enough to be of concern with respect to water yield, then Phase II, to determine the evaporation from clear-cuts in the affected areas of the southern Alberta foothills will be implemented.

2. Transpiration of beetle-infested pine

The mountain pine beetle has attacked and killed vast stands of lodgepole pine in Alberta and British Columbia. Many of these stands occupy strategic watersheds in the Saskatchewan River watershed. The impact of

death on the evapotranspiration regime of affected watersheds is not known for certain but the magnitude is thought to lie between that of a healthy stand and complete clear-cut.

During 1985, Dr. Suzuki, a visiting scientist from Japan, will be examining the role of nematodes and blue-stain fungi in the stoppage of transpiration in lodgepole pine. He has requested that the NoFC support this research by assisting in the measurement of transpiration using the Heat Pulse Velocity technique that has been perfected to a point of application in the course of our hydrological research. Dr. Suzuki's application provides an opportunity for a limited study of the changes in the transpiration regime of forest stands that occur during and following tree death.

3. Water stress of seedlings on mechanically-prepared micro-sites.

Currently, about 41% of the land cutover in any one year in Alberta are artificially regenerated. The seedling production and planting costs for such a large area are high. It is therefore important to achieve a high survival rate of planted stock. The Alberta Forest Service's Research Division is currently investigating the effect of mechanically produced micro-sites on the seedlings' chance of survival. Their work has so far concentrated in characterizing seedling root generation capacity before planting, and on a few field trials involving the planting of seedlings on different portions of mounds created by a Bracke Moulder. However, they lack the expertise and equipment to investigate water stress which is one of the key factors in seedling survival.

Water stress can result from low soil moisture content or mobility, poor root distribution, and high atmospheric evaporative demand. Some water stress is normal and is required to extract water from the soil.

The purpose of our research is to quantify the degree of seedling water stress that occurs when seedlings are planted in various mechanically-prepared micro-sites. If water stress is being aggravated by site preparation then appropriate measures could be taken to alleviate this cause of mortality, such as altering planting schedules in accordance with regional weather forecasts, or altering orientation or dimensions of mechanically-prepared micro-sites.

4. Reduced growth of spruce after site drainage.

Researchers at the University of Alberta have observed that spruce growing on saturated sites have reduced growth rates after drainage. They installed dendrometer bands and observed an increase in circumference for a very short period in the spring, and occasionally in response to rain of sufficient duration or intensity to saturate the porous surface soil. These observations are symptoms of water stress.

The purpose of our proposed investigation is to ascertain the physiological state of these trees versus those on undrained poor-growth sites and well-drained good-growth sites. These data, coupled with those from other NoFC studies should help in the specification of proper drainage programs to maintain the proper soil water conditions to improve growth.

8b. Current objectives:

1. Snow disposition phase I
 - a. Determine the magnitude of evaporation from snow under open and sheltered conditions.
 - b. Determine the importance of wind speed, vapor concentration, solar radiation, and air temperature in the evaporation of snow.
 - c. Determine the influence of clear-cut opening dimensions on the parameters influencing evaporation from snow.
 - d. Evaluate the potential importance of evaporation from snow under the clear-cutting regimes now imposed on the southern Alberta foothills.
2. Snow disposition phase II
 - a. Measure the loss by snowpack evaporation from clear-cuts of commercial size in the southern Alberta foothills.
 - b. Provide techniques for predicting or evaluating the impact of various sizes of clear-cuts on the hydrologic regime of affected watersheds (modifications of snow loss coefficients in WRENSS).
3. Transpiration of beetle-killed pine
 - a. Assist Dr. Suzuki in using the Heat Pulse Velocity technique in determining the transpiration regime of healthy lodgepole pine trees, and those that have been attacked by the mountain pine beetle.
4. Water stress of seedlings on mechanically-prepared micro-sites.
 - a. Evaluate instrumentation and techniques needed to characterize water stress of seedlings.
 - b. Determine relationships between site physical characteristics and soil water availability.
 - c. Test and prescribe site preparation techniques to alleviate water-stress related mortality in plantations.
5. Reduced growth after drainage.
 - a. Determine differences in water use and/or stress of spruce growing on overly-drained, undrained and good sites.
 - b. Determine optimum soil moisture and watertable levels to maintain maximum growth rates.
 - c. Test and prescribe drainage programs to alleviate water-stress related poor growth on formerly saturated sites that have been drained.

8c. Current resources:

1. Snow disposition phase I

Completed in 1985 as scheduled.

2. Snow disposition phase II

Starting date: 1985-1986
 Estimated date of completion: 1989
 Estimated Prof. PY: 0.2 per year
 Estimated Tech. PY: 0.3 per year

3. Transpiration of beetle-killed pine

Starting date: 1985
 Estimated date of completion: 1985
 Estimated Prof. PY: 0.1
 Estimated Tech. PY: 0.1

4. Water stress of seedlings on mechanically prepared micro sites.

Starting date: 1986
 Estimated date of completion: 1990
 Estimated professional PY (per year): 0.4
 Estimated technical PY (per year): 0.4

5. Reduced growth on drained sites.

Starting date: 1986
 Estimated date of completion: 1990
 Estimated professional PY (per year): 0.1
 Estimated technical PY (per year): 0.2

9. Goals for 1985-86:

1. Publications:

a. Submit for review:

1. Paper on snow evaporation or melt in small forest clearings. (Swanson) (13-4)
2. Paper on soil water distribution and disposition in forest clearings. (Bernier) (13-4)
3. Paper on the use of the heat pulse velocity technique for dynamic evaluation of living tree sapwood moisture content. (Data from 1983 field season - Swanson) (13-11)
4. Paper on the design and use of a multiplexer with the CR-21 micrologger. (Hurdle, Swanson) (13-15)

b. Submit for publication:

1. "A review on the potential of microwaves for the remote sensing of snowpack properties". (Bernier) (13-12)
2. Information Report on Mount Allan snow and winter climate. (Bernier-Swanson) (13-2)
3. Information Report or journal article on a users guide to WRENSS. (Bernier) (13-3)

2. Research activities

For the snow disposition project (James River site)

- a. Complete the gathering of soil moisture information at the James River experimental sites. (Bernier) (13-4)
- b. Complete the gathering of meteorological and snow pack ablation data at the site. (Swanson, Hurdle) (13-4)
- c. Analyze the results from Phase 1 of the snow disposition study and decide on mplementation of Phase 2. (Swanson, Bernier) (13-4)

Other related work

- d. Complete gathering of ground water levels on Marmot Creek basin to determine the location of the Cabin Creek phereatic divide. (Bernier) (13-1)
- e. Pursue work on the WRENSS procedure, including consultation support and upgrading of the current programmed version, and possible work on modifications for improving the compatibility of the procedure to Canadian conditions. (Bernier) (13-6)
- f. Participate in the workshop on "Snow property measurement" to be gheld at Lake Louise on 1-3 April 1985. (13-17)
- g. Install Heat Pulse Velocity (Transpiration) sensors in beetle-susceptible and non-susceptible lodgepole pine trees. Monitor to ascertain time when transpiration ceases for correlation with concurrent histological analyses being conducted by Dr. Suzuki and Dr. Hiratsuka. (Swanson, Hurdle) (13-10)

Added goal:

Survey regeneration patterns in openings of different diameters at the James River site. (13-18)

10. Accomplishments in 1985-86:

1. Publications:

- a. Submit for review

1. The data on snow evaporation or melt in forest clearings have been taken and partially analysed. However, a formal paper has not been started at this time. (Swanson) (13-4)
 2. Analysis of the data on soil water disposition is almost completed. The paper is not ready for submission for review. (Bernier) (13-4)
 3. The data from Engelmann spruce has been abstracted and analysed. When the thermal diffusivity data are analysed using the analytical theory (that has been shown to be non applicable for the determination of heat pulse velocities) the results are a significant underestimate of actual moisture content. This was not unexpected. However, it does mean that I must carry out some further numerical simulation modelling before I can complete the analyses of these data. A paper has not been started. (Swanson) (13-11)
 4. A schematic diagram has been prepared. The next step is to prepare a functional description and a set of operating instructions. (Hurdle, Swanson) (13-15)
- b. Submit for publication
1. The microwave review paper was submitted to Atmosphere-Ocean. It was rejected, and it appeared that resubmission to this journal would be fruitless because the editor indicated an unwillingness to accept articles aimed at practitioners rather than researchers. The rejection letter was cause for some concern among the members of the NRC Associate Committee on Hydrology because they have commissioned several such reviews and Atmosphere-Ocean was to be the outlet for them. In further discussion with the editor of Atmosphere-Ocean, it appears that the rejection was really because the paper was poorly organized. They have not established a policy of rejecting practical articles. It is under revision and will be resubmitted to Atmosphere-Ocean. (Bernier) (13-12)
 2. The information report on Mount Allan snow has been replaced with a presentation at a workshop on "snow properties measurements" (See goal 'F') and a journal article on the snow distribution on Marmot Basin. The journal article has been submitted to Nordic Hydrology. (Bernier) (13-2)
 3. The original information report on a user's guide to WRENSS has been replaced by a management note (Bernier), which is in editorial review, and a journal article, which is in preparation. (Swanson, Bernier) (13-3)

2. Research activities

For the snow disposition study (James River Site).

- a. Soil moisture data were gathered from mid March through June 1985. Preliminary analysis indicates that much of the snowmelt water moves through the soil layers prior to the initiation of physiological activity by trees. The variation in soil water content between points less than a meter apart has complicated statistical analyses of these data. Future plans are to interpret the soil water data in conjunction with data from the regeneration survey (see 'H' below), and micrometeorological study ('B' below). (13-4)
- b. Sufficient climatic and snow ablation data were taken to indicate that losses from the snowpack are not large where there is adequate protection from wind (generally less than 0.5 mm/day of evaporation). Losses on the order of 3 mm/day occurred from the snowpack in a large clearing where the wind speeds near the snow surface are 10 to 20 times those in the 1 to 6 tree-height diameter clearings of this study area. In either case, most of the snow ablation was melt and there was very little direct evaporation or sublimation of snow if the air temperature was above freezing (as it commonly is during chinooks). Theoretically, greatest losses to sublimation would occur under high wind speed conditions at air temperatures slightly below freezing. This condition was not sampled during this particular period, nor are the high winds necessary to maintain high vapour pressure deficits near the snow surface generally present in the small clearings of this study area. (13-4)
- c. Preliminary analyses of the snow ablation data indicated that high winds at air temperatures below freezing, or ponding of melt water plus high winds and air temperatures above freezing were necessary to produce significant evaporative loss from snow. A weather station was established at Pincher Creek to determine the frequency of such climatic occurrences. The cooperation of a local rancher, Leo Robbins, made it possible to establish and service this station this winter. Data being taken are air temperature, wind speed and direction, relative humidity, and soil temperature-moisture at 2 depths at 3 locations; under grass, a small snow deposition area and bare soil. These data will help to establish the magnitude of the problem of snow loss during chinook winds in the Pincher Creek area which is in the portion of Alberta with the highest potential for such loss. (13-4)

Other related work

- d. The collection of groundwater levels on the north shoulder of Cabin sub-basin of Marmot has been completed. We are reasonably satisfied that the north boundary should go through clear-cut No. 4. However, these groundwater data do not constitute proof. The findings have been consolidated in a file report (NOR-13-01: 20 Jan. 1986). (13-1)
- e. Work has continued on the WRENSS procedure. One version has been programmed to accept several hundred management units. This was used in a workshop with the Alberta Forest Service to prescribe

and evaluate various cutting options for the proposed pilot study area (Grease Creek). This workshop also provided a valuable tech transfer opportunity as the forest management staff were introduced to this new technique for planning.

A second new version of WRENSS was produced for interactive operation on a LOTUS 1,2,3 spreadsheet. This last version is particularly useful to the AFS as they are upgrading the computing facilities at their Forests to IBM PC's, and they will be able to run LOTUS.

The workshop and the LOTUS version of WRENSS have fostered an effort on the part of the Forest Land Branch of the AFS to require a WRENSS evaluation of potential water yield change for every new cutting operation in Alberta. (Bernier) (13-6)

- f. Bernier presented a paper on the snow distribution on Marmot at the workshop in Lake Louise. Lively discussions of snow measurement techniques occurred during most sessions. Copies of the paper were made available to participants. (13-17)
- g. Heat pulse velocity sensors were installed in 4 trees at two sites in the Pincher Creek area in July. Two trees in each group were baited with pheromones to attract bark beetles, two were left unbaited as controls and the trunk of one of these was surrounded with wire screening to prevent beetle access. An attack occurred at only one of the two sites. Heat pulse velocities were similar in the control and attacked trees until about one week following the first sign of attack when the velocities in one of the attacked trees reduced to about $\frac{1}{2}$ to $\frac{1}{3}$ that of its control. Readings were continued through September when transpiration effectively stopped for the winter. (13-10)

Added goal

- h. A regeneration survey was completed in 40, 80 and 120 m diameter clearings at the James River site. A preliminary analysis of the results show some apparent interaction with the soil water distribution patterns, and a definite effect of edge on juvenile growth. Further analyses in combination with those on soil moisture and microclimate are planned. (13-18)

11. Goals for 1986-87:

1. Publications:

a. Submit for review:

- 1. Paper on snow evaporation and/or melt in small forest clearings. (Swanson) (13-4)
- 2. Paper on soil moisture, regeneration and edge effects in small forest clearings. (Bernier) (13-18)

3. Prepare poster paper for IAHS Symposium, Budapest, Hungary, July 2 - 10, 1986, entitled "A direct method for measuring forest transpiration". (Swanson) (13-19)
- b. Submit for publication:
 1. Paper on the design and use of a multiplexer for the CR21 micrologger. (Hurdle, Swanson) (13-15)
 2. Paper on the WRENSS technique. (Swanson, Bernier) (13-3)
 3. Potential of microwaves for remote sensing of snowpack properties. (Bernier) (13-12)
 4. Paper on snow distribution on Marmot Basin. (Bernier) (13-2)
2. Research activities:
 - a. Test the IRAMS Time Domain Reflectometry soil moisture meter on various Alberta soils and verify calibration curve. (Bernier) (13-20)
 - b. Program Hydrocomp's HSPF model on the VAX computer. Become familiar with its operation by fitting it to Tri Creeks and Marmot climatic-streamflow data. Begin simplifying model structure and data requirements to permit its use on IBM PC/XT microcomputers by Alberta Forest Service personnel in evaluating potential downstream flooding effects and sediment changes resulting from clear-cutting activities. (Swanson, Bernier) (13-6)
 - c. Construct or purchase a Scholander pressure chamber for use on individual needles or fascicles. Become familiar with its operation by measuring plant water stress and soil moisture on selected problem microsites as defined by Alberta Forest Service research personnel. (Swanson, Bernier) (13-21)
 - d. Continue measurement of heat pulse velocities in bark beetle infested trees from onset of physiological activity in spring until the needles are dropped or the xylem is plugged causing cessation of water uptake. (Swanson, Hurdle) (13-10)
 - e. Obtain preliminary data on water stress, wood moisture content and transpiration from spruce on drained sites. (In conjunction with University of Alberta at Salteaux River site near Smith, Alberta). (Swanson) (13-22)
12. Publications 1985-86:

Bernier, P.Y. "Variable source areas and storm flow generation: an update of the concept and a simulation effort". Journal of Hydrology. (In press).

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Bernier 0.6
Swanson 0.2

Tech.: Hurdle 1.0

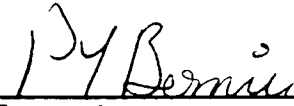
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Term/Student: 0.0

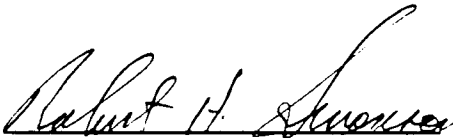
O & M: \$6,000

Capital: \$7,000

15. Signatures:


Investigator


Program Director, Extension


Investigator


Regional Director General

NOR-28

WETLANDS, CLIMATE AND ENFOR

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 09, 1986

1. Project: Wetlands, Climate, and ENFOR
2. Title: Peatland development and ecology
3. New: Cont.: X 4. No.: NOR-28-02
5. Study Leader: S.C. Zoltai and J.D. Johnson
6. Key Words: Peatland, soils, chemistry, peat, vegetation, succession
7. Location of Work: Western and Northern Region
8. Problem:

Peat is constituted by the largely undecomposed remains of vegetation growing in wet places. It usually occurs in depressions and other poorly drained areas, and supports a variety of vegetation from stunted trees to shrubs and sedges. In its natural state the high water table prohibits fast tree growth, but when sufficiently drained it can produce as well or better than the best upland sites. As a raw material, it has many uses depending on its quality, from peat moss as a soil conditioner to liquification as gas fuel.

The Prairie Provinces have enormous areas of peat, all north of the prairie zone. The most recent estimates show that about 28% of Alberta, 12% of Saskatchewan and 42% of Manitoba is covered with peat. This translates into approximately 180,000 km² in Alberta, 68,000 km² in Saskatchewan and 230,000 km² in Manitoba.

The amount of peat involved is equally impressive. Conservatively calculating on a basis of 1.5 m average thickness in Alberta and Saskatchewan, and 2 m in Manitoba, the peat resources are 270 x 10⁹ m³ in Alberta, 102 x 10⁹ m³ in Saskatchewan, and 460 x 10⁹ m³ in Manitoba. Estimating the total dry peat content on the basis of 100 kg/m³, this would amount to 27.0 x 10⁹ tonnes in Alberta, 10.2 x 10⁹ tonnes in Saskatchewan, and 46.0 x 10⁹ tonnes in Manitoba; a total of 83,200,000,000 tonnes of dry peat.

Peat is a significant reservoir of carbon. Peat formation ties up atmospheric carbon by fossilizing it. On the other hand, oxidation of peat, whether by burning as fuel or by decomposition, liberates carbon, adding it to the atmosphere as CO₂. Increased atmospheric carbon dioxide levels are believed to trigger global or regional climatic changes. The amount of carbon stored in peatlands is considerable. Using the above data of 83.2 x 10⁹ tonnes of peat, some 75 x 10⁹ tonnes of carbon are immobilized in the peat deposits of the three provinces. A more precise knowledge of the role of peat in the carbon balance is necessary to assess long term climatic changes.

The resources involved are considerable, whether viewed as a growth medium for forestry, range, agricultural or horticultural resources, or as raw material. Any development plans for the use of these resources must be based on the understanding of peatland ecology to determine the suitability of various kinds of peatlands for different uses and the possibilities of rehabilitation of exploited areas. The present state of knowledge of peatland development in the western region is very incomplete, and all available information is confined to a few local areas.

Peatlands are unique as the ecosystem (plants, water, soil, climate) creates its own environment. Accumulation of peat, upon reaching a critical thickness, can bring about a drastic change in the chemistry and nutrient levels of the peat. This in turn allows the invasion of different peat-forming vegetation, changing the complexion of the peatland. Conversely, interference with the natural ecosystem by partial drainage or excavation will interrupt this cycle in the short term and initiates the regeneration of peatland in the long term. The understanding of peatland dynamics is essential in predicting the response of a peatland to manipulation (as for example the drainage studies undertaken in NOR-28-03), in order to avoid disappointment, failure, or the creation of wastelands.

A study of peatland dynamics is in progress within the Boreal Wetland Regions of Alberta, Saskatchewan and Manitoba. This study characterizes the various peatland types in terms of vegetation, past and present, chemistry of surface and peat deposits, quantifying and characterizing the peat occurring in various peatland forms. The rate of peat deposition is measured by studying the layering and secondary root development of trees, and by obtaining radiocarbon dates of suitable peat sequences. The information gathered will be used to characterize the dynamics of various peatland forms in the Boreal Wetland Regions. It is estimated that five years of field work is sufficient to gather the basic information.

9. Study Objectives:

1. Determine the ecology of peatland development within the region and develop guidelines for peatland management and rehabilitation.

10. Goals for 1985-86:

1. Complete the determination of the chemical properties of samples collected in 1984-85 in north-central Saskatchewan. (Zoltai

2. Initiate a manuscript on "The development and ecology of peatlands in the western region." (Zoltai and Johnson)
3. Determine the radiocarbon date of 15 peat samples from central Saskatchewan. (Zoltai)
4. Initiate a manuscript on the "Management of peatlands and peat resources. (Zoltai)
5. Prepare manuscript on the bryophytes new to Manitoba and Saskatchewan, collected in 1982, 83, and 84. (Johnson)
6. Finalize report and map on "Ecoclimatic regions of Canada". (Zoltai).
7. Finalize three chapters for the book "Wetlands of Canada" for publication. (Zoltai)
8. Submit paper "Earth hummocks and thufur" for publications. (Zoltai)

Added Goal:

9. Act as one of the technical editors of the book "Wetlands of Canada". (Zoltai)
11. Accomplishments in 1985-86:
1. Chemical analyses of samples collected in Saskatchewan in 1984-85 have been completed.
 2. Material for a manuscript on "The development and ecology of peatlands in the western region" has been assembled and an outline prepared.
 3. Radiocarbon dates of 15 peat samples from central Saskatchewan have been determined.
 4. Material for a manuscript on "Management of peatlands and peat resources" is being assembled and critically examined.
 5. Draft manuscript on the bryophytes new to Manitoba and Saskatchewan, collected in 1982, -83, and -84 has been completed.
 6. "Ecoclimatic map of Canada" has been finalized and manuscript prepared.
 7. Three chapters were prepared for the book "Wetlands of Canada" (Introduction; Wetlands of the Subarctic Regions of Canada; Wetlands of the Boreal Regions of Canada). Also contributed to a chapter on Wetlands of the Arctic Regions of Canada. Manuscripts are in the review stage.
 8. Paper on "Earth hummocks and thufur" has been accepted for publication to be included in a volume. "International Perspectives of Periglacial Research" (John Wiley & Sons Ltd., London).

9. Acted as a member of an editorial group for the book "Wetlands of Canada".

12. Goals for 1986-87:

1. Prepare manuscript on "Development and ecology of peatlands in the western region". (Zoltai and Johnson)
2. Initiate manuscript on "Management of peatlands and peat resources". (Zoltai)
3. Initiate manuscript on "Wetland use classification from remotely sensed imagery". (Zoltai)
4. Prepare manuscript on "Heavy metal fallout from a smelter in peat". (Zoltai)
5. Submit for review paper on "Bryophytes new to Manitoba and Saskatchewan" for journal publication. (Johnson)
6. Submit for publication "Ecoclimatic Map of Canada" and brief report. (Zoltai)
7. Prepare a manuscript on lichens new to Alberta, Saskatchewan and Manitoba, and vascular plants new to Manitoba. (Johnson)
8. Submit for publication three chapters for the book "Wetlands of Canada". (Zoltai)
9. Prepare contribution on wetland ecology for the Forestry Report. (Zoltai and Johnson)

13. Publications 1985-86:

Wells, E.D. and S.C. Zoltai. 1985. The Canadian system of wetland classification and its application to circumboreal wetlands. Aquilo Ser. Bot. 21:45-52.

Bailey, R.G., S.C. Zoltai and E.B. Wiken. 1985. Ecological regionalization in Canada and the United States. Geoforum 16:265-275.

Zoltai, S.C. 1985. Axel Heiberg Island. Dubawnt Lake, Fosheim Peninsula. Horton Plain. Horton River. King William Island. Melville Island. Prince of Wales Island. Somerset Island. Stefansson Island. In: The Canadian Encyclopedia. Hurtig Publ. Edmonton. p. 123, 520, 680, 833, 941, 1117, 1481, 1733, 1758.

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Zoltai	0.9
	Johnson	0.5
Tech.:	Ali	0.5
Total:		1.9
Term/Student:		0.0

O & M: \$5,000

Capital:

15. Signatures:

S. C. Zoltai
Investigator

Al. M. Al. Z.
Program Director, Protection

J. D. Johnson
Investigator

C. D. Hunt
Regional Director General



Resource Development Agreement in 1984 provided the opportunity for the Canadian Forestry Service and the Alberta Forest Service to work together to study the problem from the very beginning i.e., to select, ditch and instrument new areas and investigate the effects.

This study constitutes the joint Canadian Forestry Service-Alberta Forest Service Wetland Drainage and Improvement Program, under the Canada-Alberta Forest Resource Development Agreement. It consists of several component studies:

- i) literature review of existing drainage projects in Alberta and elsewhere;
- ii) study area descriptions e.g., vegetation and peat types, topography, peat depth, chemical and physical properties of peat and groundwater;
- iii) drainage ditch network design and ditch construction methods for controlling groundwater table levels;
- iv) impact of drainage on tree growth and competing ground vegetation composition and on temperature, water content and fertility of soils;
- v) impact of drainage on the environment e.g., on stream water quantity and quality, and on peat depth (subsidence);
- vi) superposition of thinning and fertilization trials on drained areas and reforestation of suitable, cleared portions of drained areas with appropriate indigenous and exotic species;
- vii) assess, through cost/benefit analyses the economics of draining wetlands for increased wood production.

9. Study Objectives:

1. Evaluate the growth potential of commercial tree species on treed wetland sites where water tables have been lowered.
2. Measure the effects of drainage on hydrological parameters such as water table depths, and on critical soil characteristics such as moisture content, temperature, fertility, hydraulic conductivity and subsidence.
3. Monitor the effects of drainage on the composition of competing vegetation.

10. Goals for 1985-86:

1. On Manning, Kimiwan, and McLennan drainage projects, Peace River Forest: establish transects and tree growth sample plots; and install instrumentation to measure meteorological variables, groundwater levels and soil temperatures.

2. Collect and compile data from instrument network set up under goal 1.
3. On each transect, conduct ground vegetation surveys and measure height and radial growth of trees (Johnson).
4. Collect and analyze soil and water samples from each transect to determine bulk density, water content, and fertility of soils. (Johnson)
5. Prepare and submit for review Information Report on the state-of-the-art of forest drainage in the prairie provinces.
6. Submit for publication journal article on simulation of the effects of forest cover removal on subsurface flow (carried over from 1984-85).
7. Prepare poster display and working exhibit for "Open House - 1985". (Robson)

Goals Added:

8. Carry out reconnaissance survey and select three suitable wetland drainage study areas in Alberta's boreal forest (CFS/AFS).
 9. On each study area complete a peat and vegetation survey and sampling program to determine wetland, vegetation, and peat types, peat depth and other peat characteristics, and to determine the physical and chemical properties of peat and groundwater. (Johnson and Robson)
 10. On each study area, cut survey lines and conduct topographic survey for production of topographic maps (AFS/CFS).
 11. On each study area, obtain hydraulic conductivity measurements for use in Toth's synthetic hydraulic curve method of drainage system design (CFS/AFS).
 12. On each study area, install a weather station (CFS).
 13. For each study area, prepare drainage ditch system design (CFS/AFS).
 14. Prepare article on wetlands drainage research for the Wetlands and Climate issue of NoFC's Forestry Report. (Hillman)
 15. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada-Alberta Forest Resource Development Agreement (CFS/AFS).
 16. Consult with AFS on all matters pertaining to the Agreement drainage project, and to provide scientific and technical advice as necessary.
11. Accomplishments in 1985-86:
- 1-4. Goals 1, 2, 3 and 4 were not completed because there was a change in program direction when the Canada-Alberta Forest Resource Development Agreement was signed in October 1984. Under this Agreement, CFS/AFS

drainage studies are to be conducted on new areas rather than on areas already drained.

5. The Information Report entitled Improving wetlands for forestry--a review, with particular reference to Alberta is about 50 percent complete.
6. All review steps have been completed. The article entitled Simulation of the effects of forests cover removal on subsurface water is with the scientific editor.
7. A poster display and working demonstration of a groundwater level recorder were exhibited at NoFC's Open House. They were also shown in the Bramalea Building (AFS) during August, 1985.

Goals Added:

8. Study areas were established at Goose River (312 ha), near Valleyview, at McLennan (249 ha), and at Wolf Creek (131 ha), near Edson.
9. On each area, peat and vegetation surveys were completed along two transects, perpendicular to each other, and extending across the area. Nearly 400 samples were collected for physical and chemical analyses of peat and groundwater.
10. The work for two areas was completed under contracts. Topographic maps with 0.5 m contour intervals were produced for Goose River (1:5000 scale) and for McLennan (1:2000 scale). Survey lines were cut on Wolf Creek by CFS/AFS. The survey and topographic map will be done under contract in January, 1986.
11. Over 100 hydraulic conductivity measurements were taken on the three areas, most of them at about 0.6 m depth in the peat/soil. Some were taken at 1 and 2 m depth. A computer program was developed to do the calculations.
12. A recording precipitation gauge, and Stevenson screen with hygrothermograph were installed on each area.
13. Preliminary drainage ditch network designs were prepared for Goose River and McLennan areas using field observations, topographic maps and enlarged aerial photos. Mike Rosen, Ontario Ministry of Natural Resources, participated in the design process. Final designs will be based on Toth's sythetic hydraulic curve method.
14. The article for Forestry Report will be ready by the end of March, 1986.
15. The annual report required by the Agreement will be ready before the end of March, 1986.
16. Close cooperation between CFS and AFS was maintained throughout the year on all aspects of each drainage project. Scientific and technical advice was given on many occasions.

12. Goals for 1986-87:

1. Publish Information Report entitled Improving wetlands for forestry-- a review, with particular reference to Alberta. (Hillman)
2. On each study area, establish transects to intersect sites that are as uniform as possible and contain three different ditch spacings. (Hillman)
3. On each transect install reinforcing rods, groundwater table wells, soil temperature probes, data loggers, and water level recorders; install similar instrumentation on control areas. Collect and compile data from this instrument network. (Hillman)
4. On each transect, complete a peat survey and sampling program to determine peat type, peat depth, and other peat characteristics, and to determine the physical and chemical properties of peat and groundwater. (Johnson and Ali)
5. In the fall, collect foliage samples from black spruce and tamarack on each transect for nutrient study purposes. (Robson)
6. On each study area, collect bi-weekly stream water samples upstream and downstream from points where water from main ditches enters streams or other water bodies. The samples will be analyzed to determine the impact of ditching on stream chemical water quality and on suspended sediment loads. (Hillman)
7. On both treatment and control sites of each study area, establish permanent ground vegetation plots and conduct ground vegetation surveys. (Johnson)
8. On both treatment and control sites of each study area, establish permanent sample plots to measure tree growth (CFS/AFS).
9. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada-Alberta Forest Resource Development Agreement (CFS/AFS).
10. Publish article on wetlands drainage research in the Wetlands and Climate issue of NoFC's Forestry Report. (Hillman)
11. Publish in Water Resources Research, paper entitled Simulation of the effects of forest cover removal on subsurface water. (Hillman)
12. Provide scientific and technical advice on drainage projects. (Hillman)

13. Publications 1985-86:

Nil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 9, 1986

1. Project: Wetlands, Climate, and ENFOR
2. Title: Impact of climatic variation on boreal forest biomass production
3. New: Cont.: X 4. No.: NOR-28-04
5. Study Leader: T. Singh, vice Powell
6. Key Words: Climatology, climatic change, climatic variation, forest biomass, proxy data, dendrochronology, tree-rings, paleobotany, pollen analysis, X-ray densitometry, isotopic measurements, historical records, forest growth, Boreal Forest Region (B)
7. Location of Work: Edmonton laboratory, prairie provinces, N.W.T.
8. Problem:

Climate has a direct and pronounced effect of forest vegetation, however, there is a need to establish the impact of climate, and especially climatic fluctuations, on forest biomass productivity. Little is known about the effect of climatic parameters on biomass and how climatic fluctuations effect forest growth and yield. Also with the recent renewed interest in the use of forest products and wastes for energy supplements as liquid fuels, and the interest in using certain forest products for food, especially animal fodders and supplements, there is a further demonstrated need to develop long-term inventories of biomass in forested areas and to establish projected annual yields which take climatic factors into account. The rate of biomass renewal under a wide range of conditions of environment, site and growing stock is at present unknown. Climate should also have a direct and pronounced effect on planning and decision making related to present and future use of land and all renewable natural resources. Present day forests and their associated vegetation did not evolve under constant or uniform climatic conditions. Different regions of the boreal and subalpine forests in the Western and Northern Region are subjected to widely contrasting temperature and precipitation regimes. Annual weather patterns are highly variable. Forests in existence today reflect past climates. Their origins over time and space, growth rates, species composition, longevity and total biomass are largely dictated by past and present climates. Predictions relating to future forest vegetation or biomass must take that fact into consideration. Climatologists have recently concluded that the North

American climate is unlikely to remain as amenable in the near future as during the past several decades, a period with little climate fluctuations. Some are predicting a significant lowering of temperature, others a warming but all are predicting a return to increased variation with subsequent detrimental impact of energy, food and other resources. In the past, land use decisions have been made in the boreal forest and adjacent areas with little reference to impact of climate, more specifically climatic change or fluctuations, on long term success of those uses. Continuing to ignore or pay little attention to climatic variations could therefore have severe social and economic implications. There is evidence to indicate that climatic fluctuations of significant magnitude occurred in the recent and distant past. Local climates were warmer or cooler, dryer or wetter than occurs today, and the position of the boreal forest zone and northern tree line has fluctuated over time. The boreal forest presently occupies a zone with a summer temperature range of only 2°C, therefore any long-term temperature decrease, even of 0.5°C, would adversely affect this zone and its resulting biomass productivity. Information relating to climate impact on forest biomass is therefore required in two specific areas; 1) impact of climate on forest biomass production; and 2) past climates in the boreal forest region.

9. Study Objectives:

1. Assess impact of climate on forest vegetation and soils, especially those associated with forest clearcut areas.
2. Determine extent and degree of past short- and long-term climatic fluctuations and interrelationships between key parameters and measures of forest biomass productivity in selected regions of the boreal forest.
3. Provide climatic advice and represent CFS and NoFC on advisory committees and other groups, including those associated with the Canadian Climate Program.

10. Goals for 1985-86:

1. Publish paper on "Climatic variation in the boreal forest region of western Canada". (Singh, Powell)
2. Prepare and submit for review a report on the growing season climate of four clearcut areas associated with a seedling growth study (NOR-4-01). (Powell, Singh, vice Powell)
3. Continue analysis of short-term climatic data for 120 stations in the central Canadian boreal forest zone. (Singh, vice Powell)
4. Assist Forintek in preparing a paper on the use of black spruce in dendroclimatology. (Singh)
5. Assist Forintek in preparing a paper on tree-ring analysis and biomass productivity. (Singh)

6. Analyze and initiate a report on soil temperatures after clearcutting. (Singh, vice Powell)
 7. Analyze and initiate a report on paired climate stations. (Singh, vice Powell)
 8. Prepare summary report on the climate of clearcut forested areas in the Hinton region. (Singh, vice Powell)
 9. As required provide climatic and statistical advice and information to colleagues and others, and represent CFS and NoFC on various advisory committees. (Singh)
11. Accomplishments in 1985-86:
1. Paper on "Climatic variation in the boreal forest region of western Canada" has been accepted for publication in Climatic Change. (Singh, Powell)
 2. Analysis of data of growing season climate of four clearcut areas showed large gaps in the data, allowing only summary report. Further analyses to overcome data gaps are in progress. (Singh)
 3. Purchase of data from Atmospheric Environment Service for short-term climatic fluctuations in the boreal forest is in progress. (Singh)
 4. No assistance has been asked by FORINTEK to prepare paper on black spruce dendrochronology. (Singh)
 5. Assistance was provided to FORINTEK in preparing a paper on "Biomass productivity of white spruce stemwood" which is currently under review. (Powell)
 6. The analysis of soil temperatures after clearcutting has been initiated. (Singh)
 7. Analysis of data on paired climatic region was delayed due to lack of manpower. (vice Powell)
 8. Analysis of data of climate of clearcut forested areas in the Hinton region was delayed due to lack of manpower. (vice Powell)
 9. Statistical and climatic advice was provided as requested. A course on analysis of "messy" data will be attended in March 1986. Input was provided to the Alberta Energy and Natural Resources, Climate Inventory Steering and Technical Committees, the Alberta Climatological Association, Alberta Agrometeorology Advisory Committee, the Expert Committee of Agrometeorology, and the National Climate Advisory Committee (Singh, Powell, Swanson, Corns).

12. Goals for 1986-87:

1. Prepare summary report on growing season climate of clearcut areas associated with seedling growth study. (Singh)
2. Prepare summary report on soil temperature after clearcutting. (Singh)
3. Complete analysis of 120 stations, and prepare and initiate review of a journal paper on climatic extremes in the boreal forests of western Canada. (Singh)
4. Provide statistical and modelling advice to colleagues and clients in the ongoing programs of NoFC, attend short courses for updating professional skills and represent CFS and NoFC on various advisory committees. (Singh)
5. Terminate study after 1986-87.

13. Publications 1985-86:

- [Powell, J.M.] 1984. Canada/Environment Canada, Canadian Forestry Service, Northern Forest Research Centre. Pages 172-175 in Barr, W. (compiler and editor). The Canadian Association of Geographers Directory 1984. 235 pp.
- Powell, J.M. 1984. Canadian Forestry Service. Page 11, Appendix 4 in Report of the 26th Annual Meeting of the Expert Committee on Agrometeorology. November 1-2, 1984. Ottawa. Agric. Canada, Ottawa. 23 pp. + Appendices.
- [Powell, J.M.] 1984. Canadian Forestry Service. Pages 109-111 in Canadian Geophysical Bulletin, Vol. 37. Energy, Mines & Resources Canada, Earth Physics Branch, Ottawa. 195 pp.
- Singh, T. and J.M. Powell. 1985. Climate variation and trends in the Boreal Forest region of western Canada. Climate Change (in press).
- Singh, T. 1985. Recent climatic trends in the boreal forest. National Woodlands. 8(4):15
- Swanson, R.H. 1985. Northern Forest Research Centre. Pages 125-128 in Dupuis, S. (compiler) Current Climatological Activity in Alberta Proc. 9th Ann. Workshop Alta. Climatological Assoc. June 1985. Alta. Energy & Nat. Resources, Res. Eval. Plan. Div. 155 pp. (November).

14. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1986-87:

PYs: Prof.:	Singh	0.6
	vice Powell	1.0
Tech.:	Schultz	1.0
Total:		2.6
Term/Student:		0.0

O & M: \$3,000

Capital:

16. Signatures:



 Investigator

 Investigator



 Program Director, Protection



 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 24, 1986

1. Project: Wetlands, Climate, and ENFOR
2. Title: Development of integrated biomass prediction equations for Western & Northern Region
3. New: Cont.: X 4. No.: NOR-28-05
5. Study Leader: T. Singh
6. Key Words: Biomass, regional and national forest statistics, energy, inventory, simulation, prairies region, prediction equations, mathematical models
7. Location of Work: Western and Northern Region
8. Study Objectives:
 1. To synthesize the available biomass data for the regionally important tree species for predicting biomass.
 2. To develop and test regional biomass equations, for their accuracy and bias, in a pilot-scale demonstration for converting a conventional forest inventory to a biomass inventory.
9. Goals for 1985-86:
 1. Publish journal paper on variation in the wood densities of major tree species of the Northwest Territories.
 2. Complete statistical analyses and finalize Information Report on comparative predictability of biomass equations derived from the prairies and N.W.T. data.
 3. Complete analysis of the fine biomass data of the coniferous tree species of N.W.T. and prepare a note incorporating the derived equations.
 4. Finalize the review on the note on wood densities of tree species from the non-inventoried areas of the prairie provinces.

5. Analyze the heat of combustion data on the tree species of Manitoba and prepare a paper on wood for energy.
 6. Undertake review of the contractor's report for publishing the compiled information on biomass and energy potential of Manitoba.
10. Accomplishments in 1985-86:
1. A note entitled "Wood density variation of six major tree species of the Northwest Territories" was accepted for publication by Canadian J. Forestry Research.
 2. The paper entitled "Generalizing biomass equations for the boreal forest region of west-central Canada" was submitted for publication to Forest Ecology and Management.
 3. Analyses completed; a paper will be prepared before March 1986.
 4. The manuscript entitled "A note on wood densities in the non-inventoried boreal forest of western Canada" was submitted to journal and is back with a suggestion for doing some additional work to extend the scope of the paper.
 5. The material has been combined with goal 6 for a journal paper as listed below.
 6. Journal paper resulting from goals 5 and 6 has completed internal reviews, and is with the Scientific Editor for final editing before submission. The note is entitled "Calorific value variation in the ten tree species and their components".
11. Goals for 1986-87:
1. Publish journal paper on "Generalizing biomass equations for the boreal forest region of west-central Canada".
 2. Prepare, review, and publish note on fine biomass of three coniferous tree species of NWT.
 3. Publish journal note on wood densities of non-inventoried boreal forest of western Canada.
 4. Publish journal note on calorific value variations in plant components of ten tree species.
 5. Prepare a journal note on addressing problems due to unrealistic values caused by using biomass prediction equations for small trees in the prairies and NWT.
 6. Prepare paper for presentation at the workshop on "Tree biomass regression functions and their contribution to the error of forest inventory estimates", May 26-30 in Syracuse.

12. Publications 1985-86:

Singh, T. 1986. Wood density variation of six major tree species of the Northwest Territories. Can. J. For. Res. 16: (in print).

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Singh 0.3

Tech.: 0.0

Total: 0.3


Term/Student: 0.0

O & M: Nil)

) Funds to be provided from HQ ENFOR budget under NOR-28-06

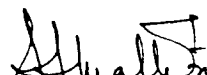
Capital: Nil)

15. Signatures:

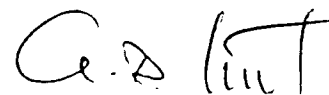


Investigator

ENFOR Representative



Program Director, Protection



Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 24, 1986

1. Project: Wetlands, Climate, and ENFOR
2. Title: An assessment of the energy potential of forest biomass in the prairie provinces and the Northwest Territories
3. New: Cont.: X 4. No.: NOR-28-06
5. Study Leader: J.M. Powell
6. Key Words: Biomass, energy, fuels, climate, productivity, availability, harvesting, simulation models, resource data, impacts
7. Location of Work: Western and Northern Region
8. Study Objectives:
 1. To develop and test biomass prediction equations for regional tree species and lesser vegetation and demonstrate their integration with resource inventory programs.
 2. To investigate the impact of biomass removal on site quality, nutrient status, silvicultural option and long-term site productivity on selected sites in the prairie provinces.
 3. To determine production and delivery costs of biomass under various operation conditions and to provide a basis for evaluating the feasibility of using various forms of biomass for energy.
 4. To develop and operate a computerized biomass data bank and information retrieval system to provide for more effective use of information and technology transfer.
9. Goals for 1985-86:
 1. Publish summary report on "Analysis of integrated utilization of aspen for wood and energy" (P-207) (Scientific Authority: W. Ondro).
 2. Complete review and publish report on "Use of geographic information system for converting forest inventories to biomass inventories" (P-148 and extension) (Scientific Authorities: W. Moore and W. Chow).

3. Publish report on "Downed-dead fuels in central Alberta forest cover types" (P-23) (Scientific Authority: T. Singh).
 4. Oversee completion of contract to "Determine the biomass and energy potential of the main tree species in Manitoba" and prepare for publication (P-315) (Scientific Authority: T. Singh). Consider whether similar studies should be undertaken for Alberta and/or Saskatchewan.
 5. Oversee completion of contract for "Chemical analysis of plant and soil samples obtained under P-205", (P-323), and provide them for contract under P-314 (Scientific Authority: I. Edwards).
 6. Oversee completion of phase I of contract for "Adaptation of FORCYTE for Alberta aspen stands" (P-314). Initiate phase II of the study including overseeing of field instrumentation on established plots (Scientific Authority: I. Edwards).
 7. Publish the summary report on "Winter harvesting of aspen for integrated utilization--a case study" to complete reporting under P-207, (P-324) (Scientific Authority: D. Boylen).
 8. Continue coordination of NoFC ENFOR projects ensuring their completion and publication; act as establishment representative on national committees. Attend Bioenergy Seminars, FORCYTE courses, and submit reports on the program as required (J. Powell; also I. Edwards, T. Singh, M. Apps).
10. Accomplishments in 1985-86:
1. A further draft of the summary report on "Analysis of integrated utilization of aspen for wood and energy" was prepared but a decision has not been made whether a report should be published or not as much of the material is now dated (P-207) (Scientific Authority: W. Ondro).
 2. An Information Report draft entitled "A mapping analysis of resources system application: Forest inventories to biomass inventories" was recently submitted to the editor after completion of review (P-148 and extension) (Scientific Authorities: W. Moore and W. Chow).
 3. The Information Report on "Downed-dead fuels in central Alberta forest cover types" has been delayed in review (P-23) (Scientific Authority: T. Singh).
 4. The contract to "Determine the biomass and energy potential of the main tree species in Manitoba" has been completed for phase I and II, and work under phase III is in progress. This phase will include a research and contract report to be submitted by contractor before the end of the fiscal year. A journal paper from the earlier phases entitled "Calorific values of major tree species components in Manitoba" has been reviewed and is with the editor (see also NOR-28-05 goals 5 and 6) (P-315) (Scientific Authority: T. Singh).

5. The contract for chemical analysis of plant and soil samples obtained under project P-205 was completed by Can Test Ltd., Vancouver. All analytical data were checked and submitted to Western Ecological Services, Ltd., Victoria under contract (P-314) to analyze data and prepare a report on biomass and nutrient content in Alberta aspen ecosystems (Scientific Authority: I. Edwards).
 6. A preliminary report was completed and, following development of biomass regression equations for small diameter trees by Dr. Teja Singh, a final report was prepared by the contractor. Phase II of the study was initiated with the installation of recording rain gauges, suction lysimeters, throughfall collectors, and litter bags. Samples of precipitation, throughfall, leachate, and litter were collected and chemically analyzed under contract. The data will be used as input for the FORCYTE growth simulation model (P-314) (Scientific Authority: I. Edwards).
 7. The report "Winter harvesting of aspen for product and biomass recovery" has been reviewed and is with author for revisions (P-207, P-324) (Scientific Authority: D. Boylen).
 8. Attended one meeting of the ENFOR Production Technical Committee on behalf of the Centre and coordinated the program throughout the year. Apps, Edwards and Grewal attended a FORCYTE workshop in Vancouver in February 1985. Brief reports were provided by Singh and Powell for the US-based Bioenergy Council for publication in their Directory. Powell and Edwards accompanied Richardson (CFS HQs) on a tour of some of the plots associated with P-314.
11. Goals for 1986-87:
1. Decide whether to publish a report on "Analysis of integrated utilization of aspen for wood and energy" after further reviews (P-207) (Scientific Authority: W. Ondro).
 2. Publish Information Report on "A mapping and analysis of resources system application: Forest inventories to biomass inventories" (P-148 and extension) (Scientific Authorities: W. Moore and W. Chow).
 3. Complete review and publish Information Report on "Downed-dead fuels in central Alberta forest covertypes" (P-23) (Scientific Authority: T. Singh).
 4. Prepare and publish reports of contract to "Determine the biomass and energy potential of the main tree species in Manitoba, Phase III" (P-315 extension) (Scientific Authority: T. Singh).
 5. Review final report on phase I of contract for "Adaptation of FORCYTE model for Alberta aspen stands" (P-314) (Scientific Authority: I. Edwards).
 6. Oversee completion of three contracts to collect and chemically analyze water and litter samples from established aspen plots (P-314) (Scientific Authority: I. Edwards).

7. Oversee completion of phase II of contract for "Adaptation of FORCYTE model for aspen stands". Summarize and review nutrient cycling data generated in Goal 6 for adaptation of FORCYTE model (P-314) (Scientific Authority: I. Edwards).
 8. Oversee an advisory contract with the originators of the FORCYTE model (P-314) (Scientific Authority: M. Apps).
 9. Complete review and publish report on "Winter harvesting of aspen for product and biomass recovery" (P-207, P-324) (Scientific Authority: D. Boylen).
 10. Oversee contract to assess the biomass productivity on the two-year-old aspen cutovers associated with P-314 (P-333) (Scientific Authority: H. Grewal).
 11. Oversee contract to assess biomass and energy potential of Saskatchewan forests (P-334) (Scientific Authority: TBA).
 12. Oversee contract on Wood density of Canadian tree species to be undertaken by FORINTEK Canada Corp., Vancouver (P-335) (Scientific Authority: J. Powell).
 13. Complete review and publish paper with FORINTEK on "Biomass productivity of white spruce stemwood"; assist FORINTEK with papers from earlier studies as required. (J. Powell)
 14. Continue coordination of NoFC ENFOR projects ensuring their completion and publication; act as establishment representative on national committees; organize a FORCYTE workshop; and submit reports on the program as required (J. Powell; also I. Edwards, M. Apps).
12. Publications 1985-86:
- Jozsa, L.A., M.L. Parker, P.A. Bramhall, and S.G. Johnson. How climate affects tree growth in the boreal forests. (Abs.) Swedish Univ. Agric. Sci., For. Energy Secretariat, Garpenberg. Forest Energy Newsletter No. 3, 1985. p. 7.
- Singh, T. Biomass equations for six major tree species of the Northwest Territories. (Abs.) Swedish Univ. Agric. Sci., For. Energy Secretariat, Garpenberg. Forest Energy Newsletter No. 3, 1985. p. 8.
13. Environmental Implications:
- The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.:	Edwards	0.2
	Singh	0.1
	Apps	0.1

Tech.:		0.0
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Total:		0.4
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Term/Student:		0.0
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Contracts:	185,100
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In-house R & D:	4,500
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Management:	13,500
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Total:	203,100 (From HQ ENFOR budget)
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15. Signatures:

J. M. Powell
Program Director, Extension

[Signature]
Program Director, Protection

[Signature]
Regional Director General



NOR-33

TECHNOLOGY TRANSFER AND INFORMATION

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1986

1. Project: Technology Transfer and Information
2. Title: Scientific and technical editing and publishing
3. New: Cont.: X 4. No.: NOR-33-01
5. Study Leader: J.K. Samoil and B.J. Boughton (cooperator)
6. Key Words: Editing, publishing, printing, information reports, journal articles, scientists, resource managers, industrial managers
7. Location of Work: Region wide
8. Study Objectives:

Edit, publish, and distribute scientific, technical, and other publications of the Northern Forestry Centre and its two district offices.

9. Goals for 1985-86:

1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately
 - a. 20 Information Reports
 - b. 7-10 Forest Management Notes
 - c. 3 Forestry Reports
 - d. 2 Pest Leaflets, and
 - e. 40 Journal articles and miscellaneous publications. (J.S., G.T.)
2. Assist in the preparation of three special technical reports: insects of the prairie provinces by W.G.H. Ives, diseases of the prairie provinces by Y. Hiratsuka, and common forest plants of west-central Alberta by I. Corns. (J.S., G.T.) (33-11)
3. Prepare and publish the Program Review 1984-85 of the Northern Forest Research Centre. (J.S., G.T.) (33-12)

4. Oversee printing and reprinting of locally published scientific and technical information. (J.S.) (33-13)
5. Continue responsibility for the production and printing of the monthly NoFRC Forestry Newsletter. (J.S., G.T.) (33-14)
6. Continue responsibility for the distribution of NoFRC publications, maintaining the mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence. (J.S., G.T.) (33-16)
7. Provide editorial, typographical, and printing assistance for public information activities, including the NoFRC open house. (J.S., G.T.) (33-11, 33-13)
8. Write and produce a brochure outlining the activities of the Northern Forest Research Centre and its District Offices. (J.S.) (33-15)

Added Goal:

9. Conduct a major updating and revision of the 1500-name mailing list to eliminate duplication and remove names of those not actively requesting to be retained. (J.S., S.P.)
10. Accomplishments in 1985-86:
1. Assisted the research staff, through the provision of editing and publishing services, in the preparation and publication of:
 - a. 8 Information Reports
 - b. 2 Forest Management Notes
 - c. 2 Pest Leaflets
 - d. 39 journal articles and miscellaneous publications.
 2. Advice was provided regarding the three special technical reports. Sample formats and options and costs regarding printing procedures were provided for the insects of the prairie provinces and diseases of the prairie provinces publications. The forest ecosystem classification of west-central Alberta publication was edited in preparation for typesetting.
 3. Prepared and published the Program Review 1984-85 of the Northern Forest Research Centre.
 4. Oversaw printing and reprinting of locally published scientific and technical information.
 5. Continued responsibility for the production and printing of the monthly NoFRC Forestry Newsletter.

6. Continued responsibility for the distribution of NoFRC publications, maintaining the mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence.
7. Provided editorial, typographical, and printing assistance for public information activities, including the NoFRC Open House.
8. Wrote and produced a brochure outlining the activities of the Northern Forest Research Centre and its District Offices.

Added Accomplishments:

9. Completed a major updating and revision of the 1500-name mailing list, making changes to about three-quarters of the names.
11. Goals for 1986-87:
1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately:
 - a. 10 Information Reports
 - b. 7-10 Forest Management Notes
 - c. 2 Forestry Reports
 - d. 15 Pest Leaflets (revisions and reprinting)
 - e. 40 journal articles and miscellaneous publications. (J.S., B.B.) (33-11)
 2. Assist in the preparation of four special technical reports: insects of the prairie provinces by W.G.H. Ives and H.R. Wong; diseases of the prairie provinces by Y. Hiratsuka; forest ecosystem classification of west-central Alberta by I. Corns and R. Annas; diagnosis and recognition of winter frost damage by H. Zalasky. (J.S., B.B.) (33-11)
 3. Prepare and publish the Program Review 1985-86 of the Northern Forestry Centre. (J.S.) (33-12)
 4. Oversee production and printing or reprinting of locally published scientific and technical information. (J.S.) (33-13)
 5. Continue responsibility for the distribution of NoFC publications, maintaining the mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence. (J.S., B.B.) (33-16)
 6. Provide editorial, typographical, and printing assistance for public information activities. (J.S., B.B., D.A.) (33-11, 33-13)

7. Prepare and publish as an Information Report a bibliography of 1980-85 publications of the Northern Forestry Centre. (J.S., B.B.) (33-23)
 8. Investigate upgrading and replacement of typesetting and word processing equipment. (J.S.) (33-24)
12. Publications 1985-86:

INFORMATION REPORTS

- Dubé, D.E., compiler. 1985. Proceedings of the Intermountain Fire Council 1983 Fire Management Workshop. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-271.
- Gorman, J.R., compiler. 1985. Proceedings of the 1984 Mechanized Silviculture Workshop. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-272.
- Johnson, J.D.; Kershaw, L.J.; Russell, J.M.; Fabijan, D.M. 1985. Checklist of specimens in the Northern Forest Research Centre herbarium (CAFB). Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-267.
- Moody, B.H.; Cerezke, H.F. 1985. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1984 and predictions for 1985. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-269.
- Newstead, R.G.; Lieskovsky, R.J. 1985. Air tanker and fire retardant drop patterns. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-273.
- Ondro, W.J.; Williamson, T.B. 1985. The forest industry in the economy of Saskatchewan, 1979-80. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-270.
- Yang, R.C. 1985. Effects of fertilization on growth of 30-year-old lodgepole pine in west-central Alberta. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-268.
- Yang, R.C. 1985. Ten-year growth response of 70-year-old lodgepole pine to fertilization in Alberta. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-266.

FOREST MANAGEMENT NOTES

- Dyck, J.R. 1985. Fertilization improves red pine seed production. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 31.
- Zalasky, H. 1985. Frost, ice-nucleating agents, and frost damage. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 30.

JOURNAL/SYMPOSIUM ARTICLES

- Achuff, P.L.; Corns, I.G.W. 1985. Plants new to Alberta from Banff and Jasper national parks. *Can. Field-Nat.* 99(1):94-98.
- Alexander, M.E. 1985. Book review of Fire in forestry. *For. Chron.* 61(2):119-120.
- Alexander, M.E. 1985. Estimating the length-to-breadth ratio of elliptical forest fire patterns. Pages 287-304 in Proceedings of the eighth conference on fire and meteorology. Soc. Am. For., Bethesda, Maryland.
- Allen, E.; Hiratsuka, Y. 1985. Artificial inoculation of young seedlings of lodgepole pine with Endocronartium harknessii. *Can. J. Bot.* 63:1168-1170.
- Bailey, R.G.; Zoltai, S.C.; Wiken, E.B. 1985. Ecological regionalization in Canada and the United States. *Geoforum* 16(3):265-275.
- Banskota, K.; Phillips, W.; Williamson, T.B. 1985. Factor substitution and economies of scale in the Alberta sawmill industry. *Can. J. For. Res.* 15:1025-1030.
- Bella, I.E. 1985. Pest damage incidence in natural and thinned lodgepole pine in Alberta. *For. Chron.* 61(3):233-238.
- Bella, I.E. 1985. Western gall rust and insect leader damage in relation to tree size in young lodgepole pine in Alberta. *Can. J. For. Res.* 15:1008-1010.
- Bernier, P.Y. 1985. Variable source areas and storm-flow generation: an update of the concept and a simulation effort. *J. Hydrol.* 79:195-213.
- Bernier, P.Y. 1985. The WRENSS procedure: from research model to management tool. Pages 115-123 in G.D. van Raalte, compiler. Proceedings of the Canadian Forestry Service modelling workshop, Hull, Quebec, June 11-13, 1985. *Can. For. Serv., Ottawa, Ontario.*
- Corns, I.G.W. 1985. Interpretation of site factors for mechanized site preparation. Pages 40-41 in J.R. Gorman, compiler. Proceedings of the 1984 mechanized silviculture workshop. *Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-272.*
- Corns, I.G.W.; Annas, R.M. 1984. Ecological classification of Alberta forests and its application for forest management. Pages 40-52 in M. Murray, editor. Forest classification at high latitudes as an aid to regeneration. Proceeding of a fifth international workshop, Fairbanks, Alaska, August 15-17, 1983. U.S. Dep. Agric., For. Serv., Pac. Northwest For. Range Exp. Stn. Gen. Tech. Rep. PNW-177.
- Drouin, J.A. 1985. Silviculture. Pages 215-242 in Western Canada section. Vol. 2. Expert Committee on Weeds research report. Agriculture Canada, Ottawa, Ontario.

- Dubé, D.E. 1984. International cooperation in forest fire research. Pages 401-404 in Proceedings of the International Forest Congress, August 5-8, Quebec City, Quebec. Soc. Am. For., Washington, D.C., and Can. Inst. For., Ottawa, Ontario
- Grewal, H. 1985. An overview of modelling work done at Northern Forest Research Centre. Pages 28-38 in G.D. van Raalte, compiler. Proceedings of the Canadian Forestry Service modelling workshop, Hull, Quebec, June 11-13, 1985. Can. For. Serv., Ottawa, Ontario.
- Hall, R.J.; Morgan, D.J.; Bowlby, R.H. 1985. Application of large-scale photography to forest resource inventories: What are the options? Pages 643-652 in Proceedings of the ninth Canadian symposium on remote sensing. Canada Centre for Remote Sensing, Ottawa, Ontario.
- Huebert, D.B.; L'Hirondelle, S.J.; Addison, P.A. 1985. The effects of sulphur dioxide on net CO₂ assimilation in the lichen Evernia mesomorpha Nyl. New Phytol. 100:643-651.
- Kennedy, K.A.; Addison, P.A.; Maynard, D.G. 1985. Effect of particulate elemental sulphur on moss. Environ. Pollut. (Series A) 39:71-77.
- Krebill, R.G.; Hoff, R.; Bella, I.E. 1985. Symposium field tours: observations on lodgepole pine forestry in North America. Pages 369-372 in Lodgepole pine: the species and its management. Symposium proceedings. Washington State University, Pullman, Washington.
- Lawson, B.D.; Stocks, B.J.; Alexander, M.E.; Van Wagner, C.E. 1985. A system for predicting fire behavior in Canadian forests. Pages 6-16 in Proceedings of the eighth conference on fire and forest meteorology. Soc. Am. For., Bethesda, Maryland.
- L'Hirondelle, S.J.; Addison, P.A. 1985. Effects of SO₂ on leaf conductance, xylem tension, fructose, and sulphur levels of jack pine seedlings. Environ. Pollut. (Series A) 39:373-386.
- Mallett, K.I.; Hiratsuka, Y. 1985. The "trap-log" method to survey the distribution of Armillaria mellea in forest soils. Can. J. For. Res. 15:1191-1193.
- Mastrogiuseppe, R.J.; Alexander, M.E.; Romme, W.H. 1985. Forest and rangeland fire history bibliography. Page 353 in Proceedings of a symposium and workshop on wilderness fire, Missoula, Montana, November 15-18, 1983. U.S. Dep. Agric., For. Serv., Intermt. For. Range Exp. Stn., Ogden, Utah. Gen. Tech. Rep. INT-182.
- Maynard, D.G.; Addison, P.A. 1985. Extraction and colorimetric determination of elemental sulfur in organic horizons of forest soils. Can. J. Soil Sci. 65:811-813.
- Maynard, D.G.; Stewart, J.W.B.; Bettany, J.R. 1985. The effects of plants on soil sulfur transformations. Soil Biol. Biochem. 17(2):127-134.

- Powell, J.M. 1984. Canada/Environment Canada, Canadian Forestry service, Northern Forest Research Centre. Pages 172-175 in W. Barr, compiler. Canadian Association of Geographers directory 1984. Canadian Association of Geographers, Montreal, Quebec.
- Powell, J.M. 1985. Canadian Forestry Service. Pages 1-4, Appendix 4, in Minutes of the twenty-sixth annual meeting of the Expert Committee on Agrometeorology, November 1-2, 1984. Agriculture Canada, Ottawa, Ontario.
- Singh, T. 1985. Current forestry concerns in Canada. Natl. Woodlands 8(3):11-12.
- Singh, T. 1985. Microcomputer software for statistical tasks. Natl. Woodlands 8(5):12.
- Singh, T. 1985. Recent climatic trends in the boreal forest. Natl. Woodlands 8(4):15.
- Swanson, R.H. 1985. Managing lodgepole pine ecosystems as watersheds. Pages 305-313 in Lodgepole pine: the species and its management. Symposium proceedings. Washington State University, Pullman, Washington.
- Swanson, R.H. 1985. Northern Forest Research Centre. Pages 1-4 in S. Dupuis, compiler. Current climatological activity in Alberta. Proceedings of the 9th annual workshop, June 1985. Alberta Energy Nat. Resour., Edmonton, Alberta.
- Tsuneda, A.; Malloch, D.; Hiratsuka, Y. 1985. Ascospore morphology and germination in Scopinella species. Trans. Mycol. Soc. Jpn. 26:221-229.
- Weetman, G.F.; Yang, R.C.; Bella, I.E. 1985. Nutrition and fertilization of lodgepole pine. Pages 225-232 in Lodgepole pine: the species and its management. Symposium proceedings. Washington State University, Pullman, Washington.
- Wells, E.D.; Zoltai, S.C. 1985. The Canadian system of wetland classification and its application to circumboreal wetlands. Aquilo Ser. Bot. 21:45-52.
- Wong, H.R.; Drouin, J.A.; Rentz, C.L. 1985. Petrova albicapitana (Busck) and P. metallica (Busck) (Lepidoptera: Tortricidae) in Pinus contorta Dougl. stands of Alberta. Can. Entomol. 117:1463-1470.
- Zalasky, H. 1985. Bud defects in winter-damaged Colorado spruce. Page 110 in W.G. Thies, compiler. Proceedings of the 33rd annual western international forest disease work conference, Olympia, Washington, September 24-27, 1985. U.S. Dep. Agric., For. Serv., Pac. Northwest For. Range Exp. Stn., Corvallis, Oregon.
- Zoltai, S.C.; Johnson, J.D. 1985. Development of a treed bog island in a minerotrophic fen. Can. J. Bot. 63:1076-1085.

MISCELLANEOUS

Hiratsuka, Y.; Maruyama, P.J. 1985. Western gall rust. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Pest Leaflet PL 27-85.

Maruyama, P.J.; Hiratsuka, Y. 1985. Silver leaf. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Pest Leaflet PL 26-85.

Northern Forest Research Centre. 1985. Program Review 1984-85. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta.

Samoil, J.K. 1985. Northern Forest Research Centre. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Brochure.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Samoil 1.0
Boughton 1.0

Tech.: Adams 1.0

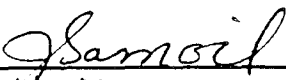
Total: 3.0

Term/Student: 0.8 (Distribution Clerk; Graphic Artist)

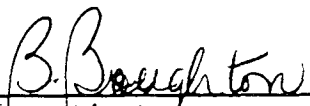
O & M: \$80,000


Capital:

15. Signatures:


Investigator


Program Director, Extension


Investigator


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1986

1. Project: Technology Transfer and Information
2. Title: Technology transfer and public information
3. New: Cont.: X 4. No.: NOR-33-02/03/04
5. Study Leader: R.G. Newstead (Cooperators: D.J. Robinson (03),
P.S. Debnam (04))
6. Key Words: Technology transfer, communications, public relations, public
information, library, photography
7. Location of Work: Throughout region
8. Study Objectives:
 1. Co-ordinate and promote the planning and delivery of an effective regional technology transfer program.
 2. Create increased public awareness and understanding of CFS and NoFC initiatives in the forestry sector, inform designated publics of the benefits of the forest resources to the people of the region and the nation; and provide a range of public and media relations services.
 3. Enhance internal CFS and NoFC communications opportunities to exchange information, solicit feedback, study and identify concerns or issues warranting attention.
 4. Provide a full range of library and photographic support services to NoFC personnel.
9. Goals for 1985-86:
 1. Coordinate technology transfer and information services and activities within NoFC including public information, public relations, scientific and technical information, extension services, library and photographic services. (R.N.) (33-2)
 2. Serve as NoFC Open House Committee Chairman (R.N.) others serve in functional role (A.K., H.S., P.D.). Evaluate and report on the outcome of this event. (R.N.) (33-3)

3. Serve on in-house regional, national and N.G.O. working/advisory committees as required. (R.N., A.K.) (33-4)
4. Participate in the development, implementation and evaluation of communications plans under the Manitoba, Saskatchewan and Alberta F.R.D.A.'s (see NOR-36). (R.N., A.K., H.S.) (33-1)
5. Oversee development and maintenance of a photographic records classification system and library. (H.S.) (33-5)
6. Develop and implement an annual public information plan to organize and conduct public information exhibits including major regional exhibitions, National Forest Week events, Federal Information Fairs, and other invitational events such as U of A Woodsmen's Competitions, Hampco '85, Forestry Capital of Canada and the like. (R.N., A.K., H.S.) (33-7)
7. Develop public information and media materials and presentations including media releases, feature articles, backgrounders, exhibits, brochures, pamphlets and other promotional materials. (R.N., A.K.) (33-9)
8. Review existing documents and activities relating to CFS/NoFC technology transfer efforts, participate in planned CFS national technology transfer workshop, and establish personal contact with USDA Forest Service Technology Transfer Unit in Washington D.C. (R.N.) (33-6)
9. Act as NoFC focal point for internal and external communications with the public and media, by responding to inquiries for information, tours, presentations and the like; and by coordinating research and technical staff representations to the public and the media. (R.N., A.K., H.S.) (33-8, 33-10)
10. Provide a full range of library services including ordering, purchasing, cataloguing, and filing reports, journals and books. Assist NoFC staff and authorized visitors in literature retrievals profiles and searches. Maintain contact and inter-library loan privileges with HQ and other associated libraries. (D.R.) (33-17)
11. Investigate and report on opportunities and costs associated with the implementation of computerized library functions and data bases access. (D.R.) (33-18)
12. Investigate and report on short-term and long term NoFC library space allocation, facilities, and storage requirements. (D.R., R.N.) (33-19)
13. Provide photographic and advisory services to NoFC research and regional development projects including processing, printing, photo enlargement/reduction, specialized photography, and layouts, and/or monitor the performance of contract services for same. (P.D.) (33-20)
14. Requisition, inventory, and maintain photographic and other audio-visual equipment. (P.D.) (33-21)

10. Accomplishments in 1985-86:

1. Coordinated inaugural year of technology transfer and information services and activities within NoFC including project and study planning and implementation phases, fiscal and staffing responsibilities, and advisory and leadership functions. Study/project leader completed three-week Middle Management Orientation Program. (R.N.) (33-2)
2. Served as NoFC Open House Committee Chairman and, with assistance of project staff, successfully completed this event. Open House evaluation and final report submitted to NoFC Management. (R.N.) (33-3)
3. Served on in-house, regional, national, and N.G.O. working/advisory committees as follows: (33-4)
 - Alberta Forestry Association - School Education Committee (R.N.)
 - National Forest Week Committee - Alberta Forestry Assn. (R.N.)
 - Canada-Alberta FRDA, Public Info. subcommittee (R.N.)
 - Open House Committee - 1985, Chairman (R.N.)
 - NoFC Library Committee, Chairman (R.N.)
 - Canada-Manitoba FRA, Public Info. subcommittee (A.K.; A.A.)
 - NoFC Science Committee - member (R.N.)
4. Played an active role in the development and implementation of communications plans under the Manitoba, Saskatchewan, and Alberta FRDAs. Provided advice and guidance to District offices regarding production of display and public information materials, including a promotional brochure for research programs under the Can-Alta FRDA. Monitored the undertaking of public opinion surveys on forestry awareness in Manitoba and Saskatchewan and actively coordinated a comparable survey under the Canada-Alberta FRDA. Participated in the planning and development of a mobile forestry exhibit trailer in Alberta (see NOR-36) (R.N., A.K., H.S.) (33-1)
5. With the assistance of a term employee, developed a photographic records classification system and acquired numerous 35 mm slides to create a library of a cross-section of forestry and related subjects for use by staff especially in technology transfer activities. (H.S.)
6. Developed and implemented an annual public information schedule to organize and conduct public information exhibits at major regional exhibitions including Red River Exhibition, Buffalo Days, Calgary Stampede, and other invitational events including a Federal Information Fair at Peace River, Alberta Science Teachers Federation exhibition at Red Deer, and National Forest Week - Forestry Centre of Alberta mall exhibit at Grande Prairie, CIF annual meeting at Winnipeg, and IUFRO and AFPA meetings at Jasper. (R.N., H.S., A.K.) (33-7)
7. Prepared, routed, translated, and distributed news releases associated with NoFC "Open House", District Office requirements, Ministerial visits, etc. Designed and fabricated public information and

- technology transfer exhibits, and wall mural for new district office in Winnipeg. Provided logistical and briefing support materials for three Ministerial visits to region. Designed and purchased promotional materials including "Connie Fir" plush toy mascot. (R.N., A.K.) (33-9)
8. Participated in CFS national Technology Transfer "Think Tank" in Ottawa where contact was established with USDA Forest Service TT Unit leader (Washington, DC). Assembled and reviewed documents and publications pertaining to technology transfer processes and planning. Attended Federal Laboratory Consortium for technology transfer fall meeting at Champaign, Illinois and discussed TT with counterparts at North Central Forest Experiment Station at St. Paul, Minn. on return trip. Designed and developed technology transfer exhibit. Prepared and presented to management and staff a review and update on TT planning and implementation processes including future intentions. (R.N.) (33-6)
 9. Guided the development and implementation of two NoFC staff opinion surveys, coordinated media/staff interaction and interviews, provided public tours of NoFC, and responded to public inquiries for information, school and group presentations as requested. (A.K., R.N., H.S.) (33-8, 33-10)
 10. Maintained a full range of library services in support of research and regional development programs. Participated in a national meeting of CFS librarians to formulate future options for CFS library services as a result of affiliation with Agriculture Canada. (D.R.) (33-17)
 11. Incomplete pending outcome of consultant's review of status and future direction of CFS library services. Lack of funds and additional PY support prohibited development and implementation of internally computerized library records. (D.R.) (33-18)
 12. Short-term library space requirements were reviewed and reported to the NoFC Library Committee. Additional shelving has been ordered to expand present facilities and additional space has been assigned to the library for microfiche reading and computer terminal use. (D.R., R.N.) (33-19)
 13. Provided ongoing photographic and advisory services to NoFC staff. Acquired additional camera and studio equipment, film processing facilities, and graphics camera system. Maintained a standing offer agreement for specialty photographic/processing services. (P.D.). (33-20)
 14. Established audio-visual equipment storage facility and acquired additional overhead projector units. Arranged for service and repair to unserviceable camera and other audio-visual equipment as required. (P.D.) (33-21)

11. Goals for 1986-87:

1. Coordinate technology transfer and information services and activities within NoFC including public information, public relations, scientific and technical information, extension services, library and photographic services. (R.N.) (33-2)
2. Serve on in-house regional, national and N.G.O. working/advisory committees as required. (R.N., A.A.) (33-4)
3. Participate in the continued development, implementation and evaluation of communications plans under the Manitoba, Saskatchewan, and Alberta FRDAs (see NOR-36). (R.N., A.A., H.S.) (33-1)
4. Maintain and continue development of a photographic records classification system and library including acquisition and duplication of general purpose forestry information slides and photos. (H.S.) (33-5)
5. Develop and implement NoFC communications strategy and annual work plan towards the conduct of public information exhibits including major regional exhibitions, National Forest Week events, Federal Information fairs, and other invitational events. (R.N., A.A., H.S.) (33-7)
6. Develop public information and media materials and presentations including media releases, feature articles, backgrounders, exhibits, brochures, pamphlets, and other promotional materials. (R.N., A.A.) (33-9)
7. Plan and organize technology transfer procedures including training requirements for regional implementation, including TT proposals under FRDAs (see NOR-36-01, 36-03-7, 36-02-9). (R.N.) (33-6)
8. Act as NoFC focal point for internal and external communications with the public and media, by responding to inquiries for information, tours, presentations and the like; and by coordinating research and technical staff representations to the public and the media. (R.N., A.A., H.S.) (33-8, 33-10)
9. Provide a full range of library services at NoFC and district offices including ordering, purchasing, cataloguing, and filing reports, journals, and books. Assist NoFC staff and authorized visitors in literature retrievals profiles and searches. Maintain contact and inter-library loan privileges with HQ and other associated libraries. (D.R.) (33-17)
10. Investigate and report with recommendations on opportunities and costs associated with the implementation of computerized library functions and data bases access. (D.R.) (33-18)
11. Implement expanded library storage and work area facilities. (D.R.) (33-19)

12. Provide photographic and advisory services to NoFC research and regional development projects including processing, printing, photo enlargement/reduction, specialized photography and layouts, and/or monitor the performance of contract services for same. Undertake field trips to gather photographic forest resource material as time allows. (P.D.) (33-20)
13. Requisition, inventory, and maintain photographic and other audio-visual equipment. (P.D.) (33-21)
14. Assess the needs for and timing and budget requirements for periodic upgrade or replacement of technologically obsolete capital equipment for the project. (R.N., P.D., D.R., A.A. and others) (33-24)
15. Prepare and publish review article on public perceptions of forestry in the three prairie provinces. (R.N., A.A.) (33-22)
16. Oversee preparation of regular NoFC newsletter. Investigate opportunities for format and content modification. (A.A.) (33-14)
17. Prepare and publish Forestry Report on "Sharing research--NoFC and other agencies". (A.A., J.S.) (33-25)

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these study activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs:	Prof.:	Newstead	1.0
		Robinson	1.0
		Ascher (term)	1.0

Tech.:	Stewart, H.	1.0
	Hopp	1.0
	Debnam	1.0

Total:	6.0
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Term/Student:	0.5 (Asst. Photographer)
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O & M: \$57,500 (TT & I \$20,000, Library \$27,500, Photography \$10,000)

Capital:

15. Signatures:


Investigator

J. M. Powell
Program Director, Extension

C. D. Hunt
Regional Director General



NOR-36

DEVELOPMENT AGREEMENTS

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Canada-Manitoba Forest Renewal Agreement
3. New: Cont.: X 4. No.: NOR-36-01
5. Study Leader: J. McQueen

N.B. See also separate study statements for:

- | | | |
|--|--------------|-------------|
| i) Insect and disease management | NOR-36-01-1 | (NOR-36-04) |
| ii) Stand tending/regeneration demonstrations | NOR-36-01-2 | (NOR-36-05) |
| iii) Fire management | NOR-36-01-3 | (NOR-36-06) |
| iv) Silviculture guidelines for white/black
spruce management | NOR-36-01-4 | (NOR-36-07) |
| v) Jack pine seed orchard development | NOR-36-01-5 | (NOR-36-08) |
| vi) Site classification | NOR-36-01-6 | (NOR-36-09) |
| vii) Nursery development | NOR-36-01-7 | (NOR-36-10) |
| viii) Forest economics | NOR-36-01-8 | (NOR-36-11) |
| ix) Forest inventory | NOR-36-01-9 | (NOR-36-12) |
| x) Tree improvement | NOR-36-01-10 | (NOR-36-13) |

6. Key Words: Forest renewal, intensive management, resource data base, fire protection, nursery construction, public information, agreement, administration, evaluation, job creation, economic development
7. Location of Work: Manitoba District Office, Manitoba; and Manitoba wide
8. Study Objectives:
 1. To manage and coordinate the implementation of federally-funded initiatives and monitor the use of federal funds related to the Canada/Manitoba Forest Renewal Agreement by:
 - a. assisting in the development and maintenance of timber supplies sufficient to ensure the long-term viability of the forest industry in Manitoba;
 - b. promoting the efficient utilization of the forest resource in Manitoba; and

- c. contributing to the economic development of the Manitoba forestry sector, including the improvement of employment opportunities in the sector.
2. To provide regional liaison for all CFS activities related to the Canada/Manitoba Forest Renewal Agreement.
 3. To coordinate the implementation of sectoral forestry employment stimulation programs in Manitoba.
 4. To facilitate the maximization of funding available to the forestry sector in Manitoba from other federal agencies.
 5. To represent the Canadian Forestry Service in matters related to federal and provincial governments, industry and the general public.
9. Goals for 1985-86:
1. Forest Renewal and Intensive Management - Review, approve and monitor reforestation and stand-tending projects developed by industry (Manfor and Abitibi); negotiate two or three contracts with Indian Bands for forest renewal or intensive management work; fund and monitor seedlings growing contracts to meet industry and, where applicable, Band requirements in relation to Agreement reforestation activity. (Supervisor: FO-2, Renewal and Intensive Management).
 2. Agreement Management - In Cooperation with the Provincial Program Manager, organize, document, and follow-up meetings of the Agreement Directorate, the Interdepartmental Advisory Group for the Agreement, the Agreement Public Information Subcommittee and such other ad hoc committees of federal, provincial, industry and/or NGO representatives as are required to facilitate implementation of Agreement Subprograms.
 3. Resource Data Base - Ensure federal acquisition, on behalf of the Province, of the hardware required in accordance with federal purchasing procedures for major capital items (including liaison with DSS and interested NoFC and CFS-HQ staff). Also monitor development and implementation of Province's short and medium-term action plans for inputting provincial forest inventory data.
 4. Fire Protection - Ensure federal acquisition and where applicable installation of equipment identified by the Province within approved funding levels for the Agreement, in accordance with federal purchasing procedures (including liaison with DSS and interested NoFC staff). Also monitor Provincial experience in using that equipment (see also Study Statement NOR-36-06 for involvement in research activity).
 5. Nursery Development - Ensure completion of the Clearwater construction projects (greenhouses and seeding line building) undertaken in 84/85 by PWC on behalf of the CFS as well as development/implementation by PWC of the Tree Improvement construction program at Hadashville in

85/86 (see also Study Statement NOR-36-08 for related work on jack pine seed orchard development. Supervisor: FO-2, Renewal and Intensive Management).

6. Public Information - Ensure continued implementation and revision, as required, of the Public Information Strategy approved in 84/85 by the Agreement Directorate, including liaison with DSS, appropriate NoFC/FEDC Office staff, contractors, and provincial representatives.
 7. Evaluation - Ensure development funding and implementation of projects pursuant to Directorate approval of an evaluation framework based on 84/85 consulting contract document. Also, implement such procedures as are necessary at the District Office to ensure collection of required data at the appropriate source.
 8. Administration - Direct District staff and coordinate functional direction from NoFC (as outlined in other Winnipeg based study statements), ensure respect of applicable federal financial and administrative regulations as identified by financial authorities, manage the District Office budget and ensure the processing of project authorization/claim forms, compliance with Agreement reporting requirements and provision of accommodation, equipment (including micro computer) and other District and NoFC needs.
 9. Continue to provide coordination, liaison and supervision (if required) for any federal forestry-related job creation program in Manitoba.
10. Accomplishments in 1985-86:
1. The two major forest industry companies in the Province (Abitibi-Price and Manfor) completed a variety of reforestation projects during the year. Site surveys, scarification, seeding and planting work was done. One contract for work on Indian Reserves was negotiated with the Moose Lake Band. A review of work being done at Dakota Plains and Dakota Tipi greenhouses was done with Abitibi being funded to purchase seedlings from Dakota Plains.
 2. Quarterly directorate meetings were held with the Provincial staff, and meetings were held with industry representatives to ensure an orderly implementation of the forest renewal sections of the agreement. The communications subcommittee approved signs, pamphlets, and a slide tape program to Forest Renewal.
 3. A Geographic Information System was purchased for provincial use. Now completely installed, provincial staff are preparing and entering forest inventory information into the machine. Preliminary results indicate that machine capabilities are greater than originally expected.
 4. Fire Management: Fire equipment to meet the special needs of the province was purchased. Initial work on the conversion of provincial fire weather information to meet the needs of fire hazard systems was started.

5. A seedling building and operational greenhouse were completed at The Pas, Manitoba. Facilities will be put into full use in the spring of 1986.

Two research greenhouses and a 300 M² header house were completed at Hadashville. The facilities will be used for research purposes in 1986. State of the art nursery equipment was included in the construction.

6. The subcommittee on public information has produced a public awareness survey which unfortunately indicates that both the Canadian Forestry Service and Manitoba Natural Resources have a very low profile in the Province. A slide tape program Agreement booklets and public information brochures were produced in part to help offset this low profile.
7. Evaluation: A format for evaluation was reviewed and agreed to by the directorate. A panel of forestry experts will be selected in 1986 and an initial review of work will be done.
8. New District Office was opened by the Minister in September 1985. The offices will accommodate 18 persons. Projects were implemented upon directorate approval; many of which have now been completed. Auditors have reviewed the procedures being followed and have found that the procedures comply with the agreed upon procedures.
9. A total of 210 mortality and growth loss sample plots were established in various areas of the Province. Methods will be developed to determine volume loss and stand damage in forest stands infested by disease or insects. (see NOR-36-01-1)
10. Initial jack pine cone collection occurred during the fall of 1985. Cones were obtained from 320 superior jack pine trees in northeastern Manitoba. The best seeds were sown in the NoFC research greenhouse. The best seedlings (15000) will be planted during June 1986 at two separate orchard locations. The end objective is to have access to genetically superior jack pine seed. (see NOR-36-01-5)

11. Goals for 1986-87:

1. Forest Renewal and Intensive Management - Review, approve and monitor reforestation and stand-tending projects developed by industry (Manfor and Abitibi); fund and monitor seedling growing contracts to meet industry and, where applicable. Band requirements in relation to Agreement reforestation activity.
2. Agreement Management - In cooperation with the Provincial Program Manager, organize, document, and follow-up meetings of the Agreement Directorate, the Interdepartmental Advisory Group for the agreement, the Agreement Public Information Subcommittee and such other ad hoc committees of federal, provincial, industry and/or NGO representatives as are required to facilitate implementation of Agreement Subprograms.

3. Monitor development and implementation of Province's short and medium-term action plans for inputting provincial forest inventory data.
 4. Public Information - Ensure continued implementation and revision, as required, of the Public Information Strategy approved in 85/86 by the Agreement Directorate, including liaison with DSS, appropriate NoFC/FEDC Office staff, contractors, and provincial representatives.
 5. Evaluation - Ensure development funding and implementation of projects pursuant to Directorate approval of an evaluation framework. Also, implement such procedures as are necessary at the District Office to ensure collection of required data at the appropriate source.
 6. To provide coordination and liaison between the Province and CEIC on forestry related job development programs.
 7. Fire Protection - to provide technical expertise in the implementation of Manitoba oriented computer fire management programs. Also to convert Manitoba fire management information to a format useable in the various CFS fire management programs.
 8. Forest mensuration - to collect insects and disease information with the end goal of being able to predict areas where an outbreak is likely to occur.
 9. Administration - Direct District staff and coordinate functional direction from NoFC (as outlined in other Winnipeg based study statements), ensure respect of applicable federal financial and administrative regulations as identified by financial authorities, manage the District Office budget and ensure the processing of project authorization/claim form, compliance with Agreement reporting requirements and provision of accommodation, equipment (including micro computer) and other District and NoFC needs.
12. Publications 1984-85:

Canada-Manitoba Forest Renewal Agreement
 Canada-Manitoba Forest Renewal Agreement - Policy and Procedures Manual

Unpublished Reports:

Canada/Abitibi-Price Inc. - Letter of Understanding (for implementation of activities under the Agreement)
 Canada/Manitoba Forest Resources Ltd. - Letter of Understanding

1985-86:

Quarterly Reports, Annual Reports, Brochures etc.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: McQueen 1.0 (A-base)
 vacant 1.0

Tech: Walker 0.9

Support: Schlawitz 1.0
 Lebedeff 1.0
 Sokol 1.0
 Ross 1.0

Total: 6.9

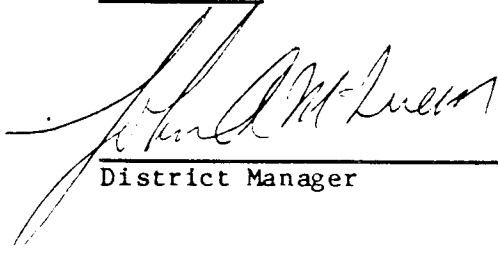
O & M: \$69,175 + \$6,000 A-base

Capital: \$225,000

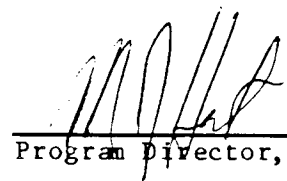
Contracts: \$149,780

Grants & Contributions: \$995,000


15. Signatures:



District Manager



Program Director, Development



Regional Director General

CANADA/MANITOBA FOREST RENEWAL AGREEMENT
Breakdown of Resources
1986/87

	PYs	O & M	Contracts/ Supplies	G & C	Capital
NOR-36-01:					
Forest renewal	1.9	\$11,079	\$56,580	\$352,600	-
Intensive management		\$22,157	\$30,000	\$642,400	-
Fire protection/GIS	0.0	-	-	-	\$205,000
Nursery development	-	-	-	-	-
Public information	-	-	\$43,200	-	-
Evaluation	-	-	\$20,000	-	-
Administration	5.0	\$35,939	-	-	\$ 20,000
NOR-36-01-1:					
Insects & diseases/ forest environment	1.0	\$11,080	-	\$66,000* \$78,000*	-
NOR-36-01-2:					
Stand tending/ regeneration demonstration	0.1	-		\$ 38,000*	-
NOR-36-01-3:					
Fire management	1.0	\$11,080	-	\$85,000*	-
NOR-36-01-4:					
Silviculture	1.0	\$11,073	-	\$2,500*	-
NOR-36-01-5:					
Jack pine seed orchards	1.0	\$20,733	\$52,000	\$104,500*	\$ 52,000
NOR-36-01-6:					
Site classification	0.0	\$12,500	-	\$105,000*	-
NOR-36-01-7:					
Nurseries	0.0	-	-	\$80,000*	-
NOR-36-01-8:					
Forest economics	1.0	\$10,000	-	\$96,000*	-
NOR-36-01-9:					
Forest inventory	0.0	-	-	-	-
NOR-36-01-10:					
Tree improvement	0.0	-	-	\$55,000*	-
Total (federal)	12.0	\$146,720	\$201,780	\$1,350,000	\$280,000

* These are cost-shared projects funded 50/50 by the federal and provincial governments. Cost-shared research projects were approved by the Agreement Directorate based on the recommendations of the Memorandum of Understanding (MOU) Committee. Development of the appropriate Project Authorization Forms (PAFs) is the responsibility of the province.



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Forest pest management and damage appraisal (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-1 (NOR-36-04)
5. Study Leader: vice Volney (Insect and Disease Specialist)
6. Key Words: Damage appraisal, impact, hosts, forest pests, sampling methods, management, mortality, growth loss, forest renewal, jack pine budworm
7. Location of Work: Manitoba District Office, Manitoba-wide
8. Study Objectives:
 1. To develop methods for predicting short and long term impacts of pest(s) including damage appraisal on forest resource uses, values, management plans and operations.
 2. To determine how and to what extent pest damage affects forest resource users and management plans.
 3. To intensify and improve the general pest detection and damage surveys and to conduct special surveys of particular forest pests or of designated areas.
 4. To evaluate or develop methods to manage pest-susceptible forests and pest populations, to limit forest damage to tolerable levels by use of silvicultural, chemical and biological techniques.
 5. To provide diagnostic and advisory services regarding tree and shrub insects and diseases.
9. Goals for 1985-86:
 1. Under functional guidance of Project Leader, NOR-11: measure and evaluate growth loss and mortality caused by the spruce budworm in plots already established.

2. Establish permanent plots in young stands or plantations of jack pine and white spruce to develop methodology to estimate tree mortality/volume loss.
3. Conduct surveys of forest pest conditions and their damage.
4. Provide pest control advisory service and technology transfer.
5. Represent NoFC and CFS on various provincial forest insect and disease committees and advisory groups.
6. Participate in Jack pine budworm workshop in January 1986.

10. Accomplishments in 1985-86:

1. Spruce budworm defoliation and mortality for 1984-85 were assessed on 9 previously established plots located on Hecla Island and in the Whiteshell Provincial forest, Manitoba.

The Hecla Island plots were visited in October and discs removed from wind thrown trees in two plots. An additional 4 trees were dissected for stem analysis. Tree rings in these discs will be measured in the winter 1985/86.

2. Nine plots (Sandilands - 3, Lake Manigotogan - 3, Kettle Hills - 3) were established in jack pine stands of differing ages. Each plot is 50 x 50 m square in which all trees greater than 5 cm dbh were labelled and their heights, diameters and crown lengths measured. These study sites will be used to test methodologies to determine volume losses.

The coordinates of all living and recently dead trees within 1 of these plots have been determined to assess the rate of mortality spread from apparent Armillaria mellea complex infection centers.

Trees in this area will be selected for protection experiments to assess the relationship between jack pine budworm defoliation and volume growth loss.

Sixteen jack pine trees which have experienced at least two jack pine budworm defoliation episodes have been dissected for stem analysis. These trees were selected to represent different crown classes and to be free of Armillaria mellea complex infections and other obvious pathogenic conditions. The discs will be examined in the coming winter.

A non-destructive technique to visually assess defoliation on standing jack pine trees was developed and instituted in a preliminary survey (see 3 below).

Provincial survey personnel were instructed on distinguishing microsporangiate buds from vegetation buds on jack pine foliage samples collected for budworm egg mass/defoliation surveys. The frequency of microsporangiate buds will be incorporated in defoliation prediction methodologies.

3. A preliminary survey to determine the association of stand characteristics on the intensity of jack pine budworm defoliation and volume growth reduction was initiated in the Sandilands Provincial Forest. Of the 240 permanent sample plots required, 210 have been established. Data from this survey will be used to design an efficient damage appraisal survey which is compatible with the Manitoba Forest Inventory System.
4. Pest management advice in developing operational survey procedures was provided to personnel in the Forest Protection Unit of the Manitoba Forestry Branch and the Manitoba based FIDS ranger. Specific examples are given in 2 paragraph 5 and 6 above.

Specific studies to develop sequential sampling plans to assess jack pine budworm population potential for damage have been designed. When in place, these plans, will streamline decision making in control operations.

5. NoFC and CFS were represented at the annual CIF meeting at which a presentation was made to the Forest Insect and Disease Working Group.

A summary of jack pine budworm conditions in Manitoba was presented to the Northwestern Ontario Forest Pest Review held at the Great Lakes Forestry Centre in Sault Ste. Marie on 13 November 1985.

6. Presented results of current studies of jack pine budworm in Manitoba at the workshop.

11. Goals for 1986-87:

1. Remeasure spruce budworm mortality plots and evaluate losses in stand. Complete stem analysis of trees dissected.

2. Assess cumulative defoliation in jack pine budworm study plots.

Complete mapping of stems in 8 plots and produce maps indicating possible additional Armillaria root rot infection centers.

Conduct protection experiment on trees which are expected to be defoliated by the jack pine budworm by injection of selected trees with insecticide.

Complete stem analysis of dissected jack pine trees affected by low defoliation episodes.

Assess the utility and sensitivity of microsporangiate bud counts and defoliation intensity in predicting future jack pine budworm defoliation.

3. Summarize stand information on the 210 plots established in 1985 and outline design of damage appraisal survey system, and complete establishment of additional 30 plots.
4. Make preliminary calculations for jack pine budworm egg mass sequential sampling system.

5. Initiate jack pine budworm phenology study.
6. Collect information which will permit prediction of defoliation levels from populations intensities.
7. Provide pest control advisory service and technology transfer.
8. Represent NoFC and CFS on various provincial forest insect and disease committees and advisory groups.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:


PYs: Prof.:	Daoust-Savoie	1.0	(starting in April)
Tech.:		0.0	
Total:		1.0	
Term/Student:		0.0	

O & M : \$11,080

Capital:

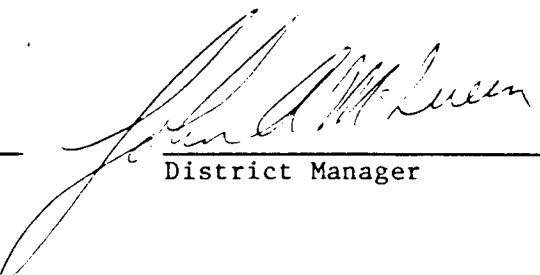
Grants & Contributions: CFS \$33,000/\$33,000 MFB
CFS \$39,000/\$39,000 MFB (Environment project)

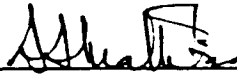
15. Signatures:


Investigator

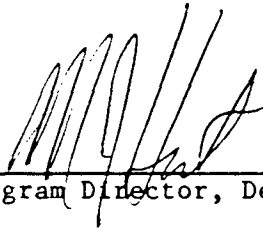
Supervisor

Technical Advisor

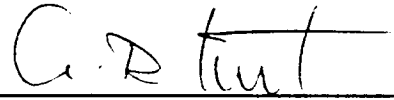

District Manager



Program Director, Forest Protection



Program Director, Development



Regional Director General



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Yields of Managed Stands. 1. Establishment of stand tending and regeneration demonstrations. (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-2 (NOR-36-05-1)
5. Study Leader: N. Walker and vice Froning
6. Key Words: Jack pine, white spruce, thinning, planting, release cutting
7. Location of Work: Manitoba District Office, Pine Falls, Sandilands Forest Reserve, Interlake, Duck Mountain, Manitoba
8. Study Objectives:
 1. To establish demonstration areas that reflect successful silviculture management techniques for the establishment of jack pine and white spruce stands.
 2. To remeasure demonstration areas and prepare appropriate reports on treatments and results obtained for use by practicing foresters and whenever possible for the general public.
9. Goals for 1985-86:
 1. In close cooperation with the Manitoba Forestry Branch, NoFC research staff, and Program Directors, and based on recommendations contained in Johnson Forestry Services' review of Manitoba-Saskatchewan R & D plots established between 1904 and 1970, select suitable field plots for use as demonstration areas.
 2. Remeasure, as appropriate, selected demonstration areas and prepare appropriate short reports (1-2 pages in length) outlining treatments and updated results.
 3. In cooperation with the Manitoba Forestry Branch and the Forestry Relations officer (NoFC) erect appropriate signage.
 4. Ensure that the selected demonstration areas are duly recorded by the Manitoba Land Titles Branch and prepare appropriate maps at suitable scales indicating plot locations(s).

5. If time permits complete and publish FMN on ten year performance of containerized seedlings.
 6. If time permits assist in the field measurement of a cooperative planted seedling performance study. (1 week)
10. Accomplishments in 1985-86:
1. Based on a review of recommendations contained in Johnson Forestry Services' report on Manitoba-Saskatchewan R&D plots established between 1904 and 1970, and a field trip to the Duck and Riding Mountains by L. Yarn (MFB) and R. Waldron 12 MS studies were selected for remeasurement in 1985-86. Specific studies chose were as follows:
 - MS-90 Seeding Duck Mountain. (Walker)
 - MS-103 Planting, Duck Mountain (Walker)
 - MS-104 Planting, Riding Mountain (Walker)
 - MS-182 Cutting methods, bS, Duck Mountain (Kolabinski)
 - MS-9 Thinning, bS, wS, jP, Duck Mountain (Walker)
 - MS-7 Releasing bS, Duck Mountain (Walker)
 - MS-8 Thinning in wS-tA, Duck Mountain (Yang)
 - MS-226 Converting tA to wS, Duck & Riding Mountains (Dyck)
 - MS-229 Scalping & cultivating wS, Riding Mountain (Dyck)
 - MS-153 Releasing wS from tA, Riding Mountain (Yang)
 - MS-228 Selterwood cutting, Riding Mountain (Kolabinski)
 - MS-211 Strip cutting, Riding Mountain (Kolabinski)

MS-90, 103, 104, 9, and 7 were selected for remeasurement by N. Walker, and K. Froning. The other studies were or will be remeasured by other CFS staff as indicated.
 2. The following studies were remeasured in 1985-86: MS-7, MS-8, MS-104, MS-153, MS-182, MS-226, MS-229, MS-245 (Seeding and planting, SFR), and D-MS-5 (Scarification for natural regeneration in cut-over jack pine). Short, 1-2 page, draft reports have been prepared for three of the demonstrations.
 3. At a meeting held on May 22, 1985 L. Yarn and R. Waldron decided to drop the idea of signage for individual study locations and instead prepare "a glossy brochure providing graphic and photographic records of intensive management treatments as they relate to the life cycle of jack pine and white spruce from harvest through regeneration, stand tending etc." for the general public. Unfortunately, K. Froning was unable to attend this meeting.
 4. This goal was not achieved in 1985-86 due to the late start (September) on the demonstration study.
 5. No progress was made on this goal. The proposed FMN will be turned over to the vice Ball position in Edmonton to review and complete (Study 10-03).

6. N. Walker spent three weeks supervising the field remeasurement of the cooperative planted seedling performance study. In addition a brief report outlining the work undertaken was written and coding of the field tally sheets for computer data entry completed.

11. Goals for 1986-87:

1. In close cooperation with the Manitoba Forestry Branch, NoFC research staff, and Program Directors, and based on recommendations contained in Johnson Forestry Services' review of Manitoba-Saskatchewan R&D plots established between 1904 and 1970, select additional field plots for use as demonstration areas in Manitoba.
2. Remeasure, as appropriate, selected demonstration areas and prepare appropriate short reports (1-2 pages in length) outlining treatments and updated results.
3. Prepare appropriate maps at suitable scales indicating demonstration plot locations(s) and ensure that the selected demonstration areas are duly recorded by the Manitoba Land Titles Branch.
4. Develop a publication format incorporating the short reports, appropriate maps, and references for distribution to provincial foresters.
5. Develop a publication format to incorporate information obtained in this demonstration study together with related information required to provide the general public with a graphic and photographic record of intensive forest management as related to the life cycle of jack pine and white spruce from harvest through regeneration, stand tending, and utilization.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.: Walker	0.1
Total:	0.1
Term/Student:	0.1 (Contract student)

O & M: \$5,000

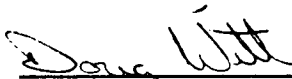
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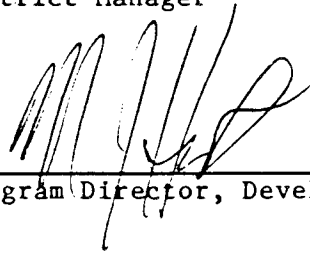
Grants & Contributions: CFS \$15,000/\$15,000 MFB


15. Signatures:


Investigator

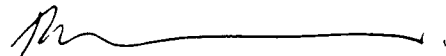

District Manager


Supervisor


Program Director, Development


Technical Advisor


Regional Director General


Program Director, Resources

OPERATIONAL PLAN
1985-1989

	1985-86	1986-87	1987-88	1988-89	Total
s	Select appropriate demonstration areas, remeasure and prepare summary reports. (see 10-5MA)	Continue and terminate.			
1:	\$20 K F	\$30 K CS			\$20 K F \$30 K CS
1:	\$5 K F	\$5 K F			\$10 K



TO
A

Ross Waldron - CFS Edmonton
John McQueen - CFS Manitoba

FROM
DE

Doug Witt
Forester
CFS - Manitoba

SECURITY CLASSIFICATION - DE SÉCURITÉ
OUR FILE - N / RÉFÉRENCE
YOUR FILE - V / RÉFÉRENCE
DATE April 2, 1986

SUBJECT
OBJET

STUDY STATEMENT FOR NOR-36-01-2 (STAND TENDING AND REGENERATION DEMONSTRATIONS)

Point #5 of the 1986-87 goals outlines the development of a publication format for the general public. This goal is much more extensive than was originally outlined in the 1985-86 study statement. The original intent was to use a document for practicing foresters and for the general public where possible.

This 1986-87 goal (#5) will be a very time consuming undertaking and requires the assistance of CFS staff who have expertise in the area of technology transfer to the general public. Also, the time allocated (0.1 PY) will not be sufficient to effectively undertake all work allocated in the 1986-87 goals.

Doug Witt

cc: Norm Walker

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Yields of Managed Stands. 2. Releasing white spruce from trembling aspen. (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-2A (NOR-36-05-2)
5. Study Leader: I. Bella (see NOR-4-01)
 R. Yang (see NOR-4-09)
 R. Waldron
6. Key Words: Releasing white spruce, biological response, economics, inventory, growth, cost/benefit, aspen
7. Location of Work: Manitoba
8. Study Objectives:
 1. To assess growth following release of white spruce from aspen in a range of stand conditions using a variety of release techniques.
 2. To assess the costs of various forms of releasing white spruce from aspen including herbicides, manual and moto-manual techniques.
 3. To carry out an inventory to locate stands of mixed white spruce and aspen suitable for releasing white spruce using a variety of release techniques.
 4. To hold a workshop on stand tending in jack pine and mixed white spruce-aspen stands.
9. Goals for 1985-86:
 1. Act as Scientific Authority for a R&D contract designed to assess the growth response of white spruce following release from trembling aspen. Plots to be utilized include those which form an old release study in Manitoba and Saskatchewan - MS-153. A number of other related studies will be reviewed by the contractor. (Yang, Waldron)

10. Accomplishments in 1985-86:

1. R. Waldron and R. Yang are NoFC's Scientific Authorities on a R&D contract awarded in August 1985 to Johnson Forestry Services of Calgary, Alberta by the Manitoba Forestry Branch - L. Yarn is MFB's Scientific Authority. The objective of the \$42 K contract is as follows:

"The Contractor agrees to prepare silviculture prescriptions for releasing White Spruce from Trembling Aspen in mixedwood stands based on ecological factors, synecological relationships, and mensurational growth responses derived from experimental and operational trials carried out since the 1950's by the Canadian Forestry Service, the provincial and industrial foresters; and to assess the impact of the prescriptions in terms of potential increases in wood production from the Duck Mountain Forest Management Unit".

A final report is expected from the contractor by March 15, 1986. Two seminars--one in Manitoba and one at NoFC--will be presented by the contractor in 1986.

It was decided by CFS and MFB that R. Yang would remeasure the old (MS-153 and MS-8) releasing white spruce from trembling aspen plots, analyze the data, and prepare an appropriate publication. Plot remeasurement was completed in October 1985 with assistance from the Canada-Saskatchewan Agreement Saskatchewan District Office staff. O&M funding of \$8 K under the Canada-Manitoba Agreement was allocated to NoFC A-base staff. Future progress on MS-153 and MS-8 plot remeasurements will be covered in study statement NOR-4-09.

11. Goals for 1986-87:

1. Review in detail the February 1986 interim, and the March 15, 1986 final, draft copy of the contractor's report on a review of literature relating to the releasing of white spruce from trembling aspen in Manitoba. Provide comments to the contractor, Johnson Forestry Services, and MFB's Scientific Authority L. Yarn. H. Johnson will present seminars at NoFC and Winnipeg in 1986. (Yang, Waldron)
2. Mensurational staff of project NOR-4 "Site Productivity and Forest Inventory" will contribute to a workshop on stand tending techniques for jack pine and white spruce to be organized by Garry Arden (MFB) and held in the fall of 1986.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The Agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M:

Capital:

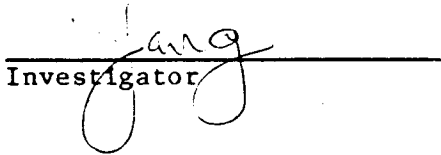
Grants & Contributions: CFS \$4,000/\$4,000 Manitoba

14. Signatures:



 Investigator

 Supervisor



 Investigator



 District Manager

 Technical Advisor



 Program Director Development



 Program Director, Resources



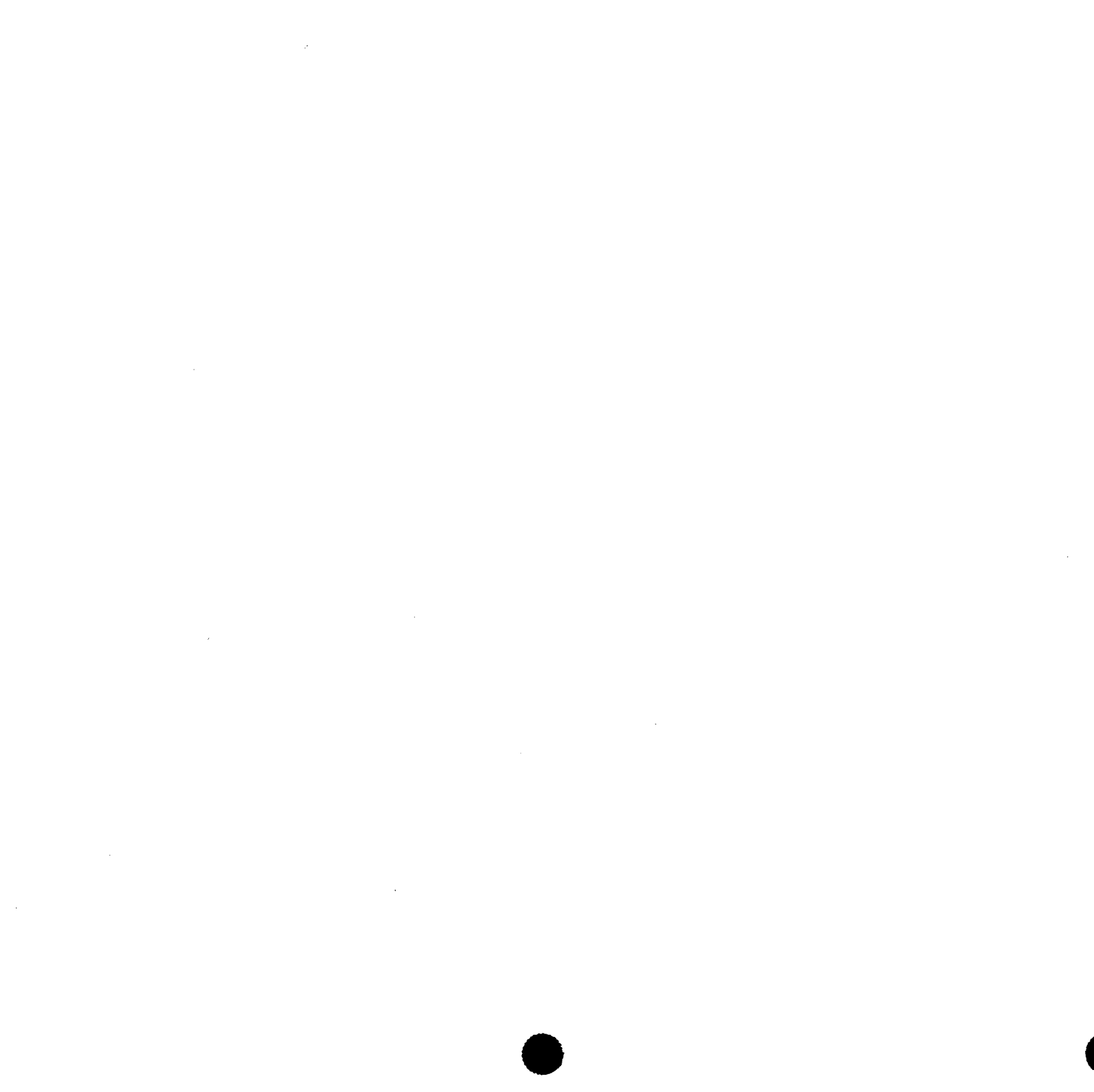
 Regional Director General

OPERATIONAL PLAN
1985-1989

1985-86	1986-87	1987-88	1988-89	Total
<p>Act as Scientific Authority for a R&D contract for assessing the growth response of white spruce following release from t aspen \$50 K CS (see 4-1MA). Terminate.</p>				\$50
	<p>Hold a workshop on stand tending techniques for jack pine and releasing white spruce from aspen. \$8 K CS (see 4-2MA). Terminate.</p>			\$8 K
		<p>Act as Scientific authority for a R&D contract to assess the costs of various release treatments for white spruce from aspen. \$90 K CS (see 4-3MA). Terminate.</p>		\$90

OPERATIONAL PLAN
1985-1989

	1985-86	1986-87	1987-88	1988-89	Total
				Provide technical advice to MFB regarding a R&D inventory contract to identify white spruce-aspen stands suitable for release treatments (see 4-4MA). Terminate. \$70 K CS	\$70 K
:	\$50 K CS	\$8 K CS	\$90 K CS	\$70 K CS	\$218 K



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Fire management (Manitoba)
3. New: Cont.: X
4. No.: NOR-36-01-3 (NOR-36-06)
5. Study Leader: K. Hirsch
6. Key Words: Fire management, information exchange, training, development
fire weather, cost effectiveness, fire behavior, fuels,
fire environment
7. Location of Work: Manitoba
8. Study Objectives:
 1. To participate in the development of and facilitate the application of fire research technology that is relevant to Manitoba and will help to improve and advance fire management in the province.
 2. To promote and encourage the identification and expression of fire research requirements by the fire management agencies in Manitoba so as to assist the effective communication and presentation of these ideas to the NoFC fire research project and other appropriate research groups.
9. Goals for 1985-86:
 1. Maintain liaison with Project Leader, Fire Research and to provide technology transfer information.
 2. Develop fire management expertise through short courses and other in-house experience.
 3. Initiate a program for effective communication, cooperation, and understanding between researchers and fire managers aimed at improving the protection and use of Manitoba's forests through efficient fire management systems and guidelines.

4. Provide information transfer through participation on committees or through personal contact.
 5. Begin to develop a plan to provide resource and data bases for a comprehensive program of daily decision-aid models for fire managers.
 6. Compile fire weather and fire report data for calibration and performance of Canadian Forest Weather Index System in Manitoba.
10. Accomplishments in 1985-86:
1. a. Upon request of both provincial and regional fire management staff, information on a wide variety of fire management items was provided by contacting various research and development organizations throughout North America.
b. Provided opportunity for improved communication between the NoFC fire research group and Manitoba's fire management people.
 2. Began to develop a plan for a series of seminars/workshops to occur in Manitoba annually over the next three years.
 3. a. Developed an understanding for Manitoba's fire management system, how it operates and the present role of fire research in this system.
b. Requested regional and provincial fire management staff to comment on and provide input to present any upcoming projects.
c. Started to investigate the most appropriate means for the effective exchange of information between researchers and operational people.
 4. Made personal contact with members of the fire management staff at all levels of the organization in attempting to establish the credibility and significance of fire research.
 5. a. Facilitated the identification and prioritization of fire research needs with respect to the present fire management policy in Manitoba.
b. Established contact with various organizations within Manitoba that presently interact or in the future would assist fire management and fire research in the Province.
c. Facilitated inter-agency cooperation on and provided input to the aircraft efficiency and fuel-type mapping research projects being conducted in Manitoba by other research groups.
d. Started to develop weather station maintenance standards based on the situation in Manitoba.

6. Compiled all available fire weather and fire report data in the province of Manitoba and started on a research project which relates the two for the period of 1976-84.

11. Goals for 1986-87:

1. To establish the credibility of fire research in Manitoba and increase the visibility of the CFS by:
 - a. participating in provincial and regional meetings which deal with the various aspects of Manitoba's fire management program,
 - b. interacting with fire management personnel at all levels of the organization especially during the fire season,
 - c. participating and/or instructing at regional and provincial training courses.
2. To bring staff members of the NoFC fire group and the Manitoba fire management organization into a better working relationship through a jointly conducted research project on detection.
3. To improve the information exchange process between NoFC and the province directly by increased personal contact (e.g. workshops, seminars, meetings) and indirectly through newsletters, video tapes, and written reports.
4. To continue aggregating research needs and suggestions from the field staff and help to communicate these to the appropriate research organizations.
5. Continue to monitor and/or provide input to fire research projects being conducted on fuel-type mapping, aircraft efficiency and damage appraisal.
6. Complete a file report on the historic relationship of fire to weather in Manitoba.
7. Conduct a workshop on a specific aspect of fire management such as fire weather & fire danger, prescribed fire, or fire planning.
8. Complete the Fire Behavior Prediction (FBP) System fuel-type photo series and begin doing a field verification study of the FBP System.
9. Begin work on the use of the 500 mb system in Manitoba.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these study activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Hirsch 1.0
 Tech.: 0.0
 Total: 1.0
 Term/Student: 0.0

O & M: \$11,080

Capital:

Grants & Contributions: CFS \$42,500/\$42,500 MFB

15. Signatures:

Kehin Hirsch
 Investigator

Richard R. Boney
 Project Leader, Fire

Coyle
 Supervisor

Paul M. Green
 District Manager

J. M. Powell
 Program Director, Forestry Extension

[Signature]
 Program Director, Development

C. D. Hunt
 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Regeneration. 1. Guidelines for the management of white and black spruce. (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-4 (NOR-36-07-1)
5. Study Leader: V.S. Kolabinski and J. Ball
6. Key Words: Shelterwood, alternate strip, and clear cutting, scarification white spruce, black spruce, natural regeneration including stocking, age, and condition
7. Location of Work: Manitoba District Office; Riding, Duck and Porcupine Mountains, Manitoba; Porcupine Mountain and Pasquin Hills, Saskatchewan
8. Study Objectives:
 1. To remeasure and publish the results of selected R & D studies carried out in Manitoba and Saskatchewan between 1955 and 1965 on the effects of harvesting and scarification techniques to induce the natural regeneration of white spruce and black spruce.
 2. To prepare silviculture guidelines for the management of white spruce and white spruce-aspen stands to induce natural regeneration of white spruce utilizing various harvesting and scarification techniques.
9. Goals for 1985-86:
 1. Act as Scientific Authority for a R & D contract designed to review the potential of old Manitoba-Saskatchewan research studies for further remeasurement, preparation of forest managed prescriptions and demonstration. (Waldron)
10. Accomplishments in 1985-86:
 1. Prepared remeasurement plans for measurement and assessment of a) MS-182 "Cutting methods for management of black spruce, Duck Mountain Forest Reserve, Manitoba", b) MS-216 "Clear cutting alternative strips and scarifying in white spruce - aspen stands to induce white spruce regeneration, Manitoba and Saskatchewan", and c) MS-211 "Clear

cutting alternate strips and scarifying in white spruce regeneration, Manitoba and Saskatchewan.

2. Field measurements for MS-182, using the plan guideline were carried out during the summer 1985. This included tallies of residual stand conditions and black spruce regeneration stocking on the 14 cut blocks based on 4, 5 and 10 m² quadrats.
3. In the summer 1985, field measurements for MS-211, Area 1 i.e., one of the five study areas in MS-211 were carried out. The data collected was for the assessment of white spruce on scarified, non scarified and logged over areas.

11. Goals for 1986-87:

1. Prepare a report - MS-182 "Cutting methods for the management of black spruce, Duck Mountain Reserve, Manitoba.
2. Compile and tabulate MS-182 remeasurement data for analysis, and prepare a report based on the measurement results.
3. Prepare a remeasurement and data analysis plans for a) MS-228 "Shelterwood cutting and mechanical seedbed treatment in white spruce regeneration, Manitoba and Saskatchewan" and b) Haig's "Operational harvesting and scarification techniques to induce white spruce regeneration - Riding Mountain Forest Experimental Area, Manitoba.
 - a. Assess residual stand growth and mortality; regeneration stocking, age, condition, and growth (both on scarified, non-scarified by moisture regime) and on a net treatment basis.
 - b. Carry out field assessments of individually treated areas, analyze the data, and prepare appropriate reports and publications.
 - c. Select suitable areas to be used as future demonstration sites and prepare appropriate summation report(s).
4. Make a reconnaissance of the seven MS-228 study areas to determine their state and condition for preparatory remeasurement survey.
5. Initiate field assessment on as many of the treatment areas as manpower and resources will permit.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: 0.0
 Tech.: Kolabinski 1.0
 Total: 1.0
 Term/Student: 0.3 (Student)

O & M: \$11,073 (includes salary and O & M for 1 student)


Capital:

Grants & Contributions:

15. Signatures:



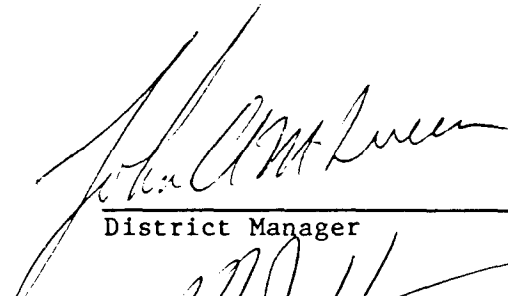
 Investigator



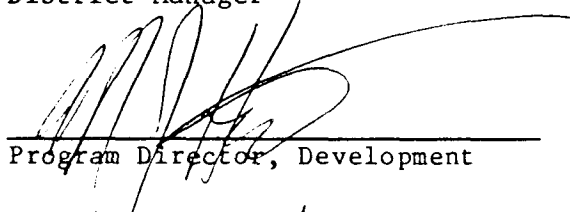
 Supervisor



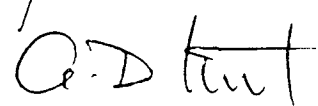
 Program Director, Forest Resources



 District Manager



 Program Director, Development



 Regional Director General

OPERATIONAL PLANS
1985-1989

ls	1985-86	1986-87	1987-88	1988-89	Tot
.	Remeasure MS 182 - black spruce cutting and scarification in the Duck Mtn. Select potential demonstration area(s) (see 10-4MA).	Analyze data and prepare publication.			\$0
.	Initiate remeasurement of MS 228 and 216; Saskatchewan blocks (see 10-4MA).	Continue and complete remeasurement of MS 228 and 216. Select demonstration areas. Analyze data.	Initiate and complete remeasurement of MS 211 blocks. Analyze data.	Prepare a publication on the management of white spruce in pure and mixedwood stands in Manitoba and Saskatchewan	\$0
al:	\$0 K	\$0 K	\$0 K	\$0 K	\$0
M:	\$11 K F	\$11 K F	\$11 K F	\$11 K F	\$4

Summary of study areas established in Project MS-211
(Strip cut - pure softwoods)

Location	Year est.	Area size ac/ha	No. 1 mil-quadrats	Yr. last measured	Remarks
Hudson Bay, Sk. (Little Swan Rd.)	1961	53/21.4	900	1965	Residual st have been l
Christopher Lake Sask.	1961	11/4.4	603	1965	Not known i logging, at not up to l
N. Montreal Lake (near La Ronge)	1963	12/4.9	605	1967	Not known-h major fires
Hudson Bay, Sask. (Little Swan Rd.)	1964	34/13.8	622	1969	Residual st probably lo by now
Dore Lake, Sask. (on shore of Lake)	1966	33/13.4	315	1970	Unknown if logging has occurred

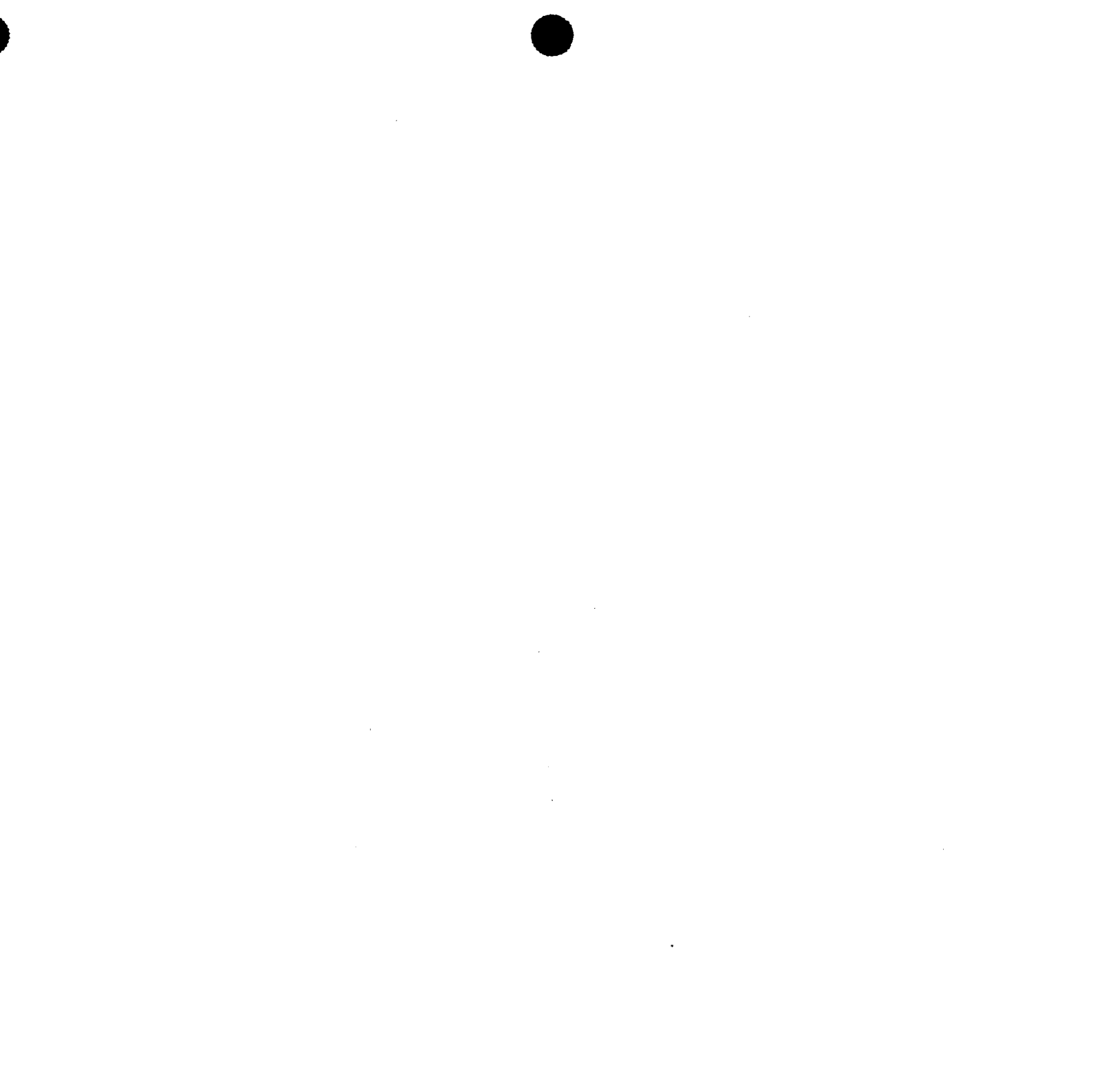
Summary of study areas established in Project MS-216
(Strip cut - mixedwood)

Location	Year est.	Area size ac/ha	No. 1 mil-quadrats	Yr. last measured	Remarks
Riding Mountain Research Area	1962	40/16.2	630	1966	Has not been disturbed
N. Montreal Lake (near La Ronge)	1963	10/4.0	615	1967	Not known - been major fire in 1970s
Carrot River, Sask. in Pasquia hills	1965	45/18.2	615	1969	Residual strip logged

Summary of study areas established in Project MS-228
(Shelterwood cutting)

Location	Year est.	Area size ac/ha	No. 1 mil-quadrats	Yr. last measured	Remarks
Riding Mountain Research Area	1963	20/8.1	600	1967	Not disturbed accessibility difficult b of beaver f
Carrot River, Sask. in Pasquia hills	1965	70/28.3	200	1969	Probably no disturbed
Dore Lake Rd. N. Big River, Sask.	1964	23/9.3	200	1968	Probably no disturbed
Porcupine Mtn. Rd. to Whitefish L.)	1965	88/35.6 ¹	200	1969	Believe are over in 197
Porcupine Mtn. (Rd. to Whitefish L.)	1965	28/11.3	200	1969	Believe are over in 197
Porcupine Mtn.	1966	100/24.7	200	1970	Probably lo
Porcupine Mtn. (S. boundary Porcupine)	1966	97/ac	200	1970	Probably lo lost in 197

Porcupine Mtn. areas - acreage treated is in reality less than area size indicated.



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Regeneration 2. Hare damage assessment and technology transfer (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-4A (NOR-36-07-2)
5. Study Leader: L. Brace (See NOR-10-03)
6. Key Words: Hare damage, stand susceptibility ratings, workshops, technology transfer
7. Location of Work: Winnipeg, throughout Manitoba
8. Study Objectives:
 1. To act as a Scientific authority for a R&D contract designed to assess stand susceptibility to hare damage of planted and natural seedlings.
 2. To hold workshops designed to permit technology transfer in the fields of silviculture with special emphasis on natural and artificial regeneration.
9. Goals for 1985-86:
 1. A meeting of the CFS's Regional Reforestation Technical Committee will be held in Brandon, Manitoba in June 1985. The focus of this workshop is plantations of spruce and pine established in the Spruce Woods and Turtle Mountain Forest Reserves between 1904 and the present.
10. Accomplishments in 1985-86:
 1. CFS's Regional Reforestation Technical Committee met as planned and minutes of the meeting and field tour were prepared and submitted to Committee members and NoFC's Senior Regional Advisory Committee.
11. Goals for 1986-87:
 1. A meeting of the CFS's Regional Reforestation Technical Committee will be held in Prince Albert, Saskatchewan in June 1986. The focus of this workshop will be on ways of assessing and treating highly productive backlog sites including the development and discussion of specific prescriptions.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M:

Capital:

Grants & Contributions: CFS \$1,250/\$1,250 Manitoba

15. Signatures:

Investigator

Technical Advisor

Program Director, Resources

H. Blane

Supervisor

Paul McQueen

District Manager

M. H. H.

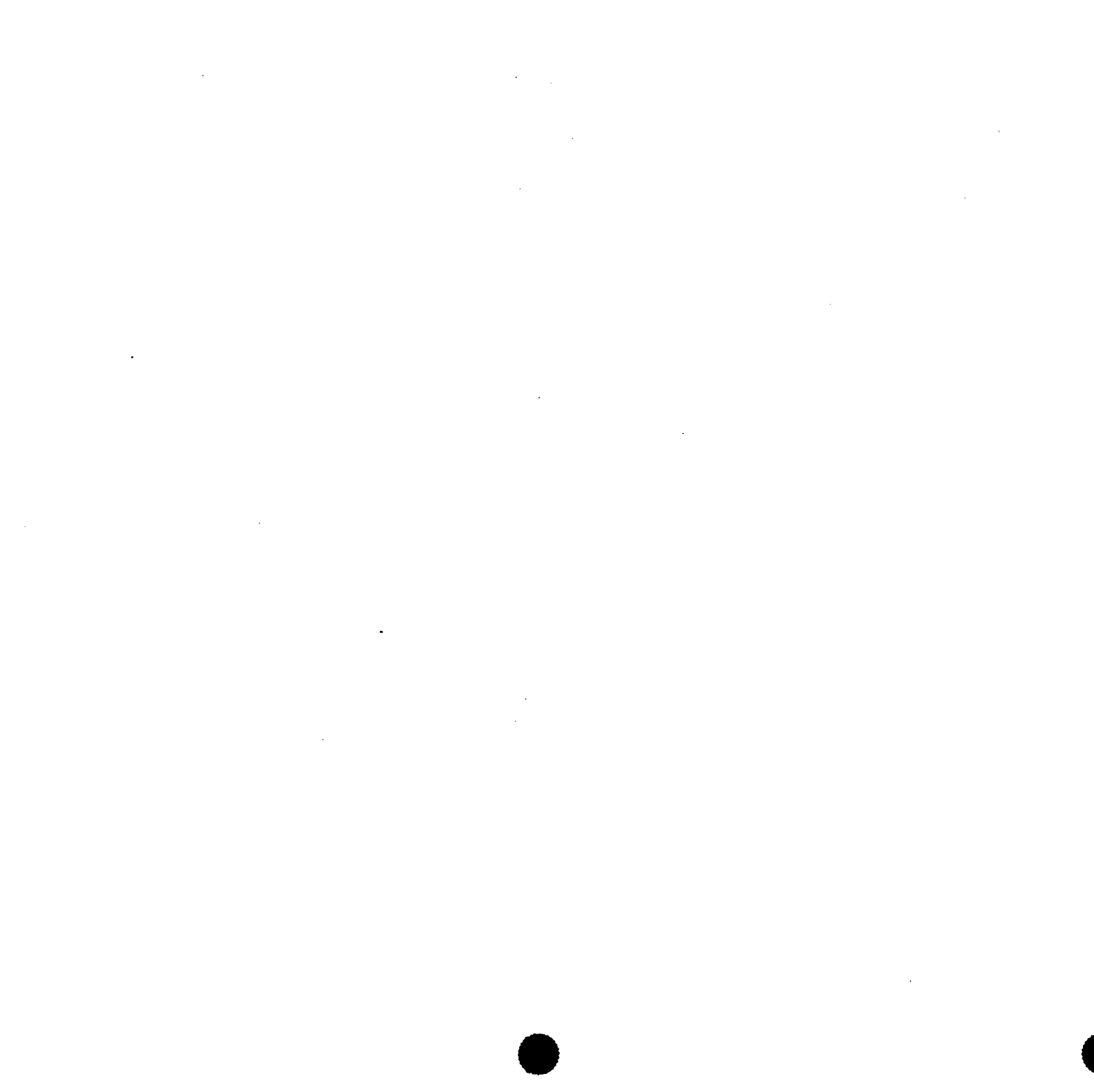
Program Director, Development

A. D. Hunt

Regional Director General

OPERATIONAL PLAN
1985-1989

	1985-86	1986-87	1987-88	1988-89	Total
	Hold a workshop on regeneration through the auspices of CFS's Regional Reforestation Technical Committee (see 10-3MA). \$2.5 K CS	Continue. \$2.5 K CS	Continue. \$2.5 K CS	Continue and Terminate. \$2.5 K CS	\$10
			Act as a Scientific authority for a R&D contract to assess stand susceptibility to hare damage of natural and artifical seedlings (see 10-1MA). \$60 K CS	Continue and Terminate \$60 K CS	\$120
:	\$2.5 K CS	\$2.5 K CS	\$62.5 K CS	\$62.5 K CS	\$130



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Establishment of jack pine seed orchards in Manitoba
3. New: Cont.: X 4. No.: NOR-36-01-5 (NOR-36-08)
5. Study Leader: A. Nanka
6. Key Words: controlled breeding, mass selection, family test, plantation tending.
7. Location of Work: Winnipeg, Oakbank, The Pas, Lonesand, Swan River, Hadashville, Marchand, Stead.
8. Study Objectives:
 1. To establish jack pine seed orchards for eastern and western Manitoba by controlled breeding of trees selected under study NOR-12-03.
 2. To establish jack pine seed orchards for the Interlake and Northern Regions of Manitoba using mass selection in plantations of source-identified populations.
 3. To prepare a comprehensive establishment report for each seed orchard established under this study to facilitate their development and utilization by the Manitoba Forestry Branch (MFB) beyond the 1989 termination of the Canada-Manitoba Forest Renewal Agreement.
 4. To provide required support to study NOR-12-03 in Manitoba, including but not limited to determining and carrying out required plantation tending.
9. Goals for 1985-86:
 1. In close cooperation with the Manitoba Forestry Branch and Canada DPW monitor the construction of the research greenhouse complex comprising a common headerhouse and two greenhouses (1 - CFS and 1 - MFB) at the Pinelands Forest Nursery (PFN) near Hadashville, Manitoba. Initiate

greenhouse start up and develop work schedules in cooperation with MFB tree improvement personnel.

2. Eastern Breeding District - collect and store seed obtained from controlled breeding carried out in 1984 on selected trees in family test plantations. Repeat controlled breeding in 1985 on selected trees which lacked sufficient flowering in 1984. Initiate irrigation system at Birds Hill. Initiate other site development activities there as time and funds permit.
3. Northern Region - initiate and complete cone collections from selected jack pine stands, process seeds, and begin rearing planting stock as part of the establishment of two mass selection seed orchards. Planting sites for the seed orchards will be selected and developed during 1985 with planting scheduled for the spring of 1986.
4. Central Breeding District - remeasure family-test plantations. Record survival and development of grafts in the holding area at PFN.
5. Birds Hill "mass selection" seed orchard - Tend seed orchard; ensure that cone collections are carried out by MFB and the seed utilized for rearing stock for use in eastern Manitoba. Along the same lines MFB should be actively encouraged to utilize seed from identified plus jack pine stands in the vicinity of the Marchand forestry office to obtain a 15% gain over random seed collections.
6. Prepare special reports of maps and source lists of jack pine breeding plantations.

Added Goal:

7. Complete measurement of height and diameter at 10 years from planting in the range-wide black spruce provenance experiment plantations in Manitoba, Saskatchewan, and Alberta.

10. Accomplishments in 1985-86:

1. Construction of the Tree Improvement Facility (TIF) at Pineland Forest Nursery (PFN) was monitored, involving major responses to unanticipated funding shortfalls. Owing to construction delays, greenhouse start-up did not occur and work schedules were not developed during the review period.
2. Fifty-six cones reached maturity and were harvested, of 129 conelets that were pollinated in 1984, but there is no record of seed extraction or storage. Controlled breeding in 1985 involved all of the 200 trees selected for use as parents of stock for the eastern breeding district seed orchard, and resulted in pollination of 1900 conelets. Contracts were arranged for installation of an irrigation line, clearing, and elevation mapping for the seed orchard at the Oakbank Tree Improvement Site (OTIS).
3. Cone collections, seed processing, and the initiation of rearing were done for 32 stand progenies from the northern region, each formed by bulking seed from 10 trees. Seed orchard plantation sites were

selected and reserved, plot markers were prepared, and a contract for clearing the site was arranged.

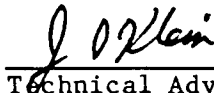
4. Provided three workers for five days to assist in measurement of the central breeding district family test plantation in Manitoba, and implemented brush control in this plantation. Recording of graft survival and development at PFN was not done owing to lack of sufficient time.
 5. Cone collections were carried out in the 1972 seed orchard at OTIS. Seed was extracted, processed, and stored. Progress was made in identifying and marking stands for cone collection in the superior source areas near Marchand forestry office, but collections were not carried out during the review period.
 6. The special report of maps and source lists of jack pine breeding program plantations was not completed owing to lack of sufficient time.
 7. Measurement of height and diameter at 10 years from planting in the range-wide black spruce provenance experiment plantations in Manitoba, Saskatchewan, and Alberta, was completed.
11. Goals for 1986-87:
1. In cooperation with Manitoba Forestry Branch (MFB), operate the Tree Improvement Facility (TIF), consisting of a common headerhouse and separate greenhouses for CFS and MFB at Pineland Forest Nursery (PFN).
 2. Work toward establishment of the eastern breeding district (ebd) 10-year selection pedigreed seed orchard by harvesting cones, extracting and processing seed, and commencing rearing, of progenies for seed orchard stock from 1985 controlled breeding; and by developing the selected seed orchard site at Oakbank Tree Improvement Site (OTIS).
 3. Work toward establishment of the central breeding district 5-year selection grafted seed orchard by arranging and implementing site selection, by compiling an inventory of grafts at PFN, and by monitoring graft tending.
 4. Establish Northern Region mass selection seed orchards by rearing 32 source collections, intensively preparing two 1-ha sites, planting 20 000 trees on the two sites, fencing the sites, and documenting the plantations.
 5. Promote availability of an interim improved seed supply by tending the ebd 1972 mass selection seed orchard at OTIS and encouraging continued cone harvest and stock production from it by MFB in 1986, and by continuing development of seed collection areas and seed production areas with MFB in superior source areas identified in Forest Management Note 24.

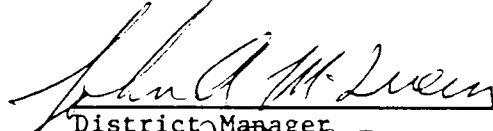
6. Assist NOR-12-02 and NOR-12-03 by measuring the jack pine provenance experiment plantation at 15 years, by measuring ebd family test at 15 years, by tending family-test plantations in Manitoba, and by thinning ebd family-test plantations.
7. Complete the special report of maps and source lists for the jack pine breeding program.
8. Assist in planning and preparation of tree improvement technical workshop to be conducted jointly with MFB under study NOR-36-13.
12. Publications 1985-86:
Nil
13. Environmental Implications:
The Agreement Manager has been directed by Management Committee to include all pertinent environment-related information on the PAF associated with the project. The PAF will serve as the official document which the environmental screening committee will review.
14. Resources 1986-87:
- | | | |
|---------------|-------|-----|
| P/Ys: | | |
| Prof: | | 0.0 |
| Tech: | Nanka | 1.0 |
| Total: | | 1.0 |
| Term/Student: | | 0.0 |
- O & M: \$20,733 (+ 52,000 contracts)
- Capital: \$52,000
- Grants & Contributions: O&M for (TIF/PFN) - CFS \$52,250/52,250 MFB

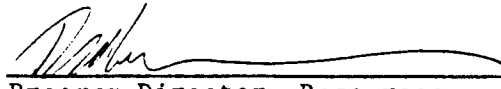
15. Signatures:

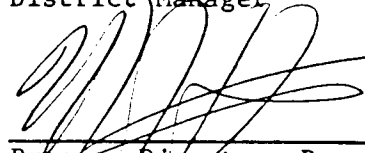

Investigator

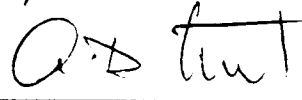
Supervisor


Technical Advisor


District Manager


Program Director, Resources


Program Director, Development


Regional Director General

OPERATIONAL PLANS
1985-1989

ls	1985-86	1986-87	1987-88	1988-89	
thern eding trict					
.	Select jack pine stands, collect cones and begin rearing	Complete rearing of seedlings and plant	Tend seed orchards	Tend seed orchards	Approa on "ma tion"
.	Select and develop seed orchard sites	contract fencing			source Grow 4
.					lings
.					Plant
.					seedli
.					2 seed
tral eding trict					Thin i
.	Tend existing grafts at Pineland Tree Nursery	Tend existing grafts	Tend existing grafts	Plant and tend seed orchard	See Ea
.			Graft additional stock based on selected families		Breedi
.	Remeasure family test plantations	compile inventory of grafts			trict
.		Implement site selection for orchard	Select and develop seed orchard sites including fencing		

OPERATIONAL PLANS*
1985-1989

	1985-86	1986-87	1987-88	1988-89	
als stern eeding strict					
1.	Mate selected trees (i.e. cross pollina- tion)	Collect cones and process seed, begin rearing	Complete rearing, plant seedlings and tend orchard	Tend seed orchard	Select on 40 famili years. 10,000
2.	Purchase vehicle. Erect greenhouse	Purchase seed orchard maintenance vehicle			1-m ta Plant seedli
3.	Initiate irrigation system - Birds Hill	Clear, level and fence Birds Hill planting site	Complete irrigation system		5-m sp 2000 t final
		Remeasure family test plantations			to pro approx 2 mill annual 1995 G gain 3
	Tend jP mass selec- tion seed orchard at Birds Hill	Continue	Continue	Continue	
	Prepare special Reports of maps and source list of jP breeding plantations.				

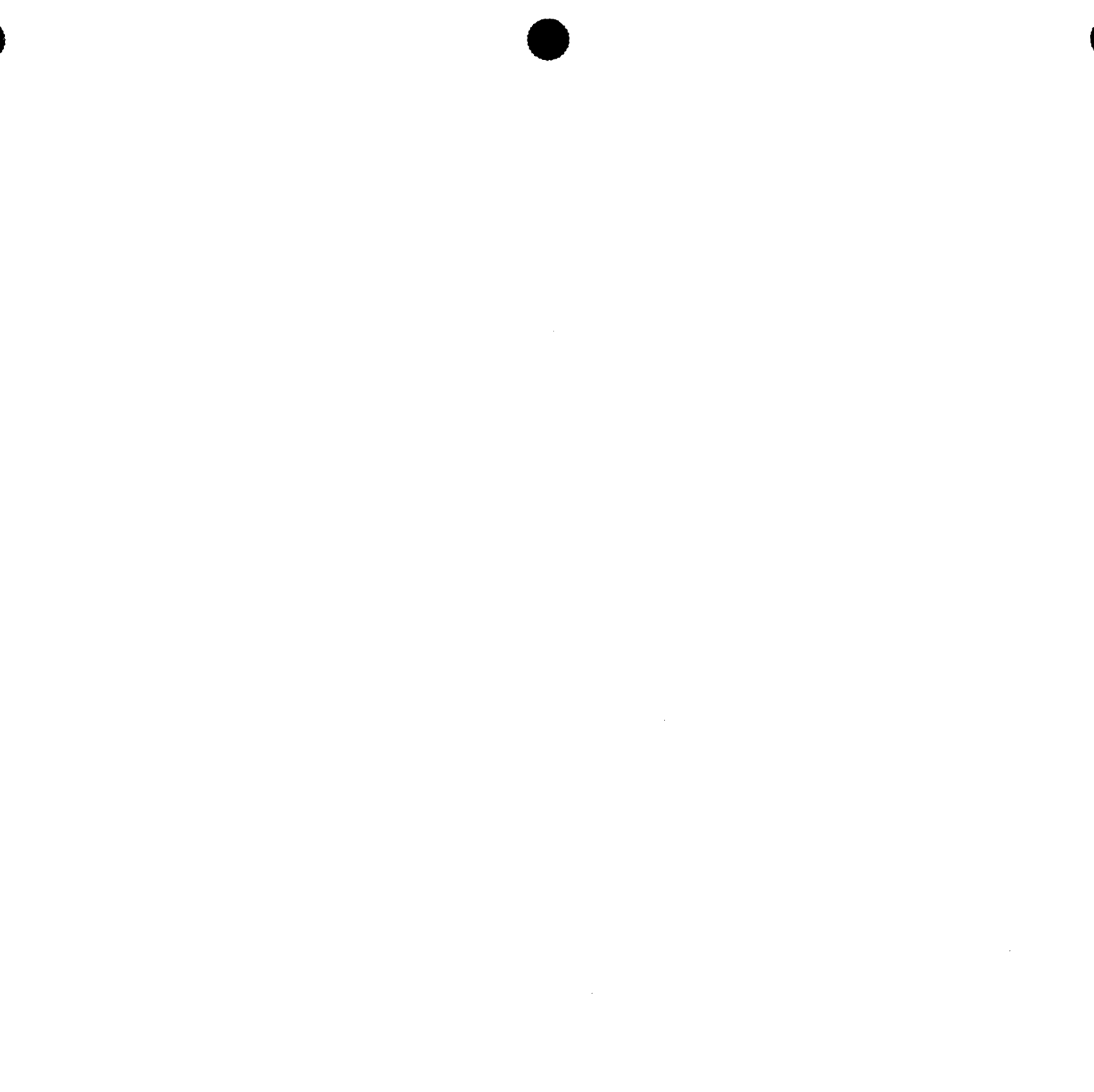
OPERATIONAL PLANS
1985-1989

Items	1985-86	1986-87	1987-88	1988-89	
GENERAL					
Capital	\$522 K	\$ 52 K	--	--	\$5
M-Travel	\$ 35 K	\$ 20.7 K	\$35 K	\$30 K	\$1
-Contracts &					
-Supplies	\$ 66 K	\$62 K	\$15 K	\$43 K	\$1
Cost shared					
Capital	\$159 K	--	--	--	\$1
& M	\$ 70 K	\$113 K	\$110 K	\$22 K	\$2
Total:	\$852 K	\$247.7 K	\$160 K	\$95 K	\$1

Technical advise on program - see 12-6MA

OPERATIONAL PLANS
1985-1989

als	1985-86	1986-87	1987-88	1988-89	
terlake eeding strict			Select and initiate development of seed orchard sites.	Complete site devel- opment including fencing.	See No Distri breedi note.
.				Select jack pine stands, collect cones process seed, and begin rearing Seedlings.	
2.				Prepare a complete and comprehensive establishment report for each of the jack pine seed orchards for MFB.	
eeding stricts					



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Forest site classification (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-6 (NOR-36-09)
5. Study Leader: I. Corns (see NOR-10-06)
6. Key Words: Site classification, forest management, forest inventory, site productivity, silviculture prescriptions, ecology, soils
7. Location of Work: Manitoba District Office, Manitoba
8. Study Objectives:
 1. To develop a forest site classification for Manitoba which adequately reflects significant differences in site productivity and for which meaningful silviculture and other forest management prescriptions can be developed.
 2. To direct and supervise a contractor who will undertake the necessary office and field work to assess and classify ecoregions, ecozones, and ecotypes according to the proposed site classification scheme.
9. Goals for 1985-86:
 1. Following a detailed review of appropriate literature and discussions with staff of the Manitoba Forestry Branch, the CFS (NoFC), the Manitoba Soils Survey and others, develop a framework for a forest management site classification system (incorporating geomorphology, surficial geology, soils, climate, vegetation, biotic and edaphic features) acceptable to the province of Manitoba to which meaningful interpretations of productivity, silviculture prescriptions, and other forest management concerns can be applied.
 2. Supervises the preparation of maps and reports containing appropriate information relevant to the zonation of the province based on the feature outlined in goal 1 at the ecoregion and ecozone level using existing and new information collected by an appropriate contractor.

10. Accomplishments in 1985-86:

1. The NoFC continues to have difficulty in getting a Site Classification Specialist position classified at a level appropriate to the goals established for the project under the Canada-Manitoba Forest Renewal Agreement. It is now proposed that CFS or MFB hire a contractor for a three year term in order to get this project "off the ground".
2. This goal was not initiated in 1985-86.

11. Goals for 1986-87:

1. Act as a Scientific Authority of a contract wherein the contractor will i) carry out a detailed review of appropriate literature and discussions with staff of the Manitoba Forestry Branch, the CFS (NoFC), the Manitoba Soils Survey and others, develop a framework for a forest management site classification system (incorporating geomorphology, surficial geology, soils, climate, vegetation, biotic and edaphic features) acceptable to the province of Manitoba to which meaningful interpretations of productivity, and other forest management concerns can be applied, and ii) develop a detailed long-term work plan for undertaking forest site classification in the province of Manitoba including time frames, resources required, and R&D needs.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: 0.0

Tech.: 0.0

Total: 0.0

Term/Student: 0.0

O & M (Contract): \$12,500

Capital:

Grants & Contributions: CFS \$52,500/\$52,000 MFB

15. Signatures:

Investigator

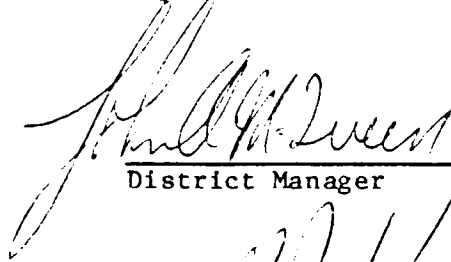


Technical Advisor

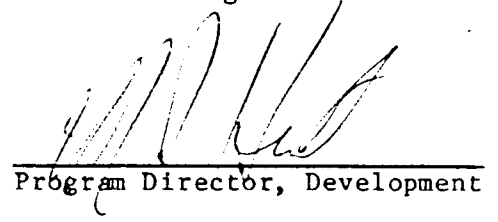


Program Director, Resources

Supervisor



District Manager



Program Director, Development



Regional Director General

OPERATIONAL PLAN
1985-1989

	1985-86	1986-87	1987-88	1988-89	Total
als	Review appropriate literature, discuss with province and technical experts, and prepare a proposed forest site classification for forest management in the Province of Manitoba for approval.(see 10-2MA)	Obtain formal approval for the proposed site classification system. Undertake field work as appropriate.	Undertake appropriate field work and prepare reports.	Undertake appropriate field work and prepare reports. Terminate.	
.	Act as Scientific authority for a R&D contract designed to collect existing data and other information for input into the design of a Man. site classification system.(see 10-2MA)	Act as a Scientific authority for a R&D contract designed to collect field data for the development of the approved Man. forest site classification system.	Continue.	Continue and terminate.	
total:	\$75 K cs	\$105 K CS	\$105 K CS	\$130 K CS	\$465 K
M	\$7 K	\$7 K	\$7 K	\$7 K	\$28 K
ary	\$36 K	\$36 K	\$36 K	\$36 K	\$144 K
ce:	It is proposed to issue a personal services contract as follows:				
		\$148 K	\$148 K	\$173 K	\$469 K

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Forest Nurseries (Manitoba)
3. New: X Cont.:
4. No.: NOR-36-01-7 (NOR-36-10)
5. Study Leader: I. Edwards (see NOR-12-06)
6. Key Words: Nursery management workshop, accelerated growth, seedling prescriptions
7. Location of Work: Pineland Forest Nursery (Hadashville), and Clearwater Forest Nursery (The Pas), Manitoba
8. Study Objectives:
 1. To hold a forest nursery management workshop to discuss specific Manitoba nursery problems.
 2. To let and supervise a R & D contract to carry out research in order to devise seedling specifications for outplanting on sites with severe vegetation competition.
9. Goals for 1985-86:

Nil - first work to be undertaken in 1986-87.
10. Accomplishments in 1985-86:

Nil
11. Goals for 1986-87:
 1. Organize and contribute to a nursery management workshop which specifically focuses on current Manitoba forest nursery problems. Edwards, Cameron, and Thornbloom form the organizing committee.
 2. Reviews a study plan prepared by S. Segaran and provide ongoing technical advise to MFB in connection with a 3-year operational R&D study on the accelerated growth of white spruce for outplanting on

difficult sites. Greenhouse and field performance results will be used in the development of rearing, stock size, and stock quality specifications for white spruce seedlings to be outplanted on sites with severe vegetation competition.

12. Publications 1985-86:

Nil - new study

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: 0.0
 Tech.: 0.0
 Total: 0.0
 Term/Student: 0.0

O & M:

Capital:

Grants and Contributions: Workshop - CFS \$5,000/\$5,000 Manitoba
 R&D - CFS \$35,000/\$35,000 Manitoba


15. Signatures:




 Investigator

 Supervisor

 Technical Advisor



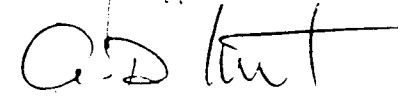
 District Manager



 Program Director, Resources



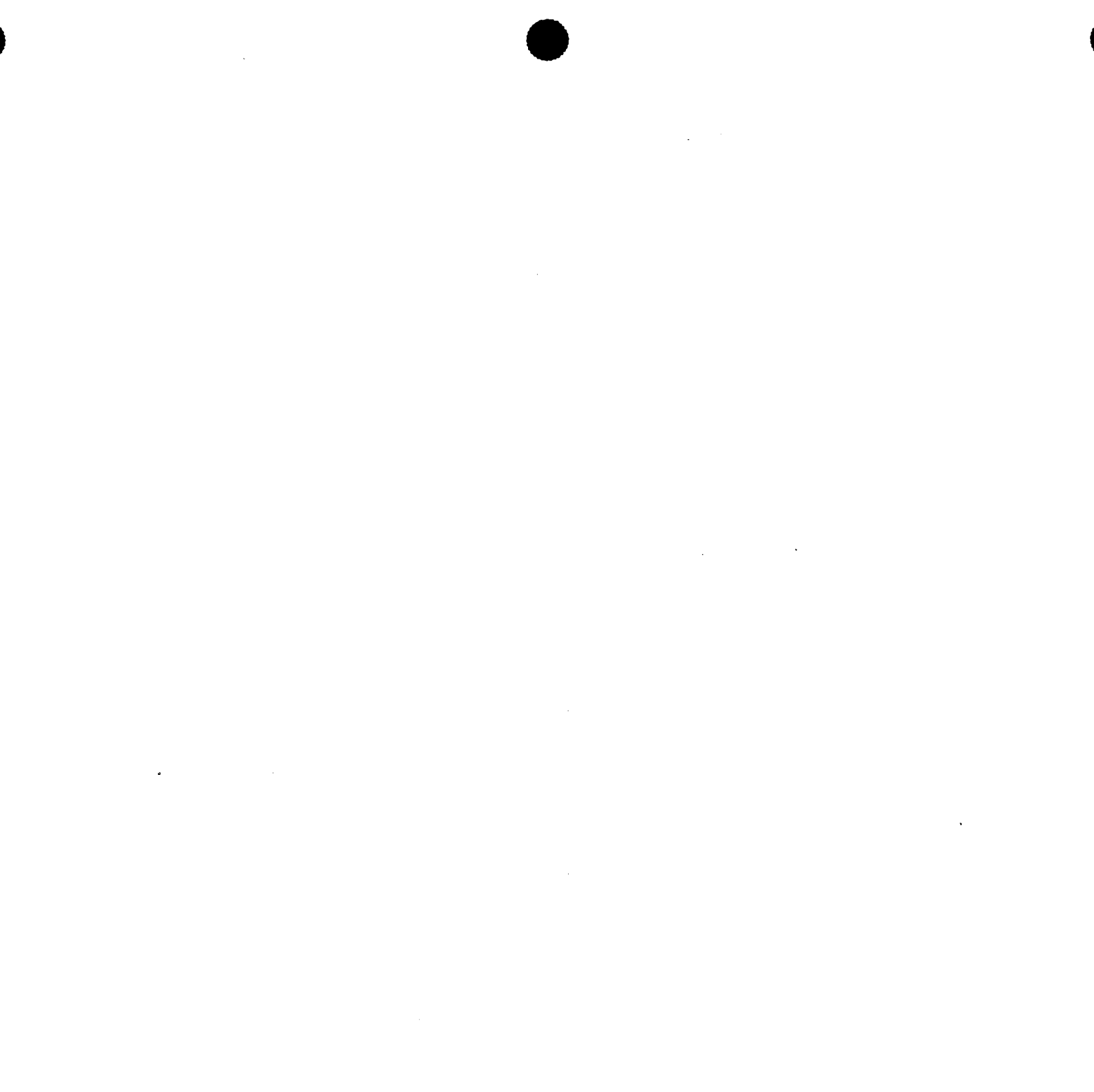
 Program Director, Development



 Regional Director General

OPERATIONAL PLAN
1985-1989

1s	1985-86	1986-87	1987-88	1988-89	Total
.		Forest nursery management workshop (see 12-4MA). \$10K CS			\$10
.		Provide technical advice to MFB for a contract to carry out research on the accelerated growth of white spruce for outplanting on difficult sites (see 12-5MA). \$70 K CS	Continue. \$70 K CS	Continue and terminate. \$70 K CS	\$2
al \$:		\$80 K CS	\$70 K CS	\$70 K CS	\$2



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Forest economics (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-8 (NOR-36-11)
5. Study Leader: T. Steele
6. Key Words: Northern employment development; economics of intensive forest management; cost effectiveness; damage appraisal; regulations and incentives; industrial structure; harvest scheduling; technology transfer
7. Location of Work: Manitoba District Office, Manitoba
8. Study Objectives:

The following Study Objectives were approved by the Canada/Manitoba Research MOU and funded by the Canada-Manitoba Forest Renewal Agreement:

1. To identify meaningful employment opportunities which can be provided by the forestry sector for residents of northern Manitoba.
2. To develop and implement an economic assessment framework for the purpose of providing guidelines to forest managers to ensure the most cost-effective use of funds in intensive forest management.
3. To implement a damage appraisal and valuation system for the purpose of assessing values at risk and post fire economic impact.
4. To assess the effect of various existing and potential incentives and regulations upon the forest industry within Manitoba.
5. To determine the current size, structure, and economic impact of the primary wood-using industries in Manitoba.
6. To provide technology transfer in the application of recently developed procedures and techniques regarding decision-making aids designed to improve forest and timber management.

9. Goals for 1985-86:

1. Initiate contract work with socio-economic consultant to define size, scale, and scope of northern Manitoba forestry work opportunities and community development, as well as assess applicable studies. (Objective 1)
2. Begin to develop an interdisciplinary economic assessment framework, and work plan (in cooperation with Manitoba Natural Resources (MNR) and GLFC, as required). (Objective 2)
3. Review previous work done by MNR and national fire economist. Develop study proposal. (Objective 3)
4. Initiate contract work with consultant on incentives and regulations which affect the efficient utilization of the forest resource. (Objective 4)
5. Develop terms of reference for contract work to survey Manitoba's primary wood-using industries. Tender contract. Consultant to finish field survey and initial compilation of data. (Objective 5)
6. Initiate preliminary work with consultant (U of A) to determine feasibility of transferring decision making model procedures and techniques (e.g., Timber RAM; FORPLAN; MUSYC) to MNR using Manitoba data. (Objective 6)
7. Maintain liaison with Project Leader, Resource Economics and Statistics and staff to provide socio-economic, forestry, statistical, and technology transfer information to various user groups. (Objective 6)

Added Goals

8. Collect data to assess the structure of the Manitoba pulpwood market. (Objective 6)

10. Accomplishments in 1985-86:

1. Study proposal to identify forestry-based employment opportunities was developed in detail. Approval of study was solicited from Manitoba Management Directorate in November 1985. (Objective 1)
2. Interdisciplinary studies of silvicultural treatments were planned and initiated: three jack pine precommercial thinning projects in Cowan, Dragline Lake, Hadashville; two black spruce precommercial thinning projects in Pine Falls and Powerview; one shear-blade site preparation in Riverton. Preliminary observations were taken for site preparation projects (TTS disc-trencher, M&M disc-trencher), as well as herbicide treatments (Roundup, Velpar). Collation and initial analysis of data was completed. (Objective 2) (In conjunction with NOR-3-03, DeFranceschi)
3. Fire damage appraisal work by L. Gravelines (MNR) was reviewed. (Objective 3)

4. After introductory discussions, no further action was taken to assess the effects of incentives and regulations upon the forest industry due to the countervail and free trade issues. (Objective 4)
5. Study proposal to determine the current size, structure, and economic impact of Manitoba's forest industry was developed in detail. Terms and conditions of contract were developed. Contract awarded to Forintek in November 1985. Survey work to be done by 31 December 1985; data analysis and preparation of tables to be done by 31 January 1986; directory to be completed by 31 March 1986. (Objective 5)
6. Dr. J. Beck Jr., consultant from University of Alberta made three visits to MNR to assess feasibility of transferring decision-making model procedures (TimberRAM) and techniques. (Objective 6)
7. Manitoba forest economist hired 10 June 1985. He has completed orientation program in Manitoba and NoFC; has developed and maintained provincial and regional liaisons in forestry and regional development sectors. (Objective 6)

Added Goal:

8. Completed data collection and initial analysis of Manitoba pulpwood statistics to assess structure of Manitoba pulpwood market. (Objective 5; NOR-3-01).
11. Goals for 1986-87:
1. Continue interdisciplinary economic/silvicultural studies to provide guidelines for cost-effective use of funds in intensive forest management. (Objective 2)
 2. Prepare a File Report presenting background information and preliminary results for pre-commercial thinning cost of production studies. (with NOR-3-03) (Objective 2)
 3. Prepare a File Report presenting background information and preliminary results for shear-blading site preparation cost of production studies. (with NOR-3-03) (Objective 2)
 4. Study proposal to implement a damage appraisal and valuation system will be developed with regional, provincial, and Agreement fire specialists and regional forest economist in 1987-88. (Objective 3).
 5. Completion of analyses and report on the size, structure and economic impact of the primary wood-using industry in Manitoba. Assist in the completion of updated "Manitoba Forestry Report" (with NOR-3-01). (Objective 5)
 6. Become familiar with the models used and being developed by FEPA for future economic analyses of Manitoba wood supply. (Objective 6)
 7. Coordinate and conduct a wood-using industry tour for Manitoba entrepreneurs of Lake States forest products plants. (Objective 6)

8. Initiate and develop contacts with forest economists in Canadian and North American context through attendance at CAFE and Mid-Western Forest Economists meetings, and participate in forest economics working groups as Canadian regional representative for Society of American Foresters. (Objective 6)
9. Complete interim evaluation of Canada-Manitoba Forest Renewal Agreement. (Program #10, Canada-Manitoba Forest Renewal Agreement; with NOR-3-01).

12. Publications 1985-86:

Stier, J.C.; Steele, T.W.; and Engelhard, R.J. 1986. Pulpwood procurement practices in the Wisconsin-Upper Michigan pulp and paper industry. N.J. Applied For. Vol. 3, No. 1.

Bolin, M.; and Steele, T. 1985. Woodlands and wildlife: How do I get started? Amer. Tree Farmer, Vol. X, No. 5.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources:

PYs: Prof.:	Steele	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

O & M: \$10,000

Capital: 0

Grants and Contributions: CFS \$48,000/\$48,000 MFB

15. Signatures:

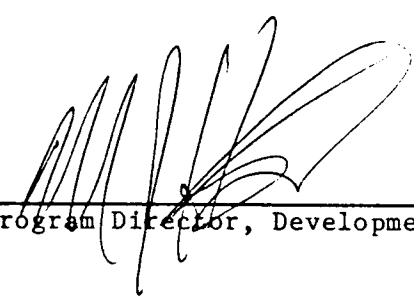
T. Steele

Investigator

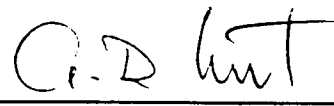
John A. Lucas

District Manager

Technical Advisor



Program Director, Development



Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Forest Inventory (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-9 (NOR-36-12)
5. Study Leader: I. Bella (see NOR-4-01)
6. Key Words: Yields, permanent sample plots, growth models, natural stands, managed stand
7. Location of Work: Winnipeg, throughout Manitoba
8. Study Objectives:
 1. To devise techniques for forecasting future yields in natural stands.
 2. To establish permanent sample plots (PSPs) to obtain ongoing growth data.
 3. To evaluate growth models, both for natural and damaged stands, to satisfy Manitoba's needs in yield forecasting and change data programs.
9. Goals for 1985-86:
 1. To provide technical advice to Manitoba on the establishment of PSPs and on the evaluation of growth models for both natural and managed stands.
10. Accomplishments in 1985-86:
 1. Initiative on these goals has been taken through the establishment of a regional growth and yield co-operative that gave high priority to the development of PSP standards and to the evaluation of growth models for local species both in natural and managed stands.
11. Goals for 1986-87:
 1. Continue to provide technical advice to Manitoba on PSP establishment and growth models for both natural and managed stands.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

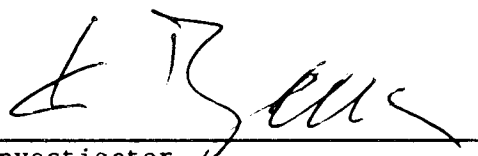
14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M: \$40,000 Provincial funding

Capital:


Grants & Contributions:

15. Signatures:



 Investigator

 Supervisor

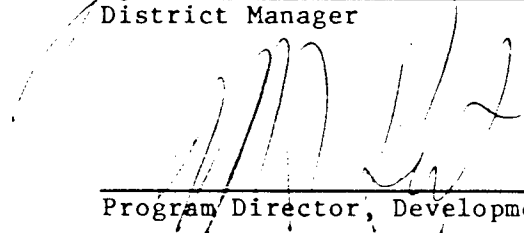
 Technical Advisor



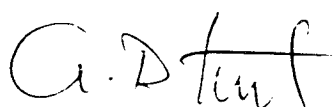
 District Manager



 Program Director, Resources



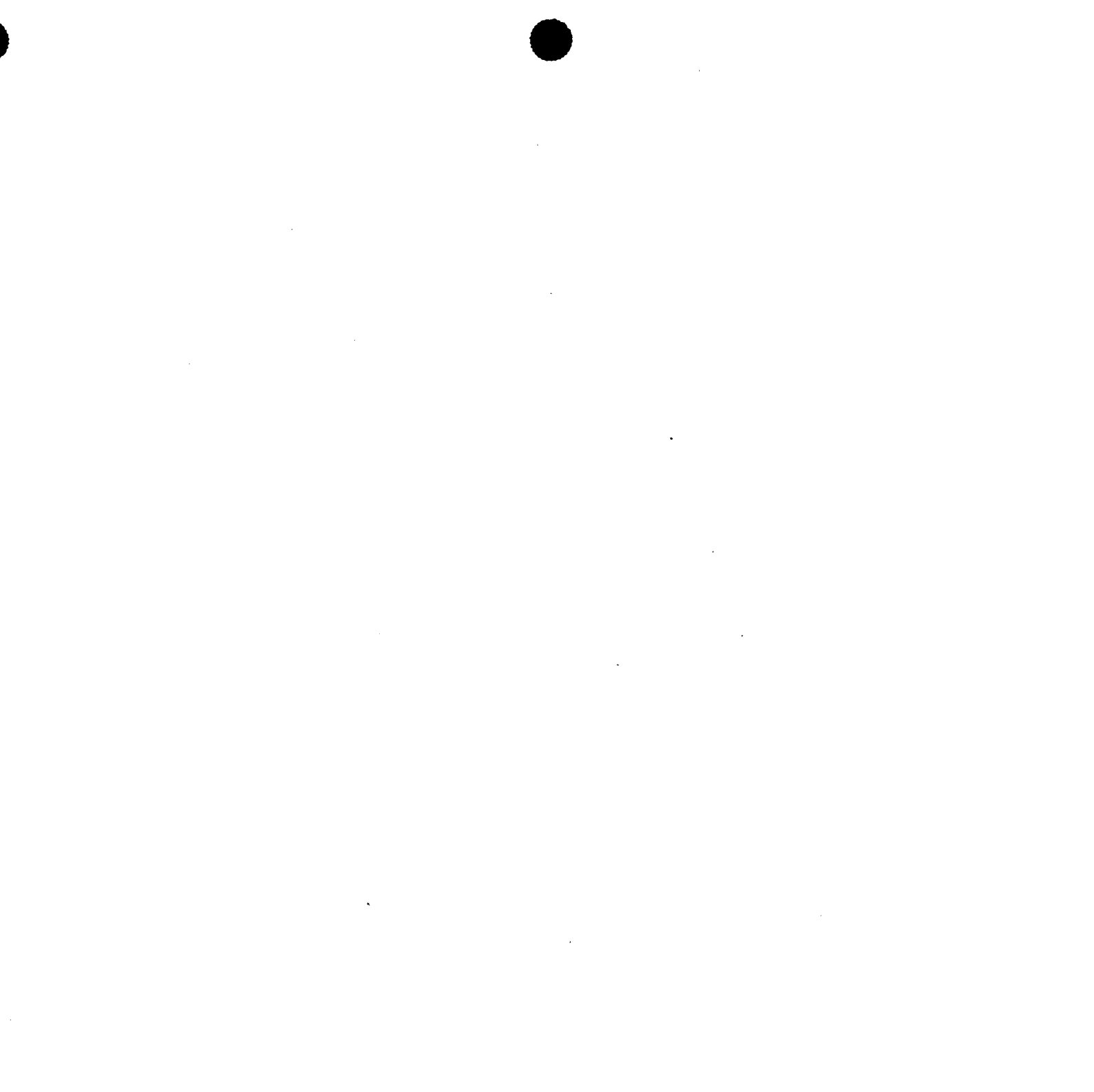
 Program Director, Development



 Regional Director General

OPERATIONAL PLAN
1985-1989

ls	1985-86	1986-87	1987-88	1988-89	Tot
.			Provide advise on forecasting yields for natural stands (see 4-5MA). \$60 K P	Continue and terminate. \$60 K P	\$1
.	Provide advice on establishing and measuring PSPs to obtain growth data. (see 4-5MA) \$10 K CS	Continue. \$10 K P	Continue. \$10 K P	Continue and terminate. \$10 K P	\$1 \$3
.	Provide advice on evaluating growth models for natural and managed stands. (see 4-5MA) \$30 K CS	Continue. \$30 K P	Continue. \$30 K P	Continue and terminate. \$25 K P	\$3 \$8
tal	\$40 K CS	\$40 K P	\$100 K P	\$95 K P	\$2 \$



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 31, 1986

1. Project: Development Agreements
2. Title: Tree Improvement (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-10 (NOR-36-13)
5. Study Leader: J. Klein (see NOR-12-03)
6. Key Words: Tree improvement workshops, rooted cutting systems, white spruce, jack pine
7. Location of Work: Pinelands Forest Nursery (Hadashville)
8. Study Objectives:
 1. To hold two workshops on tree improvement techniques.
 2. To provide technical advice to MFB in connection with a R&D study on rooted cuttings systems for white spruce and jack pine.
9. Goals for 1985-86:
 1. Conduct a workshop on tree improvement techniques with MFB tree improvement group.
10. Accomplishments in 1985-86:
 1. The workshop proposed for 1985-86 was not held.
11. Goals for 1986-87:
 1. Contribute to the planning and organizing of a tree improvement workshop to be held in Manitoba.
 2. Review a study plan and provide ongoing technical advice to MFB in connection with a 2-year operational R&D program on rooted cutting systems for jack pine and white spruce.
12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	0.0
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M:

Capital:

Grants & Contributions: CFS \$27,500/\$27,500 Manitoba

15. Signatures:

Investigator

J. Klein

Technical Advisor

[Signature]

Program Director, Resources

Supervisor

[Signature]

District Manager

[Signature]

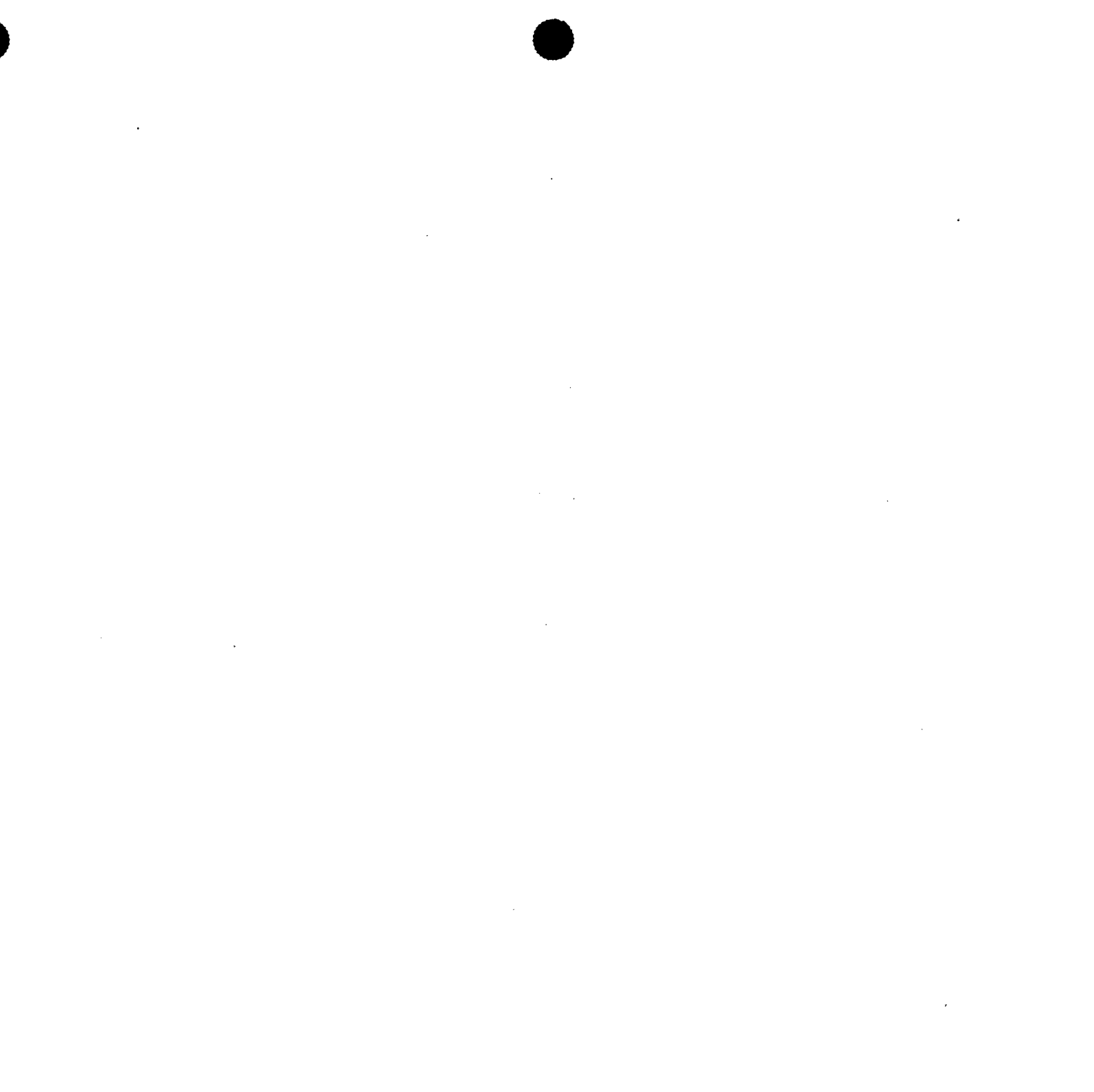
Program Director, Development

G. D. [Signature]

Regional Director General

OPERATIONAL PLAN
1985-1989

1s	1985-86	1986-87	1987-88	1988-89	Tot.
.	<p>Conduct a workshop on tree improvement techniques (see 12-1MA).</p> <p>\$5 K CS</p>		<p>Conduct a workshop on tree improvement techniques. (see 12-1MA).</p> <p>\$5 K CS</p>		\$1
.		<p>Review study plan and provide technical advice to MFB regarding R&D on rooted cutting systems for jack pine and white spruce. (see 12-3MA)</p> <p>\$55 K CS</p>	<p>Continue and terminate. (see 12-3MA)</p> <p>\$55 K CS</p>		\$1
al \$:	\$5 K CS	\$55 K CS	\$60 K CS		\$1



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1986

1. Project: Development Agreements
2. Title: Canada-Alberta Forest Resource Development Agreement and Development Program Coordination
3. New: Cont.: X 4. No.: NOR-36-02
5. Study Leader: S. Price
 N.B. See also separate study statements for:

i) Forest Vegetation Management (Alberta)	NOR-36-02-1
	NOR-36-02-1A
	NOR-36-02-1B
	NOR-36-02-1C
ii) Tree Improvement (Alberta)	NOR-36-02-2
iii) Wetland Drainage (Alberta)	NOR-36-02-3
iv) Forest Pest Management & Damage Appraisal (Alberta)	NOR-36-02-4
v) Managed Stand Yield Tables (Alberta)	NOR-36-02-5
vi) Demonstration Project (Alberta)	NOR-36-02-6
vii) Forest Economics & Statistics (Alberta)	NOR-36-02-7
viii) Public Information (Alberta)	NOR-36-02-8
6. Key Words: Canada-Alberta Forest Resource Development Agreement, reforestation, forestry research, demonstration, hardwood development, public information, administration, evaluation, job creation, economic development
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta
8. Study Objectives:
 1. To manage and coordinate the implementation of federally-funded initiatives and monitor the use of federal funds related to the Canada-Alberta Forest Resource Development Agreement by:
 - a. ensuring that economically accessible timber supplies, especially softwoods, are available to meet the long-term requirements of the forest industry in Alberta;
 - b. ensuring that the available timber supply, with emphasis on hardwoods, is utilized in the most efficient manner possible; and

- c. contributing to the economic development and diversification of the provincial economy and to the improvement of employment opportunities in the forest industry.
 - 2. To review socio-economic events, regionally, nationally, and internationally and assess impacts in terms of CFS mandate and programs in relation to regional development in the forestry sector.
 - 3. To coordinate the development, implementation and administration of forestry employment stimulation programs in the prairie provinces and NWT as required.
 - 4. To provide effective administration and financial control and technical support services for the Regional Development Program.
- 9. Goals for 1985-86:
 - A. Alberta Agreement:
 - 1. Develop standards and procedures for the Canada/Alberta Forest Resource Development Agreement.
 - 2. Manage the implementation of federal activities under the Canada-Alberta FRDA.
 - B. Development general:
 - 1. Continue to provide assistance in the staffing of positions under the Manitoba, Saskatchewan and Alberta Agreements.
 - 2. Provide staff functions as required to District Managers in Manitoba and Saskatchewan in the implementation of the Canada-Manitoba FRA and Canada-Saskatchewan FRDA.
 - 3. Review and recommend for approval all project authorization forms under the Manitoba and Saskatchewan Agreements and make recommendations re: Agreement implementations to the Program Director, Regional Development.
 - 4. Continue to manage and coordinate regionally the implementation of any federal forestry-related job creation programs.
 - 5. Provide regional Agreement and job creation information summaries to CFS-HQ as requested.
- 10. Accomplishments in 1985-86:
 - A. Alberta Agreement:
 - 1. Developed standards and procedures for the Canada-Alberta Forest Resource Development Agreement through Agriculture Canada Systems and Consulting Directorate.

2. Managed the implementation of federal activities under the Canada-Alberta FRDA by:
 - meeting with prospective project sponsors;
 - receiving and reviewing all PAFs submitted;
 - recommending proposals for funding;
 - monitoring Agreement activities and generating project status statements;
 - preparing quarterly reports, annual reports, and work plans;
 - serving on the Program Management Committee, MOU Committee, and the Forest Products Committee;
 - providing CFS input to committees established under other federal-provincial Agreements in Alberta;
 - developing brochures and forms for use under the Agreement; and
 - supervising the implementation of several Agreement projects.

B. Development general:

1. Provided assistance as required in the staffing of positions under the Manitoba, Saskatchewan, and Alberta Agreements.
2. Provided staff support as requested by District Managers in Saskatchewan and Manitoba and by the Program Director, Regional Development.
3. Reviewed all project authorization forms under the Manitoba and Saskatchewan Agreements. Provided recommendations and comments as required. Coordinated the project approval process at NoFC. Generated project status statements for both Manitoba and Saskatchewan Agreements and monitored financial status of all Agreements.
4. Managed and coordinated the federal forestry related job development program in Alberta and provided assistance as required by Manitoba and Saskatchewan District Managers in job development efforts in those provinces.
5. Provided regional Agreement and job development information summaries as requested to CFS-HQ.

11. Goals for 1986-87:

A. Alberta Agreement:

1. Reforestation:

- receive, review, discuss, process for approval, and monitor implementation of project proposals for federal lands in Alberta;
- receive, review, and provide comments and recommendations re PAFs for provincial direct delivery reforestation proposals;

2. Forestry Research Development and Demonstrations:

- receive and circulate to members of the MOU Committee all project proposals submitted under subprogram B.3 of the Agreement;
- maintain records of all proposals received, reviewed, approved, and rejected by the Committee and record all minutes of Committee meetings;
- review, discuss, recommend, and process for approval all PAFs prepared under B.3 and monitor progress on all projects receiving Agreement funding;
- review and comment on all proposals submitted for funding under subprogram B.4 of the Agreement and serve as a CFS representative to the Forest Products and Forest Industrial Development Research Committee;
- review, discuss, recommend, and process for approval all PAFs submitted under B.4 including federal direct, provincial direct, and cost-shared delivery;
- monitor projects under subprogram B.4.

3. Public Information, Evaluation, and Administration:

- review and recommend all PAFs submitted for funding;
- monitor project implementation;
- prepare project status reports, quarterly reports, annual reports, and work plans for all Agreement activities;
- coordinate the development and implementation of a management information system (MIS) (which is compatible with Devmis and CFS's Financial Information Systems);
- to ensure collection of data required for Agreement evaluation; and
- provide coordination for Agreement implementation and maintain liaison with the provincial members of the Program Management Committee.

B. Development general:

1. Provide staff functions as required to District Managers in Winnipeg and Prince Albert in the implementation of the Canada-Manitoba and Canada-Saskatchewan Agreements, and job creation projects.
2. Review and recommend for approval all project authorization forms under the Manitoba and Saskatchewan Agreements; coordinate the approval process in NoFC and make recommendations re Agreement implementation to the Program Director, Regional Development.
3. Ensure the implementation of a management information system under each Agreement.
4. Continue to manage the implementation of federal forestry-related job development programs in Alberta and provide assistance to District Offices re: job development as required.
5. Provide regional Agreement and job development summaries to CFS-HQ as required.
6. Maintain liaison and communication and provide assistance to other federal and provincial departments and agencies having programs impacting on forestry development in Alberta.
7. Begin the conceptual planning for post agreement development programming.

12. Publications 1985-86:

1984-85 Can-Alta FRDA - Annual Report.

1985-86 Can-Alta FRDA - Quarterly Reports.

Information Brochure - subprograms B.3 and B.4.

Canada-Alberta Forest Resource Development Agreement - Policy and Procedures Manual (published).

Alberta North - Forest Sector Profile. Unpublished.

Cyr, N., A. Rendall, and R.G.S. Ritchie. 1985. Characterization of aspen exploded wood. Unpublished.

DaSaulniers, V.N. 1985. Report on research priorities - Alberta board products producers. Unpublished.

Gardner, J.A.F. 1985. A study of forest products research in Alberta. Unpublished.

Pelican Spruce Mills Ltd. 1985. Hardwood species identification from leaf-off aerial photography. Unpublished.

Wenget, M.E. 1985. Evaluation of kiln drying characteristics of 8/4 Canadian aspen lumber in a commercial kiln. Unpublished.

Woodland Resource Services Ltd. 1985. Value added opportunities for Alberta lodgepole pine solid wood products. Unpublished.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environment related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs:	Prof:	Price	1.0	(A-Base)
		Côté	1.0	
		Officer	1.0	(Ottawa Desk)
	Support:	Vacant	1.0	
		Brisco Adams	1.0	
	Total:		5.0	
	Term:	Mrklas	1.0	

Contracts/O & M: \$1,205,100 + \$6,000 A-base

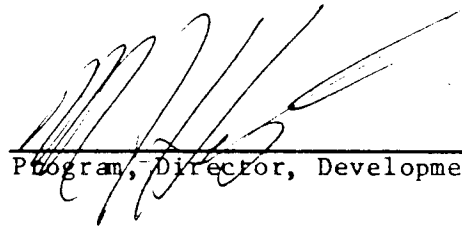
Capital: \$20,000

Grants & Contributions: \$630,000

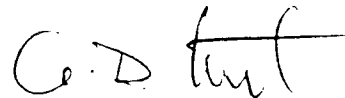
15. Signatures:



Alberta Agreement Manager



Program, Director, Development



Regional Director General

Canada-Alberta Forest Resource
Development Agreement

1986-87

	PYs	O&M	Contracts/ Supplies	G & C	Capital
NOR-36-02					
Reforestation	1.0	\$9,650		\$155,050	-
B.3 Contingency	-	-	228,300	-	-
Technical Publications	-	-	30,000	-	-
Hardwood R&D		18,000	874,150	474,950	-
Evaluation	-	-	20,000	-	-
Administration	3.0	12,000	13,000	-	20,000
NOR-36-02-1					
Vegetation Management	1.0	6,000	142,000	-	100,000
NOR-36-02-2					
Tree Improvement	-	-	175,000	-	-
NOR-36-02-3					
Wetland Drainage	-	-	105,000	-	-
NOR-36-02-4					
Insect & Disease	1.0	6,000	61,000	-	-
NOR-36-02-5					
Yields	1.0	12,000	16,000	-	-
NOR-36-02-6					
Demonstration Project	-	-	136,000	-	-
NOR-36-02-7					
Economics	-	-	75,000	-	-
NOR-36-02-8					
Public Information	-	-	88,000	-	-
TOTALS:	7.0	63,650	2,085,750	630,000	120,000



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1986

1. Project: Development Agreements
2. Title: Forest Vegetation Management: Silvicultural assessment of selected methods of site preparation and crop release in areas designated for softwood production in Alberta
3. New: X Cont.:
4. No.: NOR-36-02-1
5. Study Leader: L. Brace
6. Key Words: Vegetation management, manual, mechanical, chemical, site preparation, release, efficacy, crop tolerance, crop growth
7. Location of Work: NoFC, Grande Prairie Forest
8. Study Objectives:
 1. Assess effects of selected manual, mechanical, chemical and combined site preparation and softwood release treatments upon the growth and development of softwood crop on designated mixedwood sites in Alberta; (crop tolerance/growth).
 2. Assess effects of selected manual, mechanical, chemical and combined site preparation and softwood release treatments upon the growth and development of competing vegetation, particularly aspen and grass species, on designated mixedwood sites in Alberta; (efficacy).
9. Goals for 1985-86:
 1. Review field location sites in cooperation with AFS and CFS participants and help select primary test site.
 2. Finalize field location of treatment blocks on primary test site at Grande Prairie, in cooperation with AFS Research Branch and CFS Environment project leader.
 3. Supervise crews/machines contracted by AFS to clear boundaries around and between treatment blocks/plots on Grande Prairie test site.
 4. Locate and mark sub-plots for treatment assessment to determine silvicultural affects of treatments on site preparation test area (method II) with assistance of AFS Research Branch and CFS environment project.

5. Prepare progress report on establishment work on primary test site, for Senior Development Officer, Agreements, at NoFC.

10. Accomplishments in 1985-86:

1. Field locations for primary test site were reviewed and the Grande Prairie site selected, in August 1985.
2. Field location of treatment blocks finalized by September 1, 1985 and all treatment plot and sample plot corners located by September 30, 1985.
3. Supervision of all brush clearing on primary test site block and plot margins completed by September 18, 1985.
4. Located and marked all individual sample sub-plots for silviculture R&D on Method II area and set all supplementary iron plot centres on sub-plots designated or mechanical treatment on Method II area - by October 11, 1985 - (986 sub-plots).
5. Prepared progress report for Senior Development Officer on November 15, 1985.

11. Goals for 1986-87:

1. Coordinate all aspects of project field work, as designated by project facilitating team.
2. Participate on open house phase of public information program (May 1986 in Grande Prairie).
3. Complete all silviculture R&D sub-plot establishment in Method I area and set all supplementary iron plot centres in sub-plots designated for mechanical treatment in Method I area, Grande Prairie test site.
4. Complete all location and I.D. tagging of blocks, treatment plots and sample plots and tagging of silviculture R&D sub-plots in Method I and II areas; Grande Prairie test site.
5. Complete all pre-treatment vegetation assessment for silviculture R&D sub-plots in Method I and II areas, Grande Prairie test site, for purpose of assessing efficacy, crop tolerance, and crop tree growth on the project.
6. Cooperate with AFS staff from Reforestation and Reclamation Branch in supervising chemical treatments in Method II area in September 1986.
7. Establish automatic recording stations on Method II area.
8. Set up special markers on mechanical-chemical treatment plots on Method I and II areas in preparation for spring 1987 treatment with TTS trencher.
9. Prepare progress reports for Senior Development Officer, Agreements.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

This project has been reviewed by a CFS Peer Review Panel (Jan./Nov. 1985) and by the Research Management Division and the Chemicals Branch, Pollution Control Division of Environment Alberta and can only proceed after satisfying both federal and provincial permit requirements, which address environmental concerns in particular.

14. Resources 1986-87:

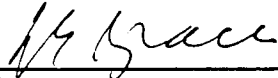
PYs: Prof.:	0.0	(Brace A-Base)
Tech.:	0.0	(vice Drouin A-Base)
Total:	0.0	
Term/Student:	1.0	(2 contract students) (Agreement)

O & M: \$44,000

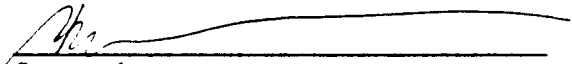
Capital: Nil

Grants & Contributions: Nil

15. Signatures:

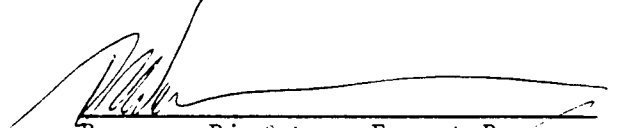


 Investigator

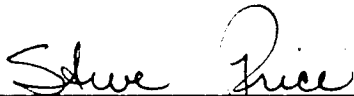


 Supervisor


 Technical Advisor



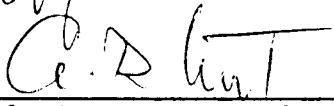
 Program Director, Forest Resources



 Alberta Agreement Manager



 Program Director, Development



 Regional Director General

6. Cooperate with CFS participants in establishment of sample plots and sub-plot centres on Method II area.
7. Participate as member of project implementation team for primary test site area, finalizing treatment prescriptions and other on-site procedures.
8. Baseline pre-treatment assessment of aspen sucker and root characteristics on Method II blocks.
9. Define environmental, site, physiological factors applicable in suppression of aspen suckering through:
 - a. Laboratory and greenhouse studies on effects of segmentation, drying out, low temperature exposure of roots on suckering ability.
 - b. Review of literature and field experience on control of aspen suckering.
 - c. Prepare a progress report on 9a and 9b.
10. Request planting stock production.
11. Start planting stock production.
12. Prepare detailed plans and site prescriptions of the satellite trials A, B, C, D, E, F aimed at suppression of aspen suckering and aspen competition with emphasis on mechanical and environmentally acceptable single tree chemical treatments.

Satellite trails A:) timing and degree of root disturbance and
 B:) exposure by mechanical site treatments;
 C:) combination of mechanical & chemical site
) preparation. Registered chemicals to be used.
 D:)
 E:) manual and chemical release treatments in
) plantations;
 F:) efficacy of spot and single tree application.
13. Purchase and install dataloggers and collect data on temperature profiles on a mechanically treated (discing) site.
14. Crew (assistant) to obtain the Alberta Environment Pesticide Application license.
15. Develop a methodology for the assessment of aspen root system disturbance/damage/exposure resulting from mechanical site preparation.
16. Prepare 1985 progress report.

10. Accomplishments in 1985-86:

1. Cooperated in preparation of program synopsis, and authorization process with other AFS and CFS participants.
2. Field locations for primary test site reviewed and the Grande Prairie site selected - August 1985.
3. Test site survey contract prepared and supervised. Completed and final report accepted November 8, 1985.
4. Project work plan and budgets completed by September 1, 1985.
5. Field location of treatment blocks on primary test site completed in cooperation with CFS participants by September 1, 1985.
6. Sample plots and sub-plot centres on Method II (site preparation) area located by October 11, 1985. (986 sub-plots).
7. Participated as member of implementation team, developing detailed silvicultural prescriptions for the primary test area determining terms and conditions of treatment and planting contracts.
8. Baseline mapping and data collection on aspen suckers on treatments 4,5 and 6 of Method II area completed.
9. a,b)Laboratory and greenhouse trials testing effects of root-fragmentation on suckering ability initiated. Literature review continues.
c) Progress reports submitted monthly to contract supervisor - CFS.
- 10,11. Planting stock production requested and initiated as scheduled.
12. Satellite site-selection for site A completed and design underway. No progress on others to date.
13. Data loggers purchased and installed at Slave Lake and Whitecourt sites for data collection on mechanically treated sites.
14. In progress.
15. Methodology being developed for assessing aspen root system disturbance/damage resulting from mechanical treatments, for application in field in 1987.
16. Report to be prepared by March 31, 1986.

11. Goals for 1986-87:

1. Baseline, pre-treatment assessments of aspen sucker and root characteristics on the Method I blocks of the main trial and continue on Method II.

2. a. Lay-out plots and establish satellite trials A and B.
 - b. Post-treatment assessment of aspen root disturbance/damage/fragmentation on the Satellite Trial A and B.
 - c. Continue plans, site selection and arrangements for satellite trials C, D, E, F.
 3. Continue laboratory and greenhouse tests of environmental factors affecting suckering ability of aspen roots.
 4. Coordinate tests of the physiological quality of planting stock to be used for the main trial (Method I & II).
 5. Plan and prepare contracts for planting on the blocks of Method I and II.
 6. Define the scope of and conditions governing the aspen ingress by seeding in softwood regenerated areas through:
 - a. review of the present-day knowledge on aspen seed biology and ingress by seeding-in.
 - b. reconnaissance of lodgepole pine and white spruce regenerated young stands.
 - c. define the problems and develop strategy for monitoring aspen ingress and assessing its impact on growth of crop trees.
 7. Prepare progress reports on 1-3 and 6.
 8. Supervise chemical application on Method II area in cooperation with CFS.
 9. Continue soil moisture/temperature data collection on mechanically treated sites.
12. Publications 1985-86:

Pedology Consultants 1985. Soil survey of two cutblock test areas and detached analysis of blocks within test areas. Prepared for Canada/Alberta For. Rsch. Dev. Proj. by Twardy and Dowgray.

13. Environmental Implications:

The study has been screened for any suspected environmental concerns by the NoFC Environmental Screening Committee. The Committee concluded that no further action is required in the screening process in view of the clarification given by the study leader:

The project has been reviewed by a CFS Peer Review Panel (Jan./Nov. 1985) and by the Research Management Division and the Chemicals Branch, Pollution Control Division of Environmental Alberta and can only proceed after satisfying both Federal and Provincial permit requirements, which address environmental concerns in particular.

14. Resources 1986-87:

PYs: Prof.: 0.0 (Brace A-base)
Tech.: 0.0
Total: 0.0
Term/Student: 0.0

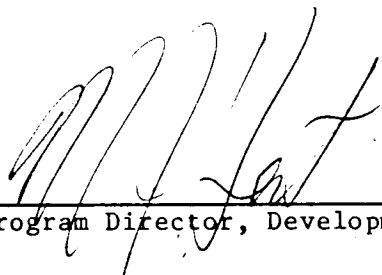
O & M: \$65,000.00

Capital: -

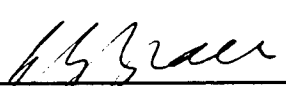
Grants & Contributions:

15. Signatures:

Investigator




Program Director, Development



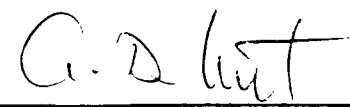
Technical Advisor



Program Director, Forest Resources



Alberta Agreement Manager



Regional Director General

Projected Resources Agreement by Budget years (\$ K)

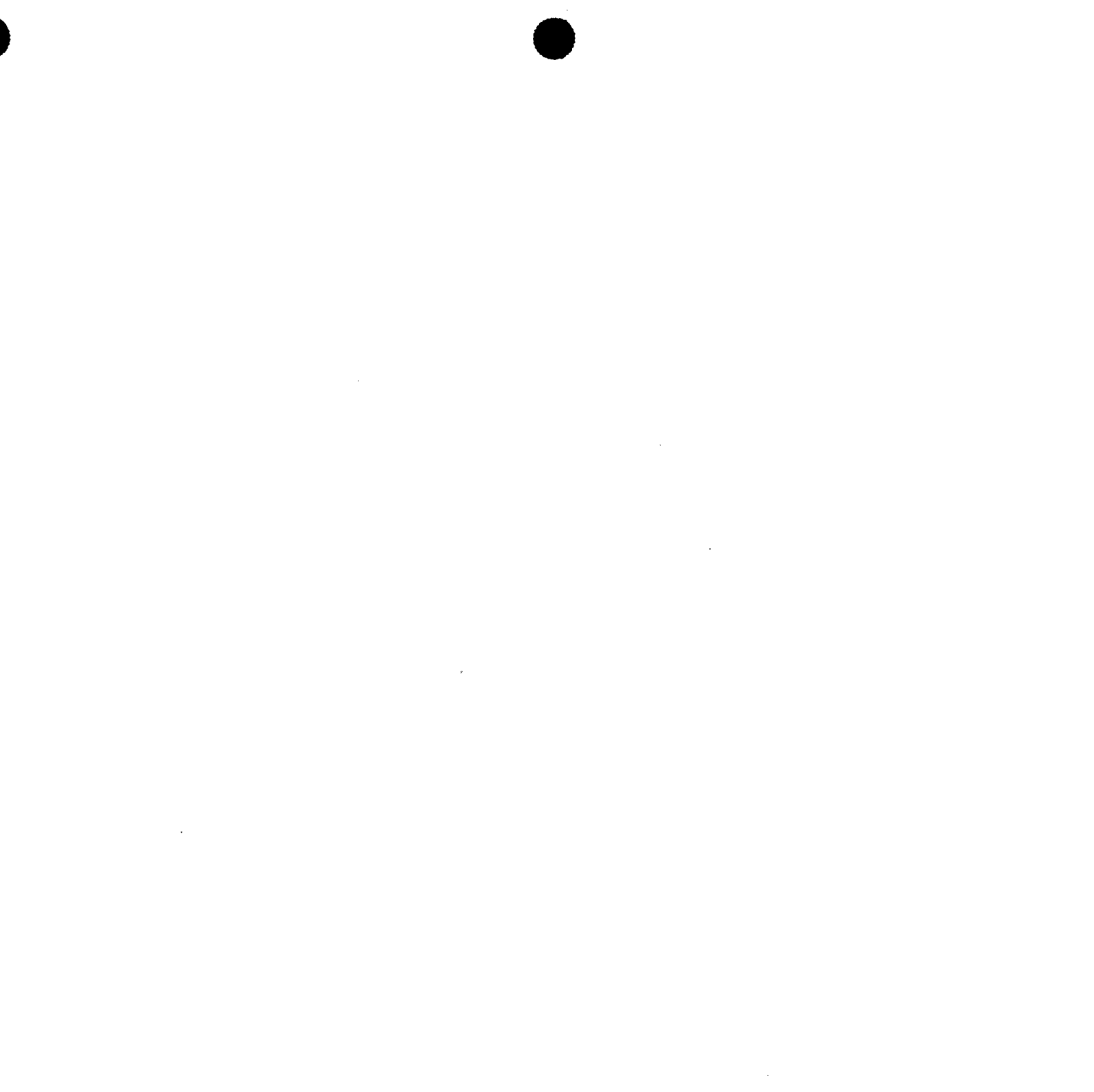
	<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-</u>
	1.0	1.0	1.0	-	3
	0.6	0.6	-	0.4	1
	40.0	30.0	20.0	20.0	110
	18.0	18.0	-	10.0	46
	38.8	38.8	38.8	38.8	155
	110.0 ¹	-	-	-	-
	196.8	86.8	58.8	68.8	411

\$100 K capital for purchasing HPLC and accessories.

<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>
pre-treatment assessments of aspen suckers and root charac- teristics on the Method I and II blocks of the main trial.	36-1: First season treatment assessment of aspen suckers and roots on the Method I and Method II blocks.	Second season treatment assessment of growth/ damage/mortality of aspen suckers and roots on the Method I and II blocks.	Third season treatment assessments on the Method I and II blocks of the main trial.
a: plots and satellite plots A and B.	<u>36-2-2-2a:</u> One-year-after treat- ment assessment of plots on the Satellite Trial A, B.	<u>36-2-2-2a:</u> Two-year after treat- ment assessments of Satellite Trials A,B.	<u>36-2-2-2a:</u> Three-year after treat- ment assessment of the Satellite Trials A,B.
b: treatment assess- ment of aspen root suckers/damage/ mortality on the main Trial A and B	<u>36-2-2-2b:</u> Lay-out plots and establish Satellite Trials C, D, and E, F.	<u>36-2-2-2b:</u> One-year after treat- ment assessments on Satellite Trials C, D, and E, F.	<u>36-2-2-2b:</u> Two-year after treat- ment assessment of the Satellite Trials C, D, and E, F.
laboratory and field tests of environmental factors affecting suckering of aspen roots.	<u>36-2-2-3a:</u> Continue laboratory and greenhouse tests of environmental factors affecting suckering ability of aspen roots.	<u>36-2-2-3:</u> Data processing and interpretation of two- year results on aspen suckering from the main and satellite trials.	<u>36-2-2-3:</u> Data processing and interpretation of three- year results on aspen suckering from the main and satellite trials.
	<u>36-2-2-3b:</u> Summarization and in- terpretation of the 1986-87 studies on suppression of suckering by environmental factors.		

<u>86-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>
<p>the tests of the ical quality ng stock to be the main trial & II).</p>	<p><u>36-2-2-4:</u> Evaluate and interpret tests of physiological and morphological qua- lity of planting stock.</p>	<p><u>36-2-2-4:</u> Prepare stock quality report and <u>terminate</u>.</p>	
<p>prepare con- r planting on s of Method I</p>	<p><u>36-2-2-5:</u> Supervise mechanical treatment and planting contracts in co-op. with CFS.</p>		
<p>the scope of and s governing ingress by n softwood ed areas</p>	<p><u>36-2-2-6:</u> Establish and monitor Aspen Ingress plots.</p>	<p><u>36-2-2-6:</u> Continue monitoring of Aspen Ingress plots.</p>	<p><u>36-2-2-6a:</u> Continue monitoring and maintenance of Aspen Ingress plots.</p>
<p>of the ay knowledge seed biology ss by seeding-</p>			
<p>naissance of pine and uce regenera- stands. the problem op strategy oring aspen nd assessing t on growth rees.</p>			

<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-</u>
<p>progress on 1,2,4,5, and</p> <p>chemical ion on Method in co-op. with minate.</p> <p>-9: soil moisture erature collec- hanically sites (Method atellites.</p>	<p><u>36-2-2-7:</u> Prepare progress reports on 1,2,3(a),4 and 6 and final report on 3(b).</p> <p>Continue</p>	<p><u>36-2-2-7:</u> Continue report preparation.</p> <p>Continue</p>	<p><u>36-2-2-6b:</u> Data processing and interpretation of the result from Aspen Ingress by seeding-in plots.</p> <p><u>36-2-2-7:</u> Prepare final reports on 3 and 6 above.</p> <p>Continue</p>	
	\$62,000	\$60,000	\$58,000	



2. Prepare a general experimental design and finalize field location of treatment blocks on primary test site at Grande Prairie, in cooperation with AFS Research Branch and CFS NOR-36-02-1 project leader.
3. Locate and mark sub-plots and sample sub-plots (5m X 5m) to monitor environmental affects of treatments.
4. Initiate pretreatment assessment of vegetation and soils on Method-II plots.

10. Accomplishments in 1985-86:

1. Field locations for primary experimental site were reviewed and the Grande Prairie site selected in August, 1985.
2. A general experimental design for the field study was prepared in cooperation with silviculture study NOR-36-02-01 leader and AFS.
3. Treatment plots and sample plots were located and marked in Methods I and II.
4. Sample sub-plots were marked in Blocks 3 of Method-II and vegetation and soil sampling initiated.

11. Goals for 1986-87:

1. Complete layout of sample plots and sub-plots in Method-I and Method-II Blocks.
2. Sample vegetation and soils for pretreatment data in Method-I and Method-II.
3. Design a method to collect herbicide deposition data and soil residue data specific to the selected herbicide.
4. Collect vegetation and soil samples for residue analysis as required for Method-II plots.
5. Initiate processing and residue analysis of vegetation and soil samples.
6. Summarize field data and prepare field plans for 1987-88.

12. Publications 1985-86:

New study - Nil.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

This project has been reviewed by a CFS Peer Review Panel (Jan/Nov., 1985) and by the Research Management Division and the Chemicals Branch, Pollution Control Division of Environment Alberta and can only proceed after satisfying both federal and Provincial permit requirements, which address environmental concerns in particular.

14. Resources 1986-87:

PYs: Prof.: 0.0 (A-base Feng J., Sidhu, Chakravarty (PDF))

Tech.: Feng, C. 1.0 (A-base Milwood, Faribarns)

Total: 1.0

Term/Student: 0.0

O & M: 40.0 K

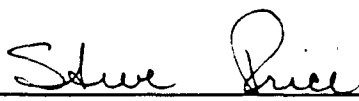
Capital: 100.0 K

Grants & Contributions:

15. Signatures:



Investigator

Technical Advisor


Alberta Agreement Manager

Supervisor


Program Director, Development


Program Director, Forest Protection


Regional Director General

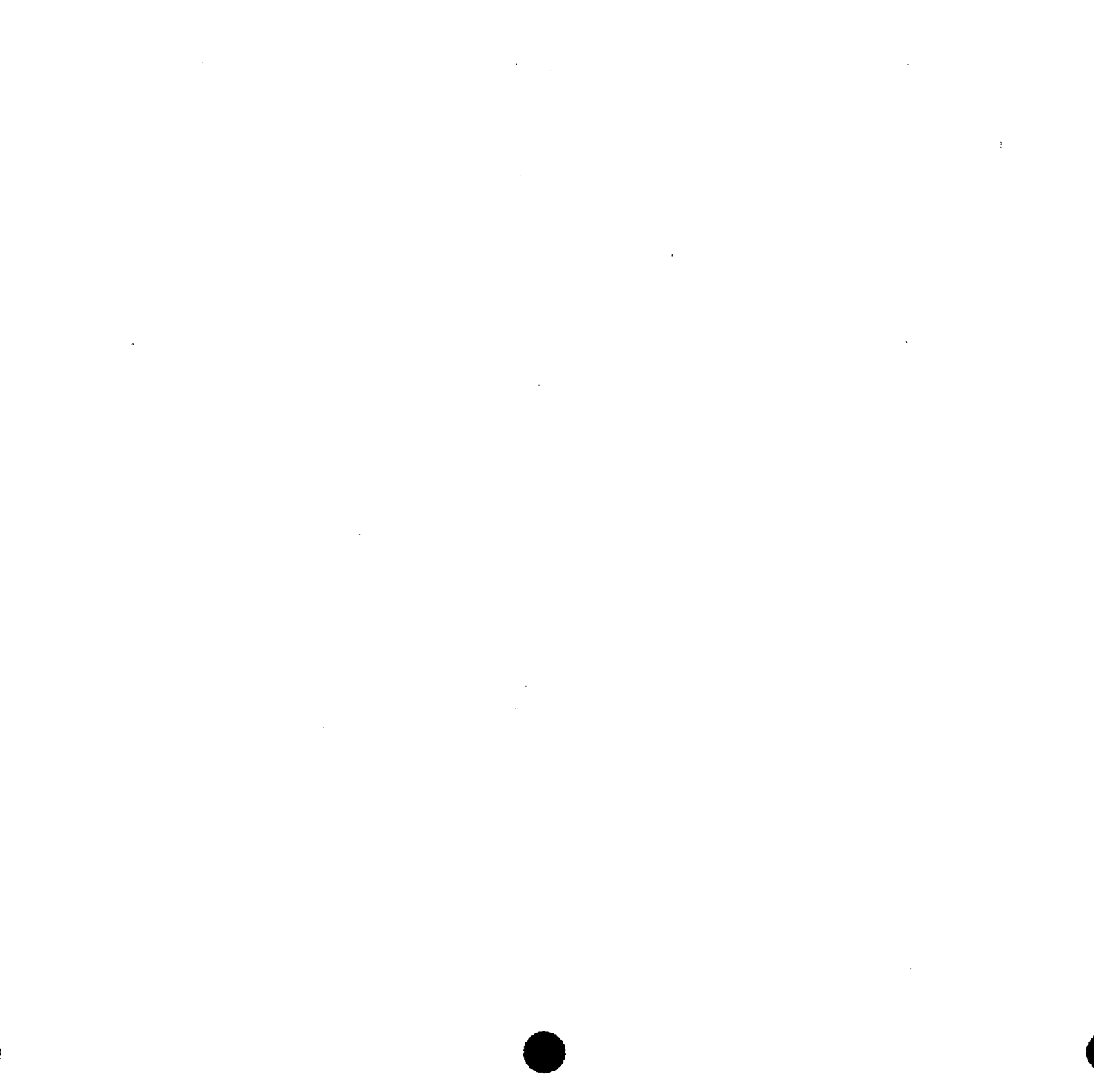
OPERATIONAL PLANS - NOR-36-02-03
1986-1991

1986-87	1987-88	1988-89	1989-90	1990-
<p>Complete layout of sample plots and sub-plots in Methods I & II and terminate.</p>				
<p>Sample plots of Method-II for pre-treatment data on vegetation. Synthesize pre-treatment field data.</p>	<p>Continue. Sample plots for 1 year post-treatment data. Synthesize post-treatment data for 1st year.</p>	<p>Continue. Sample plots for 2nd year post-treatment data. Synthesize post-treatment data for 2nd year.</p>	<p>Continue. Sample plots for 3rd year post-treatment data, synthesize post-treatment data for 3rd year. Terminate.</p>	<p>Report Base and termina</p>
<p>Design methods to collection herbicide deposition data and soil residue data.</p>	<p>Evaluate based on data collected.</p>	<p>Report on methodology</p>		
<p>Collect samples of vegetation and soils samples for residue analysis as required for Method II. Begin analysis.</p>	<p>Continue, synthesize preliminary results.</p>	<p>Continue, report early results.</p>	<p>Continue, report on 2 years' data. Terminate.</p>	<p>Final r termina (A-Base</p>
<p>Summarize field data and prepare plans for 1987-88.</p>	<p>Continue and prepare plans for 1988-89.</p>	<p>Continue and prepare plans for 1989-90.</p>	<p>Prepare 1st draft of final report. Terminate.</p>	<p>Report termina (A-Base</p>

Projected Resources Agreement by Budget years (\$ K)

	1986-87	1987-88	1988-89	1989-90	Total
n.)	1.0	1.0	1.0	-	3.0
n					
-	0.6	0.6	-	0.4	1.6
(
1	40.0	30.0	20.0	20.0	110.0
Z.	18.0	18.0	-	10.0	46.0
ry	38.8	38.8	38.8	38.8	155.2
cal	100.0 ¹	-	-	-	100.0
l	<u>196.8</u>	<u>86.8</u>	<u>58.8</u>	<u>68.8</u>	<u>411.2</u>

6/87 \$100K capital for purchasing HPLC and accessories.



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1986

1. Project: Development Agreements
2. Title: Forest Vegetation Management: Cost effective control strategies for vegetation management in areas designated for softwood production in Alberta.
3. New: X Cont.:
4. No.: NOR-36-02-1C
5. Study Leader: D. Boylen
6. Key Words: Interdisciplinary forest management economics, cost-effectiveness, benefit cost, risk benefit, decision-making models.
7. Location of Work: NoFC, Alberta
8. Study Objectives:
 1. Assess economic aspects of selected manual, mechanical, chemical and combination treatments applied in vegetation management in Alberta, for purposes of preparing cost-effectiveness and risk benefit analyses for vegetation management programs.
9. Goals for 1985-86:
 1. Prepare project cost sheets in conjunction with operational personnel for 1986-87 field season work on primary test sites.
 2. Assist in selection of satellite sites and preparation of detailed work plans for applicable satellite plots.
 3. Literature review of economics of forest herbicide useage and preparation for synopsis for team members.
10. Accomplishments in 1985-86:
 1. Cooperated in preparation of program work plans, other process documents, budgets.
 2. Literature review was initiated summer of 1985 and is in progress.
 3. Other goals are being initiated in first quarter 1986.

11. Goals for 1986-87:

1. Continue implementation of goals 1-3.
2. Assist in collection of cost data for chemical and mechanical site prep.
3. Assist in collection of cost data for stock and stock planting.
4. Assist in collection of cost data for work on satellite plots.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

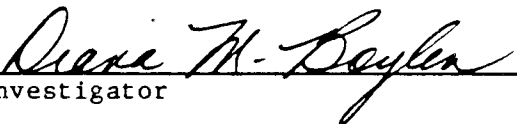
14. Resources 1986-87:

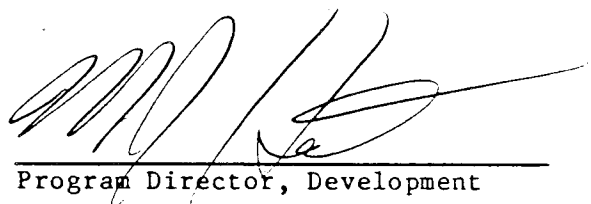
PYs: Prof.:	0.0	(A-Base Boylen)
Tech.:	0.0	(A-Base)
Total:	0.0	
Term/Student:	0.0	

O & M:

Capital: Nil

15. Signatures:


Investigator


Program Director, Development


Alberta Agreement Manager


Regional Director General

9. Study Objectives:

To fund an expanded and accelerated Alberta Forest Service tree improvement program in lodgepole pine and white spruce between 1986-87 to 1988-89 by means of contract funding under the Canada-Alberta Forest Resource Development Agreement.

10. Goals for 1985-86:

Nil - new study.

11. Accomplishments in 1985-86:

Nil - new study.

12. Goal for 1986-87:

Act as a Scientific Authority for a contract with the Alberta Forest Service to undertake tree improvement R&D in lodgepole pine and white spruce.

13. Publications 1985-86:

Nil

14. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

15. Resources 1986-87:

PYs: Prof.: 0.0


Tech.: 0.0

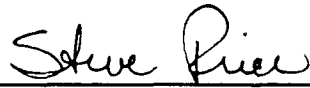
Total: 0.0


Term/Student: 0.0

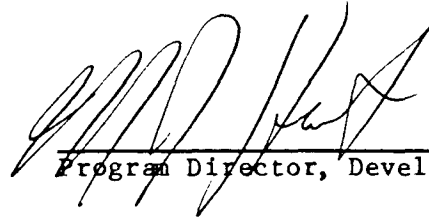
O & M: \$175,000 (contract)

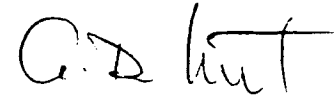
15. Signatures:


Investigator


Alberta Agreement Manager


Program Director, Resources


Program Director, Development


Regional Director General



- iii) impact of drainage on tree growth and competing ground vegetation composition and on temperature, water content and fertility of soils;
- iv) impact of drainage on the environment e.g., on stream water quantity and quality, and on peat depth (subsidence);
- v) superposition of thinning and fertilization trials on drained areas and afforestation of suitable, cleared portions of drained areas with appropriate indigenous and exotic species;
- vi) assess, through cost/benefit analyses the economics of draining wetlands for increased wood production;

9. Study Objectives:

- 1. Evaluate the growth potential of commercial tree species on treed wetland sites where water tables have been lowered.
- 2. Measure the effects of drainage on hydrological parameters such as water table depths, and on critical soil characteristics such as moisture content, temperature, fertility, hydraulic conductivity and subsidence.
- 3. Monitor the effects of drainage on the composition of competing vegetation.

10. Goals for 1985-86:

- 1. Carry out reconnaissance survey and select three suitable wetland drainage study areas in Alberta's boreal forest (CFS/AFS).
- 2. On each study area complete a peat and vegetation survey and sampling program to determine wetland, vegetation, and peat types, peat depth and other peat characteristics, and to determine the physical and chemical properties of peat and groundwater. (Johnson and Robson)
- 3. On each study area, cut survey lines and conduct topographic survey for production of topographic maps (AFS/CFS).
- 4. On each study area, obtain hydraulic conductivity measurements for use in Toth's synthetic hydraulic curve method of drainage system design (CFS/AFS).
- 5. On each study area, install a weather station (CFS).
- 6. For each study area, prepare drainage ditch system design (CFS/AFS).
- 7. On each study area, layout drainage ditch locations (AFS).
- 8. On each study area, clear drainage ditch rights-of-way (AFS).

9. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada-Alberta Forest Resource Development Agreement (CFS/AFS).
10. Consult with AFS on all matters pertaining to the Agreement drainage project, and to provide scientific and technical advice as necessary.
11. Accomplishments in 1985-86:
 1. Study areas were established at Goose River (312 ha), near Valleyview, at McLennan (249 ha), and at Wolf Creek (131 ha), near Edson.
 2. On each area, peat and vegetation surveys were completed along two transects, perpendicular to each other, and extending across the area. Nearly 400 samples were collected for physical and chemical analyses of peat and groundwater.
 3. The work for two areas was completed under contracts. Topographic maps with 0.5 m contour intervals were produced for Goose River (1:5000 scale) and for McLennan (1:2000 scale). Survey lines were cut on Wolf Creek by CFS/AFS. The survey and topographic map will be done completed under contract in January, 1986.
 4. Over 100 hydraulic conductivity measurements were taken on the three areas, most of them at about 0.6 m depth in the peat/soil. Some were taken at 1 and 2 m depth. A computer program was developed to do the calculations.
 5. A recording precipitation gauge, and Stevenson screen with hygrothermograph were installed on each area.
 6. Preliminary drainage ditch network designs were prepared for Goose River and McLennan areas using field observations, topographic maps and enlarged aerial photos. Mike Rosen, Ontario Ministry of Natural Resources, participated in the design process. Final designs will be based on Toth's sythetic hydraulic curve method.
 7. Layout of drainage ditches will be completed by March 31, 1986.
 8. Clearing of drainage ditch rights-of-way will be completed by March 31, 1986.
 9. The annual report required by the Agreement will be ready before the end of March, 1986.
 10. Close cooperation between CFS and AFS was maintained throughout the year on all aspects of each drainage project. Scientific and technical advice was given on many occasions.
12. Goals for 1986-87:
 1. On each study area, establish three transects between ditch lines and on each transect install reinforcing rods, groundwater table wells,

soil temperature probes, data loggers, and water level recorders; install similar instrumentation on control areas. Collect and compile data from this instrument network (CFS).

2. On each transect, complete a peat survey and sampling program to determine peat type, peat depth, and other peat characteristics, and to determine the physical and chemical properties of peat and groundwater. (Johnson and Ali)
3. On both treatment and control sites of each study area, establish permanent ground vegetation plots and conduct ground vegetation surveys. (Johnson)
4. On both treatment and control sites of each study area, establish permanent sample plots to measure tree growth (CFS/AFS).
5. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada/Alberta Forest Resource Development Agreement (CFS/AFS).
6. Provide scientific and technical advice on drainage projects.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: (Hillman, Johnson, Robson, Ali - see NOR-28-03)

O & M: \$105,000 approved (\$205,000 required)

Capital:

Contributions:

15. Signatures:

G.R. Hillman
Investigator

S.C. North
Supervisor

Smith
Program Director, Forest Protection

Steve Price
Alberta Agreement Manager

[Signature]
Program Director, Development

A.D. Kent
Regional Director General



CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1986

1. Project: Development Agreements
2. Title: Forest pest management and damage appraisal (Alberta)
3. New: X Cont.:
4. No.: NOR-36-02-4
5. Study Leader: P. Amirault
6. Key Words: Damage appraisal, diagnostic and advisory services, forest management, forest pests, forest pest surveys, hazard rating, pest impact, technology transfer
7. Location of Work: Northern Forestry Centre; Alberta-wide
8. Study Objectives:
 1. To identify when and where damage by forest pests may occur, and to rank stands according to potential losses.
 2. To determine how and to what extent pest damage affects forest resource users and management plans.
 3. To provide technology transfer, training, and diagnostic and advisory services to AFS staff and other forestry personnel in the province.
 4. To develop or improve FIDS methods to assess population and infestation levels of forest pests.
9. Goals for 1985-86:

Nil - New study--see accomplishments below.
10. Accomplishments in 1985-86:
 1. The study was initiated on July 8 and three contractors were hired in mid-October on 75 day contracts.
 2. Twelve stands were measured for inclusion into the mountain pine beetle hazard rating program. The program to sort data and 'rate' stands was entered on the computer and made operable. This was a continuation of a study initiated by Ben Moody.



3. Branches of white spruce and jack pine were examined for egg masses and the presence of second-instar spruce and jack pine budworm larvae. Results of these examinations provide information for the annual FIDS report.
 4. The study leader undertook a literature search of several of the more important forest pests in the province. The information gathered will serve as a reference for workshops, inquiries, and other forms of information exchange.
 5. I made several field visits in an advisory capacity as a result of requests from AFS regional personnel.
 6. A dialogue between the CFS and AFS was opened on the subject of improving the information on forest insect and disease problems collected from the AFS's permanent sample plots. The study leader Ben Moody and Bob Miyagawa (AFS) have developed suggestions for improving the recording of insect and disease damage on permanent sample plots.
 7. Thirty copies of the book 'Insects Harmful to Forest Trees' by R. Martineau (1984) have been purchased for distribution to AFS regional staff.
 8. Represented the NoFC at the Cone and Seed Pest Working Group meeting in Quebec City in August, and presented a paper on the 'Control of Tamarack Seed and Cone Insects'.
11. Goals for 1986-87:
1. To measure (up to 20 more) stands as part of the mountain pine beetle hazard-rating program and to analyze data from these and previous measurements. The results should indicate which hazard-rating system should be applied to lodgepole pine stands in southwestern Alberta.
 2. To complete and assess a dwarf mistletoe detection programme, which has been begun by the AFS in the Bow-Crow Forest.
 3. To implement the use and assess the operability of, damage codes which have been developed for AFS (Timber Management Branch) to assess tree conditions when remeasuring permanent sample plots in mature stands. To instruct the people doing the remeasurements in the identification of insect and disease problems.
 4. To develop a program to assess insect and disease problems affecting trees on permanent sample plots which have been established (by the Research Branch of AFS) in immature stands. The actual assessments will be made by the study leader and his assistant during this (86-87) field season.
 5. To assist AFS personnel in initiating surveys to detect and appraise low population levels of spruce and jack pine budworms in Alberta.

6. To maintain contact with forestry personnel in the province and to help them in becoming familiar with insect and disease problems by conducting workshops, making visits in response to inquiries, and by distributing information.
7. To provide diagnostic and advisory services as requested.

12. Publications 1985-86:

Nil - New study.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Amirault 1.0
 Tech.: 0.0
 Total: 1.0
 Term/Student: 0.0

O & M: 6.0

O & M: Contract 61.0

Capital:

Grants & Contributions:

15. Signatures:

Pete Amirault

Investigator

Technical Advisor

Small

Program Director, Forest Protection

Supervisor

Steve Price

Alberta Agreement Manager

M. J. [unclear]

Program Director, Development

C. D. [unclear]

Regional Director General

10. Goals for 1985-86:

Nil - new study.

11. Accomplishments in 1985-86:

Nil - new study.

12. Goals for 1986-87:

1. Define input and output (forecasting) requirements for the model in cooperation with AFS.
2. Identify data sources, classify data; define data format, editing criteria and write programs for data transformations; execute data entry.
3. Identify data gaps, and develop plans and procedures for additional data acquisition.
4. Choose interim site classification framework.
5. Initiate review of available managed stand yield models and assess their potential suitability.

13. Publications 1985-86:

Nil

14. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

15. Resources 1986-87:

PYs: Prof: 1.0 (Vacant)

Term: 0.0


Total: 0.0

Term/Student: 0.0

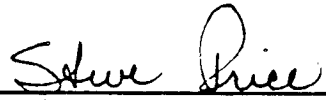
O & M: \$28,000

16. Signatures:

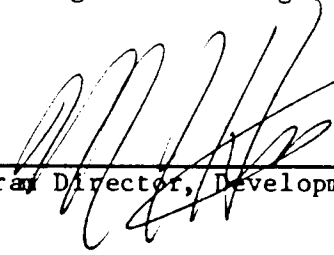
Investigator



Program Director, Resources



Alberta Agreement Manager



Program Director, Development



Regional Director General

MANAGED STAND YIELD TABLES FOR 1P AND wS: WORK PLAN

1. Define input-output requirements. Inputs would include permanent and temporary SP-s stem analysis, both from standard growth monitoring plots and from plots established to study the effects of various silvicultural treatments such as spacing, thinning and fertilization. Outputs will be designed to satisfy the needs of timber supply analysis of the AFS and the forest industry, in sufficient detail to assess the potential benefit of various silvicultural practices. 1986/2/28
- 2.1 Identify possible data sources and describe. This include CFS, AFS (Timer Management Branch, Reforestation and Reclamation Branch, Research Branch) University of Alberta, forest industry (?), other provinces (Sask., Man.) and the neighboring US states, (Montana, Idaho, Colorado, Lake States). Describe data in terms of measurement standards, cover type sampled, site, age, etc. 1986/3/31.
- 2.2 Classify data according to potential use or usefulness in terms of suitability with local cover types and conditions, and compatibility in kinds and standards of measurements. 1986/4/30
- 2.3 Define data format, develop editing criteria and program(s) for data transformations. 1986/3/1 - 1986/7/30
- 2.4 Execute data entry from different sources as defined in (2.3) by converting that data that was found suitable, to a standard format to facilitate data analysis. 1986/7-12/31
- 2.5 Identify data gaps and develops plans and procedures for additional data acquisition. 1987/1/31
- 2.6 Develop methods to interrelate fire origin and managed (second growth) stand data. This may require referencing data by some measure of site productivity and/or obtaining tree growth data in areas where old growth and second growth (managed) stands occur in close proximity. 1987/7/31
- 2.7 Prepare and implement plans for sampling to fill data gaps as identified under (2.5), and for interrelating old and second growth (2.6). 1987/8-10
- 3.1 Choose interim site classification framework. This may involve the use of traditional SI and/or ecological methods. 1986/5-10
- 3.2 Test and refine site classification framework for yield forecasting 1988/5/31
4. Review available managed stand yield models and assess their potential suitability using available data and ensure to meet output requirements as defined under (1). 1986/11 - 1987/6
- 5.1 Calibrate the most appropriate managed stand yield model using a selected subset of the data. 1987/10.
- 5.2 Test the accuracy and reliability of the model prediction using a selected subset of the data. 1987/11.

- 5.3 Conduct sensitivity analysis on the model to determine the amount of influence a change in any one input variable has on model prediction (output) so future sampling can concentrate on variables that most effect accuracy of model prediction. 1988/1.
- 5.4 Demonstrate model to users and modify model according to feedback. 1986/5/31
- 5.5 Continue model refinement and tests with additional data as they become available. 1989/3
- 5.6 Keep abreast of new developments in stand modelling and incorporate those which will improve model performance. 1989/7
6. Compare the growth and yield of LP and WS when growing on similar sites, to provide the basis for species selection at the time of planting. 1989/1
7. Prepare a final report on the project summarizing the work done and to serve as a guide fo the yield model application. Identify and recommend areas where further research may be most desirable.
 - 7.1 First Draft 1989/10
 - 7.2 Final Draft 1990/1
 - 7.3 Publication 1990/2

OPERATIONAL PLAN
1985-1989

1985-86	1986-87	1987-88	1988-89	1989
Undertake R&D designed to develop intensive management yield tables for wS and 1P in Alberta.	Continue	Continue.	Continue.	Continue and terminate.
\$28 K F	\$28 K F	\$28 K F	\$28 K F	\$28
				<u>Total \$140</u>

10. Goals for 1985-86:Weberville

1. Complete, through contract, an inventory of site and vegetation on the selected demonstration site.
2. Develop a comprehensive workplan.

Jumping Pound

1. Collect detailed site and vegetation information on the demonstration area.
2. Develop a comprehensive workplan.

11. Accomplishments in 1985-86:

Nil; program not initiated nor contract let.

12. Goals for 1986-87:

Act as a Scientific Authority of a contract with AFS to undertake intensive forest management demonstration at Jumping Pound and Weberville.

13. Publications 1985-86:

Nil

14. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

15. Resources 1986-87:

PYs: Prof.: 0.0

Tech.: 0.0

Total: 0.0

Term/Student: 0.0

O & M: \$130,000 (contract with AFS)
6,000 (CFS operating)

Capital: Nil

16. Signatures:

Investigator

L. H. Grace

Supervisor

[Signature]

Program Director, Resources

Steve Rice

Alberta Agreement Manager

[Signature]

Program Director, Development

A. D. Kent

Regional Director General

OPERATIONAL PLAN
1985-1989

1985-86	1986-87	1987-88	1988-89	1989
Act as a Scientific authority for a contract to undertake intensive forest management demonstrations in Alberta (see 10-3AA).	Continue.	Continue.	Continue and terminate.	
\$20 K F	\$136 K F	\$109 K F	\$85 K F	<u>Total \$350</u>

3. A proposal from the University of Alberta to develop an economic timber supply model for Alberta was accepted and assigned to the Forestry Resource Economics and Statistics group for support of 3 person-months and overall supervision. Work is scheduled for completion 31 March 1987.

11. Goals for 1986-87:

1. Supervise completion of NoFC region permanent sample plot contract. (Kuhnke)
2. Supervise and contribute support to economic timber supply modelling contract.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	0.0 (A-base Boylen, Kuhnke, DeFranceschi)
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M: \$75,000 (+ roll-over \$11,500)

Capital:

15. Signatures:

Diana M. Boylen
Investigator


[Signature]
Program Director, Development

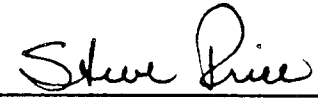
Steve Price
Alberta Agreement Manager

[Signature]
Regional Director General

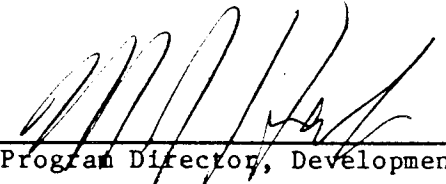
6. Produced brochure on announcement of sub programs B3 and B4 of Canada-Alberta.
 7. Assisted AFS in the design and development of a mobile forestry exhibit trailer.
11. Goals for 1986-87:
1. Continue as Public Information sub committee co-chairman.
 2. Assist in the implementation of agreement related public information activities as planned in the Canada-Alberta Public Information Work Plan. Activities will include: a) operational planning, inauguration, and co-operative funding of mobile forestry exhibit trailer; b) design and development of portable exhibit; c) development and publication of agreement related brochures, signs, and other published materials, d) development and production of promotional materials; and e) administration of agreement related contracts.
 3. Provide media and public relations services to ongoing agreement programs such as the Vegetation Management research project at Grande Prairie, Alberta.
12. Publications 1985-86:
- Canada-Alberta FRDA Sub-program B3 and B4 announcement brochure.
 - Canada-Alberta Forest Resource Development Agreement.
 - Attitudinal Study Report for the Canada-Alberta Forest Resource Development Agreement.
 - Prairies Region Public Awareness Profile on Forests and the Forest Industry.
13. Environmental Implications:
- The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.
14. Resources 1986-87:
- PYs: Prof.: (Newstead, Ascher A-base)
- Tech.: (Stewart, H. A-base)
- Total:
- O & M: \$88,000

15. Signatures:


Investigator


Alberta Agreement Manager


Program Director, Extension


Program Director, Development


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Canada-Saskatchewan Forest Resource Development Agreement
3. New: Cont.: X 4. No.: NOR-36-03
5. Study Leader: J. Farrell

Note: Refer to following study statements for additional information:

i) Forest Mensuration Research (Sask.)	NOR-36-03-1
ii) Silviculture Investigations (Sask.)	NOR-36-03-2
iii) Forest Nursery Investigations (Sask.)	NOR-36-03-3
iv) Fire Management (Sask.)	NOR-36-03-4
v) Stem Injection of Residual Aspen (Sask.)	NOR-36-03-5
vi) Vegetation Management (Sask.)	NOR-36-03-6
vii) Forestry Public Information (Sask.)	NOR-36-03-7
viii) Insect and Disease Investigations (Sask.)	NOR-36-03-8
ix) Forest Economics (Sask.)	NOR-36-03-9

6. Key Words: Canada-Saskatchewan Forest Resource Development Agreement, renewal, growth enhancement, technology transfer, public information, evaluation, job development, forest relations, management, economic development, liaison
7. Location of Work: Saskatchewan District Office, Saskatchewan and Saskatchewan wide
8. Study Objectives:
 1. To manage and coordinate the implementation of federally-funded initiatives and monitor the use of federal funds related to the Canada/Saskatchewan Forest Resource Development Agreement by:
 - a. assisting in the development and maintenance of timber supplies sufficient to ensure the long-term viability of the forest industry in Saskatchewan;
 - b. assisting in the efficient utilization of the forest resource in Saskatchewan; and

- c. contributing to the economic development of the Saskatchewan forestry sector, including the improvement of employment and human resource development opportunities in the sector.
2. To provide regional liaison for all CFS activities related to the Canada-Saskatchewan Forest Resource Development Agreement.
 3. To provide technical input into the implementation of forestry employment programs in Saskatchewan.
 4. Represent the Canadian Forestry Service in Saskatchewan within the federal and the provincial governments, industry, and general public.
 5. To facilitate the maximization of funding available to the forestry sector in Saskatchewan from other funding agencies.
9. Goals for 1985-86:
1. Continue 1985-86 implementation of work plan for Canada-Saskatchewan FRDA, including:
 - Program 1.0 Forest Renewal
 - 1.3 Federal Lands, Private Woodlots and Industrial Leasehold (\$281,000), continued implementation of operational projects
 - 1.4 Nursery Development - Capital development will continue on pumphouses and cold storage/packing facilities at the Big River and Prince Albert Provincial Tree Nurseries, (\$2.0 M)
 - 1.5 Regeneration Surveys - to be delivered by Forestry Division (DPRR), and cost-shared (\$160,000).
 - Program 2.0 Growth Enhancement and Stand Tending - project implementation will continue on industrial leasehold, federal and private lands (\$234,000)
 - Program 3.0 Technology Advancement and Transfer
 - 3.1 Technology Transfer - Joint Committee for Forest Research, (MOU) will finalize plans for forestry research and PY's and funding will be dedicated accordingly (\$402,000)
 - 3.2 Enhanced Forest Protection - additional fire weather equipment and computer hardware will be purchased for provincial fire control branch, (\$237,000)
 - 3.3 Opportunity Identification - continued analysis of opportunities in forestry in Saskatchewan (Hardwood Utilization study should be complete), total funding available for year \$80,000.00
 - 3.4 Forestry Data Base - purchase of a G.I.S. for DPRR, and initial loading--a portion of capital purchase costs will be borne by FRDA (\$1.2 M)

- Program 4.0 Administration, Evaluation and Public Information - public information activities include signage, display material, promotion related to Forestry Capital of Canada and National Forest Week - (\$80,000.00).
2. Continue to provide coordination, liaison and supervision (if required) for any federal forestry-related job creation program and sectoral job creation program in Saskatchewan.
 3. Complete the relocation, expansion, equipping and furnishing of an expanded CFS District Office in Prince Albert.
 4. In consultation with NoFC, coordinate and formalize the administrative procedures of the Saskatchewan office vis-a-vis NoFC regarding finance, purchasing, delegation, communications, and general administration.
 5. Complete the staffing of the 12 persons associated with implementing the FRDA and provide direction and initial orientation for staff members.
 6. Continue to provide assistance, advice, coordination and consultation on all regional-based forestry development and relations activities having an impact on Saskatchewan.
 7. Continue liaison with all federal departments, provincial authorities, industries, associations, Indian bands and the general public having an interest in the Canadian Forestry Service and its activities.
10. Accomplishments in 1985-86:
1. Continue implementation of the Canada-Saskatchewan FRDA 1985-86 work plan including:
 - Program 1.0 Forest Renewal
 - 1.3 Federal lands, private woodlots and industrial leasehold - funded nine projects (including Bracke Mounder trial, federal land inventories, site preparation, mapping project \$298,000)
 - 1.4 Nursery Development - includes substantial completion of the Big River Pumphouse (\$400,000); Prince Albert Pumphouse (70% completion \$350,000); Big River Cold Storage and Packing Facility (50% completion \$1.0 M)
 - 1.5 Regeneration Surveys - includes two cost-shared projects funded this year committing \$140,000 of federal funds
 - Program 2.0 Growth Enhancement and Stand Tending - includes four projects in federal direct for \$264,000 plus three cost-shared projects requiring \$31,000 of federal funds
 - Program 3.0 Technology Advancement and Transfer
 - 3.1 Technology Transfer - MOU Committee approved research proposals and multi-year research plan, staffing complete and expanded office accommodation secure (\$403,000), plus four cost-shared projects funded committing \$38,000 of federal funds

- Program 3.2 Enhanced Forest Protection - provincial fire control delayed acquisition of additional hardware until a review of fire weather network has been completed--will be 70% complete by March 31, 1986. Fire specialist hired (see NOR-36-03-4), AES weather network evaluating completed Phase II--federal funds committed \$87,000.00 (see NOR-36-03-4)
- 3.3 Opportunity Identification - completed Forintek Industrial Survey and Saskatchewan Hardwood Opportunities \$95,000.00
- 3.4 Forestry Data Base - G.I.S. purchase delayed by province until internal studies have been completed - scheduled for 1986-87 - cost-shared evaluation process initiated, this year - \$15,000.00 of federal funds committed plus acquisition of a number of micro-computers in preparation of G.I.S. - federal funds \$42,000.00

Program 4.0 Administration, Evaluation and Public Information - a number of federally funded projects were completed including a forestry awareness survey, forestry brochures and pamphlets, displays, Sask. Trees of Renown - federal funds \$100,000.00 (see NOR-36-03-7).

2. Completed the program administration of Environment 2000 job creation program and initiated forestry projects with CEIC Job's Strategy funding--provided coordination, liaison and technical advice.
3. Completed re-location, expansion, equipping and furnishing of expanded CFS District Office in Prince Albert.
4. Coordination of procedures between Saskatchewan District Office and NoFC Regional Office has been improved--new AS-2 will be responsible for formalizing these processes.
5. Staffing of District Office has been completed with work plans and study statements developed for all staff.
6. Provided assistance, advice, coordination and consultation on regional-based forestry development and relations activities having an impact on Saskatchewan, particularly with the Northern Economic Development Agreement (DRIE).
7. Continued liaison with other federal departments, provincial authorities, industries, associations, Indian Bands and the general public having an interest in the Canadian Forestry Service and its activities.
8. Hosted three-day Ministerial visit and tour for National Forest Week, 1985.
9. Sponsored one-day Insect and Disease Workshops in Prince Albert and Prince Albert National Park.

11. Goals for 1986-87:

1. Forest Renewal/Growth Enhancement and Stand Tending:

- develop, discuss and solicit forestry project proposals from forest industry, Indian Bands and private woodlot owners;
- discuss, develop and process for approval, multi-year forestry project plans for forest industry, Indian Bands and private woodlot owners;
- review, amend and process for approval, Project Authorization Forms (PAF's) for forestry projects under the FRDA in conformance to work plan;
- plan, implement (directly or indirectly), monitor and audit federally delivered forestry projects;
- review and monitor provincially implemented cost-shared projects in Programs 1 and 2;
- plan, coordinate and host a one-day forest soils field workshop in Saskatchewan in late summer, 1986;
- plan, coordinate and implement a silvicultural equipment field trial for summer, 1986;
- liaise and coordinate with the other administrative and research activities in the District and regional office (Supervisor: FO-2, Renewal and Intensive Management Coordinator (RIM), 2 EG-ESS-06's, RIM Specialists).

2. Agreement Coordination and Management:

- represent the CFS on the Program Management Committee (PMC) to consult, plan, review, administer and monitor programs and activities under the FRDA;
- consult, liaise and coordinate with other federal agencies having impacts in regional development including DRIE (NEDSA), INAC (Indian Forestry, job creation), CEIC (Jobs Strategy, training), FEDC (ERDA coordination), PFRA/PWC (construction services);
- direct, coordinate and consult with sub-committees of the PMC including Nursery Development, Public Information, GIS;
- coordinate with and advise the FRDA Directorate and the MOU sub-committee;
- provide overall day-to-day direction to programs under the FRDA with industry, Indian bands, the province, within the CFS and other federal departments.

- coordinate and facilitate the strong technology transfer aspect of the programs funded from FRDA through liaison, work planning, program review, research work planning and training.
3. Nursery Development:
- ensure completion of the construction of the Big River Nursery Irrigation Pumphouse, Prince Albert Nursery Irrigation Pumphouse and the Big River Cold Storage and Packing Facility;
 - coordinate and liaise with agents and contractors responsible for design, construction and monitoring of Nursery Development including PWC and PFRA (FO-2 RIM Coordinator).
4. Geographic Information System:
- coordinate and facilitate federal (CFS and DSS) involvement in the bench-marking and evaluation process in anticipation of the acquisition of a GIS;
 - ensure the federal acquisition, on behalf of the provincial DPRR (Forestry Division), of the hardware and associated software required and approved by the evaluation process in accordance with federal purchasing procedures including liaison with DSS, NoFC DPRR, systems consultant and any other appropriate contacts identified.
5. Evaluation:
- in consultation with the Directorate, NoFC and DPRR, develop a framework for evaluation of the FRDA for approval by the Directorate;
 - implement the Management Information System (MIS) required in the District Office, in consultation with NoFC, to ensure collection of the data required by the approved evaluation framework, CFS-HQ and CFS NoFC data requests.
6. Administration:
- direct District staff and coordinate functional direction from NoFC (see NOR-36-03 Study Statements);
 - ensure performance of all delegated financial personnel, materiel management, administrative and clerical functions in the District Office in consultation with the respective functional authorities in NoFC;
 - ensure compliance with the relevant portions of the Canada-Saskatchewan FRDA Policy and Procedures Manual in receiving, processing, approving and recording PAFs/Progress Claims for agreement projects;

- provide coordination and direction on all other administrative matters related to a District Office including accommodation, renovation, camps, vehicles, computerization, equipment, inventory and stores.

7. Job Creation:

- Continue to provide coordination, advice, liaison and monitoring on federally funded job development projects in forestry in 1986-87.

12. Publications 1984-85:

- 1985 Bracke Moulder Trial - Prince Albert Pulpwood - Saskatchewan (unpublished report);
- Stand Tending Guidelines for Forestry Job Creation Projects (joint with DPRR);
- Forest Management Plan - Homestead Heritage Park - consultation with Saskatchewan Forestry Association
- 1985/86 FRDA Work Plan and MOU Research Plan, 1985-1989;
- 1986/87 FRDA Work Plan;
- Hardwood Opportunities in Saskatchewan - Bell and Associates;
- Saskatchewan Industrial Survey - Forintek Canada
- Evaluation of the Provincial Fire Weather Network in Saskatchewan - Phase I and II - Atmospheric Environment Services;
- 1984-85 Canada-Saskatchewan FRDA Annual Report.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs	Prof:	Farrell (A-base)	1.0
		Newman	0.9
	Tech:	Sidders	0.8
		Johnston	0.8
	Support:	Urquhart	1.0
		Taylor	1.0
		Bacon (A-base)	1.0
	Total:		6.5
	Term:	Lee	0.1

Contracts/O & M: \$242,900.00 + \$6,000 A-base

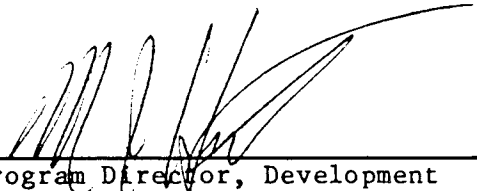
Capital: \$2,114,300.00

Grants & Contributions: \$1.208 M (includes all Agreement G & C)

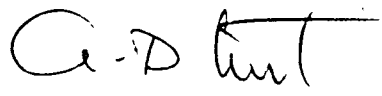
15. Signatures:



District Manager



Program Director, Development



Regional Director General

CANADA-SASKATCHEWAN FOREST RESOURCE
DEVELOPMENT AGREEMENT
1986/87

	PY's		O&M	G & C	Capital
	A-base	Agr.	Contracts		
NOR-36-01:					
Forest renewal/G.E.S.T.	-	2.5	\$191,500	\$1,130,500	-
Agr. Co-ord. & Mgmt.	1.0	-	-	-	-
Nursery Development	-	-	-	-	\$1,361,300
G.I.S.	-	-	-	62,500	743,000
Evaluation	(see NOR-36-03-9)				
Administration	1.0	2.0	57,400*	15,000	10,000
Job Creation	-	-	-	-	-
NOR-36-03-1:					
Forest Mensuration Research	-	1.0	5,000	25,000	-
NOR-36-03-2:					
Silviculture Investigations	-	1.8	76,000	80,000	-
NOR-36-03-3:					
Forest Nursery Investigations	-	0.1	45,000	-	-
NOR-36-03-4:					
Fire Management	-	1.0	52,500	-	-
NOR-36-03-5:					
Stem Injection of Aspen	-	0.4	11,000	-	-
NOR-36-03-6:					
Vegetation Management	-	0.2	2,000	-	-
NOR-36-03-7:					
Public Information	-	-	65,000	-	-
NOR-36-03-8:					
Insects and Disease	1.0	-	61,000	-	-
NOR-36-03-9:					
Forest Economics	-	1.0	72,000	-	-
Total (federal)	3.0	10.0	638,400	1,313,000	2,114,300

*Includes \$ 6,000 A-base funding

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Forest Mensuration Research (Saskatchewan)
3. New: X Cont.: 4. No.: NOR-36-03-1
5. Study Leader: Vacant
6. Key Words: Technology transfer, growth and yield, data manipulation, analytical procedures
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To interface closely with DPRR personnel in Timber Management Inventory and Silviculture Branches with the objective of undertaking specific projects relating to growth and yield data manipulation.
 2. To contribute through technology transfer to the development and advancement of growth and yield data analysis procedures in Saskatchewan.
 3. To provide an advisory role on growth and yield-related projects funded under FRDA.
9. Goals for 1985-86:

Nil - new study
10. Accomplishments 1985-86:

Nil - new study
11. Goals for 1986-87:
 1. To organize, annotate and document existing data-sets to create a comprehensive list which will be useful to other projects in Timber Management, Inventory and Silviculture Branches.
 2. To initiate the identification of sources of bias in yield data and develop methodology to remove them.

3. To initiate the identification of the schedule of events necessary to permit incorporation of managed stand yields into timber supply projections.
4. To initiate the identification of the effects of past harvesting on average stand volumes for specific forest cover types.
5. To provide advice and services in the area of growth and yield research and development to other industrial, governmental and private agencies as required.
6. Provision of advice and services liaison and coordination relating to growth and yield research project to be initiated by Prince Albert Pulpwood.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: (vacant)	1.0
Tech.:	0.0
Total	1.0
Term/Student:	0.0

O & M: \$5,000

Contract: Nil

Capital: Nil

Grants & Contributions: \$25,000

15. Signatures:

 Investigator

 Supervisor

 District Manager

 Program Director, Resources

 Program Director, Development

 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Forestry Development Agreements
2. Title: Silviculture Investigations (Saskatchewan)
3. New: X Cont.: 4. No.: NOR-36-03-2
5. Study Leader: A. Gardner, G. Barth, C. Lee
6. Key Words: Technology transfer, forest renewal, renewal surveys, LSP, site preparation, tree improvement, seeding, fertilization, demonstration, seed collection
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To contribute to the development and advancement of forest renewal operations in Saskatchewan through provision of advice and services and technology transfer relevant to several aspects of regeneration, silviculture, including surveys, site preparation, planting stock handling and assessments and seeding, as well as in the broader areas of tree improvement and forest fertilization.
 2. To initiate, conduct and report on field trials relevant to planting stock types, site preparation equipment and seeding of coniferous species.
 3. To promote technology transfer by organizing and conducting technical workshops and seminars from time to time on topics of importance and relevance to silvicultural advancement in Saskatchewan.
 4. To promote public awareness of silvicultural (forest-renewal) activities in Saskatchewan by developing self-guiding demonstration areas for use by forestry practitioners, students and the general public.
9. Goals for 1985-86:

Nil - new study

10. Accomplishments in 1985-86:

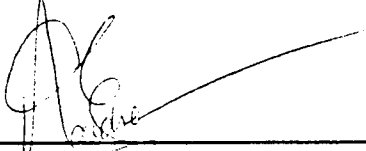
1. Participated in re-measurement and maintenance of MS-155 growth and yield plots in Saskatchewan.
2. Participated in re-measurement of Jack pine family test plantations in Hudson Bay Region.
3. Arranged and conducted a tour of selected MS-153 growth and yield plots in Saskatchewan for Johnson Forestry Services.
4. Initiated liaison and planning activities among cooperators NoFC, DPRR and PAPCO for a project to evaluate large scale aerial photography for regeneration surveying in Saskatchewan.
5. Initiated a review and analysis of 10 years of data relative to field performance of white spruce planting stock types in Saskatchewan.
6. Organized and conducted a workshop/demonstration on portable field data entry modems in cooperation with Petawawa National Forestry Institute for field forestry personnel of PAPCO and DPRR.
7. Organized and conducted a workshop/seminar on forest mycorrhizae for forest nursery and field personnel of PAPCO, DPRR and Simpson Timber Co.
8. Coordinated and prepared the forestry research and technology transfer program to be conducted under the auspices of the Federal direct delivery portion of the Canada-Saskatchewan FRDA.

11. Goals for 1986-87:

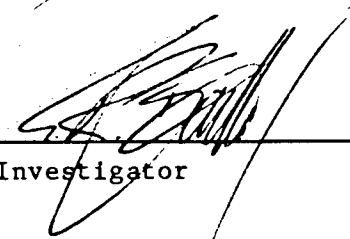
1. Review and report on DPRR first and fifth-year plantation assessment procedures and initiate development of assessment procedures for a third plantation assessment targeted for 10-20 years following harvest.
2. Review, analyze and report on a data-set pertaining to a 10-year-old planting stock trial establishment by Silviculture Branch.
3. To provide advice and services and a coordinating role with respect to acquisition and interpretation of large-scale aerial photography for coniferous regeneration assessment in cooperation with NoFC, DPRR and Papco.
4. To develop, in conjunction with DPRR staff, initiate and supervise a contract to investigate and report on planting stock handling procedures and planting standards.
5. To provide advice and services relating to site preparation with emphasis on developing use patterns for V-blades and on identifying methodology appropriate for preparation of low-land (high water table) forest sites.

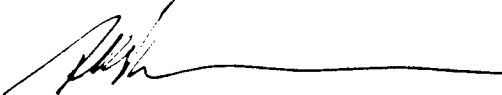
6. To coordinate CFS participation (Development and A-base) relevant to a seed collection contract designed to examine current seed collection activities in Saskatchewan and recommend possible future program directions including tree improvement.
 7. To promote and coordinate participation of forestry personnel in Saskatchewan in a technical workshop on spacing, stocking and thinning prescriptions for jack pine and white spruce to be held in Manitoba in 1986.
 8. To develop, initiate and supervise a contract to establish self-guiding demonstration areas designed to promote public awareness of silvicultural (forest renewal) activities in the mixedwood forest in Saskatchewan.
 9. To conduct a review of literature and past research and operational activities in the Prairie Region relevant to direct seeding of conifers and recommend components of a field trial project aimed at evaluating appropriate methodologies.
12. Publications 1985-86:
1. Program of research under the Canada-Saskatchewan Forest Research Development Agreement.
13. Environmental Implications:
- The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.
14. Resources 1986-87:
- | | | | |
|---------------------------|-------------------|------------------------------------|----------------------------|
| PYs: | Prof.: Gardner | 0.7 | |
| | Newman | 0.1 | |
| | | | (Hall-goal 3/Brace goal 7) |
| | Tech.: Barth | 0.8 | |
| | Sidders | 0.1 | |
| | Johnston | 0.1 | |
| | Total: | 1.8 | |
| | Term/Student: Lee | 0.3 | |
| O & M: | 24,000 | (Program 3.1) | |
| Contract: | 52,000 | (Program 3.1) | |
| Grants and Contributions: | 80,000 | (Program 1.3/2.0 Goals 3, 5 and 7) | |

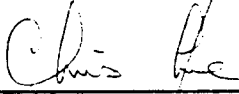
15. Signatures:

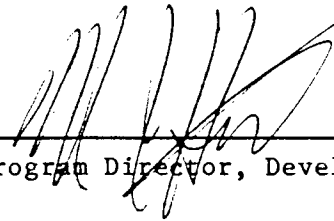

Investigator

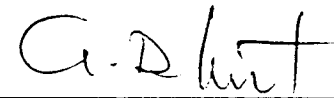

District Manager


Investigator


Program Director, Resources


Investigator


Program Director, Development


Regional Director General

2. To conceptualize and formulate terms of reference for a contract to evaluate and make recommendations with respect to current seedling handling practices in forest tree nurseries in Saskatchewan with emphasis on lifting dates and storage temperatures for spring lifted stock.
3. Provision of advice services and liaison relating to forest nursery research and development to Saskatchewan forest nurseries.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.


14. Resources 1986-87:

PYs: Prof.: Gardner	0.1	(Harvey A-base)
Tech.:	0.0	
Total:	0.1	
Term/Student:	0.0	


O & M: ^{5,000} 5,000Contract: ^{40,000} 40,000

Capital: Nil

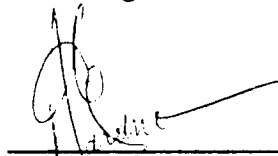
15. Signatures:



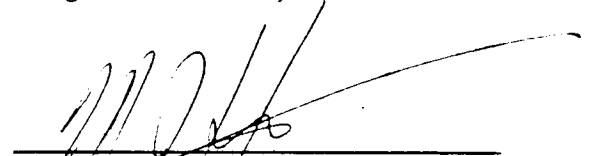
 Investigator



 Program Director, Resources



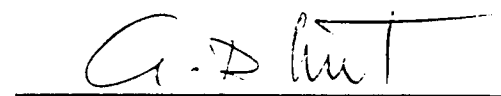
 Supervisor



 Program Director, Development



 District Manager



 Regional Director General

4. Made contact with outside agencies that will be involved in multi-disciplinary projects with fire management.
5. Actively assisted the province in the development of a prescribed burn program through meetings, field work, and personal contact.
6. Gained experience in fuel sampling methods, and the planning and conducting of prescribed burns through participation on the Bigfish Lake Experimental Burn project.
7. Initiated a photo-series project to be applied to the Canadian Forest Fire Behaviour Prediction System, for use in Saskatchewan.
8. Supervised the initiation and completion of the first 2 of 3 phases to evaluate and re-organize the Saskatchewan Fire Weather Station Network under contract.
9. Provided training/information sessions on various fire management topics for provincial fire control staff and at Kelsey Institute.
10. Assisted in providing information at public displays as part of the public information program.
11. Goals for 1986-87:
 1. Maintain liaison with Project Leader, Fire Research and staff to provide technology transfer information.
 2. Develop fire management expertise through courses and other in-house experience.
 3. Provide information transfer by various methods such as participation on committees, workshops, information sessions, seminars and personnel contact.
 4. Initiate and supervise the completion of a contract to record the daily weather observations used in the Canadian Forest Fire Weather Index System for the Atmospheric Environment Service synoptic network in Saskatchewan on magnetic tape (in ASCII format) suitable for use in VAX/VMS and micro-computer modes.
 5. Supervise the completion of a contracted evaluation and analysis of the Saskatchewan fire weather station network.
 6. Initiate and supervise a study of the Saskatchewan fire detection system to evaluate its efficiency and effectiveness.
 7. Complete the Canadian Forest Fire Behaviour Prediction System photo-series for Saskatchewan.
 8. To continue providing assistance in the development of a provincial prescribed burn program.

9. Initiate development of an information package for rural homeowners on 'fire-proofing' property in the rural/forest interface.
10. Provide provincial personnel the opportunity to attend training courses and seminars on various aspects of fire management.
11. Organize and conduct a local workshop/seminar on a specific topic to allow information transfer between provincial staff and selected persons with expertise in a particular field of fire management.

12. Publications:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: DeGroot 1.0
(Barney, Ogilvie A-base)

Tech.: 0.0

Total: 1.0

Term/Student: 0.0

O & M: 32,500

Contract: 20,000

Capital: Nil

15. Signatures:

William De Sant.

Investigator

Richard J. Boney

Technical Advisor

Ab

Supervisor

J. M. Powell

Program Director, Extension

Paul

District Manager

M/K

Program Director, Development

A. D. Hunt

Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Stem Injection of Residual Aspen
3. New: X Cont.: 4. No.: NOR-36-03-5
5. Study Leader: A. Gardner
6. Key Words: Technology transfer, aspen control, herbicide stem injection, girdling
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To determine the effects of control of residual mature aspen stems immediately following softwood removal on post harvest density of aspen suckers.
 2. To demonstrate and compare stem injection of glyphosate and stem girdling for control of mature aspen stems and for efficacy with respect to control of post harvest suckering.
 3. To contribute findings to Regional Vegetation Control Project (NOR-10-09) and to ECW Silvicultural Abstracts.
9. Goals for 1985-86:

Nil - new study
10. Accomplishments 1985-86:

Nil - new study
11. Goals for 1986-87:
 1. Conduct review of literature and past operational and research activities with respect to control of aspen suckering.
 2. Examine implements for individual stem control techniques and select appropriate tool.

3. Select appropriate research site and develop experimental working plan for review by environmental screening committee and personnel of vegetation management project at NoFC.
4. Obtain applicable Federal and Provincial permits.
5. Establish experimental plots, perform pre-treatment assessment and apply treatments.
6. Maintain liaison with Vegetation Control Project (NOR-10-09) at NoFC.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.:	Gardner	0.1
Tech:	Barth	0.1
	Sidders	0.1
	Johnston	0.1
Total		0.4
Term/Student:	Lee	0.1

O & M: 11,000

Contract: Nil


Capital: Nil

15. Signatures:



 Investigator



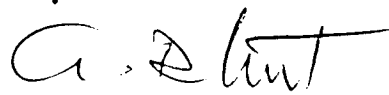
 District Manager



 Program Director, Resources



 Program Director, Development



 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Forestry Development Agreements
2. Title: Crop tree and vegetation response to various vegetation control treatments in boreal/mixedwood sites in Saskatchewan
3. New: X Cont.: 4. No.: NOR-36-03-6
5. Study Leader: A. Gardner
6. Key Words: PAPCO, vegetation response, crop tree response, efficacy, crop tolerance, chemical and non-chemical vegetation treatments
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To participate with Prince Albert Pulpwood (PAPCO) in an experimental project involving application of glyphosate and motor-manual treatments to non-crop vegetation on mixedwood forest sites in Saskatchewan with respect to assessing crop and non-crop vegetation response, chemical efficacy and crop tolerance.
 2. To contribute findings to Regional Vegetation Control Project (NOR-10-09) and to ECW Silvicultural Abstracts.
9. Goals for 1985-86:

Nil - new study
10. Accomplishments in 1985-86:

Nil - new study
11. Goals for 1986-87:
 1. Conduct a review of appropriate literature and research protocols for vegetation and crop-tree assessments and select options.
 2. Conduct examination of proposed test site and participate in development of experimental work plan. (CFS component to be reviewed by Environmental Screening Committee and personnel of vegetation management project at NoFC).

3. Establish experimental plots and conduct pre-treatment assessments.
4. Provide advice and services as required on treatment applications.
5. Maintain liaison with Vegetation Control Project (NOR-10-09) at NoFC.
6. Function as Recording Secretary of the ECW Silviculture Group and as Local Arrangements Chairman (Silviculture Group) for 1986 ECW Annual Meeting in Saskatoon.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

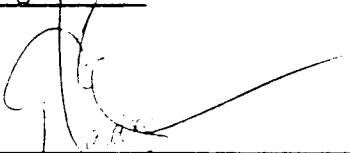
PYs: Prof.:	Gardner	0.1
		(Brace A-base)
	Tech.:	Barth
		0.1
	Total	0.2
	Term/Student:	0.0

O & M: 2,000

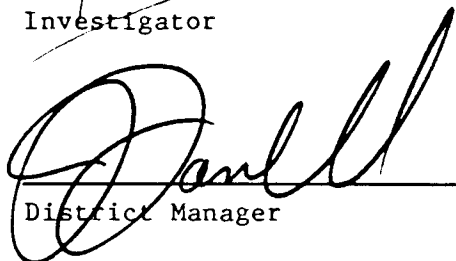
Contract: Nil

Capital: Nil

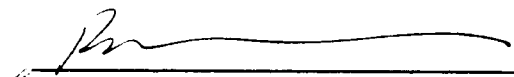
15. Signatures:



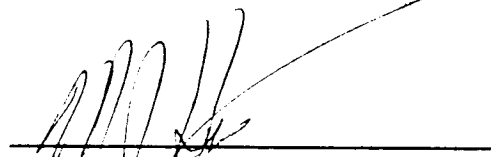
 Investigator




 District Manager



 Program Director, Resources



 Program Director, Development



 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Forestry Public Information (Saskatchewan)
3. New: X Cont.:
4. No.: NOR-36-03-7
5. Study Leader: C.A. Lee (R.G. Newstead - Cooperator)
6. Key Words: Communications, public information, public relations, press releases, media, ceremonies, liaison
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. Coordinate and administer the planning and delivery of an effective forestry public information program in Saskatchewan.
 2. Promote increased public awareness and understanding of CFS and FRDA initiatives in the forestry sector, inform targeted publics in Saskatchewan of the benefits of the forest resource.
 3. Develop and coordinate the agreement-related media activities for the CFS in Saskatchewan.
9. Goals for 1985-86:

Nil - new study. (see Accomplishments below)
10. Accomplishments in 1985-86:
 1. Administered contract for the completion of a public awareness survey on forestry in Saskatchewan through Parry Martins Public Relations Ltd. in Saskatoon.
 2. Provided assistance advice and coordination efforts in contribution to the Forestry Capital of Canada 1985 (Prince Albert and District) activities.
 3. Developed and arranged for the production of a slide tape presentation of the Canada-Saskatchewan FRDA programs and activities.

4. Completed and arranged for the production of a "Saskatchewan Trees of Renown" publication in consultation with the Saskatchewan Forestry Association.
5. Organized and arranged for staffing forestry public information display at Pioneer Days (Saskatoon), Prince Albert Exhibition (P.A.), P.A. Mall (NFW) Hudson Bay (Forestry Week - sponsored chain saw carving competition) and contributed to Buffalo Days (Regina).
6. Arranged for reprint of Canada-Saskatchewan F.R.D.A.
7. Developed and arranged for publication of Canada-Saskatchewan F.R.D.A. pamphlet as well as production of F.R.D.A. presentation covers.
8. Developed and arranged for production of F.R.D.A. project signage.
9. Contributed to drafting and production of a Saskatchewan forestry booklet entitled 'Forever Forests'.
10. Provided public information and communications liaison for the Saskatchewan District Office.
11. Goals for 1986-87:
 1. Coordinate CFS and FRDA public information programming and activities within Saskatchewan.
 2. Co-chairman of the Canada-Saskatchewan Forest Resource Development Agreement public information sub-committee.
 3. Develop with provincial consultation, a program of public information for the FRDA for 1986-87.
 4. Serve as Scientific Authority on the standing offer (with Saskatchewan public relations firm) for production of FRDA-related public information publications.
 5. Develop and coordinate approval of press releases related to FRDA activities.
 6. Arrange for a maximum of media focus on FRDA-related activities including press tours, interviews, feature articles and presentations.
 7. Provide for press clipping service of small local daily and weekly Saskatchewan newspapers.
 8. Coordinate (with NoFC - NOR-33-02) and conduct the 1986-87 public information exhibit schedule for Saskatchewan including National Forest Week, Pioneer Days (Saskatoon), Prince Albert Exhibition, and provide support for Buffalo Days (Regina).
 9. Maintain liaison between CFS Saskatchewan and other forestry organizations and associations including the SFA, CFA, CIF.

10. Organize and coordinate opening ceremonies for the Prince Albert Forest Nursery Pumphouse and the Big River Pumphouse and Cold Storage and Packing Facility.
11. Purchase video system for use in this and other agreement related programs.
12. Publications:
- Additudinal Survey for the Canada-Saskatchewan F.R.D.A. - May, 1985.
 - Saskatchewan Trees of Renown - May, 1985.
 - Forever Forests Brochure (joint) - January, 1986.
 - Canada-Saskatchewan F.R.D.A. Pamphlet - January, 1986.
 - Forever Forests - Forestry Research Pamphlet - February, 1986.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

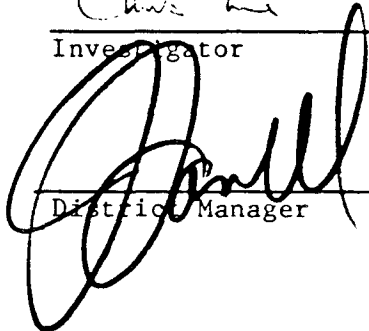
PYs: Prof.: (Newstead A-base)	0.0
Tech.:	0.0
Total:	0.0
Term/Student: Lee	0.5

O & M: 10,000
Contract: 55,000

15. Signatures:



Investigator



District Manager



Program Director, Development



Program Director, Extension



Regional Director General

11. Goals for 1986-87:

1. Survey of plantations or young stands adjacent to spruce budworm and jack pine budworm infestations. (ID-1 Impact) (Tidsbury)
2. Establish 30 plots in young and mature stands and assess for pest damage. (ID-1) (Moody)
3. Initiate studies which will permit a quantitative description of the relationship between jack pine budworm populations and individual tree growth losses. (ID-1) (Volney)
4. Initiate studies which will lead to the design of efficient survey methodologies for jack pine budworm populations and their feeding. (ID-1) (Volney)
5. Assess records on Saskatchewan's forest resources for their historical content and value in guiding future studies. (ID-1) (Volney).
6. Examine and conduct pest surveys in a limited number of DPRR Plantation Permanent Assessment Plots. (ID-3 Special Pest Surveys) (Tidsbury)
7. Conduct workshops and training sessions on forest pests for DPRR field staff. (ID-2 Advisory) (Moody, Volney)
8. Provide financial support to the production of a Disease Pictorial Guide. (ID-2)
9. Provide diagnostic and advisory services on tree and shrub pests. Identify the resource managers and meet with them to discuss their needs with respect to pest management in their jurisdiction. (ID-2) (Volney)

12. Publications 1985-86:

Tidsbury, C. 1985. Spruce budworm in Saskatchewan, 1985 and forecast for 1986. File Report

Tidsbury, C. 1985. Jack pine in Saskatchewan, 1985 and forecast for 1986. File Report.

Tidsbury, C. 1985. Forest tent caterpillar infestations, 1985 and defoliation forecasts for 1986. File Report.

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

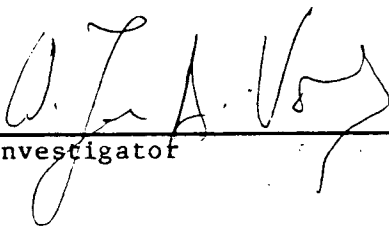
PYs: Prof.: 0.0 (Volney 0.5, Moody 0.2 A-base)
Tech.: 0.0 (Tidsbury 0.3, A-base)
Total: 0.0
Term/Student: 0.0

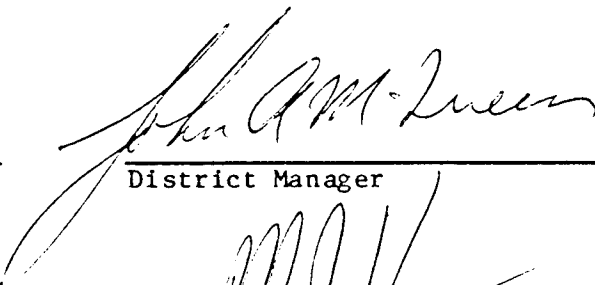
O & M: \$13,000

Contract: \$18,000
\$20,000 Publ. on Disease

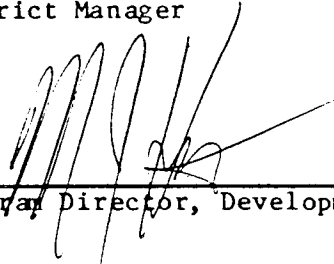
Grants & Contributions:

15. Signatures:


Investigator


District Manager

Investigator


Program Director, Development


Program Director, Forest Protection


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1986

1. Project: Development Agreements
2. Title: Forest Economics (Saskatchewan)
3. New: X Cont.:
4. No.: NOR-36-03-9
5. Study Leader: A. Mauch
6. Key Words: Hardwood utilization; economics of intensive forest management; integrated resource management plans; marketing; economic wood supply; industrial structure; technology transfer.
7. Location of Work: NoFC, Edmonton and Saskatchewan District Office, Prince Albert
8. Study Objectives:
 1. To determine the size, structure and economic impact of the primary wood using industries in Saskatchewan.
 2. To provide technology transfer in the application of recently developed procedures and techniques for determining the extent and location of economically recoverable timber.
 3. To determine the extent, location and volume of timber on private lands in the Meadow Lake region of Saskatchewan and to develop a procedure for determining the cost of utilizing this timber.
 4. To identify potential markets for a) rails, poles, and posts; b) fuelwood, and c) other specialty wood products and recommend suitable marketing techniques for these products.
 5. To develop and implement an economic assessment framework for the purpose of providing economic guidelines for the distribution of intensive forestry funds.

6. To develop a framework for a detailed integrated resource management plan in accordance with Saskatchewan management objectives and to assist in preparation of a detailed management plan, based on the developed framework.
7. To evaluate the economic potential of primary processing and marketing of birch, elm and ash in East central Saskatchewan.
9. Goals for 1985-86:
 1. Develop interdisciplinary forest economic research studies for consideration under the Saskatchewan Agreement.
 2. Develop terms of reference for hardwood study. Tender contract. Act as Scientific Authority.
 3. Develop study proposal for forest industry survey in Saskatchewan. Develop terms of reference for contract. Tender and assist in supervision of contract.
10. Accomplishments in 1985-86:
 1. Study proposal for industry survey was developed in detail. Terms of reference and conditions of contract were developed. Contract awarded to Forintek in September 1985. Survey work is completed, data analysis and preparation of tables to be done by 31 March 1985, directory to be completed by 31 March 1985. (Objective 1)
 2. Seven proposals for economics research were prepared for the Saskatchewan Research MOU Committee. All were approved with only minor modifications.
 3. Terms of reference were drawn up for hardwood study. Four proposals were received and reviewed. Contract will be awarded by December 31, 1985 and completed by March 31, 1986. (Objective 7)
 4. Saskatchewan forest economist hired 2 July 1985. Has completed orientation program in Saskatchewan and NoFC, has developed and maintained provincial and regional liaisons in forestry and regional development sectors.
 5. Has begun work on seminar on the use of financial/economic silviculture decision making models. (Objective 5)
11. Goals for 1986-87:
 1. Completion of analyses and report on the size, structure and economic impact of the primary wood using industry in Saskatchewan. Assist in the completion of updated Saskatchewan Forestry Report. (Objective 1)
 2. Help to develop an evaluation framework for the Canada-Saskatchewan Forest Resource Development Agreement.

3. Become familiar with the models used and being developed by FEPA for future economic analysis of Saskatchewan wood supply. Provide technology transfer of FEPA and other wood supply models through seminars. (Objective 2, 5)
4. a) Examine provincial and industrial silviculture data to determine how it can be used in developing financial/economic guidelines for the distribution of intensive forestry funds. (Objective 5)
- b) Develop and present a seminar on the use of financial/economic decision making models in silviculture. (Objective 5)
5. Develop terms and conditions of contract for integrated land use management plan in consultation with DPRR staff. Tender and supervise contract. (Objective 6)
6. Develop a method to analyse private land inventory data to determine the economic accessibility of the timber. Begin analysis. Objective 2, 3)

12. Publications 1985-86

Nil

13. Environmental Implications:

The agreement manager has been directed by management committee to include all pertain environmental related information on the PAF associated with this Project. The PAF will serve as the official document which the environmental screening committee will review.

14. Resources 1986-87:

PYs: Prof.: Mauch 1.0

Tech.:

Total: 1.0

Term/Student:

O & M: 12,000

Contract: 60,000

Capital:

15. Signatures:

Anne Mauch
Investigator

[Signature]
Program Manager, Development

Diana M. Boylen
Project Leader

[Signature]
District Manager

A. D. [Signature]
Regional Director General



NOR-51

FINANCIAL, ADMINISTRATIVE AND SUPPORT SERVICES

7. A training course was put on in June, 1985 which district finance staff and Edmonton finance staff attended.

11. Goals for 1986-87:

1. Process all invoices within 10 days of receipt in finance unless written evidence of problems is on the file.
2. Process all Travel claims within 10 working days of receipt in finance.
3. Process all Travel advances so all requestors receive their advances at the latest on the day they require them.
4. Maintain a monthly record of:
 - 1) turnaround time
 - 2) No. of invoices
 - 3) No. of Travel claims
 - 4) No. of Travel advances

Provide this information to the Manager, Management Services on a monthly basis.

5. Process JV's for gas, stores, and other chargebacks within 5 working days of having received them in Finance.
6. Maintain a commitment system. Commitments will be input to FINCON within 2 days of receipt. A system which enables quick access to the actual document setting up the commitment will be maintained. Commitments will be reviewed monthly to ensure only "good" commitments are in the system.
7. DSS statements, FINCON statements, Batch ledger and monthly financial statements will be reconciled monthly.
8. Requests for adjustments to the system will be performed within 2 working days of the request.
9. Requests for information such as from Manager, Management Services, HQ, Program Directors, Project Leaders, study leaders will be processed within 24 hours of the request or the deadline requested if later.
10. Accurate financial statements will be provided to Program Directors within 5 working days of monthly close off.
11. Resolve the problem of the blanket commitment of Travel.
12. Resolve the problem in the financial statements of using PAF's for commitments.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs:	Weiss	1.0
	Iskra	1.0
	Ross	1.0 (Manitoba Agreement)
	Briscoe Adams	1.0 (Alberta Agreement)
	Allen	1.0
	Total:	5.0 (2 Agreement)

O & M: \$20,400

Capital:

15. Signatures:

B. D. Weiss
Investigator

Paul Shinn
Manager, Management Services

Gene Kunt
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Management Services
3. New: Cont.: X
4. No.: NOR-51-02
5. Study Leader: P.G. Stewart
6. Key Words: Management services
7. Location of Work: NoFC, Winnipeg, Prince Albert
8. Study Objectives:

To provide financial, administrative and support services to NoFC Director General, Program Directors, Project Leaders, Study Leaders and employees.

9. Goals for 1985-86:

No study statement was prepared in 1985/86.

10. Accomplishments in 1985-86:

1. Familiarized myself with NoFC budgets including research funding and agreement funding.
2. Devised and produced monthly financial statements from July 1, 1985.
3. Participated in Project Leaders' Retreat in May, 1985.
4. Began collecting data on finance, wordprocessing, administration, purchasing functions.
5. With the assistance of B. Weiss, D.M. Burke, J. Hodgins, put on a course for finance clerks and administrative officer from NoFC and the District Offices.

6. Coordinated and monitored the minor capital funds for 1985/86.
 7. Attended Manager, Management Services meeting in Ottawa Sept. 24-29, 1985.
 8. Participated in the Management Committee of NoFC and produced minutes for the meetings.
11. Goals for 1986-87:
1. Oversee financial, administrative, materiel management, vehicles and building operations (see other study statements).
 2. Refill FI position by April 30, 1986.
 3. Collect monthly data on functions under Management Services.
 4. Write a users handbook for use by employees in NoFC.
 5. Participate in Management of NoFC; take minutes at Management Committee and circulate the typed minutes within three (3) working days of the meeting.
 6. Monitor NoFC resources on a monthly basis and draw attention to problem areas. Prepare P.Y. forecasts by July 31, Sept. 30, November 30 and January 30.
 7. Within resources provided under minor capital, upgrade public areas in the building.
12. Publications 1985-86:
- N/A
13. Environmental Implications:
- N/A
14. Resources 1986-87:
- PYs: Stewart, P. 1.0
- Total: 1.0
- O & M: 7.600
- Capital:
15. Signatures:



 Manager, Management Services



 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Administration
3. New: Cont.: X 4. No.: NOR-51-03
5. Study Leader: D.M. Burke
6. Key Words: Word processing, records management, telecommunications,
administration
7. Location of Work: NoFC
8. Study Objectives:
To provide reception, word processing, record management, mail,
telecommunications and general administrative service to NoFC.
9. Goals for 1985-86:
No study statement was prepared for 1985-86.
10. Accomplishments in 1985-86:
Word Processing:
 1. Implemented a system of logging jobs in and keeping track of them.
 2. Provided on average a one-day turn around time on projects. (This slowed down in December due to the length and volume of Study Statements).
 3. Acquired a new printer; upgraded the system to AES 7300 Series.
 4. Reclassified one position in the unit. Filled one full-time indeterminate position.

Records and Photocopying:

1. Provided a Central Records Office service to NoFC; A. Fulton assisted the District Offices in setting up their records system by visiting each.
2. Implemented a system of recording volumes of activity in the Records Office.
3. Ordered a new photocopier to replace the 3450 in the mail room.
4. Reviewed what should be logged as incoming pieces of mail, i.e. what should be kept track of.
5. Instituted Priority Post service for Ottawa, Winnipeg and Prince Albert.

Telecommunications:

1. Actioned the purchase of the NoFC SL-1 telephone system; thus saving approximately \$3,000/mo in rental charges starting March 1, 1986. Will upgrade to touch-tone system throughout the Centre.
2. Arranged for the charging of long distance costs to studies starting December 1, 1985.
3. Actioned the addition of 4 new Centrex lines into NoFC thus increasing the number of lines available from 2 to 6.
4. Arranged for telephone changes as a result of moves in the Centre.

Reception:

1. Provided a reception service for visitors and telephone answering service for callers.
2. Typed 250 pages/month in correspondence, requisitions and contracts on request.

Administration:

1. Monitored the Conference Plan; actioned changes and substitutions; put together the proposed 1986-87 conference plan and sent it to Ottawa; submitted bi-monthly reports to HQ.
2. Actioned Staffing and Reclassification requests.
3. Updated the individual organization charts for NoFC; will produce overall organizational chart and distribute to Director General and Program Directors by March 15, 1986.
4. Attended Agriculture Canada classification course.

11. Goals for 1986-87:

Word Processing:

1. Provide the following turn around time to clients:

1 - 5 pages	1 working day
5 - 25 pages	3 working days
2. Provide training to AES operators to ensure they understand and use the capabilities of the system.
3. Ensure an even distribution of workload among all three operators.

Records and Photocopying:

1. Open all mail and record all incoming mail, with the exception of advertisements, newspapers, magazines.
2. Distribute all incoming mail within one hour of receipt as per routing.
3. Hand-deliver upon receipt to addressee's office or put in mail box all DEX and telex messages.
4. Prepare and forward 3 times a week mail to the District Offices and Ottawa by Priority Post.
5. Prepare mail for pick-up each day by Canada Post.
6. Ensure photocopier in mail room is working and properly supplied; call maintenance within one hour of machine being reported as malfunctioning.
7. Maintain counts of item as presently being done.
8. Maintain and operate a BF system.
9. Review opening of mail.
10. Final evaluation of material in scientific records.
11. Catalogue and store maps.
12. Add scientific records to the clearance form.

Telecommunications:

1. Review rental charges each month to ensure they are accurate and correct.
2. Place an order for repair or change within two days of receiving the order.

Reception:

1. Greet visitors, refer to the appropriate employee in NoFC.
2. Answer the telephone switchboard, take messages, forward calls.
3. Prepare requisitions, correspondence, contracts within 24 hours of receiving them. Maintain a log of all typing.

Administration:

1. Prepare the 1987-88 Conference Plan for the deadline set by Ottawa.
 2. Monitor the 1986-87 Conference Plan:
 - a. to ensure approved attendee's know they are on the plan and make their arrangements;
 - b. to make changes and substitutions as necessary.
 - c. submit bi-monthly report to HQ.
 3. Action classification and staffing requests within 2 days of receiving them, as long as there are no extenuating circumstances. Ensure all packages forwarded to Personnel are complete.
 4. Monitor Training Plan by:
 - a. Informing attendees of approvals; arranging for approval documentation.
 - b. Monitoring the plan and following-up with approved attendees at least one (1) month prior to course date to ensure all arrangements have been made.
 - c. Ensuring all necessary documentation is completed, forwarded and filed within 2 weeks of the course completion.
 - d. Prepare 1987/88 training plan by December 1986.
 5. Prepare, monitor, and do not exceed budget for administration without specific approval from Manager, Management Services.
12. Publications 1985-86:
- Nil
13. Environmental Implications:
- The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

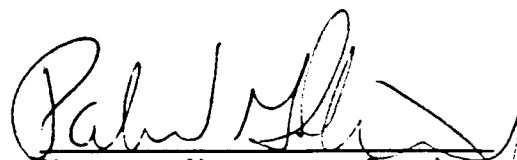
PYs:	Burke	1.0
	Fulton	1.0
	Schiewe	1.0
	Simunkovic	1.0
	Ratansi	1.0
	Phillips, T.	1.0
	Total:	6.0

O & M: \$210,600

Capital: \$12,000 - Postage scales

15. Signatures:


Investigator


Manager, Management Services


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1985-86

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Materiel Management
3. New: Cont.: X
4. No.: NOR-51-04
5. Study Leader: J.E. Hodgins
6. Key Words: Material management, purchasing, inventory, supplies, stores, removal.
7. Location of Work: NoFC, Edmonton, Alberta
8. Study Objectives:

To provide purchasing, removal, stores, inventory and Material Management Services to NoFC including functional guidance to the District Offices.

9. Goals for 1984-85:

No study statement was prepared for 1985/86.

10. Accomplishments in 1985-86:

Purchasing:

1. To December 31, 1985, 937 purchase orders were processed.
2. A study of purchasing was conducted by H. Frederiksen. His recommendations were implemented.
3. The Petty Cash process was streamlined to make it a more efficient effective purchasing method. (816 transactions between April 1 - December 31, 1985).
4. Actioned purchase orders as a result of additional minor capital funds of \$1,186.2 K. (129)
5. Intensified follow-up system for purchase requisitions.
6. Arranged 19 removals.

Stores:

1. Maintained a stores to meet NoFC needs.
2. Assumed responsibility for office supplies and lived within a set budget of \$20,000.
3. Provided the necessary information for finance to JV back issue costs to specific studies.
4. Conducted two (2) inventories of expendable items during the year.
5. Conducted inventory of stationary items.

Inventory:

1. Performed equipment-in-use inventories in the Manitoba and Saskatchewan District Offices. Updated the computer records.
2. Began the furniture inventory at NoFC. As yet incomplete.
3. Disposed of surplus equipment.

11. Goals for 1986-87:Purchasing:

1. Provide a 24 hour turnaround time on all requisitions so that end document is issued within one (1) day of receipt in purchasing as long as all information is supplied.
2. Ensure proper signing authority is on each requisition before actioning.
3. Following up on all documents issued:
 - 1) within 10 working days of issuing if delivery date is not known (10440's);
 - 2) within 2 working days if goods/services are not received on delivery date. Written documentation will be placed on each file of this follow-up.
4. Records will be maintained of all documents issued and received.
5. Monthly reports will be prepared on the above.
6. Necessary documentation will be kept on file for all exceptional purchasing (e.g., emergencies)
7. Assess the proposed CFS Material Management Computer System and implement if applicable.

Stores:

1. An inventory of all store items will be maintained. An inventory will be performed in August and February. A report will be written.
2. Items requested will be available. If not available, it will be acquired or at least ordered within 24 hours of a request if it is a stores issue item. A record of the number of issues will be maintained and reported monthly.
3. A minimum/maximum system will be maintained and stores supply will be within these.
4. Requested office supplies will be available. The budget will not be exceeded without specific permission from the Manager, Management Services.
5. Monthly costs for receivable items will be provided to Finance by the second (2) working day of the following month for J Ving back to projects.

Inventory:

1. All equipment and attractive items will be tagged and furniture, equipment and attractive items entered into the inventory before the item is released from stores.
 2. Assist in the inventory of equipment, furniture and attractive items as requested.
 3. Arrange disposal of surplus equipment.
 4. Arrange for disposal of waste chemicals twice a year in cooperation with NOR-7-06.
12. Publications 1985-86:
- Nil
13. Environmental Implications:
- For implication see NOR-7-06.
14. Resources 1986-87:
- | | | |
|------|---------|-----|
| PYs: | Hodgins | 0.5 |
| | Fawcett | 1.0 |
| | Avenell | 1.0 |
| | Total: | 2.5 |
- O & M: \$23,900
- Capital: \$2500 - Inventory counter

15. Signatures:

H. G. Hodgins
Investigator

Paul H. [unclear]
Manager, Management Services

A. D. [unclear]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Building Maintenance
3. New: Cont.: X 4. No.: NOR-51-05
5. Study Leader: H. Schoendube
6. Key Words: Maintenance, building upkeep, building repairs
7. Location of Work: NoFC
8. Study Objectives:

To conduct maintenance and repairs to the NoFC facilities to ensure they are in a superior state of upkeep and repair.

9. Goals for 1985-86:

No study statement was prepared for 1985/86

10. Accomplishments in 1985-86:

1. Maintained the building and grounds during the year. The absence of G. Schmidt with a broken leg made this a challenging task.
2. Undertook and completed extensive renovations in the building as a result of decisions to change location of staff. This entailed renovating 23 rooms.
3. Reduced the need for an electrical contractor to a minimum by undertaking work ourselves. Ensure contractor does work required under the electrical code.
4. Installed expanded metal to replace wood bases in the Greenhouse. 80% complete.
5. For Open House painted 18 additional rooms where the public would be viewing displays. This was ahead of the regular maintenance schedule.

6. Contract is let for sound-proofing the conference room (B009) and to install the cooling coil.

11. Goals for 1986-87:

1. Provide general maintenance in the building. Paint approximately 30 rooms.
2. Clear snow as required from the parking lot and walkways.
3. Maintain the grounds during the summer including cutting the grass, planting flowers and maintaining flowers and shrubs.
4. Oversee the installation of a new lawn.
5. Install shelving in the new storage shed.
6. Oversee the cleaning contract in the building.
7. Live within the budget provided.
8. Continue regular preventative maintenance program.
9. Upgrade 10 fume hoods.
10. Repair roof leak over the Administration area and one in the southwest corner.
11. Replace fan boots by July 31, 1986.
12. Replace janitor's sinks in 8 locations by July 31, 1986.
13. Perform any additional renovations that are required.

12. Publications 1985-86:

N/A

13. Environmental Implications:

N/A

14. Resources 1986-87:

PYs:	Schoendube	0.5
	Colistro	1.0
	Schmidt	1.0
	Burton	1.0
	Total:	3.5

O & M: \$21,600

Capital: \$25,000 - Lawn
\$10,000 - Emergency
\$ 5,000 - Replace fan boots
\$ 1,500 - Replace janitor's sinks

15. Signatures:

H. S. Green
Investigator

Robert H. [unclear]
Manager, Management Services

A. D. [unclear]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Building Operations
3. New: Cont.: X
4. No.: NOR-51-06
5. Study Leader: H. Schoendube
6. Key Words: Building operations, building construction, major Renovations
7. Location of Work: NoFC
8. Study Objectives:

To maintain the heating, ventilation, and air conditioning systems at NoFC; supervise the construction or renovation of major facilities at NoFC.

9. Goals for 1985-86:

No study statement was prepared for 1985/86.

10. Accomplishments in 1985-86:

Operations:

1. Maintained the heating, ventilation, and air-conditioning system in the building.
2. Installed supplementary water heater to avoid use of boilers when not needed for heating the building.
3. Ordered new intake grills for ventilation system and will oversee their installation.
4. Undertook First Aid Training to have teachers available at NoFC to train staff in-house.

Construction:

1. Let contract to oversee the reconstruction of the parking lot.
2. Installed plug-ins in vehicle compound and along the west fence.
3. Overseeing the tendering of the parking lot for completion in 1986/87.
4. Arranged plans for the storage shed and coordinated tendering through DSS.
5. Installed new weeping tile along east and north wall of Admin. Wing to correct basement leak problem.

11. Goals for 1986-87:

Operations:

1. Daily monitor the operation of the boilers.
2. When boilers not operational, conduct annual prescribed maintenance. Overhaul boiler #2.
3. Daily check the greenhouses and adjust temperatures, air, etc. to meet specifications set out by greenhouse users.
4. Perform other operational maintenance as required such as heating and ventilation.
5. Devise means to save funds in gas and electricity budgets in the building.
6. Control work by issuing work orders for all projects undertaken.
7. Conduct four (4) basic First Aid courses during the year with the aim of training 30-40 employees.
8. Conduct four (4) CPR courses in conjunction with #7 above.
9. Produce an up-to-date safety manual for NoFC.
10. Chair the safety committee.

Construction:

1. Oversee the construction of the parking lot and ensure the drainage problem is resolved.
2. Supervise the completion of construction of the storage shed; decide through the committee on the type of shelving required, order it and oversee its installation.
3. Ensure work on grounds, as a result of installing the weeping tiles, is completed by June 30, 1986.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Schoendube 0.4
 Fisher 1.0
 De Costa 1.0
 Lybbert 1.0

Total: 3.4

O & M: \$208,300

Capital: Parking lot:
 -Consultant 10.0 K
 -Parking lot 190.0 K
 -Electrical outlets 12.0 K
 212.0 K

Storage shed:
 -Flooring 50.0 K
 -Shelving 25.0 K
 -Internal walls 15.0 K
 -Chemical stores 20.0 K
 110.0 K

15. Signatures:

H. Schoendube
 Investigator

Paul Lybbert
 Manager, Management Services

C. D. Hart
 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Electronics Support
3. New: Cont.: X 4. No.: NOR-51-07
5. Study Leader: P. Bihuniak
6. Key Words: Electronics, equipment development
7. Location of Work: NoFC
8. Study Objectives:

To provide electronics support service to NoFC and to develop electronics and mechanical equipment at the request of researchers at NoFC. Maintain the growth chambers.
9. Goals for 1985-86:

No study statement was prepared for 1985/86.
10. Accomplishments in 1985-86:
 1. Oversaw the overhaul of the Growth Chambers.
 2. For J. Baker, built soil samplers (12 different types).
 3. For S. Sidhu, built two (2) soil samplers.
 4. Built risometer for E. Harvey in greenhouse.
 5. Building drying cabinet for greenhouse.
 6. Rewired the large Growth Chamber.
 7. Performed a variety of small jobs on request from a variety of people in the building.

11. Goals for 1986-87:

1. Provide electronics and mechanical development and maintenance service on request at NoFC. Maintain the Growth chambers.
2. Improve growth chambers by removing compressors from them and rewiring and redoing the lighting system.
3. Build soil sampler for Dr. S. Sidhu on request.
4. Build a pot scrubber for E. Harvey in greenhouse.

12. Publications 1985-86:

Nil

13. Environmental Implications:

N/A

14. Resources 1986-87:

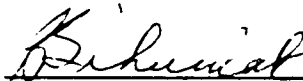
PYs: Bihuniak 1.0

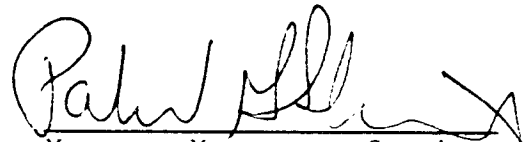
Total: 1.0

O & M: 3.0 K

Capital:

15. Signatures:


Investigator


Manager, Management Services


Regional Director General

11. Goals for 1986-87:

1. Open the Hinton camp in May and close it in October. Perform any repairs that are necessary to keep the camp in working order. Connect trailers 448 and 447 with gas, water and power. Perform maintenance at Chip Lake.
2. Coordinate with J. Hodgins the replacement of worn-out furniture in the camps.
3. Install the required sewage units at the Candle Lake camp.
4. Arrange through C. Rentz for the cutting of grass at Hinton and for him to oversee day-to-day operations of the camp.
5. Arrange for the supply of gas and electricity to Hinton, Candle Lake (only electricity) and Kananaskis.
6. Arrange for the upgrade of the roads at Hinton.
7. Replace furnaces in trailers 424 and 425 at Hinton.
8. Install government signs at Hinton.
9. Clean-up and vacate the Kananaskis facility.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Schoendube 0.1

Total: 0.1

O & M: \$9,000

Capital: \$ 3,000 - Sewage (Candle Lake)
 \$ 1,500 - Roads (Hinton)
 \$10,000 - Furniture and furnaces (trailers)
 \$20,000 - Replace roof on Pan Abode and upgrade building

15. Signatures:

H. Schenck
Investigator

Paul H. St...
Manager, Management Services

A. D. Tut
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Financial, Administrative and Support Services
2. Title: Vehicles
3. New: Cont.: X
4. No.: NOR-51-09
5. Study Leader: J. Hodgins
6. Key Words: Vehicles
7. Location of Work: Region wide
8. Study Objectives:

To maintain an adequate fleet to meet the needs of NoFC and to report the necessary information in order to perform proper fleet management.

9. Goals for 1984-85:

No study statement was prepared for 1985/86.

10. Accomplishments in 1985-86:

1. Assigned vehicles for the 1985-86 field season.
2. Ensured vehicles were repaired and ready for field use.
3. Maintained a pool of NoFC vehicles for use by users on request.
4. On an on-going basis arranged repairs and followed a maintenance schedule for the vehicles.
5. Developed a system to charge gasoline costs back to studies on a kilometer driven basis. Provided the information to finance so the charges could be processed.
6. Ordered 10 new vehicles to replace 10 worn-out vehicles. Followed up to ensure delivery by March 31/86. Will dispose of these 10 old vehicles. [The FREEZE has changed these figures].

7. Properly marked vehicles according to CFS guidelines.
8. Provided FMIS with information required to maintain the system (even if DSS did not keep it up to date).

11. Goals for 1986-87:

1. Assign vehicles for the 1986 field season by April 1, 1986.
2. Order additional replacement vehicles (requested 12) and integrate these into the fleet. Dispose of the vehicles the new ones are replacing.
3. Ensure all vehicles in the fleet have the required maintenance performed on them per a written maintenance schedule. Perform scheduled safety maintenance requirements.
4. Provide monthly the required FMIS information by the 10th of the following month.
5. Develop by June 1, 1986 the kilometer charges for 1986-87. By the tenth (10) working day of the following month provide to Finance the charges by study for the previous month.
6. Within reason satisfy all requests for vehicles during the fiscal year.
7. From May 1 to September 30, 1986 provide on a weekly basis a list of assigned vehicles which have not been used.
8. Move the trailer from Chip Lake to Manitoba as requested by J. McQueen.
9. Do not exceed the budget provided without permission from the Manager, Management Services.

12. Publications 1986-87:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:


PYs: Hodgins 0.5
Wake 1.0

Total: 1.5

O & M: \$36,600

Capital: \$185,000 - 12 vehicles
\$ 20,000 - Forklift
\$ 40,000 - Tractor
\$ 10,000 - Tractor

15. Signatures:


Investigator


Manager, Management Services


Regional Director General

NOR-53

COMPUTING AND DATA PROCESSING SERVICES

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Computing and Data Processing Services
2. Title: Computing and data processing services
3. New: Cont.: X 4. No.: NOR-53-01
5. Study Leader: W. Chow
6. Key Words: Computer, data processing, programming, system analysis, graphics, mapping, statistical analysis, information retrieval, GIMMS, MARS, RAMS, database, PDP, VAX, word processors, telecommunications, personal computers, office automation, networking, local area networking

7. Location of Work: Edmonton

8. Study Objective:

To provide an up-to-date computer service, including data processing, programming, system analysis, computer modelling, mapping and graphics, information retrieval, personal computer evaluation, word processing evaluation and telecommunications evaluation, and to provide assistance with office automation.

9. Goals for 1985-86:

1. Prepare yearly report on computer usage by individual researcher.
2. Write or adapt programs and systems as required and provide documentation.
3. Maintain and expand as necessary the stores system.
4. Continue to develop, expand and maintain programs and systems as needed.
5. Provide training and assistance as required with in-house courses.
6. Provide keypunch and data entry services and backup and restore services as required by various projects.

7. Install, expand and maintain a local area network using the in-house telephone system and cabling.
 8. Install and assist as required with the personal computers.
 9. Assist with the communications installation between the AES word processors and the VAX 11/750.
 10. Give in-house courses to potential users of the VAX system.
 11. Investigate the word processing needs of the regional sub-offices and assist with the necessary networking so the lab, sub-offices and headquarters can all communicate with each other.
 12. Attempt to keep current with all aspects of computing, word processors, personal computers and telecommunications by attending workshops, trade shows and reading trade magazines and literature and by attending meetings of the local computer groups (CIPS, DECUS, ACM).
 13. Install the new BMDP and SAS statistical packages. Install SAS/GRAPH and the new plotter.
 14. Start purchasing the personal computers, terminals, printers and other hardware and software needed for an integrated office automation strategy; most needs will be filled over the years 1985-6-7-8; prepare a feasibility study and Treasury Board submission in order to upgrade the present VAX 11/750 to either a VAX 11/780 or twin 11/750.
 15. Install DATAPAC - a network for computing communications - and test.
 16. Assist users with DATATRIEVE, MINITAB and RUNOFF as required for data bases, statistics and document editing respectively.
 17. Construct a system for use with the vehicle section so they can get a report on vehicles as to servicing, reservations, mileage, etc.
 18. Update the headquarters work plan rollup program and make corrections to the historical file as changes are made; finish the past year final upgrade.
10. Accomplishments in 1985-86:
1. Prepared yearly report for computer usage by individual researcher.
 2. Wrote or adapted programs and systems as required and provided documentation.
 3. Maintained and expanded the stores system.
 4. Continued to develop, expand and maintain programs and systems as needed.

5. Provided training and assistance as required with in-house courses.
6. Provided keypunch and data entry services and backup and restore services as required by various projects.
7. Installed, expanded and maintained a local area network using the in-house telephone system and cabling.
8. Installed and assisted as required with the personal computers.
9. Assisted with the communications installation between the AES word processors and the VAX 11/750.
10. Gave in-house courses to potential users of the VAX system.
11. Investigated the word processing needs of the regional sub-offices and assisted with the necessary networking so the lab, sub-offices and headquarters can all communicate with each other.
12. Attempted to keep current with all aspects of computing, word processors, personal computers and telecommunications by attending workshops, trade shows and reading trade magazines and literature and by attending meetings of the local computer groups (CIPS, DECUS, ACM).
13. Installed the new BMDP and SAS statistical packages. Installed SAS/GRAPH and the new plotter.
14. Started purchasing the personal computers, terminals, printers and other hardware and software needed for an integrated office automation strategy.
15. Installed DATAPAC - a network for computing communications.
16. Assisted users with DATATRIEVE, MINITAB and RUNOFF as required for data bases, statistics and document editing respectively.
17. Developed a system for use with the vehicle section so they can get a report on vehicles as to servicing, reservations, mileage, etc.
18. Updated the headquarters work plan rollup program and made corrections to the historical file as changes are made; finished the past year final upgrade. There were many errors and unanswered questions such as who is using the data, why can't the data be captured from the AFMAS system, what happens to all the extra project monies such as the FRED, ENFOR or PRUF ... therefore the project was not entirely finished.
 - a. A management information system for the FRED project was put together to supply information to the national system and to satisfy local needs.
 - b. Due to the influx of much needed capital funds, a lot of time was spent in getting a total office automation plan worked out for

NoFC; then time was spent evaluating needs of the entire Centre as to EDP - in the very broad sense - that is including telecommunications, networking, word processing, personal computing hardware and software, expansion and/or upgrading of the VAX and HP 1000. Additional studies were carried out with respect to the needs of the district offices as to their needs as far as field data recorders, printers, communications, word processing and personal computing.

- c. Terminals were delivered to the district offices along with modems and were set up and tested. The staff was given instructions on using both the Edmonton and Ottawa systems. It was determined that the Centrex system in Winnipeg is just about useless as far as EDP lines is concerned - lots of noise and not being able to get connected ... the outside lines - Manitoba Tel - work just fine.
- d. Open House took a month's preparation time in order to gather the necessary equipment, software and communications to put on the displays for the EDP section and the rest of the Centre.
- e. Our students were also recruited to help bag seedlings again this year, for the various shows and fairs.
- f. A plotting system for bar graphs was developed this summer and is available for anyone to use it is quite 'user-friendly'.
- g. A course in MACRO was attended in order to become more versatile with the system.
- h. Several new terminal lines were installed as an upgrade to the local area network was received and installed.

11. Goals for 1986-87:

- 1. Prepare yearly report on computer usage by individual researcher. Prepare the annual EDP report for headquarters and various other reports needed by AgCan. Assist users buying EDP products with the new AgCan justification statements. Maintain first line communications with the CFS senior coordinator in Ottawa using Agrinet and electronic mail.
- 2. Write or adapt programs and systems as required and provide documentation. Develop, expand and maintain programs and systems as needed.
- 3. Maintain and expand as necessary the stores system.
- 4. Continue with the study plan rollup and enter year end corrections.
- 5. Provide training and assistance as required with in-house courses.
- 6. Provide keypunch and data entry services and backup and restore services as required by various projects.

7. Expand and maintain the local area network using the in-house telephone system and cabling as needed.
8. Install and assist as required with the personal computers.
9. Attend training courses for the VAX and language utilization and on the operation and management of the VAX; give in-house courses to potential users of the new system.
10. Continue with assistance to the sub-offices regarding personal computers, data processing, word processing and telecommunications. Assist with the necessary networking so the lab, sub-offices and headquarters can all communicate with each other.
11. Attempt to keep current with all aspects of computing, word processors, personal computers and telecommunications by attending workshops, trade shows and reading trade magazines and literature, by attending meetings of the local computer groups (CIPS, DECUS, ACM) and by attending courses as appropriate on the VAX.
12. Involvement with the mapping system depends on funding being found. Assist with the upgrading of the MARS mapping system; write programs as required for report generation; assist with the evaluation of proposals regarding usage of the mapping system by outside users; evaluate proposals for obtaining other mapping or image analysis systems. Attend meetings and advise as needed regarding the GIS systems which may be purchased through the agreements. (53-7)
13. Assist with the ENFOR project when required.
14. Assist users with the new plotting system.
15. Assist users with DATATRIEVE, MINITAB and RUNOFF as required for data bases, statistics and document editing respectively. Help users with BASIC and FORTRAN as required.
16. Assist, when needed, with the software packages for the various personal computers. Assist with installation of both the finance section's new Olivetti PC system; both systems require outside connections and connections to the VAX.

12. Publications 1985-86:

Nil

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

14. Resources 1986-87:

PYs: Prof.: Chow 1.0
Paradis 1.0
Irwin 1.0

Tech.: Hai 1.0

Total: 4.0

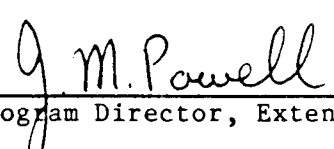
Term/Student: 1.1

O & M: \$75,000

Capital: \$250,000

15. Signatures:


Investigator


Program Director, Extension


Regional Director General

NOR-54

MANAGEMENT OF REGIONAL DEVELOPMENT PROGRAM

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1986-87

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1986

1. Project: Management of Regional Development Program
2. Title: Management of Regional Development Program
3. New: Cont.: X 4. No.: NOR-54-01
5. Study Leader: M. Heit
6. Key Words: Management, common support, economic development, agreements, job creation, prairie region, FORSTATS
7. Location of Work: Western and Northern Region
8. Study Objectives:
 1. To manage the delivery of NWT, Manitoba, Saskatchewan, and Alberta Agreements and other sundry programs such as job creation, 86 inventory
 2. To facilitate and enable economics and statistical research.
 3. To partake in corporate management decisions for NoFC as part of NoFC Management Team.
9. Goals for 1985-86:
 1. To manage economics and statistics research program.
 2. To operationalize the Agreements into a federal-provincial delivery system and job creation programs.
 3. To manage the portfolio contained under the Development Branch including the projects under the Agreement which are functionally directed elsewhere.
 4. To manage the Saskatchewan and Manitoba District Offices.

10. Accomplishments in 1985-86:

1. Staffed the Agreement positions. This involved 30 staffing actions (6 terms and 24 indeterminate).
2. Developed and implemented the programs under Canada-Manitoba, Canada-Saskatchewan, and Canada-Alberta Agreements. There were more than 100 projects approved for funding in 1985-86. (see NOR-36)
3. Developed and delivered a job creation program in Manitoba, Saskatchewan, Alberta and NWT. In excess of 30 proposals totalling over \$3 million were reviewed and processed.
4. Managed the economics and FORSTATS programs. (see NOR-3)
5. Participated on the national task force on FORSTATS.
6. Prepared a file report on Women in Forestry.

11. Goals for 1986-87:

1. To manage the Agreements, job creation, FORSTATS, and economics programs.
2. To partake in corporate management decisions for NoFC as part of NoFC's management team.
3. To complete the initial strategy for the next set of Agreements.

12. Publications 1985-86:

See NOR 3 and NOR 36.

13. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated the study activities with regards to their environmental implications. Based on information provided by the study leader, the committee concluded that the study activities present no potential to cause detrimental effects on the environment.

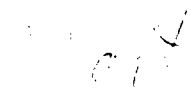
14. Resources 1986-87:

PYs:	Prof.:	Heit	1.0
	Tech.:		Nil
	Total:		1.0
	Term/Student:		Nil

O & M: \$15,600

Capital: Nil

15. Signatures:



Program Director, Development



Regional Director General

