

STUDY STATEMENTS

1987-88

NORTHERN FORESTRY CENTRE
CANADIAN FORESTRY SERVICE
5320 - 122 STREET
EDMONTON, ALBERTA
T6H 3S5

MARCH 1987

NORTHERN FORESTRY CENTRE
STUDY STATEMENTS, 1987-88

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NOR-3

FOREST RESOURCE ECONOMICS AND STATISTICS

2. 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.
3. Continue development and participation in the national economic task force, as required.
4. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required.
5. Continue to provide review/comments of journal articles, reports, proposals, and briefings.
6. An Information Report will be prepared for review using additional plus case history material (that was used in IURFO Report) on the economics of pre-commercial thinning with J. DeFranceschi.
7. An issue identification, literature review and concept paper on the economics of forest vegetation management will be prepared for review.
8. A methodology for collecting cost data for this years' work program under the Vegetation Management Project will be designed. The data will be collected.
9. Provide functional direction for NOR-36-01-8.
10. Provide direct supervision for NOR-36-03-9.
11. Provide supervision for NOR-3-02.
12. Continue as project leader of the Forestry Resource Economics and Statistics.

Added Goals:

13. Contract under the Alberta Agreement B.3 for Alberta Economic Timber Supply was to be implemented.
14. Paper presentation at annual CIF meeting.

10. Accomplishments in 1986-87:

1. Comments were provided in the development and implementation of several interdisciplinary economic/silvicultural studies to provide cost-effective investments in intensive forest management.
2. Any responsibilities for assistance for interim evaluation by Green Ribbon Committee were devolved to Manitoba economist during leave period. Answered questions on the Research MOU committee activities and initial set-up of work program.

Reviewed draft evaluation framework for Saskatchewan and discussed with Saskatchewan economist.

No evaluation task force was initiated for the Alberta Agreement.

3. Attended 3 information and general planning meetings for the National Forest Economics program. Meetings discussed the TRIM model and proposed data requirements for the wood supply model. A general planning and information meeting which would lead to an operational plan was attended.

Agreed to lead a project on Silviculture Investment Analysis. Review of available literature and a preliminary study proposal for the project were initiated.
4. Socio-economic and statistical data, analysis and documentation were provided for diverse requests. E.g., industry reports and directories for Alberta primary and secondary wood-using industries; talking points and other information for Forestry Perspectives '86 Saskatchewan & NWT; statistics on Alberta forest industry; silviculture economics.
5. Reviews and comments were provided for one research report, five contract proposals, one book review for CJAE, and about ten plans, proposals, briefings.
6. An additional report was not prepared; may become an additional goal for 1987-88. (with J. De Franceschi)
7. The literature review for economics of forest vegetation management was initiated and progress made in collection and synthesis.
8. After discussion with AFS officials and in consideration of the number of application rates, it was decided that a methodology was not necessary. The Alberta Forest Service collected cost data during the field operation.
9. Provide functional direction for NOR-36-01-8.
10. Provide direct supervision for NOR-36-03-9. Incumbent was seconded to FEDC, 1 October, 1986.
11. Provide direct supervision for NOR-3-02.
12. Continued role as project leader - reviewing all staff manuscripts; personnel and budget activities.
13. Acted as Scientific Authority for project under Alberta Agreement "Alberta Economic Timber Supply". Proposal was reviewed, tendered and supervised.
14. Paper on "Productivity and Economic Considerations in Silvicultural Decision-making" was presented at the CIF annual meeting.

15. Acted as Scientific Authority (replacing T. Williamson) for PRUF contract on An Assessment of Non-market Benefits in a Value-at Risk Framework for Fire Management. An interim final report was received in April 1986 and project was to be completed in October 1986. A report was received February 1987.
 16. Three successful learning and net-working lunches were held for forest economists in government, university and industry. This a development from the Forest Economics Research Needs for west-Central Canada publications.
 17. Active participation on the executive of Alberta Forestry Association, as head of Adult Education Committee.
 18. Developed contacts with forest economists in Canada and U.S.A. at meeting of CIF, as well as one silvicultural workshop on stand tending.
 19. Project leader was on leave for approximately four months April-August.
11. Goals for 1987-88:
1. Continue to participate in evaluation task forces for Saskatchewan and Alberta agreements, as requested.
 2. Lead and coordinate a research project on Silviculture Investment Analysis for NFEP program.

Assist in development and implementation of the timber supply project.
 3. Continue to act as Scientific Authority for PRUF project An Assessment of Non-market Benefits in a Value-at-Risk Framework for Fire Management.
 4. Continue to act as Scientific Authority for Alberta Agreement project. Alberta Economic Timber Supply. Prepare with contractor a final report for publication.
 5. Complete literature synthesis on economics of forest vegetation management. Prepare an Information Report for review.
 6. Complete a preliminary cost analysis of data for vegetation management project.
 7. Act as part of Scientific Authority team of combined PFC, GLFC, NoFC project contract An Uncertainty Model and Evaluation Framework for Intensive Forest Management Decisions to be funded for 1987-88 and 1988-89.
 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. Continue to act as Project Leader for NOR-3, as well as providing direct supervision for NOR-36-03-9 and functional supervision for NOR-36-01-8.

12. Publications 1986-87:

Phillips, W.E., Beck, J.A.; Lambie, G.W. 1986. Forest Economics Research Needs for West-Central Canada. Univ. of Alberta, Fac. Agri. For. Dept. Rural Econ., Edmonton, Alta. Bull. 27, and Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-281.

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.

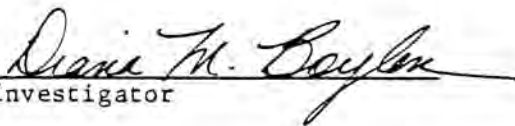
14. Resources 1987-88

PYs:	Prof:	Boylen	0.5
	Tech:	Bohning	0.1
	Total:		0.6
	Term/Student:		0.3

O&M: \$5,000

Capital:

15. Signature:


Investigator

Program Director, Development



Regional Director General

10. Accomplishments in 1986-87:

1. Development and implementation of conversion software for four provincial inventories in Saskatchewan. Performed quality control checks on converted provincial data and conducted aggregation for the three prairie provinces.

Modification of 1981 national inventory federal land files to the 1986 format NATINV specifications.
2. Completion of changes to and delivery of the national silviculture statistics questionnaire.
3. Continued to act as Scientific Authority for the PSP Catalogue project. This includes the extension of the contract to include development of user-friendly micro-computer based search and browse software, provincial PSP conversion, and subcontracting of manual PSP data entry (key punching).
4. Assisted in the development and organization of the GIS Workshop, specifically the exhibitor's display area.
5. Assisted in the development and organization of the regional growth and yield cooperative.
6. Advised senior management on NoFC's involvement in the National Forestry Statistics Program and conducted reviews on the Program's reports and recommendations.
7. Fulfilled information and data requests such as i) IUFRO request on forest management plans, ii) private land forests in the northern and western region for input into a report on private land forestry's potential, iii) nature of the tenure of DND leaseholds in Alberta and Saskatchewan.

11. Goals for 1987-88:

1. Complete delivery of national forest inventory data for NATINV86 to FORSTATS at PNFI. Complete documentation and make recommendations with respect to this experience.
2. Complete the 10-year national silviculture statistics Information Report with NOR-10. Collaborate in developing a plan to publish an integrated report of silviculture statistics and forest management expenditures with GLFC.
3. Completion of contract supervision and liaison for the PSP Catalogue project. Publish and distribute a user's package incorporating the final report, an operator's manual and two diskettes.
4. Develop a proposal to publish a booklet similar to "A Guide to Canadian Forest Inventory" to establish standard silviculture terminology, particularly as it relates to measurement of silvicultural efficacy, at the national level, in collaboration with

established committees. Assess feasibility of implementation from NoFC.

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 1987-88:

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

O & M: \$5,000

Capital:

15. Signature:

Dieter Kuhnke
Investigator

Program Director, Development

Q-D Hunt
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 6, 1987

1. Project: Resource Economics and Statistics
2. Title: Forestry development and fire management economics
3. New: X Cont.:
4. No.: NOR-3-03
5. Study Leader: T.B. Williamson
6. Key Words: Wildland fire management planning economics, cost plus net-value-charge, market and non-market benefit assessment, forest sector supply and demand modelling, forest industry, socio-economic impact evaluation, strategic planning, regional perspective development, decision support systems.
7. Location of Work: Prairie provinces, NWT, Ottawa
8. Study Objectives:
 1. To provide statistical data and analytical support for policy and program development of regional and national forestry research and development programs and policies.
 2. To provide input to working groups and study teams analyzing and reviewing forest sector related issues and policies at the national level.
 3. To assist in the development of guidelines and frameworks for use in the determination of wildland fire protection priorities in the region.
9. 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. 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. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required. (Bohning)
8. Continue to provide review/comments of journal articles, reports, proposals, and briefings. (Williamson)

Added Goals:

9. Develop and complete profile reports for Forestry Perspectives' 86 for the provinces of Alberta, Saskatchewan, Manitoba as well as NWT. (Williamson)
10. Summary report on annual forestry outlook conference by Resource Information Systems Inc., for information transfer to other forestry personnel. (Williamson, Steele)
11. Prepare project proposal for M-7.3 under the Manitoba Agreement on Damage Appraisal. (Williamson)
12. Prepare a section for the Manitoba and Saskatchewan forest industry reports on capacity utilization. (Williamson)

10. Accomplishments in 1986-87:

1. Article entitled Production structure of the Sawmilling industry in the prairie provinces was reviewed and based on reviewer comments, the authors are re-considering further attempts to publish. Suggest this task be terminated. (Williamson)
2. The updated versions of the Saskatchewan and Manitoba Directory of Wood Using Industries were published. (Mauch, Steele, Bohning)
3. Material was prepared and is currently being reviewed for updated versions of the Saskatchewan and Manitoba Forestry Report series. (Bohning).
4. A strategy framework for quantification of fire susceptible forest resource values is being developed. A procedure for quantification of Manitoba timber values for strategic fire response was developed. Initial discussions were held with the AFS regarding fire economics research priorities. (Williamson)
5. The fire management input price index was not initiated this year. Suggest this task be terminated. (Williamson)

6. The scope of the fire economics concept paper was expanded to include problem identification, literature review, concept clarification and a research action plan, several parts of which were reviewed. (Williamson)
 7. Socio-economic and statistical data, analysis and documentation were provided for diverse requests such as grade stamping, sawmill set-up, urban forestry, aspen durability, forestry generally. (Bohning)
 8. Reviews and comments were provided for Directories, Forestry Reports, Information Reports, and a provincial government sectoral policy analysis. (Williamson)
 9. Profile reports for Forestry Perspectives '86 were completed for Alberta, Saskatchewan, Manitoba and NWT. Additional material was provided as requested. (Williamson, Boylen)
 10. Summary report The Continuing Challenges: Competition and New Products in the World Forest Products Markets was prepared and is currently being reviewed. (Steele, Williamson)
 11. Project proposal now entitled Determining Forest Values for Strategic Fire Response in Manitoba was completed. Terms and conditions for the contract were developed and the contract let. (Williamson)
 12. A section entitled capacity utilization for the Manitoba and Saskatchewan forest industry reports was prepared. (Williamson)
 13. Several advisory meetings and information requests for the primary wood-using industries in Alberta Directory completed. Some advisory assistance was given to the secondary wood-using industries directory. (Williamson, Bohning, Boylen)
 14. Active participation on the executive and various sub-committees of the CIF-RMS including the Renewable Resources Subcommittee (ECA), and the Strategy for Survival Task Force. (Williamson)
 15. Developed contacts with resource managers, and forest economists and benefited from technology transfer activities through the attendance of meetings such as RISI, CAFE, Wood Expo., and the Regional Fire Technical Subcommittee. (Williamson, Bohning)
 16. The information report: The forest industry in the economy of the Northwest Territories, 1980-81 was published. (Bohning)
11. Goals for 1987-88:
1. Publish updated versions of the Saskatchewan and Manitoba Forestry Reports. Develop proposals for reports for Alberta and NWT. Assess feasibility with appropriate government agencies. (Bohning)
 2. Act as Scientific Authority for the contract study entitled Determining Forest Values for Strategic Fire Response in Manitoba. (Williamson)

3. Complete the fire economics research concept paper, as redefined, and utilize to develop strategic and operational framework for future fire economics research. The planning framework will be coordinated with the NOR-5 Strategic plan currently being developed. (Williamson)
 4. Participate in the development and implementation of the NFEP project entitled Canada's Timber Supply: Current Status and Mid-Term Outlook. (Williamson)
 5. Provide information and assistance for activities under Forestry Perspectives '87. (Williamson, Bohning)
 6. Publish summary report entitled The Continuing Challenges: Competition and New Products in the World Forest Products Market under agreement covers in Alberta, Manitoba, and Saskatchewan. (Williamson)
 7. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required. (Bohning)
 8. Continue to provide review/comments of journal articles, reports, proposals and briefings. (Williamson, Bohning)
12. Publications 1986-87:
- Bohning, R.A. 1986. The forest industry in the economy of the Northwest Territories, 1980-81. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-277.
- Giles, D.R.; Bohning, R.A. 1986. Directory of primary wood-using industries in Manitoba, 1985. Can. For. Serv., Winnipeg, Man. and Manitoba Natural Resources, For. Br., Winnipeg, Man. 141 pp.
- Giles, D.R. 1986. A Directory of Primary Wood-using Industries in Saskatchewan, 1985. Can. For. Serv., Prince Albert, Sask., 137 pp.
- Steele, T.; Williamson, T.B. (compilers) 1987. The continuing challenge: competition and new products in the world forest products markets. (Resource Information Systems Inc.; Annual Conference. Sept. 1986) Can./Alta. For. Res. Dev. Agreement, and Can./Man. For. Renewal Agreement, Edmonton, Alta.
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.

9. Study Objectives:

1. To provide socio-economic and statistical data, analyses and documentation for interdisciplinary studies in forest management.
2. To determine costs of silvicultural treatments in the region for a range of site or stand conditions. These costs to be determined through time studies of silviculture operations.
3. Based on cost information derived from this study, provide economic evaluation of silvicultural treatments to assist forest managers in allocating funds among competing treatments.

10. 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 (with Boylen).
2. Develop a strategy framework for regional co-ordination, development and initiation of silvicultural cost studies by NoFC and agreement personnel.
3. Develop and implement 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 (with Boylen).
4. Continue to provide socio-economic and statistical data, analyses and documentation for policy and program development, and provide reviews and comments on journal articles, reports, proposals and briefings as required.

11. Accomplishments in 1986-87:

1. An additional report was not prepared; may become an additional goal for 1987-88.
2. Interdisciplinary economic/silvicultural studies were developed to provide guidelines for cost-effective investments in intensive forest management. Procedures were designed and field tested to collect site and machine/labor productivity data for the following treatments: pre-commercial thinning (brush saws and chain saws), manual tree planting (bare-root and container stock), and mechanical site preparation (shear blade, disk trenchers, drum chopper, bracke). Most of the data was collected in Manitoba with some observations taken in Saskatchewan and Alberta. (with T. Steele)
3. File Reports were prepared on "Labor Productivity for Pre-commercial Selection Thinning in Young Coniferous Stands in Manitoba", and "Machine Productivity for Shear Blade Site Preparation in Manitoba". Preliminary compilations of field data for a File Report on production rates for manual tree planting are underway. (with T. Steele)

4. Provided information as required. Attended workshops held in B.C. (Silviculture) and Manitoba (Stand Tending) and economists' meetings at U. of A.

12. Goals for 1987-88:

1. In conjunction with other initiatives such as NFEP, the Agreements and research scientists at NoFC, develop a strategy framework for regional coordination, development and initiation of regional silvicultural cost studies.
2. Prepare and distribute File Reports on labor/machine productivity of manual tree planting and mechanical site preparation based on field data collected in Manitoba during 1986.
3. Prepare a File Report summarizing productivity data collected from all silvicultural treatments sampled in Manitoba during the 1987 season of field operations.
4. Provide information and assistance for activities under Forestry Perspectives '87. (with Boylen and Williamson)
5. Continue to provide socio-economic and statistical data, analyses and documentation for policy and program development as required. Continue to provide review/comments on reports, proposals, briefings etc.

13. Publications 1986-87:

Steele, T.; De Franceschi, J.P. 1986. Machine Productivity for Shear Blade Site Preparation in Manitoba. Can./Man. For. Renewal Agree. File Report. April. 21 p.

De Franceschi J.P.; Steele, T. 1986. Labor Productivity for Pre-commercial Selection Thinning in Young Coniferous Stands in Manitoba. Can./Man. For. Renewal Agree. File Report. August. 22 p.

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 1987-88:

PYs: Prof.:	De Franceschi	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student	0.0

O & M: \$5,000

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 6, 1987

1. Project: Forestry Resource Economics and Statistics
2. Title: National Forest Economics Program - Silviculture Investment Analysis Project.
3. New: X Cont.: 4. No.: NOR-3-05
5. Study Leader: D.M. Boylen
6. Key Words: Silviculture investment analysis; benefit: cost analysis, internal rate of return; risk: benefit analyses timber valuation; evaluation of joint product flows; case studies; TRIM.
7. Location of Work: NoFC, Canada
8. Problem:

Canadian forestry is now entering a period where we are starting to cut second growth forest in parts of Canada. In the NoFC region, we are now planting the second generation forest. Unlike previously, where we needed to be only concerned with harvesting and transportation costs, we now need to know or be able to estimate the costs of "growing the crop", with various combinations of capital, land, labour and management. The economics will change. Now, we will need not only to maximize PNV but also we will need to maximize profits through maximizing our input resource allocations.

Forest management expenditures have grown from \$0.7 billion in 1977 to \$1.3 billion in 1983. Indications are that they will continue to grow. We need to be able to assure our trading partners that we are not unfairly subsidizing the growing of our forestry crops.

At the national scale, we need to know what proportion of forestry investments should be in intensive silviculture and at a regional scale, we need to make the correct allocation of resource inputs to forest silviculture management planning.

9. Study Objectives:

1. To determine under what circumstances does investment in intensive silviculture treatments appear preferable to extensive forest management, by utilizing a case study approach and:
 - i) establishing the investment cost associated with a single/combined silviculture treatments;
 - ii) estimating the biological response to single/combined silviculture treatments;
 - iii) valuating the incremental volume achieved;
 - iv) estimating risk-probabilities that investment benefits will occur;

10. Goals for 1986-87:

Nil - New study

11. Accomplishments in 1986-87:

1. Attended three general planning and information meetings for the National Forest Economics program. NoFC agreed to lead a project on Silviculture Investment analysis which would also provide inputs to other study projects. All regional Forestry Centres and CFS HQ would be part of the team.
2. Review of available literature and a preliminary study proposal for the project were initiated.

12. Goals for 1987-88:

1. Materials search, collection and synthesis to be undertaken by contract with assistance of CFS regional and headquarters staff.
2. Develop a detailed problem analysis for project planning and development, as objectives for lead project on Canada's Timber Supply become clarified. Finalize project proposal. Seek participation and cooperation of provinces and industry.
3. Assist in the development of a proposal for a Canadian glossary of silviculture terminology (see NOR-3-02).

13. Publications 1986-87:

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 1987-88:

PYs: Prof.: Boylen 0.5
Tech.: 0.0
Total: 0.5
Term/Student: 0.0

O & M: (\$50,000 from NFEP project funds)

16. Signatures:

Deane M. Boylen
Investigator

NFEP Coordinator

Program Director, Development

G. E. Tut
Regional Director General

NOR-4

STAND PRODUCTIVITY AND FOREST INVENTORY

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

3. Spacing experiments have been established in jP, rP, lP, and wS. 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., Steneker, G.A., and Wilson, G.M. between 1950 and 1985.

9. Study Objectives:

1. Provide project leadership, advice and technical transfer to project and regional development staff, clients and the growth and yield coop on growth and yield R & D activities.
2. Develop and evaluate yield models for natural and managed stands of the major commercial tree species in the region. Obtain managed stand information from related spacing, thinning and fertilization experiments.
3. Prepare treatment prescriptions for different species for use by the forest manager.
4. Conduct intensive short-term studies on urgent problems as required by clients.

10. 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 1P. (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)

Added Goals:

11. Provide leadership and administrative support as acting chairman for the Regional Growth and Yield Coop.
 12. Provide advice and guidance to PDF working on a method to improve the accuracy and reduce cost of stand volume estimation; a problem from the AFS.
11. Accomplishments in 1986-87:
1. Provided 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; provided advice to colleges and clients on mensurational problems and carry out technology transfer in thinning, growth and yield and stand modelling; yield forecasting; acted as a scientific authority on related contracts as required.
 2. Preparation of guidelines for spacing lodgepole pine has been postponed to include current remeasurement (Gregg Burn; see item 4) results.
 3. Preparation of guidelines for spacing jack pine has been initiated.
 4. Remasurement of a replicate of jP strip thinning plots in SE Manitoba has been postponed to 1987; that of the 1P spacing trials at Gregg Burn is completed.
 5. Remeasurement of tA thinning studies at Turtle and Riding Mtns., Manitoba is completed.
 6. Two papers have been prepared and presented at an international symposium on stand management; (1) reducing the impact of stem disease on tree growth; (2) reducing the impact of leader damage on tree growth.

7. The planned poster paper on "red belt" impact on the growth of LP for the IUFRO Congress in Yugoslavia was reorganized into a journal article.
 8. Assisted in the organization and participated as a resource person and a field guide in the proceedings of a workshop on stand tending techniques for jP under the Canada-Manitoba agreement.
 9. An Information Report on "Spacing effects 20 years after planting three conifers in Manitoba" has been published.
 10. Acted as Scientific Authority (R. Waldron) for a contract involving the review of the 1970 CFS R&D studies in Alberta and KFES.
 11. Provided leadership and administrative support as acting chairman for the regional G&Y Coop.
 12. Provided advice and guidance to PDF in a study to improve the accuracy and reduce the cost of stand volume estimation.
- 12 Goals for 1987-88:
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, -81, -1AA, 5MA, 2SA).
 2. Publish two papers in the Proceedings of a Stand Culture Symposium in Montana. (1) "Strategies for reducing leader damage from insects" by I.E.B. and K. Stoszek, U. of Idaho; (2) "Strategies for reducing damage impact from stem diseases" by S. Navratil and I.E.B. (4-70).
 3. Publish a journal paper on "Western gall rust dynamics and impact" by I.M.B. and S. Navratil. (4-70).
 4. Publish a journal paper on "red belt" impact on LP growth in the eastern Rockies, Alberta; by I.E.B. and S. Navratil. (4-78).
 5. Cooperate with the Alberta Agreement Mensurationist to develop managed stand yield tables for LP and wS. (4-81, 4-1AA).
 6. Provide technical input and leadership in the regional growth and yield coop. (4-83).
 7. Publish an Information Report on "Guidelines for spacing/thinning LP in Alberta" combining all results from LP spacing/thinning studies (4-8).

8. Determine the feasibility and plan IP spacing trials for a range of conditions in cooperation with Champion Forest Products at Hinton. (4-39).
9. Participate in a meeting of IUFRO Economic of Thinning Working Groups in Scandinavia. (4-86).

13. Publications 1986-87:

Bella, I.E. 1985. Tree growth response along seismic line in Alberta. For. Chron. 62:29-35.

Bella, I.E. 1985. Logging practices and subsequent development of aspen stands in east-central Saskatchewan. For. Chron. 62:81-84.

Bella, I.E. 1986. Spacing effects 20 years after planting three conifers in Manitoba. F.M.N. No. 39. 12 p.

Yang, R.C.; Bella, I.E. 1986. Fertilization improves stand productivity of preharvest lodgepole pine. F.M.N. No. 36. 4 p.

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 1987-88:

PYs: Prof.:	Bella	0.8
Tech.:	Bf Kolabinski	1.0
Total:		1.8
Term/Student:		0.0

O & M: \$14,000 (Includes \$6,000 for PDF)

Capital: \$10,000 (All Terrain Vehicles-2)

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

9. Study Objectives:

1. Continue to monitor existing permanent sample plots as well as to establish new ones where necessary for studying the effect of stand treatments in the important forest types in the prairie provinces.
2. Develop and maintain a computerized database of regional forest productivity data.
3. Analyze and interpret growth and yield data and to publish appropriate information reports and forest management notes.

10. 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)

11. Accomplishments in 1986-87:

1. Prepare and revised an information report on "Guidelines on the use of STEMS for the management of jack pine, aspen, and white spruce".
2. Prepared and presented a talk on "Applications of STEMS/TWIGS model in Canada" at a Stand Tending Workshop in Winnipeg, Oct. 1986.
3. In co-operation with R. Yang tested STEMS for projecting growth of wS-tA stands.
4. Prepared about 100 entries of lodgepole pine bibliography with abstracts and these have been entered into the VAX computer and ready for publication.
5. Data from thinning bS-jP was not available. Goal was postponed till next year.

6. Acted as Scientific Authority for ENFOR contract to collect data on 2-year biomass productivity in aspen cut-overs near Calling Lake and Slave Lake. Completed field work, lab work, data analysis and prepared a paper (in review) for the 6th Canadian Bioenergy seminar in Feb, 1987.
7. Not done. Participated in a FORCYTE workshop at NoFC and gained familiarization on the model.

12. Goals for 1987-88:

1. Publish an information report on "Guidelines for the use of STEMS in the management of jack pine, aspen and white spruce". (4-1)
2. Demonstrate the use of STEMS model to Gary Ardron, silviculture forester, Manitoba Dept. Natural Resources. (4-2)
3. Publish an updated bibliography on lodgepole pine from the Reid Collins Ltd. report. (04-66)
4. Collect and analyze data and publish a FMN on thinning bS-jP in Duck Mountain, Manitoba (MS-7). (4-77)
5. Autumn 1987 remeasurement of jP multiple thinning plots in Sandilands (MS-154). (4-6)
6. Remeasure lP spacing study at Tepee Pole Creek in May, analyse data and draft a FMN. (4-8)
7. Assess growth and yield of wS-tA stands using Morton's model in relation to species mix, release of white spruce, and other variables. (4-31)
8. Establish permanent sample plots in white spruce in Turtle Mountain and jack pine in Spruce Woods. (4-82)
9. Develop and maintain a computerized data base of regional forest productivity data in cooperation with D. Kuhnke. (4-90)

13. Publications 1986-87:

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 1987-88:

PYs	Prof: Grewal	1.0
	Bella	0.2
	Tech:	
	Total:	1.0
	Term/Student:	0.3

O&M: \$7,500

Capital: Nil

16. Signatures:

Harjit S. Grewal
Investigator

[Signature]
Investigator

[Signature]
Program Director, Resources

C. D. Mitt
Regional Director General

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1987

Study No.	Location	Soil and Site	Stand age at establishment	Date of establishment	Date of re meas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
1-1P	Alberta	Varied	Varied	1951 1952 1953	1961 1974 1984 (1994)	100	0.1 0.5	N.A.; these are permanent growth and yield plots	
2-jP	Sand-lands, Man.	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 - 2 plots Thinned: to 40%,50%,60%,70% 80%, 100%, & 120% of control SDI 2 plots each
3-jP	Sand-lands, Man.	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 - 4 plots Thinned: Heavy low 4 plots Light low 4 plots Heavy crown 4 plots Light crown 4 plots
4-jP	Sand-lands Forest Res., Man.	a. Sand, fresh	9	1964	1965 1968 1973 1978 1983 Spr. (1988 Spr.) (1989 Spr.)	15	.002 .007	Mechanical Strip-thinning	Control, 5 plots Thinned 1-way: 5 plots Thinned 2-way: 5 plots
		b. Sand, fresh	11	1967	1969 1976 1981 1986 A (1996 A)	5	.002 .007	Mechanical Strip-thinning	Thinned 1-way 5 plots

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SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1987 (continued)

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

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SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1987 (continued)

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of re meas.	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
6-jP -rP	Sandi-lands, Forest Reserve	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, 6x6, 8x8 10x10 ft. spacing plus a 2-row surround. Four replications.	
6b-wS	Sandi-lands	Sand, fresh	3 y.o seedlings planted	1963 1962	1973 1978 1983 A (1988 A) (1993 A)	32	variable	as above	
7-1P	a.1 Gregg Burn	three site types	7	1964	1966 1971 1976 1981 (1986 A) (1991 A)	30	variable	100 trees in a 10x10 matrix at densities 200, 400, 800, 1600, 3200 stems/ac.	
	2 Gregg Burn	three site types	27	1984	(1989 Spr.)	24	variable	100 trees in a 10x10 matrix at densities 400, 800, 1200, 1600 stems/ac.	
	b. Tepee Pole Creek	three site types	25	1967	1972 1977 1982 (1987 A) (1992 A)	30	variable	100 trees in a 10x10 matrix at densities 200, 400, 800, 1600, 3200 stems/ac.	
8-rP	a. Sandi-lands	N/A	N/A	1980	1985A	6x4		Control: 20x20m 1. Control, 2. 8'x8', 3. 10'x10' 4. 12'x12' Treated: 30x30m	
-jP	b. Belair	N/A	N/A	1981 (tr) 1982 (co)	1985A 1985A	4	2(20x20 m) 2(10x10 m)		
-jP All	c. Hadash.	N/A	N/A	1981	1985A (1990A)		20 x 20 m	3 areas; in each 1 control, 1 thinned.	

SUMMARY OF ACTIVE THINNING AND OTHER GROWTH STUDIES IN ASPEN
1987

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.*	No. of plots	Plot size (acres)	Method	Treatment Intensity
1 (MS133)	Turtle Mtn. For. Res.	Non telluric mesic clay loam till	11	1948	1953 1960 1965 1971 1976 1981 1986A (1991A)	5	0.2	Regular spacing & alternate strips	Control, no thinning-2 plots Thinned: 5'x5', 7'x7', & 20' alternate strips - 1 plot each
2 (MS155)	Pelly, Sask.	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-2 plots Thinned: to 120, 100, 80, 70, 60, & 50% of SDI of control in 1951 - 2 plots each intensity
3 (MS146)	Riding Mountain National Park	Non telluric mesic clay loam till	14	1950	1960 1965 1971 1976 1981 1986A (1991A)	4	0.1	Regular spacing	Control, no thinning-1 plot Thinned: 8'x8', 10'x10', 12'x12' - 1 plot each
		Telluric mesic silty clay loam till	23	1950	1960 1965 1971 1976 1981 1986A (1991A)	8	0.2	Regular spacing	Control, no thinning-2 plots Thinned: 8'x8', 10'x10', 12'x12' - 2 plots each
4 (MS232)	Porcupine Mtn., Swan River, Manitoba	Non telluric mesic clay loam till	15	1964	1969 1985 Sp. (1989A)	24	0.1	Thinning to regular spacing and pruning	Control, no thinning-12 plots Thinned and Pruned: 12'x12' spacing with 5 pruning treatments

* Planned measurement years are in brackets.

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2. To determine the association, if any, of a specific nutrient fraction with growth.

10. Goals for 1986-87:

1. Publish Journal Articles on the followings:
 - 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.

Added Goal:

4. Soil data (Mercoal), study (4-17) and foliar data, study (4-60) were compiled into a report", An approach to forest fertilization for lodgepole pine in the foothills".

11. Accomplishments in 1986-87:

1. a. "Effects of fertilization on nitrogen shifts and content in the profiles of two Luvisols". This was re-titled, "Fertilization effects on Orthic and Podsollic Gray Luvisols of the foothills", and prepared as a F.M.N.
 - b. Response of a Podsollic Gray Luvisol to urea-nitrogen, was revised and retitled, "Distribution of N in a simulated profile of a Podsollic Gray Luvisol following urea fertilization". The Can. J. Soil Sci. has accepted this paper (in press).
2. Response in a Podsollic Gray Luvisol (Mercoal) to fertilization with three sources of nitrogen. R.C. Yang concluded, after "Anova", that data are inclusive. The entire report was rewritten as "Influence of N source on the distribution of N, P, & S within a Podsollic Gray Luvisol".
3. Advice and guidance on soils problems have been given to those both within and outside the N.F.C.
4. A paper, "An approach to forest fertilization of lodgepole pine in the foothills", was compiled and sent out for review (4-17, 4-60).

12. Goals for 1987-88:

1. Publish FMN on fertilization effects on two luvisols in the foothills. (4-17).

2. Prepare a file report outlining in general terms what was learned from the LP fertilization trials and what R & D should be taken in the future. (4-65)
 3. Publish an Inf. Rpt. on the influence of N source on the distribution of N in a Podsollic Gray Luvisol. (4-60)
 4. Provide advice and guidance to those researchers requiring assistance on soils problems.
 5. Terminate study.
13. Publications 1986-87:
- Baker, J. 1986. "Distribution of N in a simulated profile of a Podsollic Gray Luvisol following urea fertilization". Can. J. Soil Sci. (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 1987-88:
- | | | |
|-------------|---------------|-----|
| PYs: Prof.: | Baker | 1.0 |
| | Tech.: | 0.0 |
| | Total: | 1.0 |
| | Term/Student: | 0.0 |
- O & M: Nil
- Capital: Nil
16. Signatures:

Joseph Baker
Investigator

M. J. [Signature]
Program Director, Resources

C. D. [Signature]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 15, 1987

1. Project: Stand Productivity and Forest Inventory
2. Title: Fertilization and thinning of semi-mature lodgepole pine stands
3. New: Cont: x 4. No: NOR-4-05
5. Study leader: R. C. Yang
6. Key words: Nutrition, fertilizer, thinning, growth
7. Location of Work: Hinton, Alberta; Saskatchewan, Manitoba
8. Problem Analysis:

Although fertilizing has been found to improve lodgepole pine productivity, information on nutrient requirements of this species remains sparse. Knowledge on the mechanism of the species responding to thinning and fertilization treatments is especially limited. A correct diagnosis of nutrient requirements is often cited as a pre-requisite to effective fertilization along with the density control of the stand. The latter is particularly important in young lodgepole pine, which often grows in over-dense stands. Previous study results (NOR-4-04) showed improved diameter and volume growth of two 30-year-old stands after fertilization; stand growth response, however, was obscured by high and variable mortality associated with excessive stand density. This suggests that fertilizer should be applied in combination with thinning to improve stand productivity.

Progress to 1986

The study was initiated in 1984. Seventy-two 0.03-ha circular plots were established and half of plots were thinned; all plot trees were tagged and tallied at establishment. Nitrogen at four levels (0, 180, 360 and 540 kg/ha) along with 40 kg/ha each of P, and S were applied in the fall, 1985. Foliar, ground vegetation, and soils were sampled in 1985 prior to fertilization and 1986 for nutrient analyses. Laboratory analyses of pre-fertilization samples have been completed and 1986 samples are in progress.

9. Study Objectives:

1. To assess the effect of thinning and N fertilization on growth of semi-mature lodgepole pine.
2. To quantify the effect of thinning, fertilization and their combined effects on nutritional status in trees and soils and to establish relationships between tree growth response and nutrient status.
3. To develop a diagnostic technique for fertilizer 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 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 imbalance (4-61).
7. Examine the feasibility of undertaking a professional development leave at an institution with reputation in forest fertilization.
8. Continue to provide advice and carry out technology transfer on mensurational problems relating to forest fertilization (4-18).

11. Accomplishments in 1986-87:

1. A Forest Management Note entitled "Fertilization improves stand productivity of preharvest lodgepole pine" was published.
2. The journal article on fertilization effects on wood density and tracheid length of 70-year-old lodgepole pine was revised and under final internal review.

3. Laboratory analyses of soil, ground vegetation, and foliar samples taken in the fall 1985 have been completed; statistical analyses to determine changes in nutrient status one year following thinning are in progress.
 4. Sampling of soils, ground vegetation, and foliage for determining nutritional and dimensional responses to fertilization and thinning have been completed; nutrient determination of these samples are in progress.
 5. A Forest Management Note entitled "Growth of 25-year-old lodgepole pine after juvenile spacing in western Alberta" was published.
 6. A manuscript on N, P, S ratios in 40-year-old lodgepole pine tissues for the purpose of detecting and correcting nutrient imbalance is under preparation and will be submitted for review shortly.
 7. The proposed professional development leave was postponed until the completion of release spruce from aspen competition study.
 8. Provided advice to outside agencies (AFS) and co-workers in laboratory on problems related to forest fertilization, mensuration, statistical analysis and computing.
12. Goals for 1987-88:
1. Submit the manuscript entitled " Effects of fertilization on wood density tracheid length of 70-year-old lodgepole pine in west-central Alberta" for journal publication (4-15).
 2. Continue sampling for soils, ground vegetation and foliage to monitor nutritional and dimensional changes following fertilization and thinning (4-19).
 3. Complete nutrient analyses on soil, ground vegetation, and foliar samples taken in the fall 1986; conduct statistical analyses on treatment effects and prepare a research note if results warrant publication (4-19).
 4. Prepare a remeasurement plan to assess fertilization studies in bS and jp in Manitoba and Saskatchewan in 1988. (4-40) (4-3SA)
 5. Re-measure and verify 70-year-old lodgepole pine fertilizer results by increment core samples using Solonius method (4-88).
 6. Submit a research note on nutrient status of 40-year-old lodgepole pine needles for journal publication (4-61).
 7. Provide advice and carry out technology transfer on mensurational problems relating to forest fertilization (4-18).

13. Publications 1986-87:

Yang, R.C.; Bella, I.B. 1986. Fertilization improves stand productivity of preharvest lodgepole pine. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note No. 36.

Yang, R.C. 1986. Growth of 25-year-old lodgepole pine after juvenile spacing in western Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note No. 38.

14. Environment 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 1987-88:

PYs: Prof.: Yang 0.5
 Tech.: Lux 0.5
 Total: 1.0
 Term/Student: 0.15

O & M: \$4,000

Capital:

16. Signatures:

W. Yang
 Investigator

[Signature]
 Program Director, Resources

[Signature]
 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 16, 1987

1. Project: Stand Productivity and Forest Inventory
2. Title: Interpretation and mapping (revised).
3. New: Cont.: X 4. No.: NOR-4-06
5. Study Leader: W.C. Moore
6. Key Words: Inventory, ecosystem, remote sensing, mensuration, Alberta Forest Service (AFS), Resource Evaluation and Planning Division (REAP), and Canada Centre for Remote Sensing (CCRS) and Geographic Information System (GIS)
7. Location of Work: Alberta, Saskatchewan, Manitoba, Northwest Territories
8. Problem Analysis:

Forest demand, ecological concerns, remote sensing technologies, and GIS developments to support decision-making 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. CFS remote sensing applications R&D is particularly appropriate for determining optimum means of producing up-to-date area 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 1985

1. The Hardware and software of ENFOR GIS at NoFC has been operationally used to digitize example forest inventory maps from each of the four political jurisdictions within the Region; appropriate stand and stock tables were entered for biomass computations and mapping; and, paper, "Computer mapping for biomass inventories", was presented at the Sixth International Symposium on Automated Cartography in 1983.
2. Initiated a GIS information exchange meeting for regional forest inventory authorities in Prince Albert with Regional Development Program support.

3. 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.
4. Completed ENFOR contract supervision for non-inventoried forest land sampling across the Region, and for prairie forest land area determinations with Landsat imagery.
5. Demonstrated change monitoring techniques with Procom-2 Landsat imagery interpretation and mapping equipment at Alberta and Saskatchewan workshops in Edmonton and Saskatoon, as well as presenting such techniques to Chinese and Russian visitors at NoFC.
6. Job creation through participation as a manager in the Environment 2000 Program provided a supervisor and eight assistants to reproduce Northwest Territories summary forest inventory maps as well as to provide manpower assistance for other projects at AFS and NoFC.
7. Participated as an active member of the CFS Working Group on Remote Sensing and the Alberta Advisory 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 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. (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. (4-57)
4. Participate 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. (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)
11. Accomplishments in 1986-87:
1. Information Report, NOR-X-285, "A Mapping and Analysis of Resources System application" and Forest Management Note, No. 32, "Procom-2 mapping techniques for monitoring forest depletion" have been published, and paper "Mapping of burned forest land in the Northwest Territories" is under review by the Canadian Journal of Remote Sensing.
 2. Consultation with REAP and AFS about the most acceptable representations in Landsat Thematic Mapper imagery of conditions on the ground are continuing.
 3. Numerous communications between the parties involved have highlighted the need for the Procom-2 and Landsat imagery for integration and large-area update mapping purposes. Major portions of four inventory maps within the test area have been experimentally updated; the work and the consultations are continuing.

4. Alberta funding for STAR-1 synthetic aperture radar imagery has not been forthcoming, but an Alberta/CCRS cooperative synthetic aperture radar project should be funded in 1987-88. This is important because it is a basis for a CFS Working Group on Remote Sensing submission to CCRS for participation in the European Space Agency radar satellite program to be launched in the 1990's.
5. Procom-2 interpretation and mapping has progressed, but technical difficulties and now a lack of technical assistance have delayed completion of this goal until FY 1987-88.
6. The "Forestry Report" has been cancelled.
7. Additional advice and services have been provided as follows:
 - a. Scientific Authority services have been provided for a hardwood species differentiation project under the Canada/Alberta Forest Development Agreement;
 - b. CFS HQ has not requested forest inventories on federal lands, but northern lands and wildlife researchers from the Northwest Territories and the Yukon have come to NoFC for consultations on the Procom-2 and Landsat imagery for mapping natural habitats in particular;
 - c. participated as secretary for the CFS SCALE (Site Classification, interpretation, and Land Evaluation) Working Group in August in Grand Prairie, and consulted with representatives of the B.C. Research Council and a B.C. forestry consulting firm who came to Edmonton to test the NoFC Procom-2 for their mapping purposes.
 - d. the Procom-2 and instruction have been provided, and REAP and Wildlife representatives from Alberta have formally requested and used the NoFC Procom-2 for forestry and other mapping purposes;
 - e. the Manitoba Forestry Branch has been provided with advice and examples of forest depletion mapping, and the NoFC Procom-2 has been trucked to Winnipeg for a two-month trial in conjunction with a GIS workshop in Winnipeg;
 - f. served as a member of the Alberta Advisory Committee on Remote Sensing, and actively participated as a member of the Organizing Committee for the Tenth Canadian Symposium on Remote Sensing; and,
 - g. acted as co-host for a CFS Remote Sensing Working Group meeting in Edmonton in May, 1986.

12. Goals for 1987-88:

1. Publish Journal paper, "Mapping of burned forest lands in the Northwest Territories" (W. Moore). (4-58)
2. Provide advisory services, seminars and presentations to clients and colleagues as required on remote sensing and mapping. (W. Moore) (4-51)

3. Prepare a Journal paper on Landsat Thematic Mapper imagery spectral band combinations for interpretation for forestry in the Region. (W. Moore) (4-54)
 4. Compile data for analysis on cutovers from satellite imagery using a HP digitizer and microcomputer combination with the Procom-2 (require technical assistance for digitizing), and analyse data for a Forest Management Note. (W. Moore & R. Hall) (4-56)
 5. Analyse Landsat Multispectral Scanner and Thematic Mapper imagery for Alberta Phase 3 inventory map updating for logging and burns in cooperation with AFS, REAP CCRS and PNFI, and contribute to AFS and REAP reporting for the Whitecourt test area. (W. Moore) (4-57)
 6. Participate in the interpretation and evaluation of synthetic aperture radar imagery in cooperation with the Alberta Remote Sensing Centre, AFS and REAP as their funding permits. (W. Moore) (4-79)
 7. Prepare a journal paper with R. Nesby on mapping parklands with Landsat imagery. (W. Moore) (4-87)
13. Publications 1986-87:
- Moore, W.C. 1986. Procom-2 mapping technique for monitoring forest depletion. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note No. 32.
- Moore, W.C., Chow, W. 1987. A Mapping and Analysis of Resources System application. Can. For. Serv., North. For. Cent., Edmonton, Alta. Info. Rep. NOR-X-285. (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 1987-88:
- | | | |
|-------------|---------------|-----|
| PYs: Prof.: | Moore | 1.0 |
| | Tech.: | 0.0 |
| | Total: | 1.0 |
| | Term/Student: | 0.0 |
- O & M: \$4,500
- Capital: Nil

16. Signatures:

W. Moore
Investigator

[Signature]
Program Director, Resources

A. D. Hunt
Regional Director General

approved, computer-based, low-level aerial camera system for installation onto Bell 206B helicopters has been developed. The computer camera controller itself is now being marketed. Under a formal Agreement, a second \$200 000 camera has been assembled for operational forest inventory use by Yukon NAP. An operations and maintenance manual has been completed. A microcomputer-based photo measurement system has also been constructed which includes an adaptation of the Jena Interpretoscope. The Yukon NAP have an identical system, and have been using it operationally with some of our programs. Extensive software for photo measurements, flight planning, etc. have been written and transferred to client agencies upon request. New multistage sampling and shim size programs have been written. Change detection mapping techniques using Landsat data for tent caterpillar defoliation has been developed, and is now being adapted for operational use by AFS. 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; survey design; 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, classification and monitoring of forest resources in the region, with consideration for integration into Geographic Information Systems.

10. 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)
11. Accomplishments in 1986-87:
1. Yukon NAP camera system assembled, MOT-approved, and operational adjustments in progress. System planned for delivery as per Agreement, before the end of the 86-87 fiscal year. Camera system operations manual completed, and 5-day training course being prepared for presentation in Whitehorse at system delivery. Refinements to NoFC system airborne tested.
- Cooperative LSP paper on "Large-scale black and white and color aerial photographs for the measurement of tree crown areas" presented at 10th Canadian Symposium on Remote Sensing, and reviewed and accepted for publication. Paper on camera control system not written due to above work requirements. Tip/tilt indicator and other capital acquisitions not pursued pending agreement with Canadian Aviation Safety Board. This total goal has utilized 1/3 of Hall p.y. and 1/2 Walsh p.y.

2. Journal paper on Thematic Mapper work still in writing stage due to goal 1. Effort will be made to complete draft by end of 86-87 fiscal year. Goal to be repeated.
 3. Project specifications for Sask. LSP trial completed, contract awarded, and areal stratification in progress. Three trips to PA were made in support of this project. Project is on schedule.
 4. Replacement X-Y digitizer acquired and will be shared with Hydrology. Subroutine written and hardware problems were rectified by student on contract to integrate digitizer to HP system. Version 4 flight planning completed and used in advisory services, in addition will be transferred to Yukon NAP during system delivery. Shim size program, and sample size estimation for 2-stage sampling program written. The latter is in testing prior to application in the Sask. project.
 5. Advice and assistance were provided to clients and colleagues on LSP, image analysis, remote sensing, flight planning, statistics, forest inventory, computer systems, and 9 manuscripts were reviewed. Committee participation provided to 10th Canadian Symposium on Remote Sensing and CFS Remote Sensing Working Group. Alberta Forest Fire History Map publication has completed review, and is with editor for final preparation. Invited to Peer Program Review Board of remote Sensing Project at PNFI. Provided lecture of U. of A. forestry course. Sensing Project at PNFI. Provided lecture to U. of A. forestry course. Information transfer efforts included: Canfor (4/86), Chinese delegation (6/86), Canadian Aviation Safety Board (8, 9/86), Dean R. LeBel- Univ. Moncton (9/86), B. Caldwell-OMNR i/c FRI (10/86), and Itres Res. (11/86).
 6. Interpretation in progress by W. Moore. New digitizer to be utilized for area computations once interpretation has been completed.
 7. Forestry Report cancelled by management committee.
 8. LSP review paper with Spencer (PRUF study) on the status of LSP in Canada has completed 2nd draft review. Manuscript to be submitted to journal review following editorial revision.
 9. Research into MEIS II data is well in progress, and a tentative forestry enhancement has been produced. Instructor at 2 MED Workshops coordinated by CCRS. Work and use of ARIES systems at the Alberta Remote Sensing Center and at PNFI, have been utilized to some 40 man days during a 6 month period from May-Oct. 1986.
12. Goals 1987-88:
1. Camera system activity: maintain contact with Yukon NAP on the operating performance of their LSP camera system. Negotiate 2 hardware refinements on their behalf - terrain profiler and attitude indicator. Complete paper with Syscomp on camera control system and submit to journal. (4-46).
 2. Continue LSP applications work with REAP: complete applications paper on estimating stem dbh from large-scale photos - which parameters and

- and multifilm) to define parameters and adapt a computer-based light meter developed by REAP for low-level flying (possible commercial opportunity once fully developed and tested) (4-84)
3. Submit paper to Journal based on Master's thesis on Thematic Mapper in cooperation with U of A. (4-49)
 4. Continue analysis of MEIS II scanner data of the Whitecourt area for enhancement methodology, and draft cooperative paper with PNFI, CCRS, and REAP. Initiate follow-through work and evaluate for balsam poplar-trembling aspen discrimination. (4-75)
 5. Canada-Sask. Agreement Project LSP regeneration survey: complete interpretation, data analysis, and draft report with recommendations for operational use. (R. Hall & A. Gardner) (4-1SA)
 6. Initiate 2-year pilot project in cooperation with AFS Protection & REAP to establish operational methodology for FTC defoliation. Landsat data products proposed for purchase through Alberta Agreement. (4-85).
 7. Provide advisory services in remote sensing and forest inventory to NoFC clients and colleagues as required (4-51), particularly as follows:
 - a. Continue as member of CFS Remote Sensing Working Group;
 - b. Continue discussions with the Canadian Aviation Safety Board, and negotiate possible formal Agreement for cooperation starting in 1988;
 - c. Complete final phases of Alberta Forest Fire History Maps publication (4-50);
 - d. Cooperate as required with C. Ogilvie (NOR-0502) on joint evaluation with AFS Fire Protection group on Compuheat real time airborne and lab, thermal infrared data processing system for fire applications.
 8. Handle journal reviews of LSP review paper with Spencer (PRUF) (4-74)
 9. Once interpretation completed, compile data and conduct analysis on areas of cutovers from Landsat MSS and TM images using micro combo with Procom-2, and prepare FMN. (R. Hall & W. Moore) (4-56)
 10. Continue to write, update, and modify microcomputer programs for in-house use and for clients in cooperative projects (e.g., 2-stage sampling) (4-47) [comprehensive inf. rep. on programs produced if term or contract position provided].
13. Publications 1986-87:
- Morton, R.T., R.J. Hall, R.K. Nesby, and I. Sutherland. 1986. Large-scale black and white and color aerial photographs for the measurement of tree crown areas. Proc. 10th Canadian Symposium on Remote Sensing. 8 pp. In-press.

Hall, R.J., and T.J. Walsh. 1986. The Yukon and Canadian Forestry Service (CFS) large-scale aerial photo camera system - general description, installation, operation, and maintenance manual. (limited copies). (NOR-0407 File Report).

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 1987-88:

PYs: Prof.: Hall 1.0

Tech.: Walsh 1.0

Total: 2.0

Term/Student: 0.3

additional request 0.5 - 1.0 FO-1 to assist project load (not funded here).

O & M: \$14,000

Capital: \$70,000 PCI micro-based image processing system

16. Signatures:



Investigator


Program Director, Resources



Regional Director General

11. Accomplishments in 1986-87:

1. Manuscript on economic returns from fertilizing in 70- and 30-year-old lodgepole pine is being reviewed.
2. Problem analysis was prepared on the economics of spacing in overdense lodgepole pine and jack pine.
3. Preliminary problem analyses was completed on a variety of silvicultural techniques used in releasing white spruce from trembling aspen competition.

12. Goals for 1987-88:

1. Publish an information report on the economic returns from fertilizing lodgepole pine in 70- and 30-year-old stands. (4-68)
2. Review and publish an information report on economics of spacing in dense naturally regenerated lodgepole pine. (4-69).
3. Provide advise for R&D contract to assess costs of various release treatments for wS from tA. (4-3MA).

13. Publications 1986-87:

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 1987-88:

PYs: Prof.: Ondro 1.0

Tech.: 0.0

Total: 1.0

Term/Student: 0.0

O & M: \$2,000

Capital: Nil

16. Signatures:

Tom ...
Investigator

[Signature]
Program Director, Resources

C. R. ...
Regional Director General

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 white spruce release in terms of potential increase in wood production in mixedwood forests in the region.
3. To assess growth and yield of spruce-aspen mixedwood stands following stand tending treatments and to develop tending techniques to improve productivity of the cover type.

10. 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).

11. Accomplishments in 1986-87:

1. A total of 11 A-13 study plots established in 1954 in the Slave Lake Forest have been located and some crop trees identified.
2. Statistical analysis of white spruce tree and stand growth following release from aspen competition has been completed; a manuscript entitled "Growth response of white spruce to release from trembling aspen competition in spruce-aspen mixedwood forest" has been prepared.
3. A contractual report entitled "The release of white spruce from trembling aspen overstoreys -A review of available information and silvicultural guidelines" was prepared and released by Johnson Forestry Services.
4. Data analysis of growth and yield of wS-tA stands in relation to species mix is in progress.

12. Goals for 1987-88:

1. Continue to relocate A-13 study plots in the Slave Lake area. Re-measure crop trees and conduct analyses to assess growth of

individual tree growth following release from aspen competition (4-72).

2. Revise and publish ms on growth response of white spruce to release from trembling aspen competition in spruce-aspen mixedwood forest (4-63).
3. Continue data analysis of growth and yield of wS-tA stands in relation to species mix and other variables. Prepare ms if results warrant publication (4-31).

13. Publications in 1986-87:

Nil

14. Environment 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 1987-88:

PYs: Prof.:	Yang	0.5
Tech.:	Lux	0.5
Total:		1.0
Term/Student:		0.15

O & M: \$4,000 (Plus \$9,000.00 from Alberta Agreement)

Capital:

16. Signatures:

Investigator

Program Director, Resources

Regional Director General

NOR-5

FIRE MANAGEMENT SYSTEMS AND GUIDELINES

ecosystems in the region, and (g) testing and formulating ecologically sound and economically feasible methods for securing adequate postcut forest reproduction by the use of controlled burning and various supplementary treatments including seed-tree systems, direct seeding and planting. The work is of both fundamental and practical nature.

9. Study Objectives:

1. To determine fire spread and intensity for major fuel complexes under various weather combinations.
2. To assess fire effects in terms of fuel reduction and plant succession over a range of burning conditions.
3. To establish guidelines for rational uses of fire in manipulation of various fuel combinations.
4. To assist fire control agencies in application of the resulting guidelines.

10. Goals for 1986-87:

1. Conclude publication of an Information Report on "Fire behavior and effects in semimature 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)

Added Goals:

10. Prepare and submit for review a Forest Management Note on "Evaluation of postburn seeding of jack pine in central Saskatchewan".
11. Prepare a paper on "Study Area Synopsis NOR-5-01" for submission to the Regional Technical Subcommittee on Forest Fire Research.

11. Accomplishments in 1986-87:

1. The Information Report on "Fire behavior and effects in semimature jack pine stands, central Alberta" is in preparation.
2. The journal article on "Slash burning under seed trees to induce jack pine regeneration on an upland cutover site in central Saskatchewan" was prepared, revised, and resubmitted for publication.
3. The Information Report on "Development of forest regeneration on burned, planted, and seeded clear-cut areas in central Saskatchewan" was prepared and is under second review.
4. The journal article on "Regressions between the standard moisture codes and the actual moisture contents of forest-floor fuels on a jack pine clear-cut site in central Saskatchewan" was prepared and is ready for review.
5. The journal article on "Dimensional metric classification and dry-weight regression equations in jack pine biomass studies, central Alberta" is in preparation.
6. The journal article on "Dry-weight regression equations for dimensionally categorized biomass of six understory shrub species, central Alberta" is in preparation.
7. The journal article on "Regressions between the standard moisture codes and the actual moisture contents of forest-floor fuels in undisturbed forest stands of four different types, central Alberta" is in preparation.
8. The microclimatic differences between the open and four undisturbed forest stands were analyzed in central Alberta.
9. (a) On request, provided advisory services, and also critically refereed or otherwise reviewed papers for publication by various authors (six manuscripts).
 - (b) Translated a Polish journal article re. tuberculin testing of various ungulates.
 - (c) Gave an illustrated talk re. "Various uses of fire in regeneration silviculture" during (April 10, 1986) CIF Meeting in Prince Albert, Saskatchewan. This presentation was followed by a one-day field excursion to view some of the successful earlier trials of burning and other treatments on cutover areas northwest of Candle Lake, Saskatchewan.

- (d) Attended a meeting (Nov. 12-14, 1986) of the Regional Technical Subcommittee on Forest Fire Research in Edmonton, Alberta.
10. The Forest Management Note on "Evaluation of postburn seeding of jack pine in central Saskatchewan" was prepared, reviewed and published.
 11. The paper on "Study Area Synopsis NOR-5-01" was prepared and distributed among members of the Regional Technical Subcommittee on Forest Fire Research.
12. Goals for 1987-88:
1. Conclude publication of a journal article on "Slash burning under seed trees to induce jack pine regeneration on an upland cutover site in central Saskatchewan". (5-42)
 2. Conclude publication of an Information Report on "Development of forest regeneration on burned, planted, and seeded clear-cut areas in central Saskatchewan". (5-43)
 3. Conclude publication of a journal article on "Regressions between the standard moisture codes and the actual moisture contents of forest-floor fuels on a jack pine clear-cut site, central Saskatchewan". (5-8)
 4. Complete preparation and submit for review a journal article on "Metric roundwood classification, and dry-weight regression equations in jack pine biomass studies, central Alberta". (5-3)
 5. Complete preparation 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)
 6. Complete preparation and submit for review an Information Report on "Fire behavior and effects in semimature jack pine stands, central Alberta". (5-4)
 7. Complete preparation and submit for review a journal article on "Regressions between the standard moisture codes and the actual moisture contents of forest-floor fuels in undisturbed forest stands of four different types, central Alberta". (5-44)
 8. If time permits, commence a report on "Microclimatic differences between the open and four different forest stands in central Alberta". (5-54)
 9. As always, provide advisory services as required. (5-26)
13. Publications in 1986-87:
1. Chrosciewicz, Z. 1986. Foliar heat content variations in four coniferous tree species of central Alberta. Can. J. For. Res. 16:152-157.

2. Chrosciewicz, Z. 1986. Foliar moisture content variations in four coniferous tree species of central Alberta. Can. J. For. Res. 16:157-162.
3. Chrosciewicz, Z. 1987. Evaluation of postburn seeding of jack pine in central Saskatchewan. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note No. 41.

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 1987-88:

PYs: Prof.:	Chrosciewicz	1.0
	Tech.:	0.0
	Total:	1.0

Term/Student:

O & M: \$500.00

Capital:

16. Signatures:

L. Chrosciewicz
Investigator

J.M. Powell
Program Director, Extension

C. R. Street
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 11, 1987

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. Problem:

Each year fire starts number at least 2000 in the prairie provinces and Northwest Territories. Many of these fires become unmanageable resulting in costly suppression and mop-up activities. The objective of this study is to improve fire detection, surveillance and suppression methods. It is oriented towards the immediate needs and requests of the client agencies and so provides an excellent opportunity to improve operations which will reduce total fire losses and minimize fire suppression costs.

Many of the results achieved in this study have already been implemented, and the prospects of further findings being put to practical use are excellent.

The following general course of action is being followed:

1. Discussion with respective user agencies to define and outline the problems to be solved.
2. On-site evaluations of existing installations and analysis of available data.
3. Formulation of objectives.

4. Design of new systems or modification of existing systems in order to achieve optional returns under given local conditions and accepted restraints.
5. Assistance to user agencies during implementation including solving day-to-day problems that have a bearing on systems design and operation.

9. 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.

10. 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)

11. Accomplishments in 1986-87:

- 1 & 2 There were no retardant tests or lightning fire origin data collection due to the necessary time being allocated to the Manitoba detection study. A Forest Fire News article describing the procedure and preliminary findings of the lightning fire study in Saskatchewan has been submitted.
3. The AGA Thermovision has been combined with a video system and timer to document fire spread. This system was initially tested on an experimental fire at Big Fish Lake in August 1986. The concept shows promise for studying the acceleration phase of fire growth as well as the steady growth phase. This goal is being conducted in cooperation with study NOR-5-05 and should provide that study with useful fire behavior data.
4. Preliminary examinations of two video digitizer and analyzer systems were made. These systems make it possible to do a number of things with a video picture including density slicing, area and distance measurements, overlaying and other manipulations. A demonstration was arranged for one of the systems at NoFC which was well attended by CFS personnel and representatives from the AFS and Arbor Wildland Management services. When combined with an infrared sensor these systems could prove very useful for fire detection, surveillance and analyses. With other sensors such as ultraviolet, and visible light it is possible to detect subtle differences in vegetation cover and terrain characteristics that are not visible to the naked eye. Steps were taken to evaluate two new infrared scanners, one a FLIR type and the other a line scanner. Both of these are reported to be very sensitive with wide fields of view (FLIR resolution 1.73 mRad, field of view 38°; Line scanner resolution equal to the FLIR, field of view 100°) and are compatible with the digitizer analyzer.

This goal is being conducted in cooperation with study NOR-04-07 with the idea of expanding the scope of both studies.

5. The forestry report series of publications was cancelled. An Information Report on the 1985 Daedalus line scanner trials was written and is being reviewed.
6. This goal was changed from the Saskatchewan forest fire detection system to the Manitoba forest fire detection system.

The field work to map the visible areas of 34 towers was completed and the office work is underway. This work is an essential component of an analyses of the Manitoba detection system being undertaken by Arbor Wildland Management Services under contract with the province of Manitoba.

7. Field trials of the Daedalus line scanner were conducted near High Level. A report on the trials will be published by the Alberta Forest Service and is in the preparation stage.
8. Provided technical services and liaison as follows:
 - a) Field checked and mapped one Saskatchewan fire tower.
 - b) Conducted a 3 acre controlled burn at the Clifford E. Lee Nature Sanctuary, near Edmonton.
 - c) Managed the purchase and licensing of 11 two-way radios for the NoFC.
 - d) Reviewed an information report manuscript.
 - e) Involved in obtaining DOT approval to mount the CFS scan extender on the Alberta Government Services Bell 222 Helicopter.
 - f) Conducted a preliminary test to compare the scan extender/AGA combination with the Daedalus line scanner.
 - g) Provided advise and information on a number of occasions to the Manitoba and Saskatchewan Agreement fire specialists.
 - h) Participated in the Regional Technical Subcommittee meeting.

12. Goals for 1987-88:

1. Co-author report with AFS on 1986 field tests on Daedalus line scanner. (C.J.O.) (5-104)
2. Act as technical representative for detection study contracts of Manitoba and Saskatchewan. (C.J.O.) (5-105)
3. Complete production visible area maps for 34 Manitoba fire towers. (C.J.O.) (5-102)
4. Continue to collect lightning fire origin data to be used for supporting the lightning fire prediction model. Conclude the publication of the Forest Fire News note "Some observations on lightning fires in Saskatchewan forests". (C.J.O.) (5-17)
5. Monitor and assess new developments and technology break throughs that can be implemented directly or adapted for use in forest fire detection, surveillance and analysis. This goal will be conducted in cooperation with R. Hall (NOR-04-07). (C.J.O.) (5-16)
6. Adapt and test the suitability of available water misters for fire suppression. (C.J.O.) (5-103)
7. Provide technical services and training to client agencies. (C.J.O., R.J.B.) (5-26, 5-56)

13. Publications 1986-87:

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 1987-88:

PYs: Prof.: Barney 0.3

Tech.: Ogilvie 1.0

Total: 1.3

Term/Student: 0.0

O & M: \$5,000

Capital: Nil

16. Signatures:


Investigator


Program Director, Extension


Investigator


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 11, 1987

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: Vice Delisle, 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. Problem:

Within broad climatic limitations, fire has been the most important single, natural influence on vegetation throughout the region for about the past 10,000 years. Areal and temporal patterns of burning have varied along with fire intensity. Fire has played a significant role in influencing the physical-chemical environment; in regulating dry-matter accumulation; in controlling plant species and communities, in determining wildlife habitat patterns and populations; in controlling forest insects, parasites, fungi, etc.; in controlling major ecosystem processes and characteristics such as nutrient cycles and energy flow, succession, diversity, productivity and stability. The "natural" fire regime has been obscured by man's intervention and the long-term consequences of fire suppression are now becoming clear.

Resource management problems are developing which require an understanding of the historical role of fire, the effects of fire on a variety of landscapes, the alternatives available to resource managers and approaches required to implement alternatives.

9. 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.

10. 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)

11. Accomplishments in 1986-87:

1. Completed M.Sc Forestry thesis and submitted two papers on forest fuels physical properties for Jasper National Park, related to the Master's thesis for publication. A contract to document and summarize the study material for Parks Canada is underway. (5-63)
2. The publication "Forest fire history maps of Alberta, 1931 to 1983" by G.P. Delisle and R.J. Hall is in the final stages of the publication process. (5-27)
3. Paper entitled "Forest fire history maps of Alberta: 1931-1983" presented at "IV International Congress of Ecology" in Syracuse, NY. (5-27)
4. Provided advisory services to National Parks with emphasis on management guidelines. (5-61)
5. Turned Nahanni data over to Dennis Dubé for completion of report which is expected by March. (5-38)
6. Draft of first Pukaskwa National Park report prepared and being reviewed by GLFC. (5-24)

12. Goals for 1987-88:

1. Complete publication of two papers based on M.Sc. thesis, (a) Biomass regression equations for common shrubs and tree seedlings native to Jasper, (b) Quadratic mean diameter and specific gravity values for tree species native to Jasper. (R.B.) (5-63)

2. Completion of a personal service contract with Gilles Delisle to prepare existing data summaries for use by Parks Canada. (R.B.) (5-63)
3. Enter into an agreement with Dr. Paul Woodard to use Jasper National Park fire fuels data for additional analysis and publish a report. (R.B.) (5-63)
4. Evaluate the position of study NOR-5-03 and make formal recommendations regarding its future. (R.B.) (5-111)
5. Complete report on Pukaskwa National Park fire history and ecology study. (M.E.A.) (5-24)
6. Resample permanent plots, Vermilion Pass fire, Kootenay National Park. (R.B.) (5-47)

13. Publications 1986-87:

Delisle, G.P. 1986. Physical components and Biomass Regression Equations required for Fuel Quantification of Forest Stands in Jasper National Park, Alberta. Univ. of Alberta, Edmonton, Alta. MSc Thesis 90 p. Illus.

Delisle, G.; R.J. Hall. 1986. Forest fire history maps of Alberta: 1931-1983. (Ab.). pp. 130-131 In Program of the IV Int. Cong. of Ecology; Syracuse, N.Y., Aug. 10-16, 1986.

Delisle, G.P.; R.J. Hall. 1987. Forest fire history maps of Alberta, 1931 to 1983. Can. For. Serv., North. For. Cent., Edmonton, Alta. (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 1987-88:

PYs:	Prof.:	vice Delisle	1.0	(S.T.E.P. Dr. S.G. Pickford 0.75)
		Barney	0.1	
	Tech.:		0.0	
	Total:		1.1	
	Term/Student:		0.0	

O & M: \$2,000

Capital:

16. Signatures:

Investigator

Richard Baaney

Investigator

J. M. Powell

Program Director, Extension

C. D. Hunt

Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 11, 1987

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. Problem:

Fire management is becoming more complex every day. Increasing costs, changing values, higher risk or well or host of other factors make any fire management decision difficult at best. At the same time we are entering into an electronic age to support management operations and decision. It becomes continually important that we develop processes and support to integrate new fire research outputs, developing management science, and electronic processes into workable, friendly programs and packages for management application.

The application and integration of management science techniques such as numerical models (i.e., simulation and gaming), expert systems and artificial intelligence management emphasizes the development and technology transfer components of the innovation (research) process. Fire management needs computerized decision-aids, data base management structures and/or systems and associated technology transfer documents to operate effectively in today's environment.

Expert systems software packages for fire and natural resource management are needed to aid resource managers with their day to day decision making. These systems must integrate factual information now being derived from numerical models like the FWI and FBP systems with the knowledge and "expertise" of fire managers. These systems will add a new layer of

information into the computer assisted decision process and will provide better human-machine interfaces. Future expert systems will also automate the learning process, however such systems are probably 10 years away at this time.

9. 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.

10. 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)

Added Goal:

7. Present paper at a Missoula, Montana meeting on "Knowledge-based systems".

11. Accomplishments in 1986-87:

1. a) No AES data entered this year
 - Sask. - 2 stations completed
 - NWT - no data entered this year; 10 stations now complete.
 - Man. - no progress this year; 5 completed
 - Alta. - Cypress Hills provincial park data entered.
2. Limited progress due to academic development leave.
3. Deferred for 1-2 years pending additional modification of FWI/PC program.
4. A users help program prepared and placed on program disk as an integral part. Program FWI/PC also updated.
5. Some efforts accomplished including preparation of additional data, analysis continuing.
6. Development leave started in January 1986 at University of Washington.
7. Presented paper on knowledge-based systems in Missoula, Mont.

12. Goals for 1987-88:

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. Prepare 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 until June 1987 at the University of Washington to obtain a Master's degree in fire operations research. [B.L.] (5-87)
7. Develop and initiate coop study using artificial intelligence and expert system techniques in the areas of:
 - a) Automatic Dispatching
 - b) Prescribed fire
 - c) Mountain fire behavior

These studies are to be operated under federal/provincial agreements with Alberta, Saskatchewan and Manitoba. The NWT will also be included in these activities (B.L.) Assistance in these studies will be provided by Dr. S.G. Pickford under the S.T.E. Program. (5-109)

8. Establish visiting scientist opportunity as an adjunct to fire management system efforts (B.L.) (5-110)
 9. Complete field work and first draft of M.Sc thesis on chosen topic. (B.L.) (5-87)
13. Publications 1986-87:

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 1987-88:

PYs: Prof.: Lee	0.9	(Developmental Leave until July/87; 0.1 in Agreement NOR-36-01-3)
Tech.: Smith	1.0	
Total:	1.9	
Term/Student:	0.0	

O & M: \$5,000.00

Capital: Nil

15. Signatures:

Brian L Lee
Investigator *L. Robinson*

J. M. Powell
Program Director, Extension

A. D. Hunt
Regional Director General

9. 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.

10. 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 CFS 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.]

11. Accomplishments in 1986-87:

1. A draft FMN manuscript "Relationship between the Fine Fuel Moisture Code and the Cladonia Fire Hazard Index" will be submitted for review in early March.
2. a) Attended two working sessions of the CFS Fire Danger Group in 1986, primarily to work on the fuel consumption and frontal fire intensity components of the FBP System: Apr. 28-May 2, CIFFC, Winnipeg, [M.E.A.] Nov. 24-Dec. 2, PNFI, Chalk River [M.F.A. &

- R.S.M.]. All fuel consumption data on file at NoFC has now been incorporated into the FBP System data base and the conceptual framework for the fuel consumption and frontal fire intensity components as well as the associated computer programs has been developed. In addition, the introduction and overall design of the CFFDRS Users' Guide binder has been completed.
- b) Tables for estimating the area and perimeter length of elliptical shaped fires originating from a point ignition in FBP System fuel types have been prepared for limited distribution (see Alexander 1986a).
 - c) Representative photographs of FBP System fuel types in Alberta and the Northwest Territories were taken at several locations in 1986. [M.E.A. & M.E.M.]
3. The manuscript "Fire Behavior in the Black Spruce - Lichen Woodland: the Porter Lake Project" will be reviewed in mid March by the CFS Fire Danger Group. [M.E.A.]
 4.
 - a) Chaired the annual business meeting and coordinated the third scientific and technical seminar (four presentations) of the Western Region Fire Weather Committee (WRFWC) held Feb. 4 at the Atmospheric Environment Service's (AES) Western Region office in Edmonton. Compiled/edited seminar proceedings (see Alexander 1986b) and meeting minutes. [M.E.A.]
 - b) Served as an instructor at the Alberta Forest Service (AFS) "Mountain Fire Workshop" held Feb. 25-27 at the Alberta Forest Technology School (AFTS) Hinton (topic: CFFDRS Applications). [M.E.A.] NEC PC-8201A portable computer programs for the FWI System and FBP System were demonstrated at the workshop [R.S.M.]
 - c) Coordinated the third scientific and technical seminar (four presentations) of the Central Region Fire Weather Committee (CRFWC) held Apr. 3 at the AES's Central Region office in Winnipeg. Co-authored one of the seminar papers dealing with a case study of a wildfire in Saskatchewan (see De Groot and Alexander 1986). Compiled/edited seminar proceedings (see Alexander 1986c). Attended the CRFWC Technical Subcommittee meeting held in conjunction with the seminar. [M.E.A.]
 - d) Served as instructor at the fifth annual AFS Advanced Fire Behavior Course held at AFTS in Hinton on Apr. 8-11 (topics: chemistry & physics of forest fires, CFFDRS, extreme fire behavior: 1968 Lesser Slave Lake Fire, and fire behavior estimation: FBP System mechanics). [M.E.A.]
 - e) Co-authored a paper published in the proceedings of the 18th IUFRO World Congress concerning the adaptation of the CFFDRS in Alberta as an example of successful technology transfer (see Kiil, Quintilio, and Alexander 1986).

- f) Further work required on the fourth edition of the Canadian Committee on Forest Fire Management's glossary of forest fire management terms on several occasions during 1986 (see Merrill and Alexander 1987).
- g) Manuscript illustrating the uses of the FWI seasonal severity ratings, co-authored with AFS meteorologists, was revised and published in the December 1986 issue of the Forestry Chronicle (see Harvey, Alexander, and Janz 1986).
4. h. Reviewed the following manuscripts in 1986 [M.E.A.]:
- Forest fire and Pinus banksiana regeneration in eastern Ontario (journal article) by M.G. Weber, S.L. Hummel, and C.E. Van Wagner.
 - Fire behavior in immature jack pine (Can. J. For. Res.) by B.J. Stocks.
 - Fire potential in the spruce budworm-damaged forests of Ontario (For. Chron.) by B.J. Stocks.
 - Examples of Canadian Forest Fire Behavior Prediction System fuel types in Saskatchewan (CFS poster) by W.J. De Groot.
 - Incorporated mineral soil affects the moisture limits of smoldering duff consumption (Can. J. For. Res.) by W.H. Frandsen.
 - Ignition patterns and prescribed fire behavior in southern pine forests (South. J. Appl. For.) by R.W. Johansen.
 - Development and structure of the Canadian Forest Fire Weather Index System (CFS For. Tech. Rep.) by C.E. Van Wagner.
 - Forest Fire History Maps of Alberta: 1931-83 (NoFC misc. publ.) by G.P. Delisle and R.J. Hall.
 - Some observations on Lightning Fires in Saskatchewan Forests (Forest Fire News) by C.J. Ogilvie.
- i. Served as scientific authority on CFS-HQ PRUF (Program of Research by the Universities in Forestry) sponsored project "Climatology of Atmospheric Conditions Related to Extreme Forest Fire Behavior in West-central and Northern Canada" being undertaken by the Meteorology Division, Department of Geography, University of Alberta (Principal Investigator: Dr. E.R. Reinelt). [M.E.A.]
- j) Participated in the organization and planning of the Regional Technical Subcommittee on Fire Research meeting held at NoFC on Nov. 12-14. [M.E.A.] Prepared background paper summarizing past, present and proposed study activities for distribution at meeting. [M.E.A. & R.S.M.]

- k) Served as instructor at CFFDRS Course, organized by the CFS Saskatchewan District Office, held in Prince Albert on Jan. 15-16, Jan. 22-23, and Feb. 4-5 (topics: Fire Growth Calculator use, FWI System table calculations, FBP System introduction & overview). [R.S.M.]
5. The draft manuscript on "Spring Fires in a Semi-mature Trembling Aspen Stand, Central Alberta" will be submitted for review by late March. [M.E.A.]
6. The majority of the fieldwork associated with the Big Fish Lake experimental burning project took place between July 2 - Aug. 5. Three experimental line source fires were successfully conducted and documented in spite of the above normal precipitation in July (head fire ROS: 4 to 10 m/min). In addition, a trial attempt at a point ignition fire was undertaken to test proposed documentation techniques. Remaining preburn fuels description of the study area was also completed. Other permanent CFS fire research staff participating in the project included: M.E. Maffey (NoFC), W.J. De Groot (SDO), B.D. Lawson (PFC), B.J. Stocks (GLFC), and G.R. Hartley (GLFC). [M.E.A. & R.S.M.]

A progress report on the Big Fish Lake Project was presented at the Third WRFWC Scientific and Technical Seminar held in Edmonton on Feb. 4. The accompanying paper summarizes the fuel complex characteristics for the study area, fire behavior characteristics and associated burning conditions of the nine experimental fires conducted to date, etc. (see Alexander and McAlpine 1986).

7. All of the references have been annotated and an outline for the introductory sections of "Twenty-five Years of Canadian Forestry Service Fire Research in the Prairie Provinces and Far North: 1962-1986: An Annotated Bibliography" has been completed. A draft copy of the manuscript suitable for limited distribution was made available for the Regional Technical Subcommittee on Fire Research meeting held in Edmonton on Nov. 12-14. [M.E.A. & R.S.M.]
8. An NoFC Forest Management Note (No. 35) entitled "Forest Fire Growth Calculator" was published in June 1986 (see McAlpine 1986a). Refer to Item 4.k regarding training. [R.S.M.]
9. A draft manuscript dealing with two BASIC computer programs for the FWI System and FBP System has been reviewed and is with the editor for final editing prior to publication as a NoFC Forest Management Note. A file report has also been prepared (see McAlpine 1986b). Several copies of the two programs suitable for use with the NEC PC-8201A and IBM-PC have already been distributed to the client agencies within Western & Northern Region. [R.S.M.]
12. Goals for 1987-88:
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 project of the CFS national fire danger working group associated with the maintenance and development of the CFFDRS. [M.E.A. & R.S.M.] (5-30)
3. Publish Inf. Rep. on "Fire behavior in the black spruce-lichen woodland fuel complex: the Porter Lake Project, NWT". [M.E.A.] (5-31)
4. Continue to provide advice and services with respect to fire danger and fire behavior rating as required, including serving on the Central and Western Region Fire Weather Committees. [M.E.A. & R.S.M.] (5-32)
5. Publish Inf. Rep. on "Spring fires in a semi-mature trembling aspen stand, central Alberta". [M.E.A.] (5-67)
6. Complete fieldwork associated with experimental burning project in the lowland black spruce fuel type and begin to analyze data for publication. [M.E.A. & R.S.M.] (5-72) Continue data acquisition on the acceleration of point source fires to equilibrium spread from ignition and use for M.Sc. thesis project (see 5-100 under Study NOR-5-06). [R.S.M.] (5-92)
7. Publish Inf. Rep. "Annotated bibliography of 25 years of CFS fire research in the prairie provinces and NWT". [M.E.A. & R.S.M.] (5-75)

13. Publications 1986-87:

- Alexander, M.E. 1986a. Fire area and perimeter length tables for Canadian Forest Behavior Prediction System fuel types. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 13. 20 p.
- Alexander, M.E. (compiler & editor). 1986b. Proceedings of the third Western Region Fire Weather Committee scientific and technical seminar (Feb. 4, Edmonton, Alta.). Govt. Can., Can. For. Serv., West and North Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 15. 49 p.
- Alexander, M.E. (compiler & editor). 1986. Proceedings of the third Central Region Fire Weather Committee scientific and technical seminar (Apr. 3, Winnipeg, Man.). Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. study NOR-5-05 (NOR-5-191) File Rep. No. 16. 62 p.
- Alexander, M.E.; McAlpine, R.S. 1986. Fire behavior in the black spruce-Labrador tea-Cladonia fuel complex: the Big Fish Lake Project ... a progress report. Pages 31-46 In Proc. Third West. Reg. Fire Weather Comm. Sci. and Tech. Seminar (Feb. 4, Edmonton, Alta.). Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 15.

- De Groot, W.J.; Alexander, M.E. 1986. Wildfire behavior on the Canadian Shield: a case study of the 1980 Chachukew Fire, east-central Saskatchewan. Pages 23-45. In Proc. Third Cent. Reg. Fire Weather Comm. Sci. and Tech. Seminar (Apr. 3, Winnipeg, Man.). Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 16.
- 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(6):507-513.
- Kiil, A.D.; Quintilio, D.; Alexander, M.E. 1986. Adaptation of a national system of fire danger rating in Alberta, Canada: a case study in technology transfer. Pages 410-421. In Proc. 18th IUFRO World Congress (Sept. 7-21, Ljubljana, Yugoslavia), Division 6: General Subjects.
- McAlpine, R.S. 1986a. Forest fire growth calculator. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note No. 35. 8 p.
- McAlpine, R.S. 1986b. LAPFWI and LAPFBP - User's guide and program listing. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191). File Rep. No. 14. 32 p.
- Merrill, D.F.; Alexander, M.E. (editors). 1987. Glossary of forest fire management terms. Fourth edition. Natl. Res. Council. Can., Can. Comm. For. Fire Manage., Ottawa, Ont. Publ. NRCC No. 26516. [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 1987-88:

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

O & M: \$13,000

Capital: \$15,000

16. Signatures:

88

Martin E. Alexander
Investigator

J. M. Powell
Program Director, Extension

R. M. [unclear]
Investigator

A. D. [unclear]
Regional Director General

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 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)

Added Goals:

5. Complete a Research Methods in Forestry course at the University of Alberta. (R.S.M.)

11. Accomplishments in 1986-87:

1. Conducted a mail survey of potential prescribed fire users from all agencies within the region to determine use, and research needs. Results processed and documented as a file report and distributed to participating agencies. (5-93)
2. No progress to date. (5-94)
3. Attended meeting of the CFS Prescribed Fire Effects Working Group (Prince George, B.C., April 10-11). Presentations were made by all members on ongoing research and the state of prescribed fire use within their respective regions. (5-101)
4. a. Attended Prince George Fire Management Symposium on April 7-9 in Prince George, B.C.

- b. Acted as reviewer on the manuscript:

Evaluation of Post Burn Seeding of Jack Pine in Central Saskatchewan. (For. Manage. Note.) Z. Chrosciewicz.

- c. Provided advice on inventory of windrowed fuel to W. Kerr (Champion Forest Products, Hinton, Alberta).
- d. Toured the Prescribed fire sites within Banff National Park with C. White (Parks Canada) April 22.
- e. Meet with J. Skrenek and T. Van Nest (Alberta Forest Service) concerning the structure of an Alberta Forest Service Prescribed Fire Manual and the formation of a group of user agencies within the province to discuss the development of the manual. (5-26)
5. Completed FOR 500 - Research Methods in forestry at the University of Alberta.

12. Goals for 1987-88:

1. Continue work on a fuels documentation and prescription preparation handbook in conjunction with agency prescribed fire handbooks. (R.S.M.). (5-93)
2. Participate in cooperative projects of the CFS Prescribed Fire - Fire Effects working Group. (R.S.M.). (5-101)
3. Commence development leave in September to obtain a masters degree in fire research at the University of Montana. (R.S.M.) (5-100)
4. Provide advice and services with respect to prescribed fire. (R.S.M.) 5-26)

13. Publications 1986-87:

McAlpine, R.S. 1986. Northern and western Region prescribed fire survey results. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-06 File Rep. No. 1. 7 p. + App.

14. Environmental Implications:

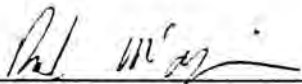
The NoFC Environmental Screening Committee has evaluated the proposed study activities. On the basis of information provided by the study leader, the committee concludes that these activities are not potentially detrimental to the environment.

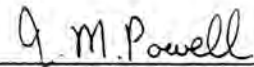
15. Resources 1987-88:

PYs: Prof: McAlpine 0.5
Tech: 0.0
Total: 0.5
Term/Student: 0.0

O & M: \$2,000
Capital: Nil

16. Signatures:


Investigator


Program Director, Extension


Regional Director General

3. To promote the fire research program within the prairie provinces and NWT as well as nationally.
4. To develop support and cooperation for fire research programs through a wide array of activities processes and action.

10. Goals for 1986-87:

(Goals transferred from Studies NOR-5-02, NOR-5-03)

1. Provide advisory services to National Parks with emphasis on the management guidelines. (R.B.) (5-61)
2. Supervise and coordinate the regional fire research program. (R.B.) (5-59).
3. 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) (5-59)
4. Prepare regional fire research strategy, including integration of studies under the Forestry Development Agreements and Memorandums of Understanding. (R.B.) (5-78)
5. Conduct regional fire research technical subcommittee meeting. (R.B.) (5-78)
6. Participate, as federal representative on NWT Fire Management Committee. (R.B.) (5-80)
7. Develop cooperative relationships and studies with University of Alberta and other Canadian universities as appropriate. (R.B.) (5-99)
8. Make presentations at academic institutions throughout the year as appropriate. (R.B. and others) (5-99)

11. Accomplishments in 1986-87:

1. Provided input to Banff and Jasper National Park and Western Region fire personnel on several occasions. Reviewed fire programs with the Western Region fire coordinator. (5-61)
2. Provided direction and supervision to programs throughout the year.
 - a) Provided guidance and personnel support in Manitoba/federal agreement detection study and contract.
 - b) Initiated proposal for University of Alberta under PRUF for public production study which resulted in a grant.
 - c) Initiated a proposal to Alberta under the provincial/federal agreement which resulted in a series of fire management studies.

- d) Conducted a research needs field analysis throughout the prairie provinces and NWT in preparation of the development of a project strategic plan.
 - e) Prepared and presented an invited paper entitled "The urban-rural wildfire challenge in the Prairie Provinces and Northwest Territory of Canada -- A problem overview" at the IUFRO meeting in Ljubljana, Yugoslavia. This paper also involved a cooperative effort of all regional agencies. (5-59)
 - f) Attended the CCFFM meeting in Halifax.
3. Continued technology transfer and related activities:
- a) Made numerous contacts throughout the region at all levels discussing problems and needs as well as providing input or appropriate.
 - b) Attended the Society of American Forestry Meeting in Birmingham, Alabama as a member of the National forestry Sciences Board also participated in the national fire working group session of the S.A.F.
 - c) Attended fall fire conference of Alberta Forest Service and made a presentation on our fire research program. (5-26)
4. Continued development of a fire research strategies for the present through study and management input from all levels. (5-78)
5. Prepared and conducted a very successful regional fire research technical subcommittee meeting in Edmonton with the aid of all project personnel. (5-79)
6. No meetings held this year. (5-80)
7. Continued work on expanding university relationships. Met with Dr. Murphy and Dr. Woodard on several occasions. Progress is continuing along these lines. Provided fuel data for additional analysis by a graduate student (see NOR-5-03, goal 3). Expect more explicit elements to evolve next year. (5-99)
8. Presented several classes and lectures at the University of Alberta and Forest Technology School in Hinton. (5-99)
12. Goals for 1987-88:
- 1. Provide advisory services to National Parks with emphasis on the management guidelines. (R.B.) (5-61)
 - 2. Supervise and coordinate the regional fire research program including that by the Fire Specialists in the District Offices. ((R.B.) (5-59)

3. Continue to provide technology, participation on committees, task forces etc. aimed at improving the protection and use of Canada's forests through efficient fire management. (R.B.) (5-26)
4. Prepare regional fire research strategy, including integration of studies under the Forestry Development Agreements and Memorandums of Understanding. (R.B.) (5-78)
5. Conduct regional fire research technical subcommittee meeting. (R.B.) (5-79)
6. Participate, as federal representative on NWT Fire Management Committee. (R.B.) (5-80)
7. Develop cooperative relationships and studies with University of Alberta and other Canadian universities as appropriate. (R.B.) (5-99)
8. Make presentations at academic institutions throughout the year as appropriate. (R.B. and others) (5-99)
9. Provide technical services and training to client agencies. (R.B. and others) (5-56).
10. Provide guidance and assistance to forest economist for studies in fire management economics. (see NOR-03-03) (R.B. and others) (5-112)

13. Publications 1986-87:

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 1987-88:

PYs:	Prof: Barney	0.6
	Tech:	0.0
	Total:	0.6
	Term/Student:	0.3

O & M: \$3,500

Capital:

16. Signatures:

Richard Barney
Investigator

G. M. Powell
Program Director, Extension

C. D. Hunt
Regional Director General

NOR-7

ENVIRONMENTAL EFFECTS OF TOXIC SUBSTANCES
AND VEGETATION MANAGEMENT

plant materials in the CFS Acid Rain-National Early Warning System (AR-NEWS) is essential to assure that any possible effects of acid deposition on the forest are detected.

9. Study Objectives:

1. Advise and contribute to the establishment and sampling of AR-NEWS plots in the region and coordinate the preparation and analysis of samples with FIDS (NoFC and PFC).
2. Provide consultative and advisory services to government agencies, industry, and the public on environmental concerns in relationship to acid deposition (air pollution), herbicides, uranium mining, and Northern development.
3. Describe and assess changes in the forest ecosystem as a result of two sour gas processing plants in west-central Alberta by (i) completion of a five year biomonitoring study and (ii) determination of the effects of elemental sulfur deposition on various soil processes.

10. 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)
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 will be presented at a workshop on acid deposition in Calgary, May 1 986. (Carried over from 1985-86, Maynard)
3. Publish a journal article entitled "Effects 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 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 Effects 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)

Added Goals:

16. Attend a workshop on "Soil Acidification Monitoring Workshop" and lead discussion on the topic of quality assurance and interlab comparison May 12, 1986 in Calgary, Alberta.
17. Invited to participate on the Analytical Methods Selection Working Group in Terrestrial LRTAP studies (working group of the Quality Assurance Subgroup of the Research, Monitoring and Coordinating Committee). Plan and coordinate a workshop of the LRTAP Terrestrial Monitoring Quality Assurance Working Groups at NoFC, January 6 and 7, 1987.
18. Participate, chair a session, and present a summary of the session at the RMCC Analysts Workshop, October 22, 1986, in Burlington, Ont.
19. Participate and present a paper at the Pacific Division, American Association for the Advancement of Science (AAAS), 67th Annual Meetings of the Pacific Division, AAAS and the 1986 Meeting of the Western Society of Soil Science, June 8-13, 1986, Vancouver, B.C.
20. Asked to review a research report entitled "Acidification in a temperate forest ecosystem: The role of sulphur gas emissions and sulphur dust" by the Kananaskis Centre for Environmental Research for the Whitecourt Environmental Study Group.

21. Publish a journal article on "Effects of V and Ni separately and in combination with SO₂ in jack pine" by A.A. Khan and S.S. Malhotra.

11. Accomplishments in 1986-87:

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 continuing involvement with a M.Sc advisory committee at U of A and several papers for national and international journal articles were reviewed. Contributed to the protocols for field and laboratory methods to be used by the AR-NEWS program. (Maynard, Sidhu, Apps, Zoltai, Feng)
2. A paper entitled "Variability in forest systems as it relates to elemental sulfur effects" was presented at the 2nd Symposium and Workshop: Acid forming emissions in Alberta and Their Ecological Effects", by D.G. Maynard and P.A. Addison. The paper was reviewed and accepted for publication in the symposium proceedings. The paper is in the final stages of editing prior to printing. (Maynard)
3. A journal article entitled "The effect of elemental sulfur on certain chemical and biological properties of surface organic horizons of forest soil" by D.G. Maynard, J.J. Germida, and P.A. Addison was published. (Maynard)
4. The preparation of this article has been delayed owing to the low priority assigned to this goal because of other commitments that have arisen during the year. In addition, the co-author J.J. Germida, University of Saskatchewan has to re-evaluate the data as there may not be sufficient information to warrant a journal publication. (Maynard)
5. The second draft of this article has been completed, reviewed within the group and is presently with the senior author P.A. Addison. He hopes to complete the revisions by the end of the fiscal year, March, 1987. (Addison: Maynard is the NoFC contact)
6. An information report on the 1985 resampling of the area around the sour gas processing plants near Rocky Mountain House is in various stages of completion. A contract was issued to K.A. Kennedy to complete the section on plant cover and diversity. The outline and first draft of this section is completed and the final draft of that portion of the report will be finished in early January. The first draft of the soil chemical analyses is nearing completion and the remainder of the draft report should be completed by the end of February, 1987. (Maynard)
7. The work outlined in the goal has been completed. In addition, the analyses for six (6) additional sites from B.C. is underway through a contract with Mr. P. Farrington initiated on December 1, 1986. (Maynard, Sidhu)
8. The author is located at the GLFC in Sault Ste Marie and has indicated part of the data was published elsewhere. However, with some

additional work, the author hopes to have the paper ready for submission in 1987. (Hogan: Maynard is the NoFC contact)

9. The third draft of the article has been recently reviewed by the co-authors P.A. Addison and D.G. Maynard, and is currently with the senior author K.A. Kennedy for final revisions prior to submission to a journal by the end of March, 1987. (Maynard)
10. The data is with the senior author P.A. Addison. Once the data is collated, a final decision will be made whether to prepare a journal article or not. (Addison, Maynard)
11. A draft of the Information Report has been completed and the author has to decide on whether to complete the article as is as an Information Report or to condense it into a review article. (Apps)
12. An Information Report NOR-X-285 entitled "Effects of oil sands emissions on the boreal forest" by P.A. Addison, S. J. L'Hirondelle, D.G. Maynard, S.S. Malhotra, and A.A. Khan is with the editor for typesetting prior to publication. (Maynard)
13. A first draft of this article is being prepared by the senior author and may be ready for submission to a journal early in 1987. This work was done through a PRUF contract. (Maynard is the NoFC contact)
- 14-15. These goals were not started since there is no vice Addison.
16. Attended a workshop on "Soil Acidification Monitoring Workshop" and lead a discussion on the topic of quality assurance and interlab comparison May 12, 1986 in Calgary, Alberta. (Maynard)
17. Agreed to work on the Analytical Methods Selection Working Group in Terrestrial LRTAP studies (working group of the Quality Assurance Subgroup of the RMCC). A coordinating meeting was held July 17, 1986 and a workshop of the LRTAP Terrestrial Monitoring Quality Assurance Working Groups will be held at NoFC, January 6 and 7, 1987. (Maynard)
18. Participated and chaired a session of the soil and vegetation section at the RMCC Analysts Workshop, October 22, 1986, in Burlington, Ont. Presented a summary report of the session at the conclusion of the workshop. (Maynard)
19. A paper entitled "Variability in certain properties of forest soils impinged by elemental sulfur in west-central Alberta" by D.G. Maynard was presented at the Pacific Division, American Association for the Advancement of Science (AAAS), 67th Annual Meetings of the Pacific Division, AAAS and the 1986 Meeting of the Western Society of Soil Science, June 8-13, 1986, Vancouver, B.C. The abstract of the paper was published in the Proceedings.
20. Reviewed a research report entitled "Acidification in a temperate forest ecosystem: The role of sulphur gas emissions and sulphur dust" by the Kananaskis Centre for Environmental Research for the Whitecourt

Environmental Study Group. The report was the final summary of ten years of work around the sour gas processing plant in West Whitecourt. The report was very lengthy and quite detailed. It took close to two weeks to complete the review. (Maynard)

21. A journal article entitled "Effects of V and Ni separately and in combination with SO₂ in jack pine" by A.A. Khan and S.S. Malhotra has been accepted for publication.

12. Goals for 1987-88:


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 Regional Toxics Committee and the NoFC Environmental Screening Committee. Attend workshops and symposia. (Maynard, Sidhu, Apps, Zoltai, Feng)
2. Publish an article entitled "Variability in forest systems as it relates to elemental sulfur effects". (Maynard)
3. Re-examine the data and if there is adequate information to warrant a journal article a paper will be prepared and submitted for review. (Carried over from 1986-87, Maynard)
4. Publish an Information Report on the results of resampling of monitoring plots and past findings in the vicinity of two sour gas processing plants. (Maynard)
5. Contribute to AR-NEWS program in a consultative and advisory role. Complete the soil and plant analyses collected from the AR-NEWS plots in B.C. and the prairie regions. Submit results to the designated CFS personal. (Sidhu, Maynard)
6. Prepare and submit a baseline report on the chemical analyses of the soil and plant samples for the AR-NEWS plots for the Prairie region. (Maynard)
7. Submit a journal article for review entitled "The effects of particulate elemental sulfur on vegetation" by K.A. Kennedy, P.A. Addison and D.G. Maynard. (Maynard)
8. Finish a summary report for the clients (Canterra Energy and Gulf Canada, Ltd) of the five year study in the vicinity of the two sour gas processing plants in west-central Alberta. (Maynard)
9. Member of the LRTAP Terrestrial Monitoring Quality Assurance Working Group (subgroup of the RMCC). Attend meetings related to the QA program and propose suitable methodology for use on soils and plants for CFS analytical laboratories. (Maynard)
10. Complete and publish a report on the uranium mining and milling and radionuclides in the terrestrial environment. (Carried over from 1986-87, Apps)

11. Maintain the Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) by preventative maintenance checks and replacement of worn parts. (Radford)
13. Publications 1986-87:
- Addison, P.A., L'Hirondelle, S.J., Maynard, D.G., Malhotra, S.S., and Khan, A.A. 1987. Effects of Oil Sands processing emissions on the boreal forest. Can. For. Serv. Inf. Rep. NOR-X-285. (in press)
- Kennedy, K.A. and Addison, P.A. 1986. Some considerations for the use of visual estimates of plant cover in biomonitoring. *Journal of Ecology* 74(4): (in press).
- L'Hirondelle, S.J., Addison, P.A., and Huebert, D. 1986. Growth and physiological response of aspen and jack pine to intermittent SO₂ fumigation episodes. *Canadian Journal of Botany* 64: 2421-2427.
- Maynard, D.G. 1986. Variability in certain properties of forest soils impinged by elemental sulfur in west-central Alberta. In *Proceedings of the Pacific Division, American Association for the Advancement of Science*, June 8-13, 1986, Vancouver, B.C. p. 38 (abstract only).
- Maynard, D.G. and Addison, P.A. 1986. Variability in forest systems as it relates to elemental sulfur effects. In *Proceedings 2nd Symposium and Workshop on Acid Forming Emissions in Alberta and Their Ecological Effects*, May 13-15, 1986, Calgary, Alberta. (in press).
- Maynard, D.G. Germida, J.J. and Addison, P.A. 1986. The effect of elemental sulfur on certain chemical and biological properties of surface organic horizons of a forest soil. *Canadian Journal of Forest Research* 16(5):1050-1054.
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 1987-88:
- | | | | |
|------|---------------|-----------|-----|
| PYs: | Prof.: | Apps | 0.1 |
| | | Feng | 0.1 |
| | | Maynard | 0.5 |
| | | Sidhu | 0.3 |
| | | Zoltai | 0.1 |
| | Tech.: | Radford | 0.5 |
| | | Fairbarns | 0.2 |
| | Total: | | 1.8 |
| | Term/Student: | | 0.0 |

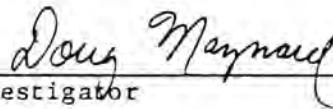
O & M: \$15,000

Capital: \$28,000 (Data system for ion chromatograph)

16. Signatures:

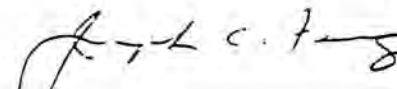

Investigator


Program Director, Protection


Investigator


Regional Director General


Investigator


Investigator


Investigator

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 ecosystem. 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 FPPI, 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-36-02-01. 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 1986-87:

1. Establish field vegetation sample plots on Procter & Gamble FMA southwest of Grande Prairie in cooperation with NOR-36-02-01 for Methods-I and Method-II in the benchmark study area. Method-I refers to "conifer release" treatments; mechanical or no site preparation before planting and chemical or manual brush clearing after planting. Method-II involves site preparation treatments; chemical, chemical/mechanical, mechanical. Both methods have controls and are replicated. (Sidhu)

2. Sample vegetation and soils for pre-treatment application data for Method-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 for post-treatment data for Method-II plots and possibly for Method-I plots. (Sidhu, Feng)
5. Sample vegetation, soils, water, and deposition plates (trays) for post-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 information 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)

Additional Goals:

14. Evaluate two application methods (a ground and an aerial) for granular Pronone 10G to determine their effectiveness in the field. (Feng, Sidhu)
15. Develop methods for inoculating, planting and retrieving granular Pronone for studying the a.i. (active ingredient) release from the granules, and its persistence and leaching in soils under field conditions. (Feng)

16. Provide information and advice to federal, provincial and industrial resource managers. Participate in ECW and CFS Weed management committees and FICP (Federal Interdepartmental Committee on pesticides) check Sample Program (Sidhu, Feng)
17. Initiate and maintain Quality Assurance Program in the herbicide residue laboratory. (Feng)
18. Participate in Information and Technology Transfer to media and public. (Sidhu, Feng)

11. Accomplishments in 1986-87:

1. Established field vegetation sample plots on Procter & Gamble FMA southwest of Grande Prairie in cooperation with NOR-10 for Method-I and Method-II in the benchmark study area.
2. Sampled vegetation and soils (Method-II only) for pre-treatment application data for Method-II and Method-I.
3. Sampled vegetation, soil and water (in cooperation with Alberta Environment) for monitoring levels of herbicide residues before treatment for Method-II.
4. Sampled vegetation, soils and water for post-treatment monitoring of Method-II plots.
5. Sampled deposition trays for herbicide distribution pattern in plots of Method-II.
6. Developed and established herbicide residue chemical laboratory, stream-lined analytical methods for hexazinone and initiated analyses of samples collected during summer 1986.
7. Continued to provide federal, provincial, and industrial resource managers in the region information on the environmental effects of the use of herbicides in forestry application.
8. Participated in ECW and CFS Weed Management Coordination Committee.
9. Completed experiments on the effects of hexazinone, Roundup and Garlon on in vitro growth of 5 species of mycorrhizae and submitted a manuscript which has been accepted for publication.
10. Completed 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.
11. Prepared a manuscript for publication of results of experiment in goal 10 and submitted to European J. Forest Pathology.
12. Planned and initiated experiments on the effect of hexazinone of mycorrhizae in pine and spruce seedlings under aseptic conditions.

13. Goal 13 will not be met because of insufficient time for PDF to carry out the planning in 1986/87 and his reassignment to PNFI on April 1, 1987.
 14. Completed the evaluation of the ground and aerial application methods for granular Pronone, presented the results at the 1986 ECW Meeting, to NOR-10 personnel, AFS, ACE Vegetation Control Service, Pfizer and DuPont.
 15. Developed methodology for inoculating, planting and retrieving Pronone granules for a.i. release studies under field conditions and completed field sampling for the release study.
 16. Attended Annual FICP (Federal Interdepartmental Committee on Pesticides) Meeting as Coordinator for Forestry Herbicides, and reported on check sample programs. Visited FPMI on request and contributed to the planning of FPMI herbicide chemistry studies. Prepared a summary on forestry herbicides, glyphosate and hexazinone, for the Minister of Alberta Forestry Department on request of Reforestation and Reclamation Branch, AFS.
 17. Coordinated a one-week analytical instrumentation training course at NoFC, involving Varian Instrument Group, and staff of NOR-7 and NOR-10. Initiated a NoFC water quality test and identified the problem source of NoFC's distilled water supplies.
 18. Co-sponsored and participated in an open-house for the Vegetation Management Project in Grande Prairie. Contributed to a forestry herbicide related article reported in the Science section in Edmonton Journal.
12. Goals for 1987-88:
1. Submit for review and publish a review article on hexazinone as an information report. (Sidhu, Feng)
 2. Continue post-herbicide treatment vegetation sampling (density, cover, presence etc.; Grande Prairie plots), enter 1986-87 field data on computer and analyse. (Sidhu)
 3. Collect post-herbicide treatment field samples of water, sediments, foliage and soils for herbicide residue analysis. (Feng, Sidhu)
 4. Prepare soil samples for bulk density determinations. Perform residue analysis on field soil samples hand-planted with inoculated Pronone granules. (Feng)
 5. Perform residue analysis on foliage samples collected in the treated area of Method-II, and water and sediment samples collected in the vicinity of Method-II areas. (Feng)
 6. Streamline and develop analytical methods for specific herbicides. Maintain Q.A. (Quality Assurance) program. (Feng)

7. Provide information and advice to federal, provincial and industrial managers in the region on environmental effects of the use of herbicides in forestry. Participate in various committees (ECW, CFS Weed Management Committee, FICP). (Sidhu, Feng)
8. Prepare and submit an article for publication on the effect of hexazinone on survival and growth of naturally occurring and artificially inoculated mycorrhizae in Pinus contorta and Picea glauca under greenhouse conditions. (Sidhu, Chakravarty)
9. Complete experiments and prepare a draft for publication on the effect of hexazinone in mycorrhizae in pine and spruce under aseptic conditions. (Sidhu,)
10. Review methodologies to herbicide behaviour in intact soil profiles from the field under greenhouse conditions and design experiments to study breakdown and release of Pronone in various soil horizons in cooperation with and complimentary to NOR-07-05. (Sidhu, Feng)
11. Provide functional guidance and supervision in cooperation with and complimentary to goal 3 of NOR-7-05 and projects initiated under agreements and prepare reports for study NOR-36-02-16 (Canada/Alberta Agreement). (Sidhu, Feng)
12. Prepare and submit for review a report on 1986-87 studies of active ingredient release and distribution patterns of granules of Pronone 10G. (Feng, Sidhu)

13. Publications 1986-87:

Journal:

Chakravarty, P. and S. S. Sidhu. 1987. Effect of glyphosate, hexazinone and triclopyr on in vitro growth of five species of ectomycorrhizal fungi. Eur. J. For. Path. (In press)

Others:

Sidhu, S. S. 1986. Hexazinone: A review. File Report. Prepared for the Management NoFC and Canada/Alberta Agreement Study on Vegetation Management.

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 1987-88:

PYs:	Prof.:	Sidhu	0.7
		Feng, J.	0.9

Tech.:	Fairbarns	0.8	
	Milward	1.0	
	Feng, C.	1.0	(Accounted for in NOR-36-02-01 Canada/Alberta Agreement)


Total: 4.4

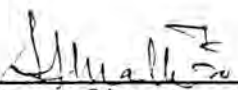
Term/Student: 1.8 (0.6 from Canada/Alberta Agreement,
accounted for in NOR-36-02-01)

O & M: \$25,000 (plus 30K from Canada/Alberta Agreement)

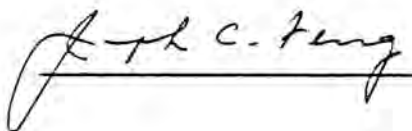
Capital: \$28,000 (for herbicide chemistry laboratory)

16. Signatures:





Program Director, Protection





Regional Director General

9. Study Objectives:

1. Determine the influence of herbicide application and other silvicultural practices on the long-term stability of nutrient balance and the biological (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.

10. 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)
2. Plan and design growth chamber experiments to study nutrient cycling processes in natural systems and to look at the effects 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)

11. Accomplishments in 1986-87:

1. Considerable literature on nutrient cycling and dynamics in forested systems related to herbicides and other silvicultural practices has been collected. The information from the literature search is being used for goal #2.
2. A growth chamber study to start in the fall of 1987, is in the initial stages of design. The object of the study will be to assess the potential effects of various herbicide application rates on the chemical nutrient status.
3. Soil samples were collected in July, 1986 prior to the herbicide applications in September, they were frozen and will be analyzed this winter to provide baseline data on the soils of the study area. Three treatments, control, 2 kg/ha and 4 kg/ha were sampled. The soils were sampled by horizon down to the B_{tnj} horizon (usually 4 samples) and 30 replicates/treatment were taken.

12. Goals for 1987-88:

1. Prepare and submit for review a report or a Journal publication on the impact of silviculture practices on nutrient cycling. A preliminary conceptual model of nutrient cycling in forest systems with an emphasis on sulfur will be designed using information from the literature review and data collected.

2. An additional field study to assess herbicide effects on nutrient dynamics will begin in the spring of 1987.
3. A growth chamber study on the effects of herbicides and sulfur deposition on nutrient dynamics will be initiated in the fall of 1987 in cooperation and complimentary to goal 10 of NOR-7-04.
4. Chemical analyses of the soil samples collected in 1986 will be analyzed.
5. Continue to monitor the nutrient status of the soils in the three treatments of Block 2 in the herbicide study area.

13. Publications 1986-87:

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 concluded that these activities are not potentially detrimental to the environment.

15. Resources 1987-88:

PYs:	Prof.:	Maynard	0.4
	Tech.:	Radford	0.3
	Total:		0.7
	Term/Student:		0.0

O & M: \$7,000

Capital: Nil

16. Signatures:

Don Maynard
Investigator

Shultz
Program Director, Protection

C. D. Hunt
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 20, 1987

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 Leaders: Y.P. Kalra, D.G. Maynard
6. Key Words: Analysis, soils, vegetation, water
7. Location of Work: Northern Forestry Centre
8. Problem Analysis:

Many of the studies at NoFC require high quality analysis of soil, plant and water samples in order to meet their objectives. In some cases analytical techniques must be modified or developed to meet the specific requirements of the users. Maintaining a high quality analytical laboratory suitable to support ongoing research and the continuing improvement, modification and development of techniques are essential to meet the needs of the users at NoFC.

9. 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.

10. Goals for 1986-87:

1. Provide analytical services to research scientists and cooperators.
2. Provide assistance to staff from other projects using the facilities of the laboratory.
3. Prepare a File Report of the work performed during 1985-86.
4. Prepare and submit for review a journal article on the determination of ammonium for cation exchange capacity by three different techniques.
5. Publish a journal article entitled "Extraction and determination of sulfur in organic forest horizons of forest soils".
6. Prepare for review an Information Report on methods used in the Analytical Services Laboratory.
7. Maintain an active role in the activities of the Western Environmental Agricultural Laboratory Association.
8. Participate in the inter-laboratory study on soil analysis coordinated by the International Soil Reference and Information Centre, Wageningen, The Netherlands
9. Collect soil and foliage samples to be used as long-term reference samples for the Analytical Services Laboratory.
10. Provide the coordination for the preparation and analysis of the ENFOR and AR-NEWS samples to staff and contract persons working on the ENFOR and AR-NEWS projects.
11. Management and disposal of old chemicals. Organization of a chemical spill response team.

Added Goals:

12. Attend and participate in the XIII Congress of the International Society of Soil Science, Hamburg, West Germany.
13. Participate and present a paper on ammonium determinations for cation exchange capacity at a workshop on The Laboratory Methods and Data Exchange Programme August 25-29, 1986 at Wageningen, The Netherlands.

11. Accomplishments in 1986-87:

1. Provided analytical services to research scientists and cooperators, in particular NOR-4, 7, 10, and 12. (Kalra)
2. Provided assistance to staff from other projects using the facilities of the Analytical Services Laboratory. (Kalra)

3. Prepared a File Report of work performed in the laboratory during 1985-86. (Kalra)
4. An article entitled "An evaluation of automated and manual methods for $\text{NH}_4\text{-N}$ analysis in the determination of cation exchange capacity of soils" by Y.P. Kalra and D.G. Maynard will be published in 1987. However, since the proceedings are for the participants only the organizers indicated that the papers may be published elsewhere. The first draft of a note on this information has been completed and will be submitted to the Canadian Journal of Soil Science in 1987. (Kalra, Maynard)
5. The journal article was submitted to the Soil Science Society of America Journal in November, 1985. However, the review process took 8 months. The paper was accepted with major revisions and has been revised and resubmitted to the Journal. The editor has requested that the article be reviewed again, therefore publication of this article will be delayed until late in 1987. (Maynard, Kalra)
6. An outline on an Information Report on methods used in the NoFC Analytical Services Laboratory has been completed and several of the methods have been written up. Completion of this report, has been stopped until the terrestrial monitoring quality assurance working groups meeting January 6 and 7, 1987 at NoFC. Most (if not all) the CFS laboratories will be participating in the quality assurance program. It is hoped that the standardization of methods for soil and plant analyses will result. If this occurs this goal may have to be re-evaluated. (Kalra, Maynard)
7. Maintained an active role in the activities of Western Environmental Agricultural Laboratory Association by attending bi-annual meetings. (Kalra)
8. Participated in the 2nd and 3rd round robins of the inter-laboratory comparison on soil analysis coordinated by the International Soil Reference and Information Centre, Wageningen, The Netherlands, and provided data for inclusion in reports. (Kalra)
9. Soils and foliage samples were not collected as long-term reference material because it was not needed. Eight reference soil samples were obtained from the Land Resource Research Centre, Expert Committee on Soil Survey (ECSS) and will be used in a quality evaluation program. In addition organic reference soils and foliage material will be obtained from the ECSS and the GLFC, respectively. (Kalra)
10. Coordinated and assisted the contract and term persons for the ENFOR and AR-NEWS projects on the preparation of analysis and analyses by ICP-AES and autoanalyzer. (Kalra)
11. A system to coordinate the management of old chemicals and disposal of them on a regular basis was set up and will be coordinated by J. Shuya. A chemical spill response team has also been organized and will be in place in 1987. (Kalra)

12. Attended and participated in the XIII Congress of the International Society of Soil Science, Hamburg, West Germany, August 13-20, 1986. (Kalra)
13. Participated in and presented a paper (as given in accomplishment #4) at a workshop on The Laboratory Methods and Data Exchange Programme August 25-29, 1986 at Wageningen, The Netherlands. (Kalra)

12. Goals for 1987-88:

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 1986-87. (Kalra)
4. Submit a note on the determination of ammonium for cation exchange capacity by three different techniques to the Canadian Journal of Soil Science. (Kalra, Maynard)
5. Publish a journal article entitled "Extraction and determination of sulfur in organic forest horizons of forest soils". (Carried over from 1986-87; Maynard, Kalra, Radford)
6. Prepare first draft of an Information Report on methods used in the Analytical Services Laboratory.
7. Maintain an active role in the activities of the Western Enviro-Agricultural Laboratory Association. (Kalra)
8. Participate in inter-laboratory studies on soil analysis coordinated by the Land Resource Research Centre, Ottawa (Kalra)
9. Management and disposal of old chemicals. (Kalra)
10. Develop procedure for microwave digestion of foliage samples (Kalra, Maynard)

13. Publications 1986-87:

- Edwards, I.K. and Y.P. Kalra. 1987. Soil analysis: Impact on forestry. In Proceedings of Workshop "Soil Analysis: Impact on agricultural and resource industries", February 26-27, 1986, Calgary, Alta. (In press).
- Kalra, Y.P. 1986. Analytical Services Laboratory: Annual Report 1985-86. File Rept. 38 p. Can. For. Serv., North. For. Cent., Edmonton, Alta.
- Kalra, Y.P., and Maynard, D.G. 1987. An evaluation of automated and manual methods for $\text{NH}_4\text{-N}$ analysis in the determination of cation exchange capacity of soils". In Proceedings of Workshop on the Laboratory Methods and Data Exchange Programme, August 25-29, 1986, Wageningen, The Netherlands. (in press)

Maynard, D.G., Kalra, Y.P., and Radford, F.G. 1987. Extraction and determination of sulfur in organic horizons of forest soils. Soil Sci. Soc. Amer. J. (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 leaders, the committee concludes that these activities are not potentially detrimental to the environment.

15. Resources 1987-88:

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

O & M: \$15,000

Capital: \$5,000 (Mechanical vacuum extractor).

16. Signatures:

Y.P. Kalra

J. M. ...
Program Director, Protection

Doug Maynard

G. D. ...
Regional Director General

NOR-10

REGENERATION AND PLANT MANAGEMENT

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1987

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, planning, computer data bank, technology transfer
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta
8. Problem:

A sustained and even increased supply of economically usable timber is a key element in the long-term economic health of Western and Northern Region and of Canada as a whole. Timber supply is affected by many factors, including available capital, accessibility and marketability of different species, utilization standards, process technology and efficiency, land base and changes in land allocation, losses to insects, disease and fire and scale and effectiveness of silvicultural practices.

Changes in any of these factors can effect timber supply and the nature and extent of silvicultural problem.

Currently one of the most acute regional silvicultural problems revolves around the need to successfully establish and bring softwood (especially spruce) to a free-to-grow state on mixedwood sites. The scale of the problem has increased over the last decade with the increase of softwood nursery stock production from about 10 million to 60 million seedlings annually. Once these trees are planted on mixedwood sites, brush and grass competition interfere with survival and growth. Mixedwoods constitute about 50 percent of productive forest land in the region (about 23,000,000 ha), often on the most productive softwood sites. In the period 1975 to 1985 white spruce related silviculture alone, mainly site preparation and planting, was carried out on about 239,000 ha of mixedwood land at a cost of about \$92 million (\$386/ha). This investment is increasing yearly and remains at risk in terms of mortality as well as quality and growth reduction for periods of up to 80 years, with attendant

yield losses of up to 30 or 40 percent, if proper silvicultural practices are not applied. These include adequate site preparation, use of high quality planting stock (properly planted) and control of competing vegetation up to the free-to-grow state.

Future silviculture problems in the region could well be different as a result of a new emphasis on aspen utilization. Until recently, aspen (which represents 96% of the hardwood inventory, which a turn represents over 1/3 of gross merchantable wood inventory in the region) was less than 10% utilized. Current plan for aspen utilization in conventional pulp, CTMP pulp, a paper mill and a number of Oriented Strand Board (OSB) plants will increase use by 5 fold (up to 2.5 million m³) by 1988. The effect of this trend on silvicultural problem can be illustrated with respect to NSR. Traditionally, regional silvicultural problem have often been stated in terms softwood NSR, which is estimated to total over 500,000 ha, of which 300,000 ha is in mixedwood burns and cutovers. the NSR problem would be significantly reduced if aspen became acceptable for regeneration, as many of these areas are already stocked with aspen. This situation generates a new set of problems. For example:

- How many softwood NSR areas are adequately stocked with aspen?
- What constitutes adequate aspen stocking and how can aspen stocking be effectively controlled?
- How is mechanized site preparation implicated in aspen stocking control?
- What are the relative growth and yield trade-offs between spruce and aspen on the same sites and should they be grown in pure or mixed stands?
- What is potential role and need for R&D in area of non-chemical competition control on future forest management/silviculture work?

Increased aspen utilization may also solve problems. For example, logging economics will improve with removal of larger volumes per unit of area, reduced slash loads will make site preparation and softwood planting easier and cheaper, and make re-entry for tendency more efficient, and acceptance of aspen as regeneration improves reforestation options.

The nature of silvicultural problems in the region is changing. The CFS recognizes that much of the information needed to address these changes is known and requires effective technology transfer. There is also a need for specific R&D initiatives, especially in the areas of mixedwood site preparation, stock quality, response, and performance, and competition control.

9. Study Objectives:

1. To conduct silviculture R&D and publish scientific and technical reports of silvicultural interest, regionally and nationally, stressing regeneration silviculture and early plantation development, with particular emphasis on chemical and non-chemical means of competition control.

2. To provide liaison and input as required to relevant regional and national programs, including the Canadian Forest Resource Data Program, and mechanization of silviculture programs, emphasizing biological aspects of silviculture mechanization.
3. To promote the development and dissemination of silvicultural knowledge through work with national, regional, and local committees, workshops and other related techniques.
4. Supervise research contracts and develop in-house research studies as an outgrowth of contracts where appropriate.

10. Goals for 1986-87:

1. Continue as project leader of NOR-10. Conduct 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. (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. (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)

11. Accomplishments in 1986-87:

- 1. Continued a project leader, NOR-10. Organized and reported 1986 RRTC meeting (Saskatchewan) which included changes in membership and terms of reference. Only correspondence activity with LOG and NACMEC committees.
- 2. Published (jointly with NOR-3) silviculture statistics for Canada - 1975 to 1983 as Information Report. Update to 1985 not completed.
- 3. Contract report on Agreement-related equipment tests (see 7e) will be made available to GLFC for inclusion in data bank. All work to CFS Standard assessment procedure requirements. No workshop was held.
- 4. Seventh year measurement of Grande Prairie field performance trial completed and annual report to AFS submitted. Preparation of 3 year results not done and will probably be replaced by a 5-year report in 1987.
- 5. No contribution required in 1986-87 aside from correspondence on work plan revision with Safranyrk (P.F.C.)
- 6. Coordination of vegetation management involved primarily two aspects:
 - a) committee work on public information, facilitating and implementation terms and b) completion of field installations and herbicide application work. There was also consultation on Saskatchewan (Gardner) and Manitoba (Ball) participation in vegetation management R&D in their respective areas.
- 7. Agreement related:
 - a) RRTC meeting held emphasis on mixedwood prescriptions. This was tied into site preparation equipment demonstrations under FRDA'S for the Prairie Provinces.
 - b) All pre-treatment assessment plots established and herbicide application completed by end of August 1986.

- c) Supervised contract covering this work under the Alberta FRDA. The work covers the Grande Prairie site and satellite sites in four other provincial forests.
 - d) Field inspection conducted by Upton in September/86 and file report prepared on status of Weberville and Jumping Pound demonstration projects.
 - e) Gorman was designated scientific authority for this work under the FRDA's. He initiated discussion on initial work scheduling (machines and sites), prepared letters of understanding between Federal and Provincial agencies (Alberta and Saskatchewan involved), supervised field work and organized a demonstration in September/86. Contractor is reporting on application of CFS Standard Assessment Procedures (SAP) which was applied under GLFC supervision on project sites.
 - f) Consulted with Gardner on development of R&D proposals for vegetation management work (Roundup) in Saskatchewan. Project initiated, including herbicide application.
 - g) Functional guidance provided by R. Waldron.
8. Not done. Work carried out by Waldron.
9. Report published on "Planting stock quality monitoring".

12. Goals for 1987-88:

- 1. Continue as project leader of NOR-10, including related committee activity:
 - a) Organize/conduct 1987 field meeting of RRTC and report results.
 - b) Participate in other committees including FERIC (siv. sub-committee), LOG, and ECW. (10-14) (10-3MA)
- 2. Cooperate with Regional Resource Data Specialist in updating national silviculture data. Publish report on 10-year results. (10-15)
- 3. Agreement Related.
 - a. Co-ordinate the regional forest vegetation management project in cooperation with NOR-3 and NOR-7. (10-56).
 - b. Complete establishment and initial measurement of silviculture R&D plots for forest vegetation management project under the Alberta Agreement. (10-1AA).
 - c. Act as scientific authority for study of control of aspen suckers and seedlings (Navratil AFS FRB) (10-2AA).
 - d. Develop contract and act as scientific authority on study to determine risk factors for hare damage. (10-1MA)

- e. Provide advice on forest vegetation management studies (Gardner) (10-1SA)
- f. Provide advice on silviculture investigation studies in Saskatchewan (10-2SA).
- g. Coordinate and act as Scientific authority in regional equipment demonstration under FRDA's. (10-4AA). (Gorman)

4. Continue to contribute as member of Canada/USA IP/MPB Committee. (10-38)

5. Continue inventory and data bank maintenance for mechanization of silviculture study. Coop. with GLFC in machine evaluations. Conduct workshop in Manitoba and report proceedings. (10-17). (Gorman)

6. Publish information report on "Snowshoe hares and forest plantations" (Radvanyi) (10-85, 10-1MA).

13. Publications 1986-87:

Kuhnke, D.H.; and L.G. Brace. 1986. Silviculture statistics for Canada, 1975-76 to 1982-83. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-275.

Navratil, S.; L.G. Brace and I.K. Edwards. 1986. Planting stock quality monitoring. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-279.

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 1987-88:

PYs: Prof.: 1.0
 Tech.: 2.0 (Gorman, vice-Walker)

Total: 3.0

Term/Student:

O & M: \$13,000

Capital: Nil

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1987

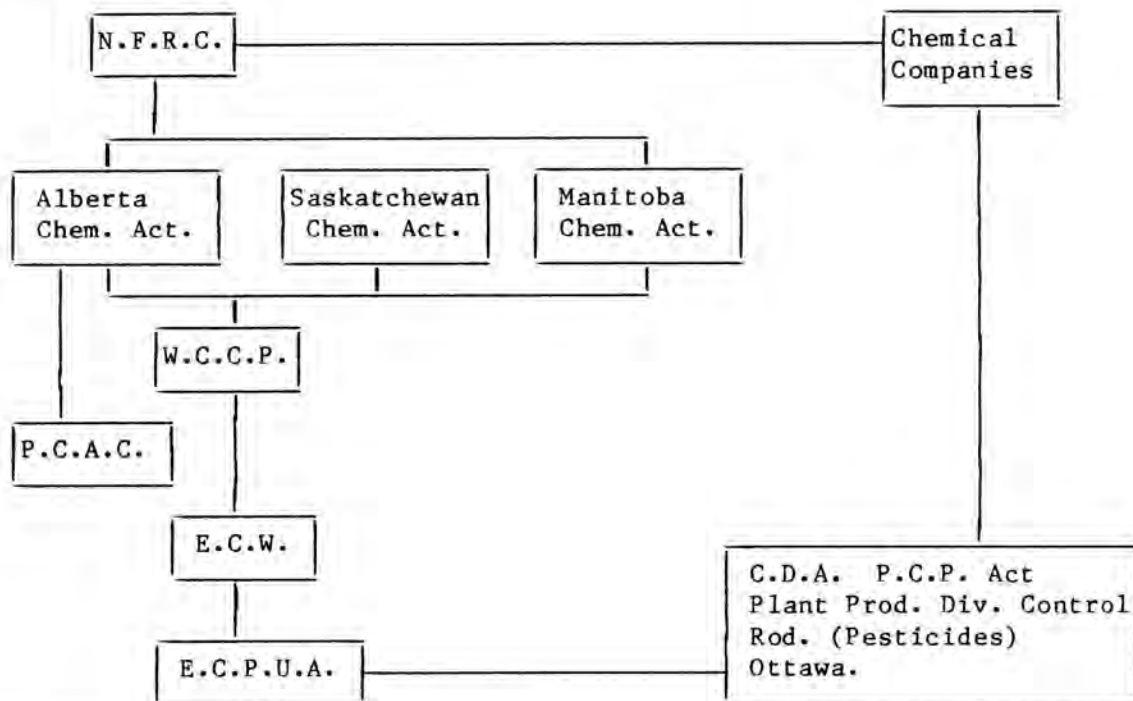
1. Project: Regeneration and Plantation Management
2. Title: Control of vegetation in managed forests
3. New: Cont.: X 4. No.: NOR-10-04
5. Study Leader: M. Upton
6. Key Words: Efficacy, crop tolerance, herbicides, vegetation management, growth performance, technology transfer
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta
8. Problem:

Currently one of the most acute silvicultural problems in the region is the control of brush, grass and herbaceous competition which hinder the survival and early development of new coniferous plantations: the problem becomes increasingly acute as seedling production and planting increases (going from 10 to 60 million seedlings annually between 1975 and 1987) and as investments in site preparation and early stand treatment increase.

In the period 1975 to 1985 white spruce regeneration in the region cost about \$92 million for 239,000 ha (mainly site preparation and planting). A high percentage of this and subsequent investments is at risk due to competition for moisture, nutrients and light from associated plant species.

Herbicides have potential application for site preparation, early release and later non-commercial thinning in regional softwood plantations, and R&D on herbicides in a regional context is essential.

A chart of study organization in relation to chemical controls with herbicides follows:



Concurrent with herbicide R&D there is a need to conduct studies on non-chemical methods of competition control in a regional context. This may become increasingly more important in the future if public opposition to herbicide use grows.

9. Study Objectives:

1. To conduct silviculture R&D on chemical and non-chemical means of competition control during establishment and early development of new softwood plantations in the region.
2. To conduct related R&D on plantation establishment and performance, including stock trials.
3. To carry out technology transfer as required.

10. 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)

11. Accomplishments in 1986-87:

1. Summary completed and in review process at NoFC.
2. Completed field observations on P. metallica and submitted to H.R. Wong.
3. Did not complete file report on Rhyacionia buoliana. No insects were captured.
4. Completed notes for information report on P. terminalis transferred to H.R. Wong.
5. Small scale screening trails not carried out in 1986 due to vacancy in position.
6. Contact with ECW maintained through project NOR-7.
7. Work on Grande Prairie benchmark site was carried out under Alberta agreement funding and NOR-10-03. Work at Calling Lake (Co-op. AFS, Dupont - Pfizer) was not pursued in 1986.
8. Not completed.

12. Goals for 1987-88:

1. Publish Information Report on results of efficacy/crop tolerance experiments conducted from 1980-86 in Alberta and Manitoba. (10-75)

2. Complete measurements of performance trials at Grande Prairie. (AFS contract) Analyse 5-year data. Prepare annual status report. (10-21).
3. Continue evaluation of herbicides for wS release at Calling Lake (AFS - Dupont - Pfizer) (Velpar and Pronone). (10-71).
4. Act as scientific authority and provide technology transfer for the forest management demonstration projects at Weberville and Jumping Pound under Alberta Agreement and prepare file report. (10-3AA)
5. Assist in completing establishment and initial measurement of plots for silviculture R&D on forest vegetation management project under Alberta agreement. (10-1AA)
6. Continue field efficacy trials with FPPI priority rated herbicides using ECW protocols. (10-69)

13. Publications 1986-87:

Drouin, J.A. 1986. Report on pine terminal weevil (P. terminolis) in Alberta. NoFC File Report to H.R. Wong.

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. 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.

15. Resources 1987-88:

PYs: Prof.: 1.0 (Upton)
 Tech.: 0.0
 Total: 1.0
 Term/Student: 0.15

O & M: \$6000

(+ Approx. \$2000. AFS Funding under contract #0012216 as well as agreement Funding for Jumping Pound/Weberville field work).

Capital: NIL

16. Signatures:

M. Upton
 Investigator

[Signature]
 Program Director, Resources

[Signature]
 Regional Director General

4. Grass competition with white spruce seedlings in our region is recognized to be a major silvicultural problem. Mechanical site preparation is expensive and often not effective. Chemical methods have encountered resistance from environmental lobby groups. Reduction of grass competition by an alternative method may be attractive.
5. The importance of the major insect and disease agents upon lodgepole pine and jack pine survival and stand development on a variety of sites in western Alberta and southeastern Manitoba is as yet unknown. Such information should prove very useful in the management of such stands originating after clearcutting operations.

9. Study Objectives:

1. Quantification of site forest productivity relationships through multivariate analysis.
2. To present Alberta forest ecological classification data in a field guide format readily comprehensible to government and industrial operational foresters, providing interpretations of the data for forest management purposes.
3. To characterize and analyze environmental influences upon tree growth on highly productive forest sites in our region, with the objective of learning potentially manageable chemical and physical factors responsible for growth. The role of some micronutrients, still unknown for our area, would be evaluated.
4. To further document plant succession and early tree growth in young (<25 yr) lodgepole pine forests originating from pulpwood clearcutting in western Alberta.
5. To initiate a study on tree root development and subsequent growth in relation to modification of soil properties through logging and subsequent site preparation activities. The study would be conducted in an ecosystematic framework. In addition to monitoring effects of compaction, erosion, alteration of drainage etc., several methods of site "rehabilitation" would be tested.

10. 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 IP 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)

Added Goals:

9. Present invited paper on soil compaction study to American Society of Agricultural Engineers winter meeting, Chicago December 16-19, 1986.
10. Nominate trees of exceptional size or those at extremes of their distribution for inclusion in Alberta Trees of Renown as requested by Dr. P. Murphy of Dept. Forest Science, U. of A. .
11. Prepare and present talk on the west central Alberta field guide to Regional Reforestation Technical Advisory Committee meeting Prince Albert, September 9, 1986.
12. Commence supervision of FRDA contracts to Dr. B. Sivak, AFS pertaining to biogeoclimatic classification of south western Alberta.
13. Participate in Alberta Forestry Lands and Wildlife workshop on Ecological Land Classification, Edmonton May 12, 1986.

11. Accomplishments in 1986-87:

1. "Field guide to forest ecosystems of west-central Alberta" was published but due to late printing (end Aug.) it was not possible to conduct field workshops on its use.
2. Considerable progress was made on the manuscript. Biomass prediction equations for lodgepole pine and aspen with greater predictive ability than existing equations were produced.
3. Work is continuing. Some multivariate analyses remain.
4. Soil compaction manuscript is ready for submission to journal.
5. PRUF contract is complete. The work is of high quality and should be of interest to scientific community, AFS and CFS.
6. The NOR-10-08 lodgepole pine development plots at Hinton were described with respect to the predominant ecosystem association, soil subgroup and other site attributes.

7. A forest site classification contract was initiated in Manitoba. I am working with contractor in developing a suitable methodology compactible with existing site information and Manitoba's new ARC-INFO GIS.
8. The IUFRO northern silviculture meeting at Grande Prairie and Dawson Creek and the Grande Prairie field trip (for which I was responsible) were very successful.
9. The paper was presented the ASAE winter meeting, Chicago December 16-19, 1986.
10. A two day field trip though Jasper and northern Banff National Parks plus a review of Banff-Jasper ELC plots and notes yielded several nominations. Five of these are included in the latest Alberta "Trees of Renown".
11. A presentation on the west central Alberta field guide was made to the RRTAC meeting Prince Albert, September 9, 1986.
12. Supervision of FRDA contracts to Dr. B. Sivak is continuing. A field trip to the study area to view sample plots and discuss interpretations was made in September.
13. A presentation on means of estimating forest productivity using site classification information was made to the provincial ELC workshop.

12 Goals for 1987-88:

1. Conduct technical transfer activities in connection with Field guide to forest ecosystems of west-central Alberta (10-34).
 - a. Conduct field workshops in cooperation with Alberta Forestry lands and wildlife personnel.
 - b. Prepare and present invited seminar to Dept. Forest Science U. of A. January 28, 1987.
 - c. Present poster paper to soil conservation Society of America 42nd Annual meeting, Billings, Montana, August 2-5, 1987.
2. Complete report for review on forest succession 24 years after clearcutting (Edson forest). (10-25)
3. Complete data analysis and characterization of highly productive sites in the region and prepare draft report. (10-22)
4. Publish paper on forest soil compaction effects. (10-35)
5. Continue to supervise contract on the development and application of a forest site classification for Manitoba. (10-2MA)

- a. Prepare jointly with contractor, a paper on the development of the Manitoba site classification for the First Symposium and Workshop on Landscape Ecology and Management, Guelph, Ontario, May 19-21, 1987.
 6. Provide site classification information as a basis for stratifying and analyzing lodgepole pine mortality data on NOR-10-08 plots near Hinton, Alberta. (10-86)
 7. Begin study of effect of black polyethylene film as a substitute for mechanical and chemical treatment to control grass competition around white spruce seedling. (10-82)
 8. Act as a regional scientific authority for revised "Native Trees of Canada" book. (10-87)
 9. Serve as member of Alberta/Saskatchewan Vegetation Working Group under the National vegetation Working Group of the Canada committee on Ecological Land Classification. (10-88)
 10. Continue to Act as Scientific Authority for Biogeoclimatic classification (Sivak) under Canada-Alberta FRDA. (10-5AA)
 11. Attend meeting of IUFRO working party SI.05-12, Northern Forest silviculture and Management, Ravaniemi, Finland, August 1987. (10-89)
13. Publications 1986-87:
- Corns, I.G.W. and R.M. Annas. 1986. Field guide to forest ecosystems of west-central Alberta. Can. For. Serv., Nor. For. Cent., Edmonton, Alta.
- Corns, I.G.W. and R.M. Annas. 1986. Ecological classification of Alberta forests and its application to forest management. Proc. COJFRC Symposium, Site Classification in Relation to Forest Management. August 27-29, 1985, Timmins, Ont. Great Lakes Forestry Centre and Ontario Ministry of Natural Resources report O-P-14.

14. 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 years) 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.

15. Resources 1987-88:

PYs: Prof.: Corns 1.0

Tech.: Allan 1.0

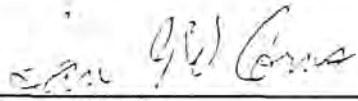
Total: 2.0

Term/Student: 0.0

O & M: \$9,000

Capital: \$7,000 (data loggers)

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

mortality for a relatively short period of time. This will allow a composite survival curve to be drawn up for each ecological site, possibly in about 5 years, which can be modified as more information becomes available. These curves should provide the information needed to determine what modifications, if any, of the stocking standards in relation to site class are required.

Each sampling unit will be a plot of 20 trees, and as many of these plots will be established in each area as is practical, typically 40 such plots per area. Several replicates will be established in a number of site and age classes. They will then be examined periodically to determine the amount and cause of mortality.

Insect and disease attack on jack pine and lodgepole pine are probably more important than in white spruce. Therefore, initial emphasis will therefore be concentrated on these two species.

9. 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.

10. 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)

11. Accomplishments in 1986-87:

1. The heights of a subsample of trees in jack pine plots in the Sandilands Provincial Forest, Manitoba were measured and a file report on 3 years mortality was prepared.
2. Fifth-year mortality in lodgepole pine plots near Hinton, Alberta was assessed and a file report outlining 1984-85 mortality was prepared.

3. The heights of a subsample of trees in lodgepole pine plots near Hinton, Alberta were measured and a computer print-out of heights prepared.
4. Data were collected in collaboration with Dr. I. Corns for the preparation of site classifications for the lodgepole pine plots near Hinton, Alberta. Publication of report has been delayed until after manuscript for the pictorial guide (Goal 5) is completed.
5. a) Collections were made and photographs obtained of insect groups needed to fill gaps in coverage. Most of the adults have emerged and have been sent to Ottawa, but a few are overwintering.
- b) Rough copies of all 115 plates have been prepared and preparation of camera-ready plates has begun (under Judy Samoil's supervision).
- c) First drafts for 90 sets of text to accompany above figures have been prepared.

12. Goals for 1987-88:

1. Complete publication of illustrations and text for a pictorial guide to the forest and shade tree insects of the prairie provinces in collaboration with H.R. Wong (NOR-11-04). (10-72)
2. Assess sixth-year mortality of lodgepole pine plots near Hinton, Alberta. Do necessary plot maintenance. Prepare file report summarizing 1985-86 mortality. (10-63)
3. Assess five-year mortality of jack pine plots in the Sandilands Provincial Forest, Manitoba. Complete height growth measurement for 5-year period of measurement. Do necessary plot maintenance. Prepare information report summarizing results. (10-64)

13. Publications 1986-87:

Ives, W.G.H.; Rentz, C.L. 1986. Growth and survival of young jack pine in plantations in the Sandilands Provincial Forest, Manitoba. Can. For. Serv., North. For. Cent., Edmonton, Alta. File Report, Study NOR-10-08.

Ives, W.G.H.; Rentz, C.L. 1986. Growth and survival of young lodgepole pine regeneration in west-central Alberta IV. 1984-85 Survival. Can. For. Serv., North. For. Cent., Edmonton, Alta. File Report Study NOR-10-08.

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 1987-88:

PYs: Prof.: Ives 0.5

Tech.: Rentz 1.0

Total: 1.5

Student: 0.75

O & M: \$25,000

Capital: \$1,000

16. 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 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-36-02-1A)
 - 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).

11. Accomplishments in 1986-87:

1. Regional forest vegetation management R&D plan developed and coordinated within NoFC (NOR-3, 7 and 10) and with contractor in AFS R&R and FRB. A wildlife (small mammal) component was added through preparation and sponsorship of a contract between D. Penner and the Wildlife Toxicology Final. Work focussed mainly on linkage of A-base work to vegetation management R&D in Canada/Alberta FRDA.
2. Work plan for vegetation management under the Canada/Alberta FRDA to be completed by March 31, 1987. Committees included Facilitation, Implementation and Public Participation team participation.
3. Liaison maintained. Work confined primarily to Alberta in 1986-87 to expedite the Grande Prairie pronone herbicide work and field trial layout in general.

4. No screening trials conducted in 1986-87.
 5. Field evaluation of velpar and pronone at Calling Lake deferred to 1987.
 6. Drouin manuscript completed and under review.
 7. Report on 2, 4-D in Manitoba not completed (Transfer to 10-36).
 8. PRUF contract discontinued.
 9. No study proposal prepared for silviculture R&D in vegetation management in Manitoba (Transfer to 10-36).
 10. a) Work on Grande Prairie site completed as planned. Final stage was application of pronone to herbicide treatment plots in fall 1986, with follow-up soil sample to assess incorporation.
 - b) Acted as scientific authority on aspen antecology study under the Canada/Alberta FRDA (NOR-36-02-1A).
 - c) Provided advice on planning and establishment of glyphosate trial in Saskatchewan by Gardner (NOR-36-03-5).
12. Goals for 1987-88:
1. Continue to plan and coordinate regional forest vegetation management R&D (particularly NOR-10 silviculture), NOR-7 (Environmental Impact) and NOR-3 (Economics) (Reference goal 10-56 (NOR-10-03)).
 2. Complete work plan update for forest vegetation management R&D under Canada/Alberta FRDA (Reference goal 10-56 (NOR-10-03)).
 3. Maintain liaison with CFS, other federal departments, provincial agencies and companies involved in vegetation management R&D in region (Brace, Upton, Gardner, Ball). (Reference goal 10-14 (NOR-10-03)). Goal 10-69 (NOR-10-04), NOR-36-03-05 and NOR-36-3.
13. Publications 1986-87:
- 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 1987-88:

PYs: Prof.: (See individual studies)

Tech.:

Total:

Term/Student:

O & M:

Capital:

16. Signatures:

M. Upton
M. Upton

Investigator

Investigator

[Signature]

Program Director, Resources

G. R. Hunt

Regional Director General

- 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)
11. Accomplishments in 1986-87:
1. a) Continued as chairman of SCALE by:
 - completion of 1985 proceedings.
 - SCALE Working Group meeting held in Grande Prairie in August 1986.
 - report for CFS is ready for presentation, and includes a set of WG recommendations and a set of chairman's recommendations.
 - 1986 SCALE Proceedings of Grande Prairie meeting are ready for printing.
 - b) The J.D. Irving PILP contract in New Brunswick was held in abeyance this year.
 - c) A spring meeting of the Technical Committee of the Waterton Biosphere Reserve was attended, followed by my resignation from the committee in the fall of 1986.
 - d) The soils course for Saskatchewan foresters was held on Weyerhaeuser lands and in Prince Albert in September of 1986.
2. A revised report was received in December 1986 from Dr. D.J. Pluth, U. of A. Department of Soil Science. The literature review is not yet completed.

3. Support for a manual on "Forest soils of the prairie provinces" did not materialize.

12. Goals for 1987-88:

1. Preparation of an Information Report on review of literature on subsoil amelioration techniques. Transferred to Study NOR-10-11. (10-59)
2. Study terminated.

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 1986-87:

Holland, W.D. 1986. SCALE - Proceedings of Canadian Forestry Service Working Group on Site Classification - Grande Prairie meeting, August 21-22, 1986.

Holland, W.D. 1986. 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. pp. 38-44.

15. Resources 1987-88:

NIL

16. Signatures:

W.D. Holland
Investigator

[Signature]
Program Director, Resources

Ce-2 [Signature]
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY PROPOSAL

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1987

1. Project: Regeneration and Plantation Management
2. Title: Technology transfer in site classification and forest soils.
3. New: X Cont.:
4. No.: NOR-10-11
5. Study Leader: W.D. Holland
6. Key Words: Site classification, land classification, ecological land classification, SCALE, technology transfer
7. Location of Work: Regional and national
8. Problem Analysis:

Forestry is the principal renewable resource industry in Canada, but the existing and economically accessible forest stands are being rapidly depleted. New forest crops take a long time to grow to commercial size. Operations to efficiently replace forest stands is a national problem with long-term payoffs that most land owners (i.e., the provinces) and forest industries cannot economically tackle alone. A detailed planning base, that is more than current forest inventories, is required. To accomplish this, a national program is required to consolidate and coordinate the expertise, time, effort and funding for site classification, interpretation, and land evaluation.

Among the SCALE activities, interpretation, productivity, and land evaluation are the most important. Site classification should be emphasized after we better understand land features that are important for forest management and productivity. Otherwise we may engage in an expensive and large scale site classification program only to discover that the mapping units cannot be accurately interpreted because they do not contain the information needed in forest land classification; e.g., the FEC program for the Ontario claybelt.

With funding and encouragement the CFS Working group can provide the focus and research leadership needed to relate land, soil, climate (i.e., growth factors and ecological characteristics) to productivity and forest management. The research must be done before the results can be applied. Because forestry is a long term and often tedious undertaking, it is imperative that we start today.

Continued support for the organization of SCALE activities is essential. Even though a number of SC systems are in place in Canada, none adequately relate site quality and productivity to mapping units. The soil surveys still retain their agricultural bias. Foresters need to know more detail of the forest resource being managed before they can learn to manage the forest land more effectively. Thus, we need to conduct research on land features that affect forest site quality and productivity, then demonstrate SC and mapping to the forestry clients, industry, and private sector who will be using it. After the detailed planning base (SC) is accomplished, policy and action plans can be instituted to provide still greater benefits from the forestry community as well as to the forestry community.

9. Study Objectives:

1. To analyze site classification problems in Canada and develop a plan, to address R&D and technology transfer needs in site classification within the CFS.
2. Undertake a technology transfer program in forest soils and site classification in the Western and Northern Region.

10. Goals for 1986-87:

NIL - new study

11. Accomplishments in 1986-87:

NIL - new study

12. Goals for 1987-88:

1. Act as chairman of the National CFS working group (WG) on forest site classification (SCALE): (10-76)
 - a) chair national WG meeting in St. John's, Newfoundland on Aug. 7/87.
 - b) prepare written presentation to CFS Headquarters, and an oral presentation to the CORE meeting in Montreal in February 1987, of the SCALE WG recommendations and chairman's recommendations, including chairman's report and action plan.
 - c) complete compilation and printing of 1986 SCALE proceedings and distribute to SCALE WG members.
 - d) presentation of a paper on SCALE at the Landscape Ecology and Management symposium in Guelph in May 1987.

2. Contribute to the development of a forest site classification system on Weyerhaeuser (PAPCO) limits in Saskatchewan in cooperation with the Sask. Soil Survey and Sask. District Office. (10-3SA)
3. Undertake a technology transfer program in forest soils and site classification to regional clientele. (10-74)
4. Complete an information report on review of literature on subsoil amelioration techniques. (10-59)
5. Prepare a contribution on ecological land classification (ELC) in Banff and Jasper national parks for a book entitled "Canada's Northern and Mountain Environment". (10-84)

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.

Site classification activities are expected to be beneficial to the environment because SC activities will provide:

- a planning base for forest investment, research, and management.
- a data base for preparing interpretations for future land use.
- data for development of land evaluation models.

14. Publications 1986-87:

Holland, W.D. (Compiler). 1987. Proceedings of Canadian Forestry Service Working Group on Site Classification - Grande Prairie meeting, August 21-22, 1986.

15. Resources 1987-88:

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

O & M: \$2,000

Capital: Nil

16. Signatures:

W.D. Hollman
Investigator

[Signature]
Program Director, Resources

C. R. [Signature]
Regional Director General

NOR-11

FOREST INSECT AND DISEASE SURVEY
AND MANAGEMENT STUDIES

9. Study Objectives:

1. To gain an improved and updated knowledge of forest insects and diseases in the region for the purpose of minimizing damage to trees and forests attributable to these organisms, provide an advisory service to management agencies and the public, contribute to FIDS national and provincial overviews of important pest conditions and FIDS-INFOBASE, and compile pest loss data to support FORSTATS.
2. To support research and plant quarantine activities with historical records, collections, and observations.
3. To contribute to nationally directed surveys such as the Acid Rain National Early Warning System (ARNEWS) and pinewood nematode.
4. Provide management agencies with pest identification, control and impact assessment services relating to effects of insects, diseases, climate influences, and pollutants on trees and other forest vegetation.

10. Progress to Date:

The FIDS collections over the years have contributed to two main permanent collections of insects, mites and fungi, maintained at NoFC, of over 80,000 specimens. The collections are recorded and maintained in the national FIDS-INFOBASE. These provide the basis for identification and diagnostic services provided annually to a variety of regional clientele. Important pest species have been monitored for distribution, area of spread, and to estimate levels of abundance and predict population and damage trends. Pest conditions have been reported annually in both national and regional publications.

Special surveys have been conducted to evaluate and document native, new or introduced pests, and in support of plant quarantine activities. Other surveys have been conducted in tree nurseries, plantations, shelterbelts, forested lands and in provincial and national parks. A network of permanent plots was established to monitor for the early effects of acid rain (AR-NEWS), and a region-wide survey was conducted for the pinewood nematode. Special studies and research-related activities have been conducted to improve survey sampling methodology such as the deployment of insect pheromones, and the definition of insect and disease sampling units. Tree mortality losses due to important insect and disease organisms have been estimated and reported by FORSTATS.

A tree pest extension and advisory service has been maintained to provide direct information to clientele. Information transfer on pest-related problems has been contributed by published reports and pest leaflets, open-house displays, presentation of lectures and training seminars, slide presentations and media interviews. Representation and reporting have been maintained on several national, regional and provincial pest committees and meetings.

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. Accomplishments in 1986-87:

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 has been provided by mostly the provinces and Parks Canada.
2. Special surveys for particular pests or of designated areas were conducted, and include the following:
 - a. Conducted field tests for spruce budworm attraction in pheromone-baited Multipher traps to develop this technique as a population

monitoring tool and to predict population trend. Moth catches are being correlated with egg masses and defoliation level. Similar field tests with pheromones were made for Choristoneura pinus and C. lambertiana.

- b. Surveys were made to detect new or introduced pests. Pheromone-baited traps were deployed cooperatively with Alberta Agriculture and Agriculture Canada for detection of gypsy moth and elm bark beetles. No gypsy moths were detected but a single specimen of the smaller European elm bark beetle was trapped in southern Alberta.
 - c. A region-wide survey for pinewood nematode was conducted at 49 locations. Wood disc samples from recent dead/dying and living conifer species were collected at each location and most have been processed for nematode species. The pinewood nematode (Bursaphelenchus xylophilus), 'r' and 'm' forms, were identified at 6 locations.
 - d. A survey of insect and disease organisms was conducted at the pine Ridge Tree Nursery, Smoky Lake, Alta.; to detect new or introduced pests. Several endemic insects and diseases were identified and a report is being prepared. Soil samples were also collected to screen for soil pathogens. Three of the provincial nurseries in Saskatchewan were also surveyed for presence of insects and diseases.
 - e. Surveys for tree conditions and associated insects and diseases were conducted at the 1982 oil well blow out site near Lodgepole, Alberta, and a report was prepared.
3. An Information Report was published that summarized the forest pest situation for 1985 and provided predictions for 1986. Similar information was sent to Ottawa H.Q. for publication in the FIDS national report.
 4. Pest extension information was provided for over 2000 inquiries relating to forest and nursery pests, and insects and diseases on shelterbelts and ornamental trees and shrubs. Information on pest control, pest identifications and tree problems was distributed in addition to pest leaflets. Several lectures and slide presentations were made to such groups as Parks Canada interpretive staff, provincial Agricultural staff, and to urban and provincial park staff. Assistance was provided in field identifications and pest recognition to provincial and industrial forestry personnel in Saskatchewan.
 5. Representation and reporting in were provided on the following committees, meetings and advisory groups:
 - Alberta Pest Control Advisory Council
 - Dutch elm disease committees in Alberta, Saskatchewan and Manitoba.
 - Western Committee on Crop Pests and Western Forum
 - Saskatchewan Advisory Council on Insect and Disease Control
 - National Forest Pest Control Forum

- Annual FIDS Heads meeting
 - Environmental Subcommittee of Alta. Hort. Adv. Committee.
6. An annual interagency FIDS review and planning meeting was held in early April with representatives from the three prairie provinces, NWT, and Parks Canada. Minutes of the meeting were prepared and plans to formalize the meeting, its representation and reporting format were discussed for follow-up action. Subsequently, a proposed terms of reference was prepared and formally presented to the Senior Regional Advisory Committee for comments and eventual adoption.
 7. First draft articles were prepared for an Insect and disease oriented Forestry Report by several authors. All were reviewed in house and revised second drafts are near completion.
 8. A first draft of a survey methodology manual for regional use has been completed.
 9. Ten AR-NEWS plots established in Alberta (4), Saskatchewan (2) and Manitoba (4) in 1985 were re-monitored by FIDS staff. Two new plots were established, one near Ft. McMurray, Alberta, and the other near Hudson's Bay, Saskatchewan. Soil and foliage samples for chemical analyses will be completed in 1987 in conjunction with NOR-7.
 10. Functional guidance for I and D studies under the three FRDA Agreements in the Prairie Provinces was accomplished by:
 - a. Telephone contact with Study Leader of NOR-36-01-1 (M. Daoust-Savoie in Manitoba) and field tour in Manitoba to view study plots.
 - b. In-house discussions with Study Leaders of NOR-36-02-4 (P. Amirault for Alberta) and NOR-36-03-8 (J. Volney for Saskatchewan) and field tour to view study plot locations in Saskatchewan.
 - c. Discussions were held with Forest Protection Staff in Manitoba, Saskatchewan, and Alberta.
 13. Goals for 1987-88:
 1. Survey, map, and report on major forest pests of the region:
 - a. Mountain pine beetle in southwestern Alberta and Saskatchewan and Rocky Mt. Nat'l. Parks.
 - b. Spruce beetle in northern, central and western Alberta.
 - c. Spruce budworm in Manitoba, Saskatchewan, Alberta, and NWT.
 - d. Jack pine budworm in Man., Sask., and Alta.
 - e. Forest tent caterpillar in Man, Sask., and Alta.
 - f. Other insect/disease organisms as identified by client agencies (Cerezke and FIDS Technical Staff)

2. Undertake special surveys and/or research trials including:
 - a. Dutch elm disease and DED vectors;
 - b. Parks Canada - general insect/disease surveys;
 - c. Spruce budworm and jack pine budworm pheromone tests;
 - d. Pinewood nematode distribution, hosts and vectors;
 - e. Insect and disease surveys in provincial tree nurseries;
 - f. Other site-specific or pest-specific surveys as requested.
(Cerezke, and FIDS Tech. Staff)
 3. Compile and publish an Information Report on forest pest conditions in the region in 1986 with some predictions for 1987, and provide similar information to H.Q. for compilation of a national FIDS report.
(Cerezke, Moody).
 4. Compile, prepare maps and tables, summarize and report pest depletion loss information within the region for the period 1981-1986. (Moody, Cerezke)
 5. Provide pest extension information and technology transfer to clientele with the region. (Cerezke, FIDS staff, other NOR-11 staff)
 6. Represent CFS and NoFC on various national, regional and provincial forest pest and related insect and disease committees and advisory groups (Cerezke, FIDS Tech. staff)
 7. Organize and conduct a federal-provincial insect and disease review and planning meeting for NOR-11 and NOR-36. (Cerezke et al)
 8. Publish Information Report on Survey Methodology. (Moody)
 9. Conduct pest surveys in young high value stands, including young regeneration, plantations, seed collecting areas. (Cerezke and FIDS Tech. staff).
 10. Re-examine AR-NEWS plots in the three prairie provinces; summarize data for reporting and update. (Cerezke, FIDS Tech. staff)
 11. Serve as project leader, head of FIDS and provide functional guidance for Insect and disease projects under the three FRDA Agreements in the prairie provinces. (Cerezke)
14. Publications 1986-87:
- Moody, B.H. and H.F. Cerezke. 1986. Forest insect and disease conditions in Alta., Sask., Man., and NWT in 1985 and predictions for 1986. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-276.

Moody, B.H. and H.F. Cerezke. 1986. Contribution In: Forest Insect and Disease Conditions in Canada. 1985. Compiled by E.S. Kondo and R.G. Taylor. Agr. Can., Can. For. Serv., Ottawa.

Moody, B.H. 1986. The jack pine budworm, history of outbreaks, damage and FIDS sampling and prediction systems in the Prairie Provinces. Pages 15-22 in Jack Pine Budworm Information Exchange. Manitoba Natural Resources, Winnipeg, Manitoba.

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.

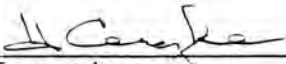
16. Resources 1987-88:

PYs:	Prof.:	Cerezke	0.6
		Moody	0.3
	Tech.:	Emond	1.0
		Gates	1.0
		Still	1.0
		Grandmaison	1.0 (Manitoba District Office)
		Tidsbury	0.7 (Part-time Sask. Dist. office)
	Total:		5.6
	Term/Student:		0.3

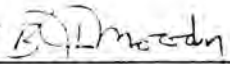
O & M: \$30,000 + 6,000 (Man. Dist. Off.)

Capital:

17. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

9. Progress to Date:

Thirty four scientific papers have been published in this study. Two new genera have been erected in North America and one in Eurasia. Twenty new species of sawflies have been described in North America, Mexico, China and Brazil. Keys were developed to separate adults and/or larvae of Pristiphora, Allantus, Pristola, Melastola, Anoplonyx, Sharliphora, Eitelius, larvae of different genera in the family Diprionidae in North America, strains of the larch sawfly, larvae defoliating birch in the Canadian Prairies, different genera of the tribe Pristolini, and genera of specialized Nematini. Reported the spread of three introduced sawflies defoliating conifers into the Canadian Prairies within the last decade. Identified several thousand species of sawflies for the Canadian National Collection, United States National Museum, and other institutions and clients.

10. 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.

11. Goals for 1986-87:

1. Identify larval and adult sawflies for research personnel, institutions, and laboratories.
2. Publish in the Canadian Entomologist "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. Accomplishments in 1986-87:

1. Identified over 800 larval and adult sawflies for clients and reviewed one manuscript for the Proc. Entomological Society of Washington.
2. The paper on "Larvae of the North American genera of Diprionidae (Hymenoptera: Symphyta) has been published in the Canadian Entomologist.

3. The 250 specimens of Pristiphora for USDA Washington, D.C. have been identified and will be returned in the new year.
4. The visiting scholar from Beijing, Peoples Republic of China has returned in the spring, and a joint paper on ants have been prepared.
5. The paper on the "Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae) in Hinton, Alberta" has been submitted to the Canadian Entomologist for publication.

13. Goals for 1987-88:

1. Identify larval and adult sawflies for research personal, institutions and laboratories.
2. Identify 203 specimens of Pristiphora collected in the James Bay area for the Canadian National Collection, Ottawa, and the U.S. National Museum, Washington.
3. Make the necessary revisions required by the Canadian Entomologist before the paper "Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae) in Hinton, Alberta" can be published.

14. Publications 1986-87:

Wong, H.R.; D.L. Szlabey. 1986. Larvae of the North American general of Diptimidae (Hymenoptera: Symphyta). Can. Ent. 118:577-587.

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 1987-88:

PYs: Prof.:	Wong	0.3
	Tech.:	0.0
	Total:	0.3
	Term/Student:	0.0

O & M: \$1,000

Capital:

17. Signatures:


Investigator


Program Director, Protection


Regional Director General

assess the effectiveness of pheromone baits, beetle behavior, and to field-test additional pheromone bait formulations for potential use in beetle/lodgepole pine management.

Major timber losses from the MPB were coincident throughout central and southern B.C., the northwestern U.S. as well as in Alta. and Sask., and necessitated a coordinated effort in research and information exchange, especially related to MPB/lodgepole pine management strategies and in border-related issues between different jurisdictions.

9. Study Objectives:

1. Investigate forest entomological problems within the region that arise annually or seasonally, and often on relatively short notice.
2. Provide knowledge, liaison and technology transfer of pest management information to provincial and industrial clientele, specifically on bark beetles, woodborers, root collar weevils, and other important forest insect groups such as regeneration pests and seed and cone insects.
3. Conduct research and development of pheromones of the mountain pine beetle, spruce beetle, other associated bark beetle species and their insectivorous predators and parasites, for use in field applications of detection and control.
4. Maintain regional, national and international perspective of bark beetle and woodborer research and pest management developments.

10. Progress to date:

Ecological studies have been conducted on the pine root-collar weevil in Alberta and the information summarized in several reports, publications and a PhD thesis (see attached list). Other insect problems investigated have included spruce budworm in spruce and spruce-fir forests in northern Alberta, NWT and Riding Mt. Nat'l Park; jack pine budworm in central Saskatchewan; seed and cone insects of white spruce in western Alberta; spruce bud midge in central and northern Alberta; woodborers in fire-killed timber in Alberta, Saskatchewan and Manitoba; and birch-leaf mining sawflies in birch in central Alberta. Special surveys were conducted for incidence of insects and diseases affecting conifer regeneration in western Alberta and in Saskatchewan and Manitoba. a partial list of published and unpublished reports of these studies is appended.

Several aspects of the mountain pine beetle (MPB) have been investigated in southwestern Alberta, Rocky Mt. Nat'l. Parks and in the Cypress Hills. Studies contributing to improved survey and impact estimation were made in lodgepole pine stands and large-scale aerial photography was used to assess infestations in Kootenay Nat'l. Park. Since 1982 studies of the pheromone communication system of the MPB have been investigated in cooperation with Dr. J. Borden, Simon Fraser Univ., and with Drs. H. Wieser and E. Dixon, Univ. of Calgary. These studies, in cooperation with the Alberta Forest Service, Alta. and Sask. provincial parks personnel and

B.C. Ministry of Forests have lead to the identification of several synthetic analog compounds attractive (and repellent in some cases) to MPB and its major predatory insect. Beetle responses to baited trees and traps have been evaluated in both lodgepole and limber pine stands. Responses in beetle catch in traps have been analyzed for seasonal trends and for sex differences. The field experiments with MPB pheromones have helped to establish practical applications of the pheromones for detection, monitoring and control strategies. Similar field trials have been initiated in spruce beetle habitats in Alberta to develop the use of pheromone baits for survey and detection of this species.

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. Accomplishments in 1986-87:

1. a. Final report presented at Jack pine Budworm Information Exchange, Winnipeg Jan./86 and published in proceedings by Manitoba Natural Resources.
- b. Graph work completed; first draft needs revisions.
- c. Report published as Inf. Rep. (NOR-X-280).
2. a. "Mountain pine beetle attack density pattern on semiochemical baited and unbaited lodgepole pine in southwest Alberta". Coauthored by Cerezke, Wieser, Dixon for journal paper. First draft and review completed.
- b. "Attractiveness of structural analogs of brevicomin to MPB in field bioassay studies in southwest Alberta". Co-authorship to include Wieser, Dixon, Ibrahim, Cerezke. Some graphical and text prepared but first draft of paper is incomplete.
- c. "Attack pattern and brood productivity of the MPB on three pine hosts". (Cerezke). Paper presented at 1985 Entomol. Soc. Alta. Abstract published in 1986 in Proceedings.
- d. "Probing the receptor site for the aggregation pheromone exo-brevicomin in MPB" (Co-authored by Dixon, Ibrahim, Castro, Wieser, Cerezke and presented as paper at 69th Canadian Chem. Conference, Saskatoon by Dr. E. Dixon).
3. Attended meeting of MPB Technical Committee at Valemont, BC to review and discuss BC/Alta./Parks Canada concerns of MPB infestations. Provided update information into CAN/US MPB Action Plan, and attended MPB/Lodgepole pine field trip in Kelowna area of BC to view a variety

of MPB/Lodgepole pine management strategies and related land use concerns.

4. MPB adults collected in a field bioassay experiment involving traps baited with different pheromone formulations in a limber pine stand were measured, sexed and statistically analyzed for differences in beetle response between bait formulations. This was a joint study with Drs. Wieser and Dixon, Univ. of Calgary.
5. b. In cooperation with Drs. Wieser and Dixon, Univ. of Calgary, and Mr. E. Begin, B.C. Ministry of Forests, a large trap baiting experiment was undertaken in a heavily infested lodgepole pine stand near Invermere, BC. Several pheromone bait formulations were deployed to examine MPB response to different analog mixtures and to follow seasonal trends in catch. Several thousand beetles were captured and data measurements and analyses are incomplete. Surveys of baited-trap plot areas have been completed to compare MPB-attacked tree patterns with adjacent un-trapped stands.
- c. Two field experiments were carried out to test the attractiveness of different pheromone-bait formulations to the spruce beetle; one experiment near Manning, Alta., the other near Blairmore. Data from the Blairmore site were unsuccessful for spruce beetle but certain bait mixtures were attractive to another scolytid species and to a scolytid predator. One formulation used at the Manning site, previously tested elsewhere, showed potential promise as a survey monitoring tool for spruce beetle.
6. A planned Alberta Forest Service review publication: "Mountain pine beetle in Alberta -- a decade of infestation, 1977-1986" is underway with main contributors designated as B. Miyagawa, W. Smith and H. Cerezke. three discussion meetings were held, table of contents formalized, and various sections have been written.
7. Technology transfer of insect/disease information was provided in a number of areas; notable contributions include:
 - Two lectures presented to Univ. Alta. forestry class on insect and disease pests important on seeds, cones and in nursery management;
 - Served as an Associate Editor of Canadian Entomologist journal and processed 10 papers in forest entomology.
 - Provided advisory role to Banff Nat'l. Park in preparing a B.N.P. Forest Insect and Disease Management Plan.

13. Goals for 1987-88:

1. Finalize report: Surveys of spruce budworm populations and damage impact in Riding Mt. National Park, 1979-80. (Cerezke)
2. Finalize manuscript and submit for publication: "Mountain pine beetle attack density pattern on semiochemical-baited and unbaited lodgepole pine in southwest Alberta". (Cerezke, Wieser, Dixon)

3. Prepare paper for publication: "Attack pattern and brood productivity of the MPB on three pine hosts". (Cerezke)
 4. Continue representation on MPB Technical Committee and provide input into CAN/US MPB Action Plan if required.
 5. Continue analyses of MPB and spruce beetle data collected in 1985-86 field season.
 6. Conduct a field experiment in cooperation with Drs. Wieser and Dixon, Univ. of Calgary and E. Begin, B.C. Min. Forests near Invermere, B.C. to test attractiveness of pheromone compounds to MPB, and rear live MPB adults at NoFC for electro antennagram studies to be undertaken by Dixon.
 7. Conduct field tests for spruce beetle attraction to pheromone candidate compounds in cooperation with Drs. Wieser and Dixon, the Alberta Forest Service and study NOR-36-02-4.
 8. Prepare contributions and editing toward completed draft of proposed Alta. For. Service publication: "Mountain pine beetle in Alberta -- a decade of infestation, 1977-1986."
 9. Provide technology transfer of information on pest problems to clientele as requested, and continue duties as Associate Editor for Canadian Entomologist.
 10. Serve as Scientific Authority and external advisor for PRUF contract to graduate student at Univ. Alberta (D. Langor and J.R. Spence) for study: "Host effects on population dynamics and differentiation of the MPB in southwestern Alberta".
 11. Present scientific paper at 70th Can. Chem. Conference, Quebec, June 1987. Titled: "The comparative attractancy of the enantiomers of exo-brevicomín and the exo-5-7-dimethyl analog for MPB as determined by trapping and tree baiting in southwestern Alberta and southeastern British Columbia by Dixon, Ibrahim, Wieser (presenting paper), Cerezke and Begin.
 12. Plan and prepare a new study statement on "Disease of nursery seedlings and plantations" (Cerezke and vice Zalasky).
14. Publications 1986-87:
- Cerezke, H.F. 1986. Impact studies of the jack pine budworm (Choristoneura pinus pinus in Nisbet Provincial Forest, Saskatchewan. Pages 25-38 in Jack Pine Budworm Information Exchange. Manitoba Natural Resources, Winnipeg, Man.
- Cerezke, H.F. and R.E. Holmes. 1986. Control studies with carbofuran on seed and cone insects of white spruce. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-280. 10 p.

Cerezke, H.F. 1986. Abstract of "Attack pattern and broad productivity of the MPB on three pine hosts", published in 1985 Proc. of Entomological Soc. Alta., Lethbridge.

Wieser, H; E.A. Dixon, and H.F. Cerezke. 1987. Pheromone technology in forest pest management: spruce beetle and mountain pine beetle. A Status Rep. to Research Br., Alta. For. Serv., 61 pp.

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 1987-88:

PYs: Prof.:	Cerezke	0.4
	vice Zalasky	1.0
Tech.:		0.0
Total:		1.4
Term/Student:		0.0


O & M: \$4,000

Capital:

17. Signatures:


Investigator


Program Director, Protection


Regional Director General

keeping abreast of the latest entomological literature and changes in nomenclature. To facilitate prompt and accurate diagnosis, keys must be devised not only to the adult and immature forms, but also to insect damage in the Canadian Prairies.

The material is provided by personnel of the Forest Insect and Disease Survey and by the investigator. The immature insects are reared in the laboratory at Edmonton and in the field. The adults obtained are submitted to specialists in Ottawa or elsewhere in North America or Europe for identification and the latest nomenclature. All adults identified by specialists and larva and damage associated with these adults are placed in the reference collection.

9. Progress to Date:

Each year, several thousand insect specimens in the mature and/or immature stages are determined and over a thousand inquiries handled for in-service personnel, clients, outside agencies and scientists. Curator of over 60,000 mature and immature insects including spiders and mites, which were obtained through rearings and collections mainly in the Canadian prairies. Recorded the spread of several introduced forest and shade tree insects into the Canadian prairies, and followed their progress each year. Elucidated the life history of 9 forest insects in our area and published these findings in scientific journals. The author of about 70 reports and publications dealing with the biology, habits, behavior, distribution, and control of forest insects in the Canadian prairies. Produced keys and guides to the identification of the following insects and mites in our area: common galls and abnormal plant growth to forest and shade trees, adult June beetles attacking coniferous plantations, insects in the club-tops of black spruce, literature guide to methods of rearing insects, some insect pests of forest nurseries, species of Proteotenus attacking shoots of Manitoba maple, and species of Petrova attacking the shoots of lodgepole pine.

10. Study Objectives:

1. Provide diagnostic and biosystematic services to clients, in-service personnel, outside agencies, and scientists engaged in biological and taxonomic research on insects.
2. Maintain and improve the regional collection of insects and mites.
3. Initiate biological and ecological studies of forest insects that cause economic damage in the Canadian prairies.

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. Accomplishments in 1986-87:

1. Only a few thousand insect specimens in the mature and/or immature stages were determined and over a thousand enquiries handled this year from in-service personnel, clients, outside agencies and scientists.
2.
 - a. Nearly 90 specimens determined by specialists in Ottawa and by myself have been incorporated into the reference collection.
 - b. Over a thousand specimens collected by W.G.H. Ives and personnel of the Insect and Disease Survey were reared in which over a hundred were overwintered to obtain biological information and specimens for the reference collection.
 - c. Over two hundred specimens were pinned, spread, labelled and preserved for the reference collection.
3. Biological information and/or specimens were provided to:
Dr. D.R. Smith, Syst. Ent. Lab. USDA, Washington, D.C.
Dr. M.M. Furniss, Univ. of Idaho, Moscow, Idaho.
Dr. H. Goulet, Brusyst. Res. Inst., Ottawa, Ontario.
4.
 - a. A survey was made in 1986 for the following introduced insects, which have entered southeastern Manitoba in recent years.

- The introduced pine sawfly which was first collected in 1983 was not collected in 1986.

- The European spruce sawfly, present since 1969 was observed only in the Hadashville area in 1986.
- The larch casebearer, which was observed since 1965 was collected in the Sprague and Marchand area. This infestation is within the boundary of the previous year.
- More trees were damaged by the mountain ash sawfly this year. Damage to mountain ash was observed on Elder and Fairway streets at Falcon Lake, Man. This sawfly was first recorded on Elder Street, Falcon Lake in 1984.
- Numerous pheromone traps set out by the Food Production and Inspection Branch failed to capture any males of the Gypsy moth in 1986. The only collection of the species in Alberta was in Sherwood Park in 1985.

b. The European pine shoot moth present in Ontario and British Columbia is still absent in the Canadian prairies.

5. Accomplishments in the pictorial guide to the forest and shade tree insects of the Canadian prairies are as follows:

- a. Collections were made and photographs obtained of the insect groups needed to fill gaps in the coverage. Particular emphasis was placed on wood boring insects.
- b. A literature review was made for the forest insects not already written.
- c. First draft for approximately 95 sets of text with accompanying figures have been prepared.
- d. Positive identification have been made for nearly a hundred specimens for the guide by specialists in Ottawa from the 1985-86 rearings.
- e. The majority of the write-ups have been submitted for reviews.
- f. Rough copies of all plates (115) have been prepared and camera ready plates have begun under Judy Samoil's supervision.

13. Goals for 1987-88:

- 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 "A pictorial guide to the forest and shade tree insects of the Prairie Provinces" by:
 - a. make limited collections to fill in gaps in the coverage (Ives, Wong);
 - b. Publish the above reports (Ives, Wong)

14. Publications 1986-87:

Emond, F.J. and H.R. Wong. 1986. Common insects attacking the poplar stooling beds in the Canadian Prairies. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note. No. 42.

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.

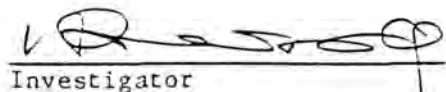
16. Resources 1987-88:

PYs: Prof.:	Wong	0.7
	Ives	0.5
Tech.:		0.0
Total:		1.2
Term/Student:		0.0

O & M: \$1,000

Capital:

17. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

9. Progress to Date:

A series of impact plots were established in the early 1980's across the region in ongoing outbreaks or infestations of major forest pests, to study their effects on timber volume and the forest. Permanent impact plots were established in lodgepole pine stands in Waterton (25 plots), Kootenay (6 plots) and Yoho (6 plots) for long term studies on the impact of the mountain pine beetle in uncontrolled forests. These plots will also be used to evaluate several hazard rating systems and depletion estimates.

Permanent impact plots were established in spruce-fir stands in current spruce budworm outbreak areas (13 plots); and in jack pine budworm infested stands (10 plots) in Manitoba. These will provide information on annual defoliation and egg mass counts and their relationship to damage and tree mortality.

Permanent impact plots (15) were established in dwarf mistletoe infested jack pine forests in Saskatchewan to study the effects of tree growth and tree mortality. This will also provide information on the relationship between mistletoe and other pests and on their combined effects on the forest.

A network of permanent impact plots in stands of different ages, growing under different density and site conditions have been established in jack pine forests of Manitoba (240 plots) and Saskatchewan (ca. 600 plots). A latitudinal analysis of damage in these stands together with an analysis of historical records will permit an initial description of the impacts of jack pine budworm and other pest populations on these stands.

A network of intensive study plots were established in Manitoba (9 plots) and Saskatchewan (9 plots) in which population and defoliation estimates were made. Studies conducted in these plots are aimed at developing efficient sampling techniques as well as descriptions of the dynamics of jack pine budworm populations.

10. Study Objectives:

1. To determine the significance of specific forest pests in terms of measured damage to trees and forest stands.
2. To develop or modify appraisal methods for assessment of losses caused by forest pests; and to provide information on forest depletion that can be used in the national forest statistics data program.
3. Design forest pest management systems which optimize the return from stand management activities.

11. Goals for 1986-87:

1. Remeasure 37 impact plots and assess damage by the mountain pine beetle in the national parks and re-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 F.I.D.S. 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 F.I.D.S. 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)

Added Goals

9. a. Present talk on Conifer-feeding budworms to the Elm Guard Group of Manitoba.
b. Present talk on the history of jack pine budworm in the Prairie Provinces to the North Central Forest Pest Workshop. (Volney)
10. Prepare proceedings of the Thirty sixth Annual Western Forest Insect and Disease Work Conference. (Moody)
11. Participate in 1986 W.F.I.W.C. and moderate workshop.
12. Accomplishments in 1986-87:
 1. The mountain pine beetle impact plots in the Rocky Mountain National Parks were re-assessed for the presence of beetles, tree condition, and condition of beetle killed trees such as checks, blow-down, decay, etc. A computer analysis of the data was completed and a report is in the final stages.

2. First draft of an information report of a literature review on the effects (mortality, top kill, growth loss, etc.) of major pests on the forests of the region, is near completion.
3.
 - a. The spruce budworm impact plots in Manitoba were assessed for current and old defoliation, top-kill and mortality of spruce and fir. After several years of infestation the outbreak is still in progress, and an interim report is near completion.
 - b. Assessed, for the fourth year, damage caused by jack pine budworms in 10 permanent plots in Grand Rapids, Manitoba. Branch samples were taken for egg-mass and larval counts and for defoliation estimates. This is in cooperation with the Manitoba Forestry Branch. Data have been analysed relating egg-mass counts to defoliation and a report is being prepared.
 - c. Dwarf mistletoe impact plots in Saskatchewan were remeasured and assessed for infestation intensity, spread, and tree mortality four years after plot establishment in jack pine forests. A forest management note is being prepared.
4.
 - a. Spent 3 months in Manitoba initiating and supervising new Insect and Disease Specialist in work of the insect and disease program of the Canada/Manitoba Forest Renewal Agreement. (NOR-36-04)
 - b. Spent 10 days in Manitoba reviewing and discussing progress of I & D work.
 - c. Continued to advise I & D specialist on conduct of studies, data management and data analysis procedures in Manitoba. (NOR-36-04)
 - d. Conducted field studies in Saskatchewan under the Canada/Saskatchewan Forestry Development Agreement.
5. Continued to give support in the use of remote sensing methods to detect insect damage in Alberta (mountain pine beetle and forest tent caterpillar) and in Saskatchewan (spruce budworm).
6.
 - a. Met with forest protection personnel in Manitoba to plan and discuss research in progress and discuss future plans.
 - b. Met with D.P.R.R. personnel in Saskatchewan to initiate forest pest surveys and advise on structure of studies.
 - c. Met with Weyehaeuser forestry personnel to discuss jack pine budworm management
7.
 - a. Participated in the design and planning of a jack pine budworm damage appraisal survey of the Torch River Provincial Forest of Saskatchewan being conducted by the Saskatchewan Department of Parks and Renewable Resources.
 - b. Obtained representative trees in jack pine stands to determine individual tree growth loss by stem analyses.

8. a. Designed and initiated studies to provide the scientific basis to develop pest management system for the jack pine budworm. This work was done under the Saskatchewan and Manitoba Federal/Provincial Forest Resources Development Agreements (NOR-36-01-1 and NOR-36-03-8).
9. a. Presented invitational talk to the Elm Guard Group of Manitoba entitled "Budworms in the North American time-scape".
 - b. Presented invitational talk to the North Central Forest Pest Workshop held at Sault Ste. Marie. Talk entitled: "A fifty year history of the jack pine budworm in the Prairie Provinces."
10. Prepared and printed Proceedings of the Thirty-sixth Annual Western Forest Insect and Disease Work Conference, Boulder Colorado 1985.
11. Participated in the 1986 W.F.I.W.C. in Victoria, B.C. and was Moderator of a workshop on "Estimating Mortality Rates in Wild Populations".
13. Goals for 1987-88:
 1. Assess damage caused by the jack pine budworm in Manitoba in co-operation with the Provincial Forestry Branch and prepare report. (Volney)
 2. Continue to collect branch samples in Manitoba and Saskatchewan to estimate jack pine budworm population densities and defoliation intensities (in co-operation with NOR-36). (Volney)
 3. Continue jack pine budworm pheromone-trapping studies in conjunction with R.P.C. and expand area in Saskatchewan in an attempt to monitor the spread of the infestation. (Volney)
 4. Prepare life table estimates from population study plot information in the 1985/86 generation of the jack pine budworm in Manitoba. (Volney)
 5. Initiate studies on improving rearing techniques for the jack pine budworm on artificial diets. (Volney)
 6. Initiate studies on the interaction among jack pine growth and survival, mistletoe infection and the jack pine budworm feeding. (Volney)
 7. Prepare paper for review on jack pine budworm outbreaks and the historical record. (Volney)
 8. 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 to the F.I.D.S. annual report as required. (Volney & Moody)
 9. Summarize data in mountain pine beetle damage impact plots located in three Rocky Mt. Nat'l. parks and prepare a status report. (Moody)

10. Publish Information Report on a literature review on the effects of major forest pests on tree mortality and growth in the forests of the region (Moody).
11. Summarize data on tree condition and damage caused by the spruce budworm in impact plots in Manitoba and prepare status report. (Moody)
12. Summarize data on tree condition and damage caused by the jack pine budworm in impact plots in Manitoba, and prepare report in cooperation with Manitoba Forestry Branch. (Moody)
14. Publications 1986-87:

Volney, W.J.A. 1986. Current jack pine budworm research in Manitoba. Pages 41-46 in Jack Pine Budworm Information Exchange. Manitoba Natural Resources, Winnipeg, Man.

15. Environmental Implications:


The NoFC Environmental Screening Committee has evaluated 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.

16. Resources 1987-88:

PYs.	Prof.:	Volney	0.5
		Moody	0.5
	Tech.:	Szlabey	1.0
	Total:		2.0
	Term/Student:		0.3

O & M \$ 8,000

17. Signatures:


Investigator


Program Director, Protection


Investigator


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 27, 1987

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Forest tree rusts of Western North America
3. New: Cont: X 4. No.: NOR-11-06
5. Study Leader: Y. Hiratsuka
6. Key Words: Cronartium, Endocronartium, Pucciniastrum, Melampsora,
Chrysomyxa, Peridermium, cytology, morphology, taxonomy,
Uredinales, inoculation experiments, pathogenicity,
resistance, tree improvement, hyperparasite, biological
control
7. Location of Work: Edmonton (laboratory, greenhouse, and mycological
herbarium), western North America with particular
emphasis on northern region (field)
8. Background Statement:

Rust fungi are known to attack vigorously growing plants rather than weakened ones because of their obligate parasitism. Damage caused by this group of fungi tends to increase under intensive and extensive cultivation of forest trees, as evidenced by such cases as white pine blister rust in North America, poplar rusts in Europe, fusiform rust of hard pines in southeastern U. S., and western gall rust of hard pines in North America.

An estimate of the losses attributable to forest tree rusts in this region has not been obtained but significant growth loss and mortality caused by species of rusts of several major forest tree species, including lodgepole pine, jack pine, white spruce, black spruce, balsam fir, alpine fir, aspen, and poplar have been suggested. In addition, several rust species endemic to the region have been recognized as serious pathogens in other areas where forestry practices are more intensive. Western gall rust has been identified as the most important disease of artificial regeneration and intensive management of lodgepole and jack pines in the region, and is considered important in genetic improvement programs of hard pines.

Our knowledge of western forest tree rusts has been inadequate to solve present and future problems which are and will be caused by this group of fungi, and studies of selected species on identity, life history, host

range, cytology, pathogenicity, conditions of infection, and taxonomy are necessary.

9. Study Objectives:

1. To study biology, cytology, pathology, host-parasite relationship, inoculation techniques, and resistance screening methods of western gall rust to contribute to the genetic improvement programs and management of lodgepole and jack pines in the prairie provinces.
2. To study pathology, taxonomy, morphology, and life-cycle of forest tree rusts, especially those of pine stem rusts of Canada and related species in the world, aiming to compile a definitive manual of forest tree rusts of Canada (or North America) and a monograph of pine stem rusts.
3. To make contributions to the taxonomy, nomenclature, and terminology of rust fungi.

10. Progress to Date:

A. Pine stem rusts

1. Distribution, damage, and life cycles of pine stem rusts of the region were investigated and reported in five journal publications.
2. A major publication entitled "Pine stem rusts of Canada" by Y. Hiratsuka and J. M. Powell was published in 1977. This fully illustrated publication discusses aspects of identification, hosts, distribution, morphology, life cycle, cytology, damage, epidemiology, and control of all pine stem rust species which occur in Canada.
3. Comprehensive studies of cytology and morphology of pine stem rusts in the region resulted in a new method of determining the type of life cycles of pine stem rusts by simple germination tests. This new method has been successfully applied not only in North America but also in Europe and Asia. A new genus, Endocronartium, has been established based on cytological studies of pine-to-pine species from North America (E. harknessii--western gall rust) and Europe (E. pini--resin-top). Thirteen journal publications have been prepared on the related subjects.
4. Three aggressive hyperparasites (Monocillium nordinii, Cladosporium gallicola, and Scytalidium uredinicola) of western gall rust and other pine stem rusts have been investigated with a visiting scientist (NSERC Visiting Fellow 1983-84). Modes of parasitism, and production of bioactive metabolites produced by these fungi were investigated and documented in eight journal publications.
5. Incidence and identity of hyperparasitic fungi, rust-feeding insects, and animal damage to pine stem rusts have been recorded and reported by J. M. Powell in eight journal publications.

6. Several study leaves and field trips were conducted to study pine stem rusts of Asia (Japan, Korea, and China) and Europe (Scotland, Netherlands, and Norway) to make comparisons with forms that exist in North America. The purpose of the study is to evaluate interrelationships of pine stem rust species that occur on different continents and to contribute to genetic improvement programs of pine species in North America. The results have been reported in four journal publications.
 7. Mode of penetration, condition of infection, early infection symptoms, and methods of inoculation of western gall rust are investigated and results are published in two journal publications.
- B. Forest tree rusts other than pine stem rusts
1. Morphology, life cycle and taxonomy of several conifer needle rusts including Pucciniastrum sparsum, P. goeppertianum, and P. epilobii have been studied and results have been reported in six journal publications.
- C. Taxonomy of rust fungi
1. A new and rational set of terminology of rust spore states based on function and morphology was proposed in several journal publications and has been accepted widely and adopted in most of the major mycology textbooks published in recent years.
 2. With Dr. G. B. Cummins (University of Arizona), proposed a new system of taxonomic divisions among the rust fungi by designating 14 families, including 7 new families.
 3. Several new concepts of the taxonomy of rust fungi emphasizing nuclear cycles and spermogonial morphology have been proposed.
 4. Co-authored a reference book on the taxonomy of rust fungi entitled "Illustrated Genera of Rust Fungi" with Dr. G. B. Cummins.
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. Accomplishments for 1986-87:

A. Western gall rust study

- 1. Continued investigation of early infection symptoms and inoculation method and published one journal paper.
- 2. A significant progress has been made to prepare an information report on western gall rust with Dr. P. Blenis of the University of Alberta.
- 3. Various vegetative propagation methods of lodgepole pine were tried by a graduate student Mr. Eric Allen (U. of Alberta).
- 4. & 5. Tissue culture of hard pines and axenic culture of western gall rust were not tried actively.

B. Taxonomy and biology of forest tree rusts

- 6. The first draft of 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 (PFC) is prepared and ready for review.
- 7. A pine stem rust specimen sent from Mexico was examined. The fungus may be a new species and further comparative examinations are in progress.
- 8. A field trip to northern China was made in May to June 1986 with the financial assistance from NSERC (International Collaborative Research Grant) through the University of Alberta. Several interesting pine stem rust specimens were collected on native pine species and under cytological and morphological examinations to find out interrelationships between forms exist in North America. A paper entitled "Pine stem rusts of China" was presented at the annual meeting of the Plant Pathological Society of Alberta in Vegreville, Alberta.
- 9. Preliminary plans for IUFRO "Rusts of Hard Pines" Working Party meeting in Alberta (Possibly at Banff Centre) in 1989 were made.

13. Goals for 1987-88:

A. Western gall rust study

1. Complete an comprehensive information report on western gall rust with Dr. P. Blenis of the University of Alberta.
2. Cytological examinations of spores and germ tubes will be conducted to clarify the nature of nuclear events in the rust.
3. Continue to fill in the gaps in field plantings of graftlings obtained from field resistant and field susceptible lodgepole pine trees from four different locations in Alberta.
4. Host parasite interactions will be studied with a visiting fellow (NSERC), Dr. A. Hopkin and a graduate student Mr. E. Allen (U of Alberta).

B. Taxonomy, biology and pathology of forest tree rusts

5. Specimens of pine stem rusts collected from China will be examined and compared with forms in North America.
6. Continue organizing IUFRO "Rusts of Hard Pines" Working Party meeting in Alberta in 1989 as the chairman of the organizing committee.
7. Complete an information report entitled "Impact of pine stem rusts of hard pines" with Drs. J. Powell and A. Van Sickle.

14. Publications 1986-87:

Hiratsuka, Y. 1986. Cytology of an autoecious soft pine blister rust (Peridermium yamabense) in Japan. *Mycologia* 74:637-640.

Hiratsuka, Y. 1986. Origin, distribution, and taxonomy of Cronartium ribicola and related species. (Abst.) *Phytopathology* 76:1059.

Blenis, P. V.; Hiratsuka, Y. 1986. A technique for inoculating Pinus contorta var. latifolia seedlings with Endocronartium harknessii. *Can. J. Plant Pathol.* 8: 335-337.

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 1987-88:

PYs: Prof.:	Hiratsuka	0.7
	Tech.: Maruyama	0.7
	Total:	1.4
	Term/Student	0.0


O & M: \$12,000

Capital:

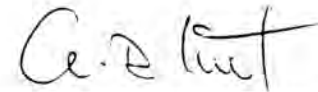
17. Signatures:



Investigator



Program Director/ Protection



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 27, 1987

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Forest diseases: Research and technical transfer services
3. New: Cont: X 4. No.: NOR-11-07
5. Study Leader: Y. Hiratsuka
6. Key Words: Mycology, herbarium, culture collection, nomenclature, identification, forest pathology, Armillaria root rot, DED, Ceratocystis spp., mountain pine beetle
7. Location of Work: Edmonton (Northern Forestry Centre-laboratory), Various field locations in the region.
8. Background Statement:

Accurate and prompt diagnosis of tree diseases and identification of causal organisms are essential to the disease surveys, pest extension services, damage appraisal studies, environmental assessment studies, and consideration of possible control measures of tree diseases. Besides, many non-pathogenic fungi in forest ecosystems also play important roles in nature. Proper identification of mycorrhizal fungi, decomposing fungi, and hyperparasitic fungi of forest tree pathogens are important to many research studies and provide better understanding of forest ecosystems.

Taxonomy and nomenclature of fungi are constantly being revised. Changes in the concepts and limits of species and application of new or different names for the same organisms often cause confusion. Proper applications of up-to-date information of taxonomy and nomenclature are necessary whenever names of the organisms are used in reports or journal publications. To provide satisfactory taxonomic and nomenclatural service, a highly trained technical and professional staff is required.

To maintain and improve diagnostic and taxonomic service capabilities, it is necessary to maintain a high quality disease reference collection, a fungus culture collection, and a reference literature collection.

Research on selected tree diseases becomes necessary from time to time when certain diseases are identified as important in forest management practices in the region or recognized as public and media concerns.

9. Study objectives:

1. To conduct disease identification and taxonomic service, and to maintain and upgrade a disease reference collection (Mycological Herbarium) and a fungus culture collection.
2. To conduct investigations of selected forest tree diseases of the region such as *Armillaria* root rot, Dutch elm disease, and mortality caused by mountain pine beetle.

10. Progress to date:

1. Tree disease diagnosis and identification service has been provided for FIDS activities since 1950s.
2. Disease reference collection (Mycological Herbarium) has been maintained and upgraded for many years, and now contains more than 20,000 catalogued specimens. "Annotated check list of tree and shrub diseases of the Prairie Provinces" was published in 1977.
3. Fungal culture collection was established in 1950s, maintained, and upgraded. The collection now contains more than 1000 cultures. A list of cultures in the collection was published in 1985. The collection includes important isolates of: *Armillaria* root rot complex, wood decay fungi, *Scleroderris* canker organisms, hyperparasites of pine stem rusts, fungi associated with mountain pine beetle attacked trees, and Dutch elm disease pathogens.
4. An information publication entitled "Forest tree diseases of the Prairie Provinces of Canada" is under review and will be published in 1986-87 fiscal year.
5. Described and reported several new forest fungi, e.g. *Phaeoseptoria contorta*, *Capnobotrys piceae*, and *Marssonina balsamiferae*.
6. Together with Dr. S. Takai of GLFC, investigated host-parasite interaction of Dutch elm disease and contributed to the discovery of specific toxin of the disease (cerato-ulmin=CU).
7. Identification of biological forms of pathogens, pathogenicity, and host preference of *Armillaria* root rot in the prairie provinces has been investigated with Dr. K. I. Mallett (Alberta Horticultural Research Centre), Mr. Martin Mugala (graduate student U of Alberta), and Dr. P. V. Blenis (U of Alberta).
8. Bioactive metabolites of forest disease pathogens such as *Gremmeniella abietina* (*Scleroderris* canker), *Ceratocystis* spp. (blue stain fungi associated with mountain pine beetle), and *Stereum purpureum* (silver leaf) are investigated in cooperation with Dr. W. Ayer of the University of Alberta.
9. Cause(s) of mortality of mountain pine beetle attacked trees has been investigated with Dr. W. A. Ayer of the University of Alberta and Dr. R. Swanson of NoFC.

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 made.
 - 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 prepared by 1 December 1986 for 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 disease reference collection (Mycological Herbarium), and a fungus culture collection.
3. Armillaria root rot investigation.
 - a. Initiate 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 which biological species exist in the region.
 - d. Conduct morphological examinations of sporophores (mushrooms), rhizomorphs, hyphae etc. to determine taxonomic species of Armillaria mellea complex in this region.
 - e. Conduct cytological examinations of various diploid and haploid isolates to clarify nuclear cycle of the group.
4. Microbiological and pathological status 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 (with Dr. Y. Yamaoka, a visiting scientist) will be conducted.

12. Accomplishments for 1986-87:

1. Manuscript and plates of the information publication entitled "Forest tree diseases of the Prairie Provinces" has been prepared, reviewed, and under editorial processes for publication before the end of 1986-87 fiscal year.
2. Provided diagnostic and identification service of tree and shrub diseases.
3. Investigated aspects of *Armillaria* root rot, especially identification of biological species which occur in the region and compared with standard cultures of known biological species. Two biological species (*Armillaria obscura* and Biological Species V) were identified as the major species in the region and two other biological species were identified. Two papers were presented at the Plant Pathology Society of Alberta meeting in Vegreville, Alberta.

Mugala, M.; Blenis, P.V.; Hiratsuka, Y. 1986. A new method of inoculation of *Armillaria* root rot using Spencer-Lamere Roottrainer.

Maruyama, P. J.; Mugala, M.; Hiratsuka, Y. 1986. Comparison of aspen and lodgepole pine as trap logs of *Armillaria* root rot in forest soils.

4. Inoculation experiments with four major blue stain fungi (*Ceratocystis* spp.) associated with mountain pine beetle were conducted with Dr. Yamaoka (visiting scientist) using heat-pulse verocity (HPV) instrument operated by Dr. R. H. Swanson (NoFC). The results clearly indicated that one fungus, *C. clavigera*, can completely stop water conduction in pine trees within 2 to 3 weeks. A paper was presented at the Plant Pathology Society of Alberta meeting in Vegreville, Alberta.

Yamaoka, Y.; Hiratsuka, Y.; Swanson, R. H. 1986. Preliminary results of inoculation experiments of lodgepole pine with blue stain fungi monitored by heat-pulse velocity (HPV) instrument.

13. Goals for 1987-88:

A. Disease identification and taxonomic service.

1. Provide diagnostic and identification service for tree and shrub diseases.
2. Maintain and upgrade the disease reference collection (Mycological Herbarium), and a fungus culture collection.
3. Start revision of an infromation report entitled "Annotated check list of the tree diseases of the prairie provinces."

4. Assist Mr. H. Zalasky to prepare an information report entitled "Diagnosis and recognition of winter frost damage in trees."

B. *Armillaria* root rot investigation.

5. Publish two journal papers on pathogenicity and cultural characteristics with Dr. K. I. Mallett (Alberta Horticultural Research Centre).
6. Continue inoculation experiments with Mr. Mugala (a graduate student, U of Alberta) using different biological species on lodgepole pine and white spruce to find out differences in host preference and pathogenicity.
7. Continue collaborative research on epidemiology and damage impact assessment with Dr. P. Blenis of the University of Alberta.
8. Continue morphological, cytological, and cultural examinations of various isolates to clarify identity of forms present in the region.

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

9. Publish results obtained by naturally attacked and fungus inoculated lodgepole pine trees with heat pulse velocity instruments (with Dr. R. Swanson, and Dr. Y. Yamaoka).
10. Start compiling compendium of microorganisms associated with mountain pine beetle, and beetle attacked trees with Dr. Y. Yamaoka (visiting scientist).
11. Conduct more inoculation experiments with selected blue stain fungi using heat pulse velocity instruments (with Dr. R. Swanson, and Dr. Y. Yamaoka).
12. Conduct histological examinations of tissues invaded by selected blue stain fungi to find out the mechanism of water stoppage in sapwood of lodgepole pine.
13. Continue investigation of bioactive fungal metabolites of blue stain fungi and other fungi associated with mountain pine beetle and beetle attacked trees with Dr. W. A. Ayer of the Department of Chemistry, University of Alberta.

14. Publications 1986-87:

Mallett, K. I.; Hiratsuka, Y. 1986. Nature of the "black line" produced between different biological species of *Armillaria mellea* complex. *Can J. Bot.* 64:2588-2590.

Suzuki, K.; Hiratsuka, Y.; Ayer, W. A. Pathophysiological investigation on water potential components in lodgepole pine seedlings. *Ann. Phytopathol. Soc. Jpn.* (In press.)

Hiratsuka, Y. 1987. Forest tree diseases of the Prairie Provinces. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-286 (In press).

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 1987-88:

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

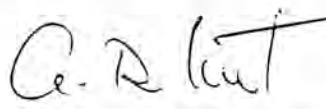
O & M: \$7,000

Capital:

17. Signatures:


Investigator


Program Director, Protection


Regional Director General


2. Attempt to document results of experiments in 5 and 6. File Report.
 3. Terminate study.
10. Accomplishments for 1986-87:
1. The information report entitled "Diagnosis and recognition of winter frost damage in trees" is being prepared with Y. Hiratsuka (see 1987-88 goal NOR-11-07).
 2. File report was prepared
 3. Study terminated.
11. Goals for 1987-88:
- Nil
12. Publications 1986-87:
- Zalasky, H. 1986. Effects of conditioning and storage on containerized conifer seedlings. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note 34.
- Zalasky, H. 1986. Field performance of containerized conifer seedlings south of Grande Prairie, Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note 33.
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 1987-88:
- | | |
|---------------|-----|
| PYs: Prof.: | 0.0 |
| Tech.: | 0.0 |
| Total: | 0.0 |
| Term/Student: | 0.0 |
- O & M:
- Capital:

15. Signatures:

Investigator



Program Director, Protection



Regional Director General

NOR-12

NURSERY MANAGEMENT AND IMPROVEMENT

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

1. Project: Nursery Management and Tree Improvement
2. Title: Forest tree seedling and seed physiology
3. New: Cont.: X 4. No.: NOR-12-01
5. Study Leader: I.J. Dymock
6. Key Words: Tree seedling physiology, cold hardiness, dormancy, physiological and biochemical testing, influence of environmental parameters, bareroot and container stock production, accelerated growth and flowering, cone and seed production
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta; locations within Western and Northern Region as may be required
9. Problem:

Forest regeneration has recently been identified as a major problem area, and a limiting factor in achieving sustained yield forest management, both in the Western and Northern Region, as well as across the country. There has been a greatly increased demand for conifer seedlings for reforestation purposes, which has resulted in a concomitant increase in the demand for good quality conifer seed and on nurseries for increased production of high quality seedlings for planting purposes.

The increased demand for both container and bareroot seedlings to meet the increasing needs of both government and private sector reforestation has been receiving considerable attention. Earlier research efforts have been focussed on applied aspects of intensive container and bareroot stock production, with emphasis on various aspects of growth requirements (nutrients, light regimes, temperature, and water), conditioning of seedlings for overwintering, methods of assessing frost damage, determination of adequate winter storage and preplanting conditioning, and field performance (growth and survival).

Some effort has gone into determining the negative and positive effects of accelerated growth, and other rearing practices on field performance of the seedlings. Various methods of physiological testing of seedling condition have been devised. What has been absent is an attempt to tie

together the environmental parameters that could influence phenology of container and bareroot stock development, and the physiological events that occur during seedling growth, the hardening-off period, dormancy (overwintering) and the subsequent survival and growth during successive seasons prior to and after outplanting.

There is a need for an in-depth, long term analysis of the early growth and development of bareroot and container stock employing specialized testing techniques. Such tests should include monitoring the environmental parameters and the various morphological, biochemical, and physiological events that occur from seedling emergence through to early field performance. A better understanding of the events that occur in the environment and within the seedling would help in the improvement of current methods and in developing new methods and procedures for intensive culture of seedlings for reforestation practice.

With the increased demand for high quality seedlings for reforestation, is a requirement for greater quantities of good quality or even improved tree seed, from which the seedlings can be reared. A re-examination of the work on increasing flowering and cone and seed production in conifers is warranted, particularly in light of initial results on accelerated growth as a means of promoting early and enhanced flowering. Treatments should be initiated far earlier than was previously reported, and continued through the first six months following seedling emergence. The interactions between supplemental light sources, photoperiod, and use of applied growth regulators must be examined in detail for each species of interest to foresters. Results could readily be applied to tree improvement programs for the development of seed orchards and seed production areas.

Therefore, the research investigations under this study will examine the physiological basis of nursery management and tree improvement practices. This will entail planning, conducting, analysing and reporting of basic and applied research in the primary areas of: a) overwintering physiology of container stock, including an assessment of methods of monitoring seedling viability, b) accelerated growth practices, and c) the promotion and enhancement of early flowering and cone and seed production in conifers.

8. Study Objectives:

1. Conducts investigations into physiological aspects of: 1) growing, conditioning, and testing of container and bareroot seedlings, 2) field performance of seedlings, and 3) cone and seed development and production.
2. Analyses and interprets existing and new research data in support of cone and seed production stock conditioning, physiological testing and initial field performance of bareroot and container seedlings.
3. Provides consultative services to federal, provincial, and industry agencies concerning the physiology of cone and seed production, seedling conditioning, physiological testing, and field performance.

4. Performs the duties of a seed analyst for certification of forest reproductive material moving in international trade.

9. 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.

10. Accomplishments for 1986-87:

1. Seedling physiological research.

- a. Grew 37,856 seedlings for overwintering and accelerated growth studies.
- b. Completed weekly (jP) and bi-weekly (lP, bS, wS, rP) cold hardiness and dormancy testing of 1985 container stock. Compiled data, and carried out preliminary statistical analyses. Stored shoot and root tip samples for analysis as time permits.
- c. Completed the majority of data analyses and summaries of 1983-86 lP and bS and 1984-86 rP and wS overwintering physiology results. Prepared a report titled - Monitoring viability of five species of container stock, for presentation at the 1986 Prairie Nurserymen's Meeting in The Pas, Manitoba. The paper was presented at the meeting by Dr. I.K. Edwards.

- d. Prepared and presented an oral report titled - Comparative physiology of four cold temperate conifers during overwintering, at the 1986 Annual Meeting of the Canadian Society of Plant Physiologists, in Saskatoon, Saskatchewan.
- e. Compiled weather data for Edmonton for inclusion in overwintering physiology study. Plotted annual data for 1982-83, 1983-84, 1984-85 and 1985-86, against thirty year (1941-70) averages. Initiated second year of cold hardiness and dormancy testing of jP.
- f. Methods development for studying the role of endogenous cellular metabolites of interest in overwintering physiology.

No progress was made due to lack of technical support.

- g. Biochemical analysis research to study the role of metabolites in determining overwintering success in conifer seedlings.

No progress was made due to lack of technical support.

2. Cone and seed physiological research.

- a. Accelerated growth/promotion of early flowering in conifers.

- Continued study on lP. Completed tables and figures for publication purposes. Final statistical analyses carried out on initial results. Manuscript is in preparation. Monitored second year of growth of outplanted lP. First male and female flowering is noted. Prepared and presented a seminar at the University of Alberta titled - The influence of accelerated growth conditions on early growth and survival of lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.). Prepared and presented an oral report titled - The influence of accelerated growth treatments on growth of lodgepole pine 14 months after outplanting in a nursery, at the 1986 Annual Meeting of the Canadian Society of Plant Physiologists in Saskatoon Saskatchewan.
- Continued study on wS. Continued statistical analyses of initial greenhouse data. Monitored survival and first year of growth of wS outplanted in 1985. Carried out literature review on flowering in wS. Started initial draft of manuscript on the influence of accelerated growth conditions on early growth and survival of wS.
- Continued study on jP. Initiated growth regulator treatments under all photoperiods and light treatments and completed outplanting. Began data entry and statistical analyses.
- Initiated study on bS and supplemental work on lP. Seeded both species, transplanted to pots, and initiated photoperiod, light and growth regulator treatments.

- b. Ecophysiology of seed maturation in lodgepole pine.
 - Manuscript published.
 - 3. Provision of consultative services to NoFC staff and CFS clients.
 - a. Provided consultative services as requested to NoFC staff, CFS, CWS, EPS, AFS-Research Branch, University of Alberta, University of Calgary, Saskatchewan and Manitoba Forestry Departments Branches, and the private sector.
 - b. Prepared and presented two 1½ hour lectures at the Forest Science Department, University of Alberta. The topics were: Germination mechanisms and storage products and Inhibitors and Promoters.
 - c. Acted as a member of a Monitoring Committee to oversee Can/Man MOU contracts on: 1) rooted cuttings and 2) accelerated growth production.
 - 4. Seed analyst duties.
 - No requests were received for seed analysis in 1986.
- ii. Goals for 1987-88:
- 1. Seedling physiological research (12-49, 12-51, 12-60).
 - a. Complete final year of cold hardiness and dormancy tests on 1986 1P, bS, wS, and rP. Compile and analyse data. (12-49)
 - b. Publish report - Monitoring viability of five species of container stock in the Proceedings of the 1986 Prairie Nurserymen's Meeting.
 - c. Prepare manuscripts on overwintering physiology of 1P, bS, wS, and rP for internal (CFS) review and submission to scientific journals (Can. J. For. Res. or Can. J. Bot.).
 - d. Prepare and present a research report on comparative aspects of cold hardiness/dormancy development in bS/wS for presentation at the Annual Meeting of the Canadian Society of Plant Physiologists, at Kingston, Ontario.
 - e. Prepare and present a technical report on cold hardiness/dormancy development in 1P and rP at the Annual Prairie Nurserymen's Meeting at PFRA Tree Nursery, Indian Head, Saskatchewan.
 - f. Initiate final year of cold hardiness/dormancy testing of jP.
 - 2. Cone and seed physiological research (12-62).
 - a. Accelerated growth/promotion of early flowering in conifers.

- Continue study on lP. Submit manuscript on initial results for internal review prior to submission to journal (Can. J. For. Res.), Monitor third year of growth, flowering, and cone and seed production of outplanted lP. Outplant lP supplements.
- Continue study on wS. Complete manuscript on initial results and submit for internal review prior to submission to journal (Can. J. For. Res.). Monitor second year of growth, flowering, cone and seed production of outplanted wS. Initiate supplemental work on wS.
- Continue study on jP. Monitor first year of growth, survival, and any flowering response of outplanted jP. Compile initial data and carry out statistical analyses. Begin manuscript on initial results.
- Continue study on bS. Complete growth regulator, photoperiod and light treatments on bS. Outplant bS trees in NoFC nursery. Complete destructive sampling for dry matter distribution analysis. Compile and enter data into computer data files for statistical analysis.
- Continue study on rP. Seed, transplant, and initiate light/photoperiod and growth regulator treatments.
- Prepare and present an oral report on the comparative interaction of photoperiod and light types on early growth of lP, wS and jP at the Western Regional Meeting of the CSPP, February 19-20, 1987 at U.B.C. in Vancouver, B.C.

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. (12-52)
5. Provide technical advice to MFB for a contract to grow large, high quality stock (12-5MA).

13. Publications 1986-87:

- A.K. Hellum and I.J. Dymock. Cold stratification for lodgepole pine seed, p. 107 - 111. In: Shearer, R.C., compiler. Proceedings - Conifer Tree Seed In The Inland Mountain West Symposium; 1985 August 5-6; Missoula, MT. General technical Report INT-203. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1986. 289 p.
- I.J. Dymock and S. Wilson. Effects of light quality and photoperiod on twelve coniferous species. p 34-54. In: Harvey, E.M., compiler. Proceedings of the 1984 Prairie Federal-Provincial Nurserymen's Meeting. Canadian Forestry Service, Northern Forestry Centre, Edmonton, Alberta. Information Report NOR-X-274; 1986. 60 p.

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 1987-88:

PYs: Prof.:	Dymock	1.0
	Tech.:	Dendwick 1.0
	Total:	2.0
	Term/ Student:	0.0

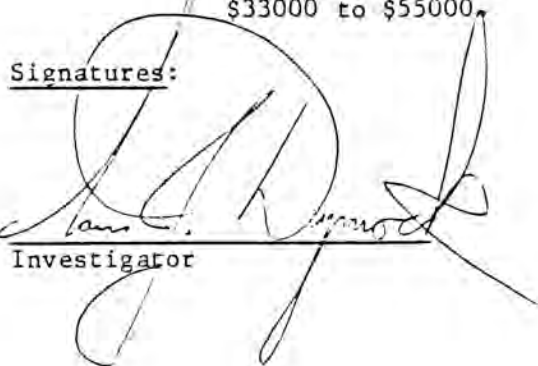
Contract: none

O & M: \$12,000

Capital: The following items were included in my 1986-87 study statement request and remain for 1987-88.

1. Shelving/cupboards upgrading in laboratory M132 (Capital Replacement) \$4600.
2. ELISA photometer/microplate reader for enzyme-linked immunoassays (New Capital) \$10000 to \$33000.
3. Liquid scintillation counter (spectrometer) system for counting radioactivity in samples (Capital Replacement) \$33000 to \$55000.

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

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. Problem:

This study comprises provenance experiments with six conifer species. five are sub-experiments of co-operative investigations initiated by Petawawa Forest Experiment Station. The white spruce experiment was initiated by the District Forest Officer in Winnipeg.

Each experiment consists of one or more plantations containing populations of one species but of varying geographic origin, arranged in a replicated design. Populations are compared within experiments on the basis of mean performance at periodic observations usually on survival and growth plus other traits deemed appropriate for a particular experiment). The outcomes of the comparisons are used to draw inferences about (1) the productivity of the tested populations for planting in similar environments, (2) the usefulness of further provenance testing with the same species, (3) patterns of geographic variation, or (4) the value of the tested populations for breeding.

9. 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.

10. 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)

11. Accomplishments in 1986-87:

1. A file report entitled "Recommendations for Continuance or Termination of Provenance Tests" was completed in December 1986 and sent to cooperators for comment. The report recommended termination of the white spruce, red pine, Scots pine, and Norway spruce experiments with no further measurement or reporting. Reporting will be done for the jack pine experiment based on results to 15 years, but the plantation may be abandoned owing to heavy fire damage. The black spruce experiment will be continued.

Red Pine.

1. Scrutiny of data analysis results from the 25-year measurement indicated insufficient potential value of a new publication to justify allocation of time and funds for that purpose.

Jack Pine:

1. The plantation at Lonesand, Manitoba was measured at 15 years from planting.

Black Spruce:

1. Brush control was carried out in the Alberta plantation.

12. Goals for 1987-88:

1. Determine the appropriate disposition of documents pertaining to the terminated experiments, and dispose of these documents accordingly. (12-11, 12-18, 12-37)

Jack Pine:

1. Draft a journal paper on results to 15 years in the jack pine provenance experiment plantation at Lonesand, Manitoba. (12-29)

Black Spruce:

1. Tend the test plantations as required. Verify location, layout, and stocking. (12-10)

13. Publications 1986-87:

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 1987-88:

PYs: Prof: Klein 0.1

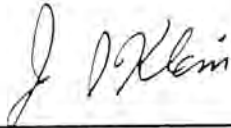
Tech: Chapman 0.1

Total: 0.2

O & M: \$2,000

Capital: Nil

16. Signatures:



Investigator



Program Director, Resources



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

1. Project: Nursery Management and Tree Improvement
2. Title: Breeding jack pine for the Northern Region.
3. New: Cont.: X 4. No.: NOR-12-03
5. Study Leader: J.I. Klein
6. Key Words: Pinus banksiana, progeny test, family test, seed orchard, forest genetics, tree breeding, artificial selection, grafting, clone bank, Saskatchewan, Manitoba, Alberta
7. Location of Work: Lonesand, Marchand, Stead, Oakbank, and Boggy Creek, Manitoba; Smeaton, Meadow Lake, and Hudson Bay, Saskatchewan; Wildwood, Alberta
8. Problem:

This study is the first step in an applied breeding program, intended to identify superior genotypes in base breeding populations which are samples of wild populations. These superior genotypes will be propagated for establishment of seed orchards, not necessarily within this study. Future plantations planted with the output from those seed orchards, will have enhanced profitability in consequence of genetic gain achieved under this study.

The sampling and assessment strategy chosen for this study ensures efficient use of whatever genetic variation exists in the sampled populations. No evidence was available as to the magnitude of this variation prior to study initiation.

Breeding districts were delineated in eastern Manitoba, western Manitoba to eastern Saskatchewan, and central Saskatchewan to eastern Alberta. In each breeding district, family tests were established on representative sites, using open-pollinated progenies of parent trees selected primarily within each district. Each family test includes more than 200 progenies in replicated test plantations.

The tests are measured and data analyzed periodically for elucidation of genetic variation patterns within populations, selection of superior genotypes, and estimation of genetic gain from selection. When

appropriate, new trees are produced from selected trees in the test plantations or the clone bank, by grafting or controlled breeding, for establishment of seed orchards. Test results can also be applied by designating superior source locations for seed collections.

9. Study Objectives:

1. To identify wild jack pine genotypes that are genetically superior in terms of economic yield for areas of major jack pine planting activity in the Northern Region.
2. To produce scions or control-pollinated seed of the superior genotypes for propagation of seed orchard trees.
3. To identify genetically superior source areas for seed collection.

10. 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)

11. Accomplishments in 1986-87:

1. Functional guidance was provided for development of jack pine seed orchards under the Canada-Manitoba Forest Renewal Agreement by assisting with the setting of study goals, and by participation in a meeting of the Monitoring Committee.
2. A journal paper on the 10-year results of the eastern breeding district family test was not completed owing to the lack of sufficient time. There was substantial progress toward this goal.
3. The special report of maps and source lists for the breeding program, to be produced under the Canada-Manitoba Forest Renewal Agreement, was not completed, owing to the lack of sufficient time.
4. Preparation of planting sites and rearing of planting stock for a gain test of the mass selection seed orchard at Oakbank was not attempted owing to insufficiency of resources.
5. The eastern breeding district family test was measured at 15 years from planting, but the data from most of one day's work were lost due to a malfunction of the computer used for recording measurements.
6. For promotion of the use of tree improvement technology in this region, a seed orchard layout was designed for and delivered to Saskatchewan Silviculture Section. On-site advice was provided on tending of grafts of superior western and central district clones at South Branch Nursery, and on siting of seed orchards for both districts there. There were no requests for service as regional contact for the national tree improvement program.
7. A plan was prepared for a research contract on rooting cuttings of black and white spruce and jack pine, but authority for that contract is with Manitoba Forestry Branch, and no contract research is now active.
8. Grafts were made to fill clone bank shortages. Lack of action on a Job Development proposal for clone bank work and denial of a funding request to the Canada-Alberta Forest Renewal Agreement left resources unavailable for planting of grafts. There were 2433 stocked positions in summer of 1986.
9. There was no workshop on rearing of trees in containers for forest genetics plantations. The delay in reaching full operational capability in the tree improvement greenhouse at Pineland Forest Nursery has been a contributing factor in the postponement of the workshop.
10. A paper entitled "Selection and Mating of Family-Test Trees for a Jack Pine Seed Orchard" was presented at the meeting of IUFRO working parties on breeding theory, progeny testing, and seed orchards in

October 1986. A report was filed, which summarizes highlights of the meeting and the post-meeting tour.

11. Forty families from the central breeding district family test were selected based on their scores in a multi-trait index incorporating height, diameter, and stem quality at 10 years from planting. Heritability and gain were calculated for the constituent traits.
12. The paper entitled "Development of a Jack Pine Seed Orchard by Mass Selection" appeared in the June 1986 issue of The Forestry Chronicle.

12. Goals for 1987-88:

1. Complete data analysis and draft a journal paper on the 10-year results of all Breeding Districts' family tests. (12-26)
2. Prepare and present an invited symposium paper on second generation breeding to the 1987 meeting of the Canadian Tree Improvement Association. (12-6)
3. Remeasure the eastern breeding district family test blocks for which data were lost due to computer malfunction. (12-25)
4. Resolve the future of the clone bank and the Chip Lake Research Planting Area. Implement a major part of the determined plan, commensurate with available resources. (12-1)
5. Plan an experimental design and field layout, assemble seedlots, and select planting sites for a test of genetic gain for the eastern breeding district from the mass selection seed orchard, and from selection based on family test results. (12-15)
6. Tend family-test plantations and the clone bank as required. (12-1)
7. Provide functional guidance for development of jack pine seed orchards under the Canada-Manitoba Forest Renewal Agreement. (12-6MA)
8. 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)
9. Analyse data and draft a FMN on selection of western district families at 10 years. (12-13)
10. Act as scientific authority for contract involving tree improvement R&D in Alberta under the FRDA. (12-1AA)

13. Publications 1986-87:

Klein, J.I. 1986. Development of a jack pine seed orchard by mass selection. For Chron. 62:143-146.

Klein, J.I. 1986. Selection and mating of family-test trees for a jack pine seed orchard. Pages 521-526 in A.V. Hatcher and R.J. Weir, Coordinators. Proc. IUFRO Joint Working Parties on Breeding Theory, Progeny Testing, and Seed Orchards, Williamsburg, VA.

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.

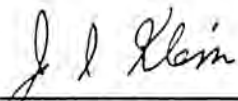
15. Resources 1987-88:

PYs: Prof.:	Klein	0.9
	Tech.:	Chapman 0.9
	Total:	1.8
	Term/Student:	0.3

O & M: \$10,000

Capital: Nil

16. Signatures:


Investigator


Program Director, Resources


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

1. Project: Nursery Management and Tree Improvement
2. Title: Forest nursery research and technology transfer
3. New: Cont.: X 4. No.: NOR-12-04
5. Study Leader: E. Harvey
6. Key Words: Root pruning and wrenching, storage and packing, storage mold, disease control, seedling mortality, Pinus, Picea, conifer seedbed culture, containerized seedling rearing, quality control, stock quality monitoring
7. Location of Work: Northern Forestry Centre, Edmonton; Provincial Tree Nursery, Oliver; Alberta Forest Service Nursery, Smoky Lake, Champion Forest Products (Alberta) Ltd., Hinton; Blue Ridge Lumber (1981) Ltd., Whitecourt; Prairie Sun Greenhouses, Joffre, Alberta; Saskatchewan Department of Parks and Renewable Resources Nurseries, Big River, Chitek Lake, MacDowall, Prince Albert, PFRA Tree Nursery, Indian Head, Saskatchewan; Pineland Nursery, Hadashville; Dakota Ventures, Portage La Prairie; Clearwater Provincial Forest Nursery, The Pas, Manitoba.

8. Problem:

Alberta, Saskatchewan, and Manitoba shipped over 51 million containerized and bareroot tree seedlings in 1984 and future increase is anticipated. The signing of the Forest Resources Development Agreements for Manitoba and Saskatchewan in 1984 will ensure that seedling productive capability will increase to meet increased demands. The present cost of producing a seedling of plantable size is 9 cents for container stock and 11 cents for bare root stock. The operating costs of nurseries in the region is in excess of 6 million dollars per annum. While it is important to ship sufficient numbers of seedlings in order to maintain adequate stocking in the field, it is of equal or even greater importance to ensure that the seedlings shipped are of high quality so that they will establish and grow rapidly in the field. Poor plantation establishment and later growth 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 NoFC and regional nursery facilities.
5. To conduct OECD seed inspections as required.

10. 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, Manitoba 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)

11. Accomplishments in 1986-87:

1. Provided technology transfer and advised regional nurserymen of any workshops or publications which might be of benefit to them. Examined stock quality problems and tested growing media and fertilizer solutions from Clearwater Nursery, The Pas, Manitoba. Wrote a joint file report with I. K. Edwards regarding this. Advised Clearwater Nursery on PMS measurement and stock quality indices. Advised Clearwater on phosphorous deficiency in black spruce container stock. Advised Clearwater on fungicide tank mixes. Tested stock for Abitibi-Price from Pineland Nursery, Hadashville, Manitoba for root growth potential, bud break, bud quality and viability. Provided recommendations to the Manitoba District Office regarding this. Met with Abitibi-Price and Dakota Ventures staff at Portage La Prairie and discussed growing regimes and stock quality of container stock grown by Dakota Ventures under the Manitoba Agreement. Tested stock from Dakota Ventures for root growth potential, bud break, bud quality and viability and provided recommendations. Met with Abitibi-Price in Edmonton and discussed stock quality standards, size specifications and a monitoring schedule for Dakota Ventures stock for 1987.

Advised Saskatchewan on stock quality and growing media problems. Advised Saskatchewan on calcium deficiency of seedlings from Chitek Lake Nursery due to low soil pH. Demonstrated the methodology of bud dissection and needle primordia counts at NoFC to Pine Ridge Nursery (Smoky Lake, Alberta) staff. Advised Pine Ridge Nursery on desired modifications to programmable freezers.

Diagnosed pythium disease and thrip insect damage at Champion Greenhouses, Hinton, Alberta and suggested control measures. Analysed fertilizer solution for Champion and diagnosed a fertilizer injector problem and problems when mixing stock solution. Advised Champion on fertilizer regimes. Diagnosed stunting and twisting of seedlings as a fertilizer / growing media compaction problem. Constructed an insulated box for freezing tests and conducted freezing tests for Champion. Advised Champion on methods of stock quality monitoring and provided advice on needed equipment for this purpose. Grew a sample of stock from Blue Ridge Lumber Ltd. Greenhouses, Whitecourt, Alberta under the extended greenhouse technique and conducted freezing tests on the stock.

Presented a paper on "Forest Tree Nursery Operations in the Prairie Provinces" at the Annual Meeting of the Forest Nursery Association of British Columbia.

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. Continued the study on establishment of size class standards and methods of monitoring stock quality in the region, working primarily in Saskatchewan. Presented progress report "Methods of Stock Quality Monitoring for the Prairie Provinces" at the regional nurserymen's meeting. (12-55)

4. Participated in the National Tree Nursery Weed Control Committee as required by reviewing the methodology for the national Goal (oxyfluorfen) trial and distributing it to interested participants (12-69). Acted as regional contact for the Committee by providing names and addresses for the annual meeting. Presented the "Introduction to the Session on the Prairie Nurseries" at the annual meeting and chaired the Prairie Section. Presented a review of the National Tree Nursery Weed Control Association Workshop at the regional nurserymen's meeting in The Pas, Manitoba.
 5. Acted as lead NoFC contact in cooperating with organizers of regional nurserymen's meeting by providing names and addresses of attendees, chairing the business section of the meeting and compiling the proceedings. (12-56)
 6. Sent 'Request to Present Collections Plans' letter to Reid Collins Nurseries Ltd. Contributed to D.G. Edwards' (PFC) summary report. (12-44)
 7. Visited Abitibi-Price, Pine Falls, Manitoba and advised on reforestation problems. Provided comments and suggestions on the design of field trials.
 8. Acted as Scientific Authority for R & D contract to conduct nursery investigations under Canada-Saskatchewan FRDA. Reviewed and provided comments on contract proposal and progress report. (12-1SA)
 9. Published the Proceedings of the 1984 Regional Nurserymen's meeting as an Information Report. (12-56)
12. Goals for 1987-88:
1. Investigate greenhouse and nursery problems and provide routine advisory service and technology transfer to regional nurseries, for example, monitor Dakota Ventures stock for root growth potential and frost hardiness according to the schedule established in 1986 as part of the Canada- Manitoba Agreement. (12-40)
 2. Prepare proposals for federal/provincial agreements to buy soil and plant analytical equipment for nurseries and for NoFC to offer advice and training on this equipment. Provide appropriate recommendations to nursery managers on soil fertility management. (12-65)
 3. Continue the study on establishment of size class standards and methods of monitoring stock quality in the region, working primarily in Saskatchewan. Publish progress report in the Proceedings of the 1986 Prairie Federal - Provincial Nurserymen's Meeting. Report to the RRT Committee. (12-55)
 4. Participate on the National Tree Nursery Weed Control Committee as required. Write up the constitution and formalize the name of the Committee. (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. Act as Scientific Authority for R & D contract to conduct nursery investigations under Canada-Saskatchewan FRDA. (12-1SA)
8. Publish the Proceedings of the 1986 Regional Nurserymen's meeting as an Information Report. (12-56).

13. Publications 1986-87:

Harvey, E.M. (compiler). 1986. Proceedings of the 1984 prairie federal - provincial nurserymen's meeting. Inf. Rep. NOR-X-274. Northern Forestry Centre.

Harvey, E.M. and I.K. Edwards. 1986. Morphological and physiological attributes of and fertilizer recommendations for containerized black spruce and jack pine grown at Clearwater Forest Nursery, Manitoba. File Report NOR 12-04 and NOR 12-06.

Harvey, E.M. 1986. Forest tree nursery operations in the prairie provinces. Paper presented at the Annual Meeting of the Forest Nursery Association of British Columbia. File Report NOR-12-04.

Harvey, E.M. 1986. Introduction to session on the prairie nurseries. Proceedings of the 1986 Tree Nursery Weed Control Workshop. B.C. Ministry of Forests and Lands, Victoria, B.C.

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 1987-88:

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

O & M: \$8,000

Capital: \$20,000 programmable freezer

16. Signatures:

E M King
Investigator

[Signature]
Program Director, Resources

A. D. [Signature]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

1. Project: Nursery Management and Tree Improvement
2. Title: Greenhouse and nursery operations
3. New: Cont.: X 4. No.: NOR-12-05
5. Study Leader: E. Harvey
6. Key Words: NoFC greenhouse and nursery, facilities maintenance, management and planning
7. Location of Work: NoFC, Edmonton
8. Study Objectives:
 1. To administer NoFC greenhouse and nursery facilities.
 2. To provide advice on rearing bareroot and container stock to NoFC R & D staff.
9. Progress to Date:
 1. Sodium lamps were installed in the greenhouse.
 2. Extensive "clean-up" was conducted in the headerhouse and NoFC nursery complex.
10. 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.
11. Accomplishments in 1986-87:
 1. Routine administration was carried out. Wendy Mill's job description was revised and sent in for classification.

2. The NoFC nursery facilities plan was finalized by having the depressions in the complex filled in and installing an irrigation system . (12-70)
 3. Bedding plants were started for the NoFC outdoor beds and tropicals were grown and maintained in the reception area.
12. Goals for 1987-88:

1. Administer the NoFC greenhouse and nursery facilities. (12-42)
2. 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 1986-87:

Nil

15. Resources 1987-88:

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

O & M: \$3,000

Capital: \$11,000 tractor replacement

15. Signatures:

E M Harvey

 Investigator

[Signature]

 Program Director, Resources

C. D. Kent

 Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 21, 1987

1. Project: Nursery Management and Tree Improvement
2. Title: Nursery soil fertility and seedling growth
3. New: Cont.: X 4. No.: NOR-12-06
5. Study Leader: I.K. Edwards
6. Key Words: Nutrient uptake, plant nutrition, Pinus contorta, Pinus banksiana, Picea glauca, Picea mariana, Pinus resinosa
7. Location of Work: Edmonton, Smoky Lake, Athabasca, and Slave Lake, Alberta; Prince Albert and Big River, Saskatchewan; Hadashville and The Pas, Manitoba
8. Problem:

Demand for conifer seedlings in the Prairie Provinces has been increasing steadily to meet reforestation needs. Traditionally, bareroot seedlings (lodgepole pine and white spruce in Alberta, jack pine and white spruce in Saskatchewan, and jack pine, red pine, Scots pine, white spruce, and black spruce in Manitoba) have been used to meet reforestation targets. However, sub-optimal quality of the nursery stock is a recurring problem owing to a) poor choice of location, soil too fine-textured for conifers and b) improper cultural practices and soil management techniques. The ideal soil texture for producing conifer seedlings is a sand or loamy sand, i.e., the total of silt and clay fractions should not exceed 20 percent. At one Alberta site, clay alone varies between 23 and 76 percent. Fine-textured soil reduces root growth because of high bulk density, drains slowly, and damages the root system during lifting.

Bareroot nurseries in Saskatchewan and Manitoba, although located on coarse or moderately coarse textured soil, are derived from calcareous parent material and are highly calcareous within or just below the root zone, depending on the fluctuating level of the groundwater. Because the soils are coarse, minimum levels of organic matter are necessary; because their pH is unsuitably high, acidification of the soil and irrigation water is required.

The intensive nature of seedling production (high seedling density, three-year crop cycle, and the removal of the complete plant from the

soil at harvest) results in a "mining action" where the plant nutrients are concerned. Replacement of soil fertility and plant available nutrients through fertilization and judicious application of irrigation water are necessary to maintain or improve the quality of stock produced. Plot experiments will be required to determine appropriate levels for seedling density and soil amendments.

Greenhouse production of containerized seedlings has been increasing steadily since 1970 to supplement the number of seedlings available for reforestation by client agencies. Operational development progressed so quickly that, in some cases, questions were being asked of the CFS before we had the answers. Although requirements for light (quality and intensity), photoperiod, temperature, nutrients, growing medium, and container type and configuration are being tested for different species in different regions, minimal research and development was being done on conifer species that are of economic importance to the prairie provinces. Nutrition experiments have centred on proprietary fertilizers to determine the most effective dosage but there have been no factorial experiments to test nutrient combinations for these species.

Nature of Study:

Growing bare root and containerized coniferous stock under different fertilizer regimes and cultural practices in provincial nurseries in order to optimize production.

Benefits to be expected from the solution:

1. Higher quality of seedlings in terms of height, weight, top/root ratio and higher survival in stand establishment.
2. Reduced growing cycle in the nursery thus affording more efficient use of resources.

Probability of Success:

High but progress will be slow. Seedlings are grown in nurseries for three years before being field-planted. Besides, subsidiary work may be necessary to establish firm conclusions about certain treatments either in the nursery or at field sites.

Probability of results being put into practice:

Potentially high but decision rests entirely with provincial nursery management. Demonstration plots may be necessary to accomplish implementation.

Method Used:

Seedlings are grown in the nurseries in the presence of different combinations of N, P, and K fertilizers. The optimum combination will be selected according to seedling quality in the nursery and on field survival. Support studies of cultural practices will provide data on such aspects as best nutrient source, time and method of fertilization.

9. Study Objectives:

1. To determine the nutrient requirements for growth and hardening off of bareroot and containerized conifer seedlings.
2. To determine the effect of residual soil fertility on growth of bareroot seedlings.
3. To develop guidelines for efficient water use in bareroot nurseries.

10. 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)

11. Accomplishments in 1986-87:

1. a. Soil fertility and site productivity (IR). The report has been reviewed once and revised; it is ready for second review.
- b. Erodibility index for forest land (IR). The report was reviewed and revised twice; it is ready for editorial review.

- c. Fertilization and conifer seed production (FMN). The report was published as Forest Management Note No. 40.
 - d. Uptake of soil phosphorus (J). First draft of the paper is incomplete.
2. Completed field work for the study of the effect of residual fertility on bareroot seedlings at Prince Albert. Data analysis was initiated.
 3. Provided advisory services, investigated seedling growth problems, and offered recommendations to industry and government agencies:
 - Blue Ridge Lumber: analysis of fertilizer solution and peat;
 - Saskatchewan Department of Parks and Renewable Resources: advice on acidification of peat and irrigation water;
 - Dakota Ventures: analysis of conifer seedlings;
 - Abitibi-Price: analysis of soil from reforestation areas;
 - Parks Canada: analysis of tree foliage and litter to determine lethal contaminant.
 4. Drafted internal report on nutrient requirements for hardening off wS and lP. Completed a similar study on bS and jP.
 5. Acted as project leader and coordinator of NOR-12.
 6. Visited Pine Falls, Manitoba to advise Abitibi-Price on reforestation problems with bS.
 7. Organized workshop to discuss Manitoba nursery management needs. The workshop will be held in Winnipeg on February 25-26, 1987. (The workshop is being organized jointly with Manitoba Forestry Branch)-
 8. Provided technical advice to Manitoba Forestry Branch to grow large high quality stock by reviewing proposals.
12. Goals for 1987-88:
1. Complete data analysis for experiment on effects of residual fertility on bareroot seedlings (jP and wS) at Prince Albert. Prepare a Forest Management Note. (12-48)
 2. Provide advisory services, investigate seedling growth problems, and offer recommendations in soil fertility and seedling nutrition as requested by industry and government agencies. (12-54)
 3. Complete study on the effects of fertilization on hardening off rP and sP and draft a report. Publish results (FMN) on hardening off wS, lP, bS, and jP. (12-58)

4. Act as project leader and coordinator of NOR-12. (12-67)
5. Review forest nursery management research, development, and technology transfer needs in the region. (12-77)

13. Publications 1986-87:

Edwards, I.K. 1986. Review of literature on fertilization and conifer seed production. Can. For. Serv., Nor. For. Cent., Edmonton, Alta. For. Manag. Note No. 40.

Edwards, I.K. 1986. Nutrient regimes and cold hardiness in conifer seedlings. In Proceedings of 1986 Prairie Nurseryman's Meeting held at The Pas, Manitoba, September 9-11, 1986. (In Preparation)

Harvey, E.M. and I.K. Edwards. 1986. Morphological and physiological attributes and fertilizer recommendations for containerized black spruce and jack pine grown at Clearwater Forest Nursery, Manitoba. File Report NOR-12-04.

Navratil, S.; Brace, L.G.; and I.K. Edwards. 1986. Planting stock quality monitoring. Can. For. Serv., Nor. For. Cen., Edmonton, Alta. Inf. Rep. NOR-X-279.

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 1987-88:

PYs: Prof.: Edwards 0.7
Tech.: Van Dyk 1.0

Total: 1.7

Term/Student: 0.0

O & M: \$7,000

Capital: Nil

16. Signatures:

I.K. Edwards

Investigator

[Signature]
Program Director, Resources

A. D. [Signature]

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 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)

Added Goals

- 4. Review microcomputer requirements, select, and purchase appropriate hardware. Begin transfer of FORCYTE code to the microcomputer.
 - 5. Attend and present a review of FORCYTE model progress and status at the 2nd CFS Modelling Workshop, Victoria B.C., Sept. 1986.
 - 6. Contribute an article on the new microcomputer hardware selected for FORCYTE applications to the Resource Applications Management Newsletter (U. of New Brunswick).
 - 7. Develop a user friendly driver program for FORCYTE Applications on a microcomputer.
 - 8. Attend, and prepare a manuscript on user friendly gaming with FORCYTE on a microcomputer for the 6th Bioenergy Seminar, Vancouver, B.C. Feb. 16-18, 1987.
 - 9. Prepare and submit an abstract on FORCYTE applications for presentation at the IUFRO conference on Forest Growth Modelling and Prediction, Minneapolis, Minn., Aug. 24-28, 1987.
 - 10. Attend the G.I.S. Workshop, Winnipeg, February 16-19, 1987.
11. Accomplishments in 1986-87:
- 1. FORCYTE-10 and FORCYTE-11 (preliminary release) were both successfully installed on the NoFC VAX computer and used for the FORCYTE workshop (see item 11.2a) and see goal 4a.
 - 2. This goal was fully met:
 - a) A successful FORCYTE seminar was attended by 30-40 scientists from the NoFC, U. of A., the Alberta Forest Service and other CFS establishments. A subsequent workshop drew 15 participants from AFS, U of A, Newfoundland, Ontario, and BC as well as 7 from NoFC.
 - b) Contact with other FORCYTE users, particularly within CFS, was established and maintained throughout the year. A study period of 6 weeks was spent at UBC working with Prof. Kimmins and his graduate students, gaining familiarity with the model.
 - c) The aspen study sites at Calling Lake and Kinuso were visited with collaborators from Western Ecological Services (the prime contractor for the calibration of the model for aspen).

3. This goal was met to the extent possible given the state of FORCYTE-11 model development by its authors (Kimmins and Scoullar).
 - a) An Alberta aspen data set has been assembled by Western Ecological Services, under ENFOR project P314, and initial calibration of FORCYTE-11 has been performed. Progress has been slowed by very late completion of certain model components by its developers (Kimmins and Scoullar).
 - b) Preliminary trial model runs have been performed using the "super structure" driver program (PROBE, see goal 4) to perform multiple runs of the FORCYTE model in a user friendly manner.
 - c) A preliminary list of important input and output variables to be investigated has been established through a series of work sessions with the model developers and contractors (Western Ecological Services). A protocol for conducting sensitivity analysis has been defined and incorporated in PROBE (see 11.7).
4. MICROCOMPUTER ADAPTATION. Following an extensive review, an IBM PC/AT was purchased together with a DEFINICON DSI-32, 32 bit, coprocessor and supporting hardware and software. Despite lengthy purchasing delays, the FORCYTE-11 code was transferred to the microcomputer (coprocessor) environment very easily. The system has now become the standard used, or ordered, by most Canadian FORCYTE workers.
5. CFS MODELLING WORKSHOP. A paper entitled "A Current View of FORCYTE and its use in CFS" (M.J. Apps) was presented at the 2nd CFS Modelling Workshop (Victoria, BC, Sept. 1986) and will appear in its proceedings.
6. RAM PAGES: A feature article by M.J. Apps on the coprocessor board and its use with FORCYTE appeared in the November 1986 issue of "RAM pages", the Resource Applications Management Newsletter published by the Dept. of Forest Engineering, University of New Brunswick.
7. DEVELOPMENT OF A USER FRIENDLY DRIVER FOR FORCYTE: PROBE. This superstructure program permits the user to predetermine the parameters for a series of FORCYTE simulation runs and controls the subsequent operation of the model on the microcomputer. It produces on-screen graphical display for user interpretation, evaluation, and statistical analysis of the model results and predictions. Developed to expedite the multiple/repetitive runs required for sensitivity analysis, this program may form the kernel for future user friendly management gaming with the model.
8. 6th BIOENERGY SEMINAR. A poster has been prepared for presentation at this meeting in Vancouver. The accompanying manuscript, "PROBE: A Program to Facilitate User-friendly Gaming with FORECYTE" and its application to aspen ecosystems will appear in the proceedings.
9. Two abstracts were prepared and submitted to the IUFRO International Conference on "Forest Growth Modelling & Prediction", Aug. 24-28, 1987, Minneapolis, Minn.

10. The Geographic Information Systems (GIS) Workshop Feb. 16-19, 1987 (Winnipeg) was attended.
12. Goals for 1987-88:
1. Continue the development of the driver program PROBE for FORCYTE applications by incorporating important management gaming options.
 2. Continue to maintain communication and collaboration where appropriate with other Canadian FORCYTE users.
 3. Continue to assist in the Sensitivity analysis of the aspen FORCYTE-11 model in collaboration with Western Ecological Services (ref. P314).
 4. Attend and present "User Friendly Applications of the FORCYTE Ecosystem Model on Microcomputers" at IUFRO Int'l. Conf. on "Forest Growth Modelling & Prediction" Minneapolis, Minn. Aug. 24-28, 1987. Prepare manuscript for publication in Proceedings.
 5. Contribute to manuscript "FORCYTE-11: An example of the Hybrid Simulation Approach to Predicting the Consequences for Production, Yield, Economics, Soil Fertility, Nutrient & Organic Matter Reserves and Energy Efficiency of Alternative Forestry and Agro Forestry Crop Production Systems" (senior author J.P. Kimmins) for IUFRO Conference Minneapolis, Minn., Aug. 24-28, 1987.
 6. Plan and initiate application of FORCYTE-11 to aspen and aspen/mixed stand management by:
 - a) Evaluate the data requirements and management needs for aspen/mixed wood stands (see NOR-28-06, ENFOR P-353)
 - b) Design and begin construction of a customized model, simplified where possible, for aspen and aspen/mixed stand simulations. (see NOR-28-06, ENFOR P-353).
 - c) Evaluate the need and feasibility of incorporating moisture limitations on growth and early stand development (see NOR-28-06, ENFOR P-357).
13. Publications 1986-87:
- Apps, M.J. A current view of FORCYTE and its use in CFS. Can. For. Serv., Proceedings of the 2nd CFS Modelling Workshop (Victoria, BC, Sept. 1986) (in press).
- Apps, M.J. 1986. Feature article in RAM pages, (Resource Applications Management Newsletter), November 1986. Published the Dept. of Forest Engineering, University of New Brunswick, Editor: Ted Robak.
- Kurz, W.A.; M.J. Apps; Y.H. Chan. 1987. Implementation of user friendly gaming with FORCYTE-11 calibrated for an aspen ecosystem. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 12.

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 1987/88:

PYs:	Prof.:	Apps	0.8
	Tech.:		0.0
	Total:		0.8
	Term/Student:		0.0

O & M: \$1,000 (\$16,000 ENFOR funds available for In-house R&D and Contract) Management.

Capital: \$1000

16. Signatures:



 Investigator



 Program Director, Resources



 Regional Director, General

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NOR-13

FOREST HYDROLOGY AND MICROCLIMATE RESEARCH

9. 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).
2. Journal article: The Hydrologic effects of Clear-cutting Alberta's Eastern Slopes Watershed. (Swanson, Bernier).
3. Forestry Report on Marmot-Streeter results, Mount Allan snow. (Swanson, Bernier).
4. Management note: Water yield improvement harvesting prescriptions for Alberta's Eastern Slopes subalpine forests. (Swanson, Bernier).
5. Management note: Enhancing snow retention and local water supply in the Aspen-Grassland type. (Swanson).
6. Conference proceedings - Canadian Hydrology Symposium (CHS-86): The potential for increasing water supply in the Saskatchewan River system by forest harvesting. (Swanson, Bernier).
7. Conference proceedings - Western Snow Conference: A watershed management pilot project in Alberta. (Bernier, Swanson, Swan-Alberta Forest Service).
8. Conference panel paper - Canadian Institute of Forestry annual meeting, Victoria: Altering stand microclimate for increased growth and/or water yield. (Swanson).
9. Information report: The Streeter Basin Aspen-Grassland Watershed Experiment. (Swanson, Golding, Singh, Hillman, Telfer-CWS).

2. Interaction with Provincial clients:

- a. Convene Steering Committee, Alberta Watershed Research Program. Make arrangements for final closing down of Marmot Experimental Watershed. (Swanson)
- b. Provide assistance to Alberta Forest Service in conduct of Tri Creeks watershed study. Participate in study of evapotranspiration if requested. (Swanson)
- c. Provide CFS input into pilot watershed management program with Province. (Swanson, Bernier)

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 request. (Hurdle)

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)
- 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)
- 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)

10. Accomplishments in 1986-87:

1. Publications:

- a. The Information Report was completed and published.
- b. The Journal Article was not completed due to lack of different information than that already presented in the above information report. If we are able to do some modeling that indicates a result from the the Twin treatment, then we should consider a Journal publication in the future.
- c. The Forestry Report was published.
- d. This management note was not prepared due to other reporting commitments.
- e. This management note was not prepared due to other reporting commitments.
- f. A paper entitled "The potential for increasing water supply in the Saskatchewan river system through watershed management" was presented at CHS:86 and published in the proceedings.
- g. A paper entitled "A watershed management pilot project in Alberta" was presented at the Western Snow Conference in Phoenix, Arizona and subsequently published in the proceedings.

- h. A paper entitled "Altering stand microclimate for increased growth and/or water yield" was presented at the Canadian Institute of Forestry meeting in Victoria.
 - i. The information report on Streeter Basin was not completed due to other time commitments.
2. Interaction with provincial clients:
- a. Convened Steering Committee AWRP on 17 October. Marmot Basin is to close officially as of 31 October. The NoFC is to continue servicing instruments through 31 December, possibly to 31 March, depending upon the date for Fisera's move to Edmonton. (Fisera will move to Edmonton 1 March 1987: Our servicing ceases as of that date.) The NoFC may still have some responsibility for site cleanup at Marmot in 1987.
 - b. The evapotranspiration study was discussed and the AFS decided not to carry it out. In subsequent discussions with the NHRI in Saskatoon, Swanson ascertained that they are still interested in carrying out tests to ascertain the applicability of F. I. Morton's method to the calculation of forest evapotranspiration.
3. Provision of data:
- a. All of the data from Marmot was sent (on 16 disks!) to one requester at the University of Regina. Several other requests for specific periods or stations were serviced.
4. Interaction with outside agencies and NoFC staff:
- a. Attended annual meeting of Associate Committee on Hydrology as CFS member, in conjunction with CHS:86 at Regina in June. Also attended meeting of Executive Committee, ACH, in Ottawa in December, as the CFS has been rotated into the EC for the next two years.
 - b. Continued as lead convener of the IAHS symposium on Forest Hydrology and Watershed Management to be held in Vancouver in August. Sent out call for papers. Prepared a database to keep track of, and to receipt for, abstracts and papers. Received and reviewed 87 abstracts of which 75 were accepted for presentation. Notified authors of acceptance. Have received 54 papers to date for final review and editing. Have started having camera-ready copy prepared.
 - c. Continued preparations for Canadian Hydrology Symposium-88 at Banff, May 1988. Appointed local arrangements and program committees. Prepared first call for papers. Met with chairman of local arrangements committee to initiate action on field trips and social events.

11. Goals for 1987-88:

1. Publications:

- a. Prepare critique and review of Marmot and Streeter Basin projects for CHS-88 papers. (Swanson with contributions from Alberta Environment, IWD, AES, AFS.) (1301-8702P)
- b. Prepare proceedings paper "Applying hydrologic principles to the management of sub alpine forests for water supply", for presentation at USFS Technical Conference "Management of subalpine Forests: Building on 50 years of research", July 6-9, 1987, Fraser, Colorado. (Swanson) (1301-8703P)

2. Interaction with provincial clients:

- a. Terminate NoFC field involvement in Marmot Creek Basin. Look at possible role for NoFC in a differently-oriented Alberta Watershed Research Program. (Swanson) (1301-8701C)
- b. Continue to provide CFS input into the watershed management pilot project. (Swanson). (1301-8501C)

3. Provision of data:

- a. Continue to assist in the use of Mount Allan (Marmot) data. Clean up Marmot climatic instrument sites. Continue to compile and archive data from microloggers after servicing is assumed by Alberta Environment. Supply data in machine readable or printed form upon request. (Fisera, Hurdle). (1301-8601C)
- b. Prepare indexed database for Marmot and Streeter photographs. (Fisera) (1301-8705C)

4. Interaction with outside agencies and NoFC staff:

- a. Attend annual and executive committee meetings of the NRC Associate Committee on Hydrology as CFS member. Continue to provide input into the research priorities sub committee of the ACH. (Swanson) (1301-7601C)
- b. Convene IAHS symposium on Forest Hydrology and Watershed Management in Vancouver in August. Complete editing of all submitted papers by May. Prepare camera-ready copy of submitted papers for publication prior to June. (Swanson, Bernier-editing only). (1301-8502T)
- c. Continue as organiser and general chairman of Canadian Hydrology Symposium-88 on results from small basin research, to be held in Banff, May 9-11, 1988. Complete selection of papers, finalize technical program and field trips. Start preparation of final program and registration materials. (Swanson) (1301-8503T)

- d. Serve as acting editor, Canadian Journal of Forest Research, for two 6-week periods while the editor is away from Edmonton on sabbatical. (Swanson) (1301-8704T)
- e. Conduct lecture tour across Canada on Small Basin Hydroglogy under sponsorship of Canadian Water Resources Association and NRC Associate Committee on Hydrology. (Swanson) (1301-8706T)
- f. Initiate task force to review hydrologic-forestry problems in the Prairies/Northern region. Report to SRAC in November 87. (Swanson, help from Bernier) (1301-8707C)

12. Publications 1986-87:

Bernier, P. Y. and R. H. Swanson. 1986. A watershed management pilot project in Alberta. Proceedings, 54th Annual Meeting Western Snow Conference, April 15-17, 1986, Phoenix, Arizona. pp 87-92.

Swanson, R. H., D. L. Golding, R. L. Rothwell, and P. Y. Bernier. 1986. Hydrologic effects of clear-cutting at Marmot Creek and Streeter watersheds, Alberta. Gov. Can., Agric. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-278. 27pp.

Swanson, R. H., P. Y. Bernier, and J. K. Samoil. 1986. Hydrology. Gov. Can., Agric. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Rep. No. 31 (Sept. 1986). 12 pp.

Swanson, R. H. and P. Y. Bernier. 1986. The potential for increasing water supply in the Saskatchewan river system. Canadian Hydrology Symposium (CHS:86), Assoc. Comm. Hydrology, Nat. Res. Counc. Can. June 3-6, 1986, Regina, Sask. pp 485-496.

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 1987-88:

P/Ys:	Prof:	Swanson	0.8
		Bernier	0.4
	Tech:	Fisera	0.5
	Total		1.7

O&M: \$4000
Capital: Nil

15. Signatures:

Robert H. Swanson
Investigator

G. M. Powell
Program Director, Extension

Piers Y. Bernie
Investigator

C. D. Hart
Regional Director General

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 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. In areas where water supply is not plentiful, the reduction of the snowpack through evaporation can also result in reduced growth of trees, or, in the extreme case, mortality of regeneration.

The evaporation process is affected by wind speed, temperature and air dryness. Evaporation occurs from snow on the ground even at temperatures below 0°C. Snow evaporation is thought to be especially important in Chinook areas such as southern Alberta where wind speeds are high and the air is often dry and warm for extended periods during the winter. There, 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. We know from recent measurements taken at the James River experimental site that evaporation from snow in a large clearcut is at least 5 times greater than that in the forest, and 3 to 4 times greater than that in a 1 ha cut. With measured rates of nearly up to 2 mm per day, and potential calculated rates of near 1 cm per day in extreme meteorological conditions, evaporation from exposed snowpacks can have a substantial impact on seedling survival or water yield.

The essence of the problem is that the mathematical tools for estimating snow evaporation have been developed for smooth fields, and cannot be directly applied to "rough" surfaces like clearcut edges, clearcuts with debris, or regenerating clearcuts. 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, vapour concentration and site-specific roughness parameters. 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 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 has been carried out in the James River microclimate study site near Sundre. In a continuation of Phase I, the investigation on snow evaporation is being carried out for a young stand of lodgepole pine. The work is performed on a small artificial stand of 2-3 m pines near the Northern Forestry Centre. From this particular experiment, we expect to get some idea of the length of the "recovery" period, or how quickly does regeneration shelter the snow from the wind. We also want to relate the effect on wind profile to the geometry of the canopies and to the structure of the stand. In that way, results obtained here will be transferable to natural juvenile stands. Once we feel that we can predict snow evaporative loss under a variety of conditions, Phase II will be implemented to

give us a wider variety of field conditions to validate our techniques.

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.

Dr. Hiratsuka has been studying the mechanism of death of trees invaded by bark beetles. Two hypotheses have been advanced. 1) The beetles either release a toxin, or cause one to be released, that interferes with the stomatal mechanism of the leaves and the tree dehydrates out of control, with water loss much greater than can be supplied from the soil. 2) The blue stain fungi that accompany the bark beetles invades the sapwood, plugs the xylem, and cuts off the upper parts of the tree from water from the soil.

The heat pulse velocity instrumentation developed during earlier years in this project can be used to determine transpiration from beetle infested trees. It can also be used to test for sapwood blockage in xylem where only a portion of the xylem in a cross section is affected by blue stain fungi. Dr. Hiratsuka has developed techniques for inoculating xylem with various fungi. A test of the inoculating technique in conjunction with measurements of heat pulse velocities will give us a chance to determine if stomatal failure or xylem blockage is the primary cause of death from bark beetle attacks.

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

Currently, about 41% of cut over lands in Alberta are considered not sufficiently regenerated with softwoods. The seedling production and planting costs for such a large area will be very large. 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 extreme water stress, one of the key parameters in seedling survival or mortality.

The purpose of our research effort is to quantify the degree of water stress that occurs on various sites and exposure as a function of the silvicultural activities that have taken place. We hope to link the work on snow evaporation with the water stress aspect and study how, in some of the more critical locations, water stress can be reduced through appropriate management practices.

4. Reduced growth of spruce after 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 during the spring, and occasionally in response of rain of sufficient duration and intensity to saturate the porous soil surface. 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 for improved tree 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 to snow loss coefficients in WRENSS).

3. Transpiration of beetle-infested 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.
- b. Install heat pulse velocity sensors in xylem above locations inoculated with various fungi and placebo material to ascertain if the fungi plug the sapwood.

4. Water stress of seedlings
 - a. Evaluate instrumentation and techniques needed to characterize water stress of seedlings on micro-sites.
 - b. Determine relationships between site physical characteristics and soil water availability.
 - c. Test and prescribe forest management techniques to alleviate water-stress related mortality in reforested cut blocks.
5. Reduced growth after drainage.
 - a. Determine the differences in water use and/or stress of spruce growing on overly-drained, undrained and good sites.
 - b. Determine optimum soil moisture and water table 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 and II
 Starting date: 1984-1985
 Estimated date of completion: 1989
 Estimated Prof. PY: 0.5 per year
 Estimated Tech. PY: 1.0 per year
2. Transpiration of beetle-infested pine and water relations of trees on drained sites
 Starting date: 1985
 Estimated date of completion: 1988
 Estimated Prof. PY: 0.1 per year
 Estimated Tech. PY: 0.1 per year
3. Water stress of seedlings
 Starting date: 1986
 Estimated date of completion: 1990
 Estimated prof. PY: 0.5 per year
 Estimated tech. PY: 0.5 per year

9. 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. Poster paper for IASH 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 with the CR-21 micrologger. (Hurdle, Swanson) (13-15)
 2. Paper on the WRENSS technique. (Bernier, Swanson) (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 soil types to verify the 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 data. Begin simplifying model structure and data requirements to permit its use on IBM PC/XT micro-computers 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 micro-sites as defined by Alberta Forest Service research personnel. (Swanson, Bernier) (13-21)
 - d. Continue measurements 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)
3. Added Goals:
- a. Initiate research on the influence of regeneration on wind profiles at ground level and snow evaporation. (Bernier, Swanson)

- b. Evaluate the potential of a soil-plant-atmosphere water relations model for lodgepole pine developed by S.W. Running for predicting pine growth or mortality as a function of moisture stress. (Bernier)
- c. Collaborate in the preparation of a note on the incidence of western gall rust on lodgepole pine regenerating in various size of small openings. (Bernier)
- d. Prepare and present an invited paper at the Water Research Themes Conference held by the Canadian Water Resources Association in Saskatoon, October 1986. (Bernier)
- e. Prepare and present an invited paper on the role of microclimate in tree growth at the Forest Climate Symposium, Orillia, Ontario, November 1986. (Swanson)
- f. Publish a paper on "Snow distribution patterns in clearings and adjacent forest" with D. L. Golding (Swanson).

10. Accomplishments for 1986-87:

1. Publications

a. Submit for review:

- 1. Data on snow evaporation and/or melt from the James River experiment have been analyzed but a paper has not been prepared.
- 2. A manuscript entitled "Regeneration and growth of lodgepole pine in small forest openings in the Alberta Foothills" has been reviewed and submitted to the Canadian Journal of Forest Research.
- 3. The poster presentation was not prepared as the investigator did not attend the IAHS symposium in Hungary.

b. Submit for publication:

- 1. A paper on the multiplexer has been prepared and is in internal review within the project.
- 2. A forest management note (No. 27) entitled "A programmed procedure for evaluating the effect of forest management on water yield" was published.
- 3. The manuscript entitled "A review of the potential of millimeter microwaves for the remote sensing of snowpack properties" was accepted for publication in Nordic Hydrology.
- 4. A paper entitled "Extrapolating snow measurements on the Marmot Creek Experimental Basin" was published in Nordic Hydrology.

2. Research activities:

- a. The IRAMS time domain reflectometry soil moisture meter has proven technically unreliable. All five units purchased by various individuals or agencies in Edmonton are now back at the manufacture for repairs. (All of the instruments sold by Foundation were defective. The necessary modifications have apparently been made, but the company has been taken over by Soil Test who do not seem to have the same sense of obligation for the instrument that Foundation had. The instruments will eventually be modified, but no one is predicting when. This information was gotten from the inventor of the IRAMS instrument, Dr. Clarke Topp, who is on the Associate Committee on Hydrology with Swanson). No work has been carried out with the instrument.
- b. The HSPF model sent by Hydrocomp turned out to be a version designed for an IBM mainframe. The company agreed to correct their mistake and send a version adapted to a VAX environment. This version has not arrived yet.
- c. The Scholander plant water stress bomb was not needed because the soil moisture data to support the readings could not be taken.
- d. Heat pulse velocity instrumentation was installed on two groups of lodgepole pine selected for artificial inoculation with several strains of blue stain fungi. In both test groups, the xylem sections inoculated with one particular strain of fungi were plugged and sap movement stopped in 10 to 14 days after inoculation. Two papers, one on the technique and another on the effectiveness of the particular fungi are planned for the coming year.
- e. Frequent instrument breakdown occurred at the drained site resulting in very little useful heat pulse data. If replacement heat pulse instruments can be constructed this winter, we will try to obtain data on the water status of trees on drained and undrained sites next summer. However, further efforts on this study may have to be deferred until 1988 due to the involvement by Swanson in the organisation of conferences in 87 and 88.

3. Added goals.

- a. The research on the influence of regeneration on snow evaporation has been started. A semi-circular stand of 400 pines 2-3 m tall was erected in the field adjacent to the Northern Forestry Centre. Wind and other associated measurements are being carried out.
- b. The photosynthesis/water relations model developed by S. Running for lodgepole pine is operational on our IBM PC's. The structure of the model has been analyzed. The model is useful 'as is' on juvenile and large trees. It will require some modification for use with seedlings.

- c. A note with Dr. P. Blenis, University of Alberta, entitled "Incidence of Western gall rust infection of lodgepole pine in different sized forest openings" has been accepted for publication in the Canadian Journal of Forestry Research.
- d. A paper entitled "Research needs in forest hydrology" was presented at the CWRA Water Research Themes Conference in Saskatoon in October and will be published in the proceedings.
- e. A paper entitled "Microclimate in the establishment, growth and development of man-made forests" was presented at the Forest Climate Symposium, November 17-20. The paper will be published in a proceedings in 1987.

11. Goals for 1987-88:

1. Publications:

a. Submit for review:

- 1. A paper on using the heat pulse velocity technique in pathological investigations. (Swanson, Hiratsuka) (8701P).
- 2. A paper on invasion of xylem sapwood by fungi. (Hiratsuka, Swanson) (8702P).

b. Complete for publication:

- 1. Paper on the regeneration and growth of lodgepole pine in small forest openings (Bernier) (8601P).
- 2. Paper on a multiplexer for the CR21 and 21X microloggers. Probably a short Information Report. (Hurdle) (8401P).
- 3. Paper on the influence of forest cover on snow evaporation. To be presented at a Symposium on Forest and Agricultural Meteorology, 12-17 September 1987, West Lafayette, Indiana. (Bernier) (8706P).

2. Research activities:

- a. Program Hydrocomp's HSPF model on the VAX computer. Become familiar with its operation by trying to use it with data from one of the province's experimental basin. Assess its potential usefulness in evaluating downstream flooding effects and sediment changes resulting from clear-cutting activities. (Bernier) (8602R).
- b. Pursue the research on snow evaporation in a stand of juvenile lodgepole pine. Determine the effect of the trees on the wind profile and on the evaporation of the snow pack. (Bernier, Swanson) (8703R).

- c. Pursue the evaluation of S. Running's evapotranspiration model by applying it to local data. Seek out possible sites for testing some of the physiological predictions made by the simulator. (Bernier, Swanson) (8704R).
- d. Determine effectiveness of blue stain fungi in invading xylem sapwood and blocking the transpiration stream during periods of low to moderate plant water stress. (Swanson) (8705R).
- e. Evaluate results of regeneration survey conducted by the Alberta Forest Service to determine the necessity for plant water relations research. (Bernier) (8707R).

12. Publications 1986-87:

Bernier, P.Y. 1986. "Extrapolating snow measurements on the Marmot Creek Experimental Basin". *Nordic Hydrology* 17:83-92.

Bernier, P.Y. 1987. "A review of the potential of millimeter microwaves for the remote sensing of snowpack properties". *Nordic Hydrology*. (In press).

Bernier, P.Y. 1986. "A programmed procedure for evaluating the effect of forest management on water yield". *Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manag. Note No.27*.

Blenis, P.V., and P.Y. Bernier. 1987. "Incidence of Western gall rust infection of lodgepole pine in different sized forest openings". *Can. J. For. Res.* (In press).

Bernier, P.Y. 1987. "Research needs in forest hydrology". In *Proceedings, CWRA Water Research Themes Conference, Saskatoon, 2-3 October 1986*. (In press).

Golding, D. L. and R. H. Swanson. 1986. Snow distribution patterns in clearings and adjacent forest. *Water Resources Research*, 22:1931-1940.

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 1987-88:

P/Ys:	Prof:	Bernier	0.6
		Swanson	0.2
	Tech:	Hurdle	1.0
		Fisera	0.5
	Total		2.3

O&M	\$6000
Capital	\$20,000

15. Signatures:

Bob Y. Romain
Investigator

J. M. Powell
Program Director, Extension

Robert H. Anderson
Investigator

C. D. Witt
Regional Director General

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NOR-28

WETLANDS AND FOREST PRODUCTIVITY MODELLING

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 CO_2 . 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 83.2×10^9 tonnes of peat, some 75×10^9 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 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)

Added Goal

10. Participate in the organization of an international symposium on wetlands to be held in Edmonton, August 1987 (Zoltai, Johnson).
11. Accomplishments in 1986-87:
1. Draft manuscript "Relationships between nutrients and vegetation in peatlands of the Prairie Provinces" prepared and abstract submitted for presentation at Wetland '87 Symposium (Zoltai and Johnson).
 2. Material for a paper on management of peatlands and peat resources has been assembled.
 3. Material for a paper on wetland classification from remotely sensed imagery is being assembled.
 4. Material for manuscript on heavy metal fallout from a smelter in peat has been assembled and statistical analysis completed.
 5. Manuscript "Additions to the Bryophyte flora of Alberta, Saskatchewan and Manitoba, Canada" with author after technical review.
 6. Map and brief report "Ecoclimatic regions of Canada" is with publisher.
 - 7a. Manuscript "Lichens new to Alberta, Saskatchewan, and Manitoba" with author after technical review.
 - 7b. Manuscript "Vascular plants new to Manitoba" with author after technical review.

8. Four chapters for the book "Wetlands of Canada" are with publisher:
Chapter 1. Wetlands environments and classification.
Chapter 2. Wetlands of the Arctic regions of Canada (co-author).
Chapter 3. Wetlands of the Subarctic regions of Canada.
Chapter 4. Wetlands of the Boreal regions of Canada.
 9. Contributed to Timberline.
 10. Participating in planning of international peat symposium by acting as co-chariman of local arrangements committee (Zoltai) and handling publicity and publications (Johnson).
12. Goals for 1987-88:
1. Present paper "relationships between nutrients and vegetation in peatlands of the Prairie Provinces" at symposium (Zoltai and Johnson).
 2. Continue work on manuscript on management of peatlands and peat resources (Zoltai).
 3. Continue work on manuscript on wetland classification from remotely sensed imagery (Zoltai).
 4. Finalize manuscript on heavy metal fallout from a smelter in peat (Zoltai).
 5. Submit for publication "Additions to the Bryophyte flora of Alberta, Saskatchewan and Manitoba, Canada" (Johnson).
 6. Submit for publications "Lichens new to Alberta, Saskatchewan and Manitoba" (Johnson).
 7. Submit for publication "Vascular plants new to Manitoba" (Johnson).
 8. Prepare manuscript on volcanic ash layers in peat in Alberta (Zoltai).
 9. Take active part in planning of Wetland Symposium, held in Edmonton, August 1987 (Zoltai, Johnson).
13. Publications 1986-87:
- Zoltai, S.C. (National Wetlands Working Group). 1986. Canada - Wetland regions. National Atlas of Canada, 5th ed. Energy, Mines and Resources Canada.
- Zoltai, S.C. (National Wetlands Working Group). 1986. Canada - Distribution of Wetlands. National Atlas of Canada, 5th ed. Energy, Mines and Resources Canada.

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 1987-88:


PYs: Prof.:	Zoltai	0.9	
	Johnson	0.5	
	Tech.:	Ali	0.8
	Total:		2.2
	Term/Student:		0.0

O & M: \$4,000

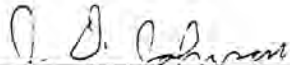
Capital:

16. Signatures:


Investigator



Program Director, Protection



Investigator



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1987

1. Project: Wetlands, and Forest Productivity Modelling
2. Title: Increasing wood production through forest land drainage
(Wetland drainage and improvement program)
3. New: Cont.: X 4. No.: NOR-28-03 (NOR-36-02-3)
5. Study Leader: G.R. Hillman and J.D. Johnson
6. Key Words: Wetlands, peatlands, regeneration, forest growth, Larix laricina, Picea mariana, ditches, groundwater, soil water, hydrology, hydrodynamics, site preparation
7. Location of Work: Boreal forest, Western and Northern Region
8. Problem:

In Alberta, concern about the decreasing productive forest land base as more forest land was withdrawn for other uses led foresters to consider increasing the wood-growing capability of forested wetlands. Alberta contains nearly 13 million ha of peatlands or about 11% of the peatlands in Canada. About 4 million ha are considered suitable for drainage and conversion to productive forest. Several forestry drainage projects were initiated in Alberta, all but one of which are less than 5 years old. Consequently, very little information is available on the long-term effects of forest drainage in Alberta on tree growth and the environment. It is believed that the potential in Alberta for increasing tree growth through peatland drainage is good.

The wetland drainage and improvement program, funded by the Canada/Alberta Forest Resource Development Agreement, arose in response to the concerns and shortcomings outlined above. In 1985, three forested wetland areas were selected as experimental drainage sites: a treed bog (McLennan), a treed fen (Wolf Creek), and a treed swamp (Goose River). Portions of each area were designated for ditching, and the remainder preserved as control. The experimental design required that data be collected before and after drainage.

Each area was surveyed and sampled in a similar manner. Weather stations consisting of a recording precipitation gauge and a hydrothermograph were installed. Survey lines were cut, topographic surveys conducted and

topographic maps produced with contour interval of 0.5 m and scales 1:2000 or 1:5000.

Preliminary peat, water and vegetation surveys and sampling programs were completed to determine wetland, vegetation and peat types, peat depths, nutrient status and other site characteristics. Saturated hydraulic conductivity was measured in the top 1 m of soil.

Drainage ditch network designs were prepared using Tóth's synthetic hydraulic curve method to find the optimum ditch spacings. Each network design allowed for evaluation of different ditch spacings on the same site.

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 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)

Added Goals

13. Attend Forest Drainage Workshop in Northern Ontario.

11. Accomplishments in 1986-87:

1. A manuscript entitled Improving wetlands for forestry in Canada was prepared and submitted to the scientific editor.
2. On each study area, four transects were established, one on the control, and three at different ditch spacings.
3. On each transect, 1 data-logger, 1 temperature probe, 2 pressure transducers and 3 13 mm diameter reinforcing rods were installed. A total of 97 5 cm dia. and 6 15 cm dia. groundwater wells were installed on the three experimental areas. Data collection commenced May, 1986.
4. The peat survey and sampling program was completed on each transect. 270 peat samples and 50 water samples were collected and analyzed.
5. 180 foliage samples were collected from 12 transects and analyzed in the laboratory to determine nitrogen, phosphorus and potassium concentrations.
6. 233 stream water samples were collected on the three experimental areas throughout the summer, and analyzed in the laboratory.
7. 150 ground vegetation permanent sample plots, 1 m², were installed and measured on the three experimental areas.
8. 55 tree growth permanent sample plots were established and measured on the Wolf Creek site. There was no progress on the other two areas.

9. The annual report required by the agreement will be ready before the end of March, 1987.
 10. Before March 31, 1987, the study leader will assist in preparing an article, on wetlands drainage research, for Timberlines, successor to Forestry Report.
 11. The final draft of the paper Simulation of the effects of forest cover removal on subsurface water was submitted to Water Resources Research.
 12. 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. The study leader was consulted by Abitibi-Price Inc. about drainage problems on its forest management licence near Pine Falls, Manitoba.
 13. Attended Forest Drainage Workshop in northern Ontario, October, 1986 and made a presentation on the Alberta Wetland Drainage and Improvement Program.
12. Goals for 1987-88:
1. Publish information report entitled Improving wetlands for forestry in Canada. (Hillman)
 2. On each experimental area, install instrumentation as required to complete instrumentation networks. Continue program of data collection from these networks. (Hillman, Robson)
 3. On each experimental area, continue the stream water quality data collection program. (Robson)
 4. On each experimental area, remeasure ground vegetation permanent sample plots. (Johnson)
 5. On the Goose River and McLennan experimental area, establish and measure tree growth permanent sample plots, on both treatment and control sites. (Johnson)
 6. Write paper entitled Improving wetlands for forestry in Alberta for presentation at the Wetlands '87 Symposium to be held in Edmonton, August 1987. (Hillman)
 7. Organize field tour of wetlands drainage experimental areas as part of the Wetlands '87 Symposium. (Hillman, Robson)
 8. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada-Alberta Forest Resource Development Agreement (CFS/AFS).

9. Publish in Water Resources Research paper entitled Simulation of the effects of forest cover removal on subsurface water. (Hillman)
10. Provide scientific and technical advice on forest drainage projects and problems. (Hillman)
13. Publications 1986-87:

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 1987-88:

PYs: Prof.: Hillman 1.0
Johnson 0.5

Tech.: Robson 1.0
Ali 0.2

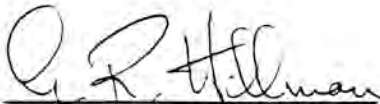
Total: 2.7

Term/Student: 0.3

O & M: \$1,000 (+\$16,000 Canada-Alberta Agreement)

Capital:

16. Signatures:



Investigator


Program Director, Protection



Investigator


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 30, 1987

1. Project: Wetlands and Forest Productivity Modelling
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
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 on 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 1986-87:

1. Prepare summary report on growing season climate of clearcut areas associated with seedling growth study.
2. Prepare summary report on soil temperature after clearcutting.
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.
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.

11. Accomplishments in 1986-87:

1. A paper on "Microclimate of clearcuts in west-central Alberta" was presented and published in the Proceedings of the Tenth annual General Meeting of the Alberta Climatological Association.
2. Technical support was not available and the goal has to be deferred. (Goal transferred to NOR-28-07).
3. Analyses for the 1871-1981 data were completed. Part of the results were reported in "Climate of the boreal forest in western Canada", General Circulation, Summer 1986.
4. Advice provided to the colleagues and clients. Participated as a member of the Executive Committee for Alberta Climatological Association, and helped organize the Eleventh Annual Meeting at NoFC. Also participated as a member of the Steering Committee for planning and organizing a Symposium on "Impacts of climate variability and change on the Canadian prairies" to be held in Edmonton, 9-11 September, 1987. (Goal transferred to NOR-28-07).

12. Goals for 1987-88:

Goals 2 and 4 transferred to NOR-28-07. Study terminated.

13. Publications 1986-87:

Singh, T.; J.M. Powell. 1986. Climatic variation and trends in the boreal forest region of western Canada. *Climatic Change* 8:267-278.

Singh, T. 1986. Microclimate of clearcuts in west-central Alberta. Pages 47-59 in *Current Climatological Activity in Alberta*. *Envir. Can., Proceedings of the Tenth Annual General Meeting of the Alberta Climatological Association*, 20 Feb. 1986.

Singh, T. 1986. Northern Forestry Centre. Pages 89-91 in *Current climatological activity in Alberta*. *Envir. Can., Proceedings of the Tenth Annual General Meeting of the Alberta Climatological Association*, 20 Feb. 1986.

Singh, T. 1986. Climate of the boreal forest in western Canada. *Alta. Climatological Assoc., General Circulation, Summer 1986*. p. 6.

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 1987-88:

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

O & M: Nil

Capital: Nil

16. Signatures:

T Singh
Investigator

S. K. Singh
Program Director, Protection

A. D. Singh
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1987

1. Project: Wetlands and Forest Productivity Modelling
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. Problem:

Rapid depletion of non-renewable resources used for energy requirements in the modern world is a matter of growing concern. Present estimates indicate that about 90 percent of the total known oil reserves are likely to be consumed by the year 1990. Renewable resources provide only 3½ percent of all energy used in Canada at present.

Alternative sources of energy, such as energy from forests, need to be quantitatively assessed to help meet future demands and to supplement existing supply levels from the fossil fuels. Biomass is gaining increased recognition as a potentially viable renewable resource for partial solution to the existing energy problems on the American continent.

Gathering quantitative information on the availability of forestry biomass on a sustained basis is an essential pre-requisite to the future planned use of this resource. At present only very limited data are available to make a reliable estimate of the existing forest biomass in the Prairie Provinces. The great diversity of vegetation occupying widely different sites over a vast geographical area makes such estimations exceedingly difficult. Poplars, for example, have the widest range and largest volume of any of the hardwood genera in Canada, occupying a wide range of site conditions with quite different growth rates. Poplars are the fastest growing species on many sites in the Prairies Region and, along with other tree species, present attractive possibilities for future use as a source of energy from forest lands.

Much information is already available in the regional forest inventories on the merchantable volume of the growing stock, at least for important species. Such inventories are constantly being updated and expanded through modern techniques involving aerial photography and computer technology. It is possible to incorporate biomass estimates by collecting additional information on relatively few parameters.

9. 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.

10. 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.

11. Accomplishments in 1986-87:

1. Paper on "Generalizing biomass equations for the boreal forest region of west-central Canada" accepted for publication and is to appear in the next issue of Forest Ecology and Management.
2. Preliminary draft of a journal paper entitled "Variation and prediction of conifer crown fuels in the Northwest Territories" has been prepared and is being revised for initiating the review process.
3. The note was reviewed and expanded according to the suggestions received from reviewers. The revised paper entitled "Wood density variations in 13 Canadian wood species" has been accepted for publications in Wood and Fiber Science.

4. A paper entitled "Calorific value variations in components of ten Canadian tree species" has been accepted for publication by the Can. J. Forest Research.
 5. Analyses have been completed and a note entitled "Predicting fuel weights for small trees and components" is being prepared for Forestry Chronicle.
 6. Presented a paper on "Prediction error in tree biomass regression functions for western Canada" at the U.S. national workshop in Syracuse, N.W. The workshop as held from May 26 to 30, 1986, and was entitled: Tree biomass regression functions and their contribution to the error of forest inventory estimates. Paper has been accepted for inclusion in the Proceedings.
11. Goals for 1987-88:
1. Completion of goals 2 and 5 above transferred to NOR-28-06.
 2. Study terminated.
12. Publications 1986-87:
- Singh, T. 1986. Wood density variation of six major tree species of the Northwest Territories. Can. J. For. Res. 16:127-129.
- Singh, T. 1986. Forest biomass research in Canada. National Woodlands 9(3):17.
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 1987-88:
- | | |
|---------------|-----|
| PYs: Prof.: | 0.0 |
| Tech.: | 0.0 |
| Total: | 0.0 |
| Term/Student: | 0.0 |
- O & M: Nil
- Capital: Nil

16. Signatures:

T Singh
Investigator

[Signature]
Program Director, Protection

J. M. Powell
ENFOR Representative

[Signature]
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1987

1. Project: Wetlands and Forest Productivity Modelling
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. Problem:

Fossil fuels such as crude oil, natural gas, tar sands and coals are relatively abundant in Canada, but nevertheless of finite extent. Because such reserves are dwindling, there has been a fresh look at forest fuels as renewable resource. Forest biomass, the total quantity of organic matter in the forest, is an energy source that is currently largely untapped and in many cases going to waste. At the initiation of this program Canada derived about 4% of its total energy supply from forest biomass. The federal program established in 1978 aimed at generating sufficient knowledge and technology to realize a marked increase in the contribution of forest biomass to Canada's energy supply.

Current biomass productivity in the forested areas of the Prairie Provinces and the Northwest Territories ranges from less than 1 t/ha/yr in the north to over 3 t/ha/yr in some southern parts of the provinces. The initial estimate of the above-ground tree biomass reserve in Alberta alone is more than 1 billion tons of oven-dry material. Annual biomass production amounts to 25 million oven-dry tons, which in methanol represents twice the annual energy production from oil sands at the Syncrude plant in Fort McMurray.

The Canadian Forestry Service is the lead agency in administering the federal ENergy from the FORest (ENFOR) program, part of the Federal Panel

on Energy R&D (PERD). The NoFC studies are an integral part of the national CFS ENFOR program to assess the potential of biomass as an alternate energy source. The main areas of the CFS ENFOR program have looked at resource assessment, environmental effects, mechanization, silviculture and socio-economic technical studies.

9. 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.

10. 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-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).
11. Accomplishments in 1986-87:
1. A report entitled "Economic evaluations of 15 alternatives for industrial utilization of poplars", has been prepared, reviewed and is with the editor. In addition a directory of forest production mills in Alberta utilizing aspen in 1986 was prepared as a supplement to the above report. A poster presentation entitled "Development of an integrated operation for aspen wood products and energy from aspen biomass" was prepared by the contractors for the 6th Bioenergy Seminar. (P-207) (Scientific Authority: W. Ondro).
 2. An Information Report entitled "A Mapping and Analysis of Resource System application" (NOR-X-285) is in final stages of preparation for printing (P-148 and extension) (Scientific Authorities: W. Moore and W. Chow).
 3. An Information Report on "Downed-dead fuels in central Alberta forest cover types" is with the editor (P-23) (Scientific Authority: T. Singh).
 4. Drafts of two reports from the contract "Determine the biomass and energy potential of the main tree species in Manitoba" have been prepared; these will be revised before submitting for review. A poster presentation has been prepared entitled "Energy potential from Manitoba forest biomass" by the contractor and T. Singh for the 6th Bioenergy Seminar. (P-315) (Scientific Authority: T. Singh)

5. Contract: "Data analysis of biomass and nutrient content in Alberta aspen ecosystems" (P-205). A literature review has been completed but the final report is incomplete. Biomass values derived for small diameter (>10 cm) trees were considered to be overestimated and further refinement of the regression equations will be made in consultation with Teja Singh. A poster presentation entitled "Biomass and nutrient content of aspen ecosystems in Alberta, Canada" was prepared by the contractor for the 6th Bioenergy Seminar. (Scientific Authority: I. Edwards)
6. Water and litter samples were collected from the Kinuso and Calling Lake calibration sites under two separate contracts and the samples were chemically analysed under a third contract. Analysis was completed and the nutrient cycling data are being summarized for delivery to Western Ecological Services Ltd. (P-314 subcontracts) (Scientific Authority: I. Edwards).
7. Contract: "Adaptation of nutrient cycling data to the FORCYTE growth simulation model for aspen stands in Alberta" (P-314). A review of input data requirements was published in an interim report, March 1986. Nutrient cycling data were reviewed and partially summarized. A request for extension of the contract to September 30 has been made because of delay in delivery of tested components of the FORCYTE program. Through use of a coprocessor, the contractor has been able to run the model on a desk-top computer, thus saving on main-frame computer time. A poster presentation titled "Calibration of FORCYTE-11 growth simulation model for aspen ecosystems in Alberta, Canada" was prepared by the contract for the 6th Bioenergy Seminar. (P-314) (Scientific Authority: I. Edwards)
8. An advisory contract "Planning, Executing and Interpretation of FORCYTE Gaming trials" was established with Life Science Programming Ltd. (Kim Scoullar). Assistance with the adaptation of FORCYTE-11 to the microcomputer, modifications to expedite sensitivity analysis, and preliminary identification of important input and output parameters have been accomplished. A presentation on FORCYTE was presented at the CFS Modelling workshop in September. A poster entitled "Implementation of user friendly gaming with FORCYTE-11 calibrated for an aspen ecosystem" was presented at the 6th Bioenergy Seminar. (P-314) (Scientific Authority: M.J. Apps)
9. Further review of the manuscript "Winter harvesting of aspen for product and biomass recovery" is on hold pending completion of reports under goal 1. (P-324) (Scientific Authority: D. Boylen).
10. The contract to assess the biomass productivity on the two-year-old aspen cutovers was completed and analyzed. A poster presentation entitled "Biomass productivity in two-year-old aspen cutovers near Calling Lake and Slave Lake, Alberta", was prepared for the 6th Bioenergy R&D Seminar, and a paper to be published in the proceedings. (P-333) (Scientific Authority: H. Grewal)
11. The proposed contract to assess the "Non-core area wood supply" in central Saskatchewan was recently initiated. (P-334) (Scientific Authority: Saskatchewan District Office).

12. The two-year contract on "Wood density of Canadian tree species was initiated by FORINTEK Canada Corp., Vancouver, and the preliminary results were given in a poster presentation at the 6th Bioenergy Seminar entitled "Wood density of tree species in British Columbia". (P-335) (Scientific Authority: J.M. Powell)
 13. The paper on "Biomass productivity of white spruce stemwood" was submitted to the Can. J. For. Res. and is back for revisions prior to acceptance. (P-149 and extensions) (Scientific Authority: J.M. Powell).
 14. Two meetings of the ENFOR Production Technical committee were attended by Edwards (May) and Powell (December) on behalf of the Centre. Coordination was continued and further proposals were submitted for 1987-88. A FORCYTE workshop was successful run by Apps at NoFC in March. (J. Powell, I. Edwards, M. Apps).
13. Goals for 1987-88:
1. Publish Information Report entitled "Economic evaluations of 15 alternatives for industrial utilization of poplars" (P-207) (Scientific Authority: W. Ondro)
 2. Publish information report on "Downed dead fuels in central Alberta forest cover types" (P-23) (Scientific Authority: T. Singh).
 3. Check validity of regression equations and oversee completion of the final report for the contract. "Data analysis of biomass and nutrient in Alberta aspen ecosystem" (P-205). Review final report and prepare for CFS publication (Information Report). (Scientific Authority: I. Edwards).
 4. Complete summary of nutrient cycling data and deliver to Western Ecological Services Ltd. Liaise with contractor (and Apps) during sensitivity tests of the FORCYTE model and through review, oversee completion of the final report for the contract, "Adaptation of nutrient cycling data to the FORCYTE Growth simulation model for aspen stands in Alberta" (P-314). (Scientific Authority: I. Edwards).
 5. Oversee a contract(s) for the application of FORCYTE-11 to aspen & mixed stands in Alberta. (P-353) (Scientific Authority: M.J. Apps).
 6. Oversee a contract on the "Modification of FORCYTE-11 to simulate moisture limitation on growth and early stand development" if approved for tendering (P-357) (Scientific Authority: M.J. Apps).
 7. Oversee a contract in "Non-core area wood supply in central Saskatchewan" (P-334). (Scientific Authority: Saskatchewan District Office).
 8. Continue to oversee the two-year contract on "Wood density of Canadian tree species" being undertaken by FORINTEK (P-335) (Scientific Authority: J.M. Powell).

9. Assist in completing revisions to the paper on "Some climatic aspects of biomass productivity of white spruce stemwood" submitted to Can. J. For. Res. (P-149 and extensions) (Scientific Authority: J.M. Powell).
 10. Publish Information Report: "Utilization of poplars in Alberta" (P-207 and extension) (Scientific Authority: W. Ondro).
 11. Complete preparation of paper on "Variation and prediction of conifer crown fuels in the Northwest Territories". (Transferred from NOR-28-05). (P-169) (T. Singh)
 12. Complete preparation of note on "Predicting fuel weights for small trees and components". (P-314 extension) (Transferred from NOR-28-05) (T. Singh)
 13. Continue coordination of NoFC ENFOR projects ensuring their completion and publication. Act as establishment representative on national committees and submit reports on the program as required (J. Powell).
14. Publications 1986-87:
- Grewal, H.S. 1987. Biomass productivity in two-year-old aspen cutovers near Calling Lake and Slave Lake, Alberta. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 8.
- Gonzalez, J.S. 1987. Wood density of tree species in British Columbia, In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 5.
- Kurz, W.; M.J. Apps; Y.H. Chan. 1987. Implementation of user friendly gaming with FORCYTE-11 calibrated for an aspen ecosystem. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 12.
- Moore, W.; W. Chow. 1987. A Mapping and Analysis of Resources System application. Can. For. Serv., North. For. Cent., Edmonton, Alta. Info. Rep. NOR-X-285.
- Peterson, E.B.; Y.H. Chan; N.M. Peterson. 1987. Biomass and nutrient content of aspen ecosystems in Alberta, Canada. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 8.
- Peterson, E.B.; Y.H. Chan; N.M. Peterson; R.D. Kabzems. 1987. Calibration of FORCYTE-11 growth simulation model for aspen ecosystems in Alberta, Canada. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 11.
- Singh, T; M.M. Kosticky. 1987. Energy potential from Manitoba forest biomass. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 5.

Woodland Resource Services Ltd. 1987. Development of an integrated operation from aspen wood products and energy from aspen biomass. In Energy, Mines and Resources Can., 6th Can. Bioenergy R&D Seminar, Feb. 16-18, 1987. Abstracts p. 15.

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 1987-88:

PYs: Prof.:	Edwards	0.3
	Apps	0.1
Tech.:		0.0
Total:		0.4
Term/Student:		0.0

O&M: Nil

Contracts:	\$128,080 (+ 27,000 in on hold)	ENFOR funding
In-house R & D:	10,000	ENFOR funding
Management:	9,000	ENFOR funding

Total: \$147,080 (From HQ ENFOR budget)(+27,000 on hold)

16. Signatures:

J. M. Powell

Program Director, Extension
ENFOR Representative

Shuttleworth

Program Director, Protection

C. D. Hunt

Regional Director General

insect, and disease risk losses must be included in projected expectations as these are predictable for large areas within a given time frame. The objective assessment of these risk factors and uncertainties is a necessity for a rational formulation of management and timber harvesting strategies in the boreal forest of western Canada.

Development of the risk factor model for forest yield prediction will be based on Alberta data. The existing data on risk factors and growth and yield will be located and examined through necessary data screening, computer programming, and preliminary modelling procedures under the guidance of the Study Leader. Permanent sample plot data and the data collected by researchers at NoFC for their specific and related purposes will be accessed. Similarly, the historic data will be retrieved from provincial records on fire and disease occurrences, and from the Canadian Climate Centre for climatic data. The data so examined will be used in expressing the various causative factors determined in the study. Field collection of current data will be useful to fill in existing data gaps and to validate the model and its components. The model will have potential for application in the boreal ecoregions in the remaining prairie provinces after needed modifications.

The study will need cooperation from interested project and study leaders at NoFC because of its multi-disciplinary nature. Inputs from growth and yield, fire, insect and disease, and forest resource groups will form an essential part of the study strategy. As the mathematical techniques for probability and risk analysis are basically similar in these disciplines, the study will provide a unifying link among them. There will also be an opportunity to cooperate with provincial agencies and forest industry to meet their requirements for realistic determination of future yields when subjected to the above-mentioned risk factors and uncertainties.

Because of the availability of most data bases for modelling, McLeod working circle in the leasehold of Champion Forest Products Ltd. will be selected as a logical unit for the formulation and development of the model. Other boreal ecoregions will be accessed to extend the general scope of the risk factor model. A total of four years is estimated to cover all stages of the study. These stages are:

- a) Initial stage: A review of risk and uncertainty factors in growth and yield due to fire and insect and disease occurrences; collection and evaluation of data relating to such factors.
- b) Preliminary development stage: Preliminary attempts at development of a conceptual model dealing with risk factors relating to growth and yield.
- c) Intermediary stage: Implementation of model concepts and strategies to achieve parameter estimation and calibration.
- d) Refinement stage: Improvement and refinement in risk factor model and parameter estimates to enhance model capabilities, and a validation test on independently collected and most recent data in a different geographical location within Alberta.

- e) Final stage: Finalizing risk factor model and its components for the boreal forest, and recommendations for its extension to disjunct outliers or ecoregions, including preparation of a manual for operational use, and guidelines to prescribe needed management plans and timber harvesting strategies.

9. Study Objectives:

- 1. To model the risk of fire at the stand and forest level to aid management decisions on the effect of such occurrences on allowable cut and future timber supplies.
- 2. To determine the frequency of large-scale insect and disease occurrences and derive a model to assess their effect on the present and future forest yields.
- 3. To test, review, and modify the fire and disease risk factor model to extend its application over other boreal forest ecoregions in western Canada.

10. Goals for 1986-87:

New Study:

- 1. Initiate review of literature on current status of risk factor models in forestry.
- 2. Examine McLeod Working Circle risk factor and growth and yield data from permanent sample plots of Champion Forest Products Ltd., Hinton, for preliminary work on a conceptual model.

11. Accomplishments in 1986-87:

- 1. Literature review information is being compiled for preparing a paper entitled "Risk factor modelling in forestry".
- 2. A contract to review risk factors in the boreal forest and develop procedures to simulate their impact on annual allowable cut in the McLeod Working Circle was granted to W.R. Dempster & Associates Ltd. The contract is expected to produce a report describing preliminary work on a conceptual model. Data files and computer analyses will be made available by the contractor for future work on risk factor modelling in the boreal forest of western Canada.

12. Goals for 1987-88:

- 1. Locate risk factor data and create data bases for disjunct outliers and ecoregions adjoining McLeod Working Circle in Alberta:
 - a) Fire risk data: Temperature, precipitation, humidity, wind velocity; soil moisture, elevation, aspect, forest cover, density; fuel type, flammability; fire history and area burnt annually; fire hazard indices.

- b) Insect and disease data: Insect and disease history of major occurrences; mortality and reduction in growth rates; site and stand characteristics, and climatic variables which influence insect and disease risks.
 - c) Site and growth data: Site factors, cover type, age classes, elevation, aspect, and PSP data on diameter, height, density and growth rates; harvest-scheduling data.
 - d) Any other data essential for use in harvesting scheduling and risk models.
2. Contact and collect available information and data from NoFC scientists and technicians on fire occurrences, and insect and disease infestations, for their effect on growth rate and annual allowable cut.
 3. Initiate work on computing the probabilities of short- and long-term timber losses in the boreal forest ecoregions adjoining McLeod Working Circle in Alberta, by locating/collecting cover type, age, and other needed site data for such ecoregions according to each risk factor.
 4. Write/modify computer programs for operating IBM-PC and NoFC computing systems to study the effects of changes in risk factor levels on harvest scheduling.
 5. Determine depletions/accumulations in growing stock at various risk levels over selected time periods in the Hinton leasehold, and initiate correction procedures for reconciling discrepancies.
 6. Initiate work on preparation of risk factor maps for incorporation in research publication.
 7. Undertake short-term courses to update training on simulation modelling, computer graphics, time series, and linear programming optimization methodologies.
 8. Prepare and initiate review of a paper on "Risk factor modelling in forestry".
 9. Prepare annual progress report as required by the Canada-Alberta Agreement.
 10. Prepare summary report on soil temperature after clearcutting. (Transferred from NOR-28-04)
 11. Provide statistical and other advice to colleagues and clients in the ongoing programs of NoFC, represent CFS and NoFC on advisory committees and other groups, and participate in the planning and organizing of their activities. (Transferred from NOR-28-04)

12. Provide input and contribute expertise on forestry considerations relating to Saskatchewan Research Council (SRC) contract entitled "Assessment of the implications of climatic change for boreal forests and the forest industry in the Prairie provinces and Northeast Territories".
13. Act as compiler for the Proceedings of 11th Annual Meeting of the Alberta Climatological Association, Feb. 24, 1987.

13. Publications 1986-87:

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 1987-88:

PYs:	Prof.: Singh	1.0
	Tech.: vice Schultz	1.0
	Total	2.0

O & M: \$4,000

Capital:

16. Signatures:

T Singh

Investigator

S Schultz

Program Director, Protection

C. R. Kent

Regional Director General

NOR-33

INFORMATION

- 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)

Added Goals:

- 9. Revise and reprint the Northern Forestry Centre general information brochure in both English and French. (J.S.) (33-11)
 - 10. Prepare an initial draft of specifications for reports produced under the Canada-Alberta Forest Resource Development Agreement. (J.S.) (33-13)
 - 11. Revise the NoFC manuscript review procedure. (J.S.) (33-11)
 - 12. Revise the Information Progress Report categories. (J.S., B.B.) (33-11)
 - 13. Develop instructions to authors of workshop, conference, and symposium proceedings manuscripts to be produced in NoFC publications. (J.S.) (33-11)
 - 14. Serve on a committee to finalize updating of the Canadian Forestry Service publications policy. (J.S.)
11. Accomplishments in 1986-87:
- 1. Assisted the research staff, through the provision of editing and publishing services, in the preparation and publication of:

- a. 14 Information Reports
 - b. 11 Forest Management Notes
 - c. 1 Forestry Report
 - d. 16 Pest Leaflets (revisions and reprinting)
 - e. 41 journal articles and miscellaneous publications.
2. The Field guide to forest ecosystems of west-central Alberta, by I.G.W. Corns and R.M. Annas, was published and distributed in mid-1986. Information Report NOR-X-286, Forest tree diseases of the prairie provinces, by Y. Hiratsuka, has been edited and is being typeset in preparation for printing in March 1987. Advice has been provided and the color photographs are being pasted-up into full-page plates for the report by W.G.H. Ives and H.R. Wong on forest insects of the prairie provinces. The report on diagnosis and recognition of winter frost damage, by H. Zalasky, was given a preliminary editorial review resulting in suggestions for reorganization that were passed on to Y. Hiratsuka, who is to be a coauthor of the report.
 3. Prepared and published the Program Review 1985-86 of the Northern Forestry Centre.
 4. Oversaw production and printing or reprinting of locally published scientific and technical information. This included the typesetting, paste-up, and production of the fire growth calculator, which resembles a slide rule in design.
 5. Continued 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.
 6. Provided editorial, typographical, and printing assistance for public information activities.
 7. A draft of the bibliography of 1980-85 publications of the Northern Forestry Centre was prepared and reviewed by all staff. It is awaiting author revision to incorporate additional publications.
 8. New models of typesetting equipment were investigated, and a tentative proposal and price for upgrading the AM Varityper were included by B. Chow in the Headquarters work plan for computer acquisitions.
 9. The Northern Forestry Centre brochure was updated and reprinted in both English and French.
 10. Specifications for Canada-Alberta agreement reports were prepared and then finalized for distribution to contract authors.

11. The NoFC manuscript review procedure was revised and expanded to clarify the flexibility of the review procedure, and copies were distributed to all staff.
 12. The Information Progress Report categories were revised to better indicate progress of manuscripts in the early review and editorial stages.
 13. Guidelines for preparation of workshop, conference, and symposium proceedings manuscripts and a consent-to-publish form (based on new national guidelines) were prepared, and copies were distributed to all projects.
 14. J. Samoil met with the chief, Scientific and Technical Publications, at CFS Headquarters to finalize a revision of the CFS publications policy.
12. Goals for 1987-88:
1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately:
 - a. 8 Information Reports
 - b. 7 Forest Management Notes
 - c. 2 Forestry Reports
 - d. 40 journal articles and miscellaneous publications. (J.S., B.B.) (33-11)
 2. Assist in the preparation of two special technical reports: Forest insects of the prairie provinces, by W.G.H. Ives and H.R. Wong; and diagnosis and recognition of winter frost damage, by H. Zalasky and Y. Hiratsuka. (J.S., B.B.) (33-11)
 3. Oversee production and printing or reprinting of locally published scientific and technical information. (J.S.) (33-13)
 4. 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)
 5. Provide editorial, typographical, and printing assistance for public information activities. (J.S., B.B., D.A.) (33-11, 33-13)
 6. Finalize and publish as an Information Report a bibliography of 1980-85 publications of the Northern Forestry Centre. (J.S., B.B.) (33-23)
 7. Investigate upgrading and replacement of typesetting equipment. (J.S.) (33-24)

8. Serve on in-house, regional, and national working/advisory committees as required. (J.S.) (33-4)

12. Publications 1986-87:

INFORMATION REPORTS

- Addison, P.A.; L'Hirondelle, S.J.; Maynard, D.G.; Malhotra, S.S.; Khan, A.A. 1986. Effects of oil sands processing emissions on the boreal forest. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-284.
- Ball, W.J.; Kolabinski, V.S. 1986. Performance of container and bare-root stock on prescribed burns in Saskatchewan. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-283.
- Bohning, R.A. 1986. The forest industry in the economy of the Northwest Territories, 1980-81. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-277.
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- Harvey, E.M., compiler. 1986. Proceedings of the 1984 Prairie Federal-Provincial Nurserymen's meeting. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-274.
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FORESTRY REPORT AND ITS ARTICLES

- Bernier, P.Y.; Swanson, R.H. 1986. Snow measurements. Pages 3-6 in J.K. Samoil, editor. Hydrology. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 31.
- Samoil, J.K., editor. 1986. Hydrology. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 31.
- Swanson, R.H. 1986. Cabin Creek subbasin of the Marmot Creek basin. Pages 6-8 in J.K. Samoil, editor. Hydrology. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 31.
- Swanson, R.H. 1986. Forests, snow, and water. Pages 1-2 in J.K. Samoil, editor. Hydrology. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 31.
- Swanson, R.H. 1986. The Streeter grassland experiment. Pages 9-12 in J.K. Samoil, editor. Hydrology. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 31.

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- Bella, I.E. 1986. Spacing effects 20 years after planting three conifers in Manitoba. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 39.
- Bernier, P.Y. 1986. A programmed procedure for evaluating the effect of forest management on water yield. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note. 37.
- Chrosiewicz, Z. 1987. Evaluation of postburn seeding of jack pine in central Saskatchewan. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 41.
- Edwards, I.K. 1986. Review of literature on fertilization and conifer seed production. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 40.

- Emond, F.J.; Wong, H.R. 1987. Common insects attacking poplar stooling beds in the prairie provinces. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 42.
- McAlpine, R.S. 1986. Forest fire growth calculator. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 35.
- Moore, W.C. 1986. Procom-2 mapping technique for monitoring forest depletion. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 32.
- Yang, R.C. 1986. Growth of 25-year-old lodgepole pine after juvenile spacing in western Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 38.
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- Zalasky, H. 1986. Effects of conditioning and storage on containerized conifer seedlings. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 34.
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- Bella, I.E. 1986. Logging practices and subsequent development of aspen stands in east-central Saskatchewan. For. Chron. 62:81-83.
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- Bernier, P.Y. 1986. Extrapolating snow measurements on the Marmot Creek experimental basin. Nordic Hydrol. 17:83-92.
- Bernier, P.Y.; Swanson, R.H. 1986. A watershed management pilot project in Alberta. Pages 87-92 in Proc. West. Snow Conf. Annu. Meet., April 15-17, 1986, Phoenix, Arizona. Colorado State University, Fort Collins, Colorado.
- Chrosiewicz, Z. 1986. Foliar heat content variations in four coniferous tree species of central Alberta. Can. J. For. Res. 16:152-157.
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- Golding, D.L.; Swanson, R.H. 1986. Snow distribution patterns in clearings and adjacent forest. *Water Resour. Res.* 22(13):1931-1940.
- 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 Proc. Ninth Can. Symp. Remote Sensing. Can. Cent. Remote Sensing, Ottawa, Ont.
- 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.* 62:507-513.
- Harvey, E.M. 1986. Introduction to session on the prairie nurseries. Pages 24-30 in J.N. Maxwell, editor. Proc. Can. for. tree nursery control workshop. B.C. Minist. For. Lands, Surrey, B.C.
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- Volney, W.J.A. 1985. Temperature effects on development and survival of western spruce budworms. Pages 92-93 in C.J. Sanders, R.W. Stark, E.J. Mullins, and J. Murphy, editors. Recent advances in spruce budworms research. Proc. CANUSA spruce budworms res. symp. *Can. For. Serv.*, Ottawa, Ont.
- Volney, W.J.A. 1985. The historical record and its value in developing chronologies for western spruce budworms. Pages 138-139 in C.J. Sanders, R.W. Stark, E.J. Mullins, and J. Murphy, editors. Recent advances in spruce budworms research. Proc. CANSUA spruce budworms res. symp. *Can. For. Serv.*, Ottawa, Ont.
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- Drouin, J. 1987. Pear slug. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Pest Leaflet. PL 2-75.
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- Kusch, D.S. 1987. Yellow-headed spruce sawfly. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Pest Leaflet. PL 5-75.
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MISCELLANEOUS

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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 1987-88:

PYs: Prof.:	Samoil	1.0	
	Boughton	1.0	
	Tech.:	Adams	1.0
	Total:	3.0	
	Term/Student:	0.25	

O & M: \$80,000

Capital:

15. Signatures:

Sawyer
Investigator

J. Zuchtor
Investigator

J. M. Powell
Program Director, Extension

C. R. Hunt
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1987

1. Project: Information
2. Title: Technology transfer and extension services
3. New: Cont.: X 4. No.: NOR-33-02
5. Study Leader: R.G. Newstead
6. Key Words: Technology transfer, forestry extension, innovations, research application
7. Location of Work: Throughout region
8. Problem:

At NoFC, to date, technology transfer has been conducted largely on an "ad hoc" basis and has generally been effective in encouraging the implementation of research results. Scientific information dissemination has been achieved primarily by traditional publication of research findings, but the more significant achievements have been the result of personal involvement and commitment to implementation on the part of research and technical personnel.

The technology transfer process must encourage the use of planned adoption and innovation procedures. This approach will result in improved estimates of costs involved and benefits accrued and will enable senior management to better estimate time, money, and human resource requirements. This process will also encourage full "user" or "client" participation in any given undertaking. Communication means, methods, and media can be identified and planned and budgeted beforehand. In addition, forthright evaluation can be undertaken in comparison with anticipated goals.

9. Study Objectives:

1. Co-ordinate and promote the planning and delivery of an effective regional technology transfer and extension forestry program.

10. Goals for 1986-87:

1. Provide project leadership and coordination of 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)

Added Goal:

18. Assist in organizing a major technology transfer workshop on Geographic Information Systems (GIS). (R.N.)

11. Accomplishments in 1986-87:

1. Coordinated activities of technology transfer and information project staff written NoFC, including public information, public relations, scientific and technical editing and publishing, extension services, library, and photographic services. (R.N.) (33-2)
2. Served on in-house, regional, and NGO Committees as follows:
 - Canada- Alberta FRDA Public Information Subcommittee (R.N.). (33-4)
 - NoFC library committee (R.N.). (33-4)
 - NoFC employee orientation committee (R.N.). (33-4)
 - EG-ESS conversion committee including one-week classification training course (R.N.). (33-4)
 - AFA School Education Committee and NFW organizing committee (R.N.). (33-4)
 - Canada-Manitoba FRA Public Information Subcommittee (A.A.). (33-4)
3. Continued to participate in implementation of communications plans under the Manitoba, Saskatchewan, and Alberta FRDA including the preparations of brochures, mobile and static displays/exhibits, contracting out services, committee co-chairmanship etc. (see NOR-36). (R.N., A.A., H.S.). (33-1)
4. Maintained photographic information library including acquisition and duplication of historic photos and a photo series on aspen harvesting. (H.S.). (33-5)

5. Developed and implemented an annual public information schedule to organize and conduct public information exhibits at major regional exhibitions including Red River Exhibition, North Battleford Territorial Days, Calgary Stampede, and other invitational events including the Edmonton Sportsmens Show, the Sherwood Park Trade Fair, Alberta Science Teachers Federation exhibition at Red Deer, and National Forest Week, West Edmonton Mall exhibit, Forestry Centre of Alberta mall exhibit at Whitecourt, AFPA annual meeting at Jasper Park Lodge (R.N., H.S., A.A.). (33-7)
6. Prepared, arranged translation of, routed and distributed news releases, briefing notes and speaking materials as required. Acquired promotional materials and information materials in support of NoFC Public Information activities co-ordinated translation requests and established standing offer agreement for 1987-88 translation requirements. Organized media training session for NoFC personnel. (R.N., A.A., H.S.). (33-9)
7. Initiated a retrospective evaluation of NoFC research applications according to procedures established by consultant R.Z. Callahan. Attended semi-annual meeting of Federal Laboratory Consortium for Technology Transfer at Albuquerque, New Mexico. (see also NOR-36-01, 36-03-7, 36-02-9) (R.N.). (33-6)
8. Coordinated or provided responses to public inquiries, requests for lab tours, presentations and the like. Acted as regional distribution centre for AFA "Forever a Tree" tree planting program. Distributed tree seedlings to Boy Scout troops for outplanting. Contracted for the private production of 40,000 Colorado blue spruce for public distribution at fairs and exhibits. (R.N., H.S., A.A.). (33-10)
9. Provided a full range of library services in support of research and regional development programs. Participated in one national meeting of CFS librarians held in Ottawa in April to discuss automation options with a library consultant and also to attend various demonstrations of computerized library systems given by vendors. (D.R.) (33-17)
10. Incomplete goal although the number of vendors of automated library systems has been narrowed down to a short list of systems capable of providing computerized inventory and library functions. Costs of such systems have also been obtained. Demonstrations of on-line literature searching were given by the librarian of the Pacific Forestry Centre. developed a computer based extended loan inventory system and initiated physical inventory checks on extended book loans. (D.R.) (33-18)
11. New shelving has been installed in the additional room allocated to the library back volumes of journals (1960 and earlier) have been re-located there as well as map cabinets and microfilm equipment. (D.R.) (33-19)

12. Provided NoFC research and regional development staff with a full range of photographic services. Modified studio facilities to facilitate expansion and new equipment requirements. Undertook only one field photographic assignment owing to funding and time limitations (P.D.). (33-20)
 13. Ordered and maintained photographic equipment and supplies and participated in a detailed inventory of same. (P.D.) (33-21).
 14. No action was taken in reviewing the need for replacement or upgrading of technologically obsolete capital equipment because of recent equipment upgrading/replacement. (R.N., P.D., D.R., A.A. et. al.) (33-24)
 15. Published an article in the Forestry Chronicle summarizing public perceptions of forestry in the prairie provinces (R.N., A.A.) (33-22)
 16. Produced, published, and distributed inaugural issue of TIMBERLINES a new NoFC newsletter (A.A.). (33-14)
 17. Not published owing to inclusion of relevant material in NoFC newsletter TIMBERLINES (A.A., J.S.) (33-25)
 18. Participated in program proposal and organizing committee directed at conducting a major technology transfer workshop on Geographic Information Systems (GIS) in Winnipeg. (R.N.)
12. Goals for 1987-88:
1. Provide project leadership and coordination of technology transfer and information services and activities within NoFC including public information, public relations, scientific and technical editing and publishing, extension services, library and photographic services. (R.N.) (33-2)
 2. Serve on in-house, regional, national and NGO working/advisory committees as required. (R.N.) (33-4)
 3. Participate in the continued implementation of public information plans under the Manitoba, Saskatchewan, and Alberta FRDAs (see NOR-36). (R.N.) (33-1)
 4. Complete retrospective evaluation of NoFC research accomplishments and report on same (R.N.) (33-6)
 5. Develop NoFC technology transfer planning process and implementation procedures including TT proposals under FRDA's. (see NOR-36) (R.N.) (33-6)
 6. Attend semi-annual meeting of Federal Laboratory Consortium for Technology Transfer. (R.N.) (33-40)

7. Participate in phase II of planning and implementation of C.C.F.M. national forestry awareness campaign (Green Gold/L'or Vert) (R.N.). (33-26)
8. Continue development of a photographic records system and library including acquisition and duplication of general purpose forestry information slides and photos. (H.S.) (33-5)
9. Develop and implement NoFC public exhibition schedule to include major regional exhibitions, National Forest Week events, Federal Information fairs, and other invitational events. (H.S.) (33-7)
10. Co-ordinate and provide tours and other extension services to schools, youth groups and other publics visiting NoFC. (H.S.) (33-8)
11. Maintain inventory control, stock supplies, re-order schedules etc. for all NoFC Public Information materials, exhibition materials and supplies as required to present and distribute same to public audiences. (H.S.) (33-42)
12. Participate in the development of a major technology transfer project proposal and assist in implementation of same. (R.N.) (33-43)

13. Publications 1986-87:

Newstead, R.G. and A. Ascher. 1986. Perceptions of the forestry sector in the prairie provinces. *Forestry Chronicle*. 62:178-179.

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 study activities are not potentially detrimental to the environment.

15. Resources 1987-88:

PYs: Prof.:	Newstead	1.0
	Tech.:Stewart, H.	1.0
	Total:	2.0

O & M: \$20,000

Capital:

16. Signatures:



 Investigator



 Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1987

1. Project: Information
2. Title: Library Services
3. New: X Cont.:
4. No.: NOR-33-03
5. Study Leader: D.J. Robinson
6. Key Words: Library, acquisitions, cataloguing, interlibrary loans, circulation, reference, SDI profiles, on-line literature searching, automated library systems, information science, data bases.

7. Location of Work: NoFC

8. Problem:

The Library is responsible for providing the staff at the centre and the District Offices with access to publications and the printed materials to meet the needs of NoFC's mandate within the CFS. The library also serves university and college personnel, staff from other federal, provincial and municipal government departments and members of the public.

The problem of access to research information is affected by the rapid growth in the volume of scientific and technical literature, increasing costs of publications and demands for service as well as resource constraints.

9. Study Objectives:

1. To budget, plan and develop library services to support existing research projects.
2. To develop and maintain a collection which contains copies of all CFS publications and significant internal reports and other publications required to meet the ongoing and planned research needs of NoFC's and district offices.
3. To provide reference and current awareness services.
4. To coordinate requests for translation of relevant scientific and technical literature.

5. To select and obtain library materials by means of purchase, gift or exchange.
 6. To provide a means of access to the collection by cataloguing and classifying library materials according to a recognized standard or system.
 7. To provide information or publications through interlibrary loan services where items are not available in the local collection and cooperate with other libraries by supplying reciprocal interlibrary loan services.
10. Goals for 1986-87:
- See NOR-33-02
11. Accomplishments in 1986-87:
- See NOR-33-02
12. Goals for 1987-88:
1. To continue to provide library services as required to support the research conducted at NoFC and its district offices. (D.R.) (33-17)
 2. To offer additional levels of library services and streamline operations to attain standards compatible with other CFS libraries by:
 - a) providing on-line data base literature searches on site;
 - b) acquiring an ENVOY 100 mail box for electronic mail to contact associated libraries not linked by AGRINET for interlibrary loans. (D.R.) (33-33)
 3. To select, recommend and implement an automated library system compatible with CFS needs both at the local and national levels. (D.R.) (33-18)
 4. To cooperate with CFS and other associated libraries with regard to the sharing of resources, selection/cancellation of journal titles and other publications in order to maximize the use of the collection in the light of budgetary restrictions and space limitations. (D.R.) (33-34)
 5. To shift the collection of USDA Forest Service publications from the storage area to the main library. (D.R.) (33-35)
 6. To formulate a collection development and weeding policy. (D.R.) (33-36)
 7. To write the terms of reference and mandate of the Library Committee. (D.R.) (33-37)

8. Work towards updating the Periodicals Holdings list. (D.R.) (33-38)
9. Work towards disposal of duplicate and gift materials. (D.R.)
(33-39)
13. Publications 1986-87:
Nil
14. Environmental Implications:
N/A
15. Resources 1987-88:
- | | | |
|-------------|----------|-----|
| PYs: Prof.: | Robinson | 1.0 |
| Tech.: | Hopp | 1.0 |
| Total: | | 2.0 |
- O & M: \$25,000
- Capital:
16. Signatures:

David P. Robinson

Investigator

A.D. Hunt

Regional Director General

11. Accomplishments in 1986-87:

See NOR-33-02

12. Goals for 1987-88:

1. Coordinate information services and activities within NoFC including public information, public relations, media relations, photographic services. (A.A.) (33-2)
2. Serve on in-house, regional, national and NGO working/advisory committees as required (A.A.). (33-4)
3. Participate in the continued implementation of public information plans under the Manitoba, Saskatchewan, and Alberta FRDAs (see NOR-36) (A.A.). (33-1)
4. Develop public information and media materials and presentations including media releases, feature articles, backgrounders, exhibits, brochures, pamphlets, and other promotional materials. (A.A.) (33-9)
5. Act as NoFC focal point for communication with the public by responding to inquiries for information, tours, presentations and the like. (A.A.) (33-8)
6. 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)
7. Continue to work with stores on transfer of photography inventory, developing a system workable for both photo section and stores. (P.D.) (33-21)
8. To cultivate and maintain active working relationships with the print, radio, television and business media throughout the region by supplying media with information, booking interviews with staff members, organizing tours, etc. (A.A.) (33-27)
9. To assist NoFC staff members in working with the media when contacted for an interview; to streamline and ensure NoFC staff follow a system reporting their contact with media; to assist staff members in identifying and promoting newsworthy activities, workshops, symposiums etc. (A.A.) (33-28)
10. To maintain an ongoing dialogue with regional director general, program directors and project leaders to assist in identifying events or programs suitable for promotion to one or more of our target audiences. (A.A.) (33-29)
11. To complete script and production of updated NoFC slide-tape presentation. (A.A.) (33-30)

12. To complete script and production of audio tape for Connie Fir mascot. (A.A., H.S.) (33-31)
13. To work with NoFC clients (e.g. affiliated NGO's, forest industry, universities) when and where possible for joint promotional endeavors. (A.A., (R.N.) (33-32)
14. To continue to publish TimberLines four times a year, taking into account both management objectives and public interest. (A.A.) (33-14)
15. To inventory the various in-house video, photographic, and computer generated graphics systems, and compile a list for staff detailing where each can be found and range of uses for each item or system. (A.A., P.D.) (33-21)
16. To assist CFS headquarters and the Canadian Council of Forestry Communicators when required in the planning and execution of the Green Gold national forestry awareness campaign. (A.A.) (33-26)
17. To publish the annual Program Review in cooperation with the Scientific and Technical Publishing Unit. (A.A., B.B.) (33-12)
18. To contribute towards the development of an annual Information Project Workplan. (A.A., R.N., H.S., D.S., D.R.) (33-7)

13. Publications 1985-86:

Newstead, R.G. and A. Ascher. 1986. Perceptions of the forestry sector in the prairie provinces. *Forestry Chronicle*. 62:178-179.

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 study activities are not potentially detrimental to the environment.

15. Resources 1987-88:

PYs:	Prof.:	Ascher	1.0
	Tech.:	Debnam	1.0
	Total:		2.0

O & M: \$17,000

Capital:

16. Signatures:

W. Scher

Investigator

R.D. Hunt

Regional Director General

NOR-36

DEVELOPMENT AGREEMENTS

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

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 details in separate study statements for:

Name

i) Insect and disease management	36-01-01	
ii) Stand-tending/regeneration demonstrations	36-01-02	(see 36-01-12)
iii) Fire management	36-01-03	
iv) Silvicultural guidelines for spruce	36-01-04	(see 36-01-12)
v) Jack pine seed orchards	36-01-05	
vi) Site classification	36-01-06	
vii) Nursery development	36-01-07	
viii) Forest economics	36-01-08	
ix) Forest inventory	36-01-09	
x) Tree improvement	36-01-10	
xi) Silviculture research & technology transfer	36-01-11	
xii) Forest renewal & intensive forest management	36-01-12	

6. Key Words: Forest renewal, intensive management, resource data base, fire management, fire protection, nursery management, public information, agreement, administration, evaluation, job creation, economic development

7. Location of work: Winnipeg District Office 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 CFS in matters related to federal and provincial governments, industry and the general public.
9. Goals for 1986-87:
1. Forest Renewal and Intensive Management- Review, approve and monitor reforestation and stand tending projects developed by industry, 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 as hoc committees of federal, provincial, industry and/or NGO representatives as are required to facilitate the implementation of the Agreement subprograms.
 3. Monitor development and implementation of Province's short and medium-term action plans for recording provincial forest inventory data.
 4. Public Information- Ensure continued implementation and revision, as required, of the Public Information strategy approved in 1965/86 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 the evaluation framework. Also, to 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 usable in the various CFS fire management programs.
 8. Economics- To continue work defining the size, scale and scope of the Northern Manitoba forestry work opportunities.
 9. Forest Mensuration- To collect insect and disease information with the end goal of being able to predict areas where an outbreak is likely to occur.
 10. Administration- Direct district staff and coordinate functional direction from NoFC (as outlined in other Winnipeg 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 and other District and NoFC needs.
10. Accomplishments in 1986-87:
1. The two major forest industry companies in the Province 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 Teepee greenhouses was done with Abitibi being funded to purchase seedlings from Dakota Plains.
 2. Quarterly Directorate meetings were held with provincial staff and meetings were held with industry representatives to ensure an orderly implementation of the forest renewal sections of the agreement.
 3. Cost-shared funding was provided to the Manitoba Forest Inventory group for the purpose of loading the G.I.S. Approximately 80 townships in the South-eastern corner of the Province have been completed.
 4. The CFS cooperated with the Manitoba Forestry Association to produce a series of poster and pamphlets which are complimentary to the slide film prepared during the year 1985/86. The CFS was involved in the ten community fairs during the year and made an estimated 38,000 visitor contacts.
 5. A committee of four independent forestry specialists from university, industry, federal and provincial governments were selected to review the work being done under the Canada-Manitoba Forest Renewal Agreement. The report, being produced in late 1986/87 will cover the work done to date and make recommendations for the remaining two years as well as provide recommendations for any future agreements.

6. Approximately \$650,000 worth of CEIC job development programs were approved during the year. Most of the work was in the area of Dutch Elm disease control.
 7. Initial work on the conversions of fire weather information to meet provincial needs was completed. A review of all fire weather stations within the province was done and a report on the findings was prepared and given to the province.
 8. Economics - Several reports were completed including "A Directory of Wood Using Industries in Manitoba". A series of time and motion studies were also done with more planned for 1987-88.
 9. Forest Mensuration: 210 damage plots were remeasured and 135 new plots were established. A series of population study plots were also established each was remeasured four times during the summer season.
 10. Administration Projects were implemented upon directorate approval with funding obtained from the appropriate allocation. Agreement activities involved expenditures of \$2,600,000.
 11. A second jack pine cone collection occurred during the fall of 1986. Cones were obtained from 320 superior jack pine trees in central Manitoba. The best seeds were sown in the Hadashville greenhouse. The best seedlings (15000) will be planted during June 1987 at two separate orchard locations. The end objective is to have access to genetically superior jack pine seed.
11. Goals for 1987-88:
1. Forest Renewal and Intensive Management - Review, approve and monitor reforestation and stand tending projects developed by industry (Manfor and Abitibi); fund and monitor seeding growing contracts to meet industry and, where applicable and 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.
8. Economics - to continue work defining the size scale and scope of Northern Manitoba forestry work opportunities.
9. 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.
10. 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 1986-87:

Canada-Manitoba Green Ribbon Committee Evaluation

Quarterly and Annual Reports.

13. Environmental Implications:

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

14. Resources 1987-88:

(see breakdown of all Agreement resources attached)

PYs: Agreement:	3.0
A-base:	1.0

Total:	4.0
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O & M: \$98,000 + \$11,000 A-base

Capital: \$225,000

Contracts:

Grants & Contributions:

15. Signatures:



Manitoba District Manager



Program Director, Development



Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987.

1. Project: Development Agreements
2. Title: Forest pest management, surveys, and damage appraisal(Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-1
5. Study Leader: M. Daoust-Savoie
6. Key Words: Damage appraisal, impact, hosts, forest pests, sampling methods, management, mortality, growth loss, forest renewal, jack pine budworm, detection, distribution, parks, recreation, easement atmosphere, effluents.
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 resources, 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 management agencies, and the public with diagnostic impact and appraisal services relating to insects, diseases, climatic influences, and pollutants on trees, shrubs and other types of vegetation.
 6. To contribute to FIDS national overview of important pest conditions.

9. Goals for 1986-87:

1. Remeasure spruce budworm mortality plots and evaluate losses in stands. 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 centres.

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. Survey, map and report on major forest pests of Manitoba ie. jack pine budworm, spruce budworm, forest tent caterpillar, larch sawfly, Armillaria root rot, dwarf mistletoe.
8. Conduct special surveys for particular pests or of designated areas.
9. Compile and report on the forest pest situation in Manitoba for 1986 and make predictions for 1987.
10. Collaborate with W. Ives and H.R. Wong and provide assistance with photography and insect collection for the pictorial guide to forest and shade tree insects of the prairie provinces.
11. Survey plots established under the national program to detect early signs of acid rain (ARNEWS) (pollutants) damage to the forests with NOR-7.
12. Participate in the annual Interagency FIDS Review and Planning meeting and various other meeting with Forest Protection personnel.
13. Provide pest extension services and technology transfer to various client agencies and the general public.

14. Represent NoFC and CFS on various provincial forest insect and disease committees and advisory groups.

10. Accomplishments in 1986-87:

1. The spruce budworm mortality plots were remeasured and losses evaluated. The stem analysis of the trees dissected has been completed. (Moody, Volney)
2. The mapping of stems in 8 plots and the production of maps indicating possible additional Armillaria root rot infectious centers will be accomplished in 1987. (Daoust-Savoie)

Twenty jack pine trees were injected by Acecap (orthane) before bud-break. The rate of defoliation of the control trees and the injected trees were assessed in October 1986. (Volney, Daoust-Savoie)

Disks from sixteen jack pine trees affected by low defoliation have been measured and the data has been made machine readable. Data analysis will be made in 1987. (Daoust-Savoie)

The microsporangiate bud counts and defoliation intensity were calculated from the 1985 foliage samples taken from the Population Study plots (Sandilands, Manigotogan and Kettle Hills). The results from the above were compared to the number of budworms found on the samples taken from the same Population Study plots, at the peak of the 4th instar, 6th instar, pupae, and egg mass stage in the life cycle of the jack pine budworm. This year's 86-87 microsporangiate bud counts and defoliation intensities have also been calculated. (Daoust-Savoie)

3. The stand information on the 210 plots damage appraisal plots have been summarized and recorded. An additional 105 permanent sample plots have been established in the Sandilands Provincial Forest. These plots supplement those previously established for the Damage Appraisal Survey that was designed to study the effects of defoliation by the jack pine budworm on the jack pine tree. (Daoust-Savoie)
4. The preliminary calculations for the jack pine budworm egg mass sequential sampling system has been accomplished. (Volney)
5. The jack pine budworm phenology study was initiated this year. Two plots (Sandilands and Belair) were established with eight trees in each. A total of 576 samples were taken from bud break to the laying of eggs by the jack pine budworm. The results have been tabulated. (Daoust-Savoie)
6. A Population Study of the jack pine budworm continued this year in the three plots established in 1985, Sandilands, Manigotogan and Kettle Hills. Two hundred and twenty-four branch samples were examined at each of the three plots and at each of the following jack pine budworm stages, the peak of the following jack pine budworm stages, the peak of the 4th instar, 6th instar, pupae and egg mass, totalling 2688 samples. The results have been tabulated. (Daoust-Savoie)

7. Aerial and ground surveys were conducted. The areas of tree mortality and moderate to severe infestations were mapped from major forest pests (jack pine budworm, spruce budworm, aspen defoliators) of Manitoba. (Grandmaison)

8. The special surveys conducted for particular pests or of designated areas, were as follows:

An extensive survey was undertaken in 20 localities in Manitoba. to sample for the pinewood nematode. Disks and logs were collected from seven hosts (white and black spruce, jack, red and scots pine, eastern white cedar and balsam fir) .

Conducted a survey for Jack pine resin midge at the federal-provincial plots in Grand Rapids. (Grandmaison)

9. Compiled and reported on the forest pest situation in Manitoba (Manitoba Forest Insect and Disease Conditions 1986, File Report). Jack pine and spruce budworm egg mass samples and spruce budworm pheromone traps were used to help predict next years budworm population. (Grandmaison)
10. Provided assistance in collecting samples for Ives' and Wong's "Pictorial Guide to Forest and Shade Tree Insects of the Prairie Provinces". (Grandmaison)
11. Four survey plots (Jenpeg, Swanee River, Whiteshell, Duck Mountain) were monitored to detect early signs of acid rain (ARNEWS) pollutants. (Grandmaison, Daoust-Savoie)
12. Presented an overview on the forest pest situation in Manitoba at the Interagency FIDS Review and Planning meeting. Participated in several meetings with Forest Protection, Province of Manitoba. (Grandmaison)
13. Provided photography expertise for the upcoming publication of "The Heritage Trees of Manitoba" (for the Manitoba Forestry Association). (Grandmaison)
14. NoFC and CFS were represented at the following workshops, committees, and advisory groups:
 - Pesticide Applicators Course (Feb. 1986) (Grandmaison)
 - Federal-Provincial Forest Insect and Disease Survey Review and Planning Meeting (Apr. 1986) (Grandmaison)
 - Prairie Federal-Provincial Nurserymen's Annual Meeting (Sept. 1986) (Daoust-Savoie, Grandmaison)
 - North Central Pest Workshop (Oct. 1986). (Daoust-Savoie, Grandmaison)
 - Annual Forest Pest Review - Northern Ontario (Nov. 1986). (Daoust-Savoie, Grandmaison)
 - Dutch Elm Disease Research Committee. (Daoust-Savoie, Grandmaison)
 - Dutch Elm Disease Advisory Committee. (Daoust-Savoie)

11. Goals for 1987-88:

1. Continue assessment of possible relationship between microsporangiate bud counts and defoliation intensity in the prediction of future defoliation by the jack pine budworm. (Daoust-Savoie)
2. Assess cumulative and current defoliation from the jack pine budworm in the 315 "Damage Appraisal Permanent Plots". (Daoust-Savoie)
3. Continue jack pine phenology study in Belair and Sandilands. (Daoust-Savoie)
4. Continue the Jack Pine Population Study, in the Sandilands, Kettle Hills, and Manigotogan plots. (Daoust-Savoie)
5. Place jack pine pheromone traps at the Belair, Sandilands, Kettle Hills, Sandilands (Haddashville) and Manigotogan plots. (Daoust-Savoie)
6. Complete mapping of stems in 8 jack pine population plots and produce maps indicating possible additional Armillaria root rot infection centres. (Daoust-Savoie)
7. Survey, map and report on major forest pests of Manitoba (jack pine budworm, spruce budworm, forest tent caterpillar, and larch sawfly). (Grandmaison)
8. Conduct special surveys for particular pests or of designated areas. (Grandmaison)
9. Compile and report on the forest pest situation in Manitoba for 1987 and make predictions for 1988. (Grandmaison)
10. Perform annual assessments on the four ARNEWS plots. (Grandmaison)
11. Participate in the annual Interagency FIDS Review and Planning meeting. (Daoust-Savoie, Grandmaison)
12. Provide pest extension service and technology transfer to various client agencies and the general public. (Daoust-Savoie, Grandmaison)
13. Represent NoFC and CFS on various provincial forest insect and disease committees and advisory groups. (Daoust-Savoie, Grandmaison)

12. Publications 1986-87:

Grandmaison, M. 1987. Manitoba forest insect and disease conditions, 1986. Can. For. Serv., Man. Dist. Off., Winnipeg, Man. File Rep

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 1987-88:

PYs: Prof.: Daoust-Savoie 1.0 (Agreement)

Tech.: Grandmaison 1.0 (A-base)

Total: 2.0

Term/Student: 0.0

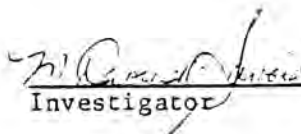
O & M : \$11,080 (Daoust-Savoie)

O & M : \$ 9,000 (Grandmaison) (\$3,000.00 supplied by district,
\$6,000.00 supplied by Edmonton, NOR-11-01)


Capital:

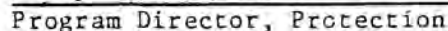
Grants & Contributions: CFS \$33,000/\$33,000 MFB
CFS \$39,000/\$39,000 MFB (Environment
Project)


15. Signatures:



Investigator


Technical Advisor


Supervisor


Program Director, Protection


District Manager


Regional Director General


Program Director, Development

10. Accomplishment in 1986-87:

1. Completed review (Waldron, Yang) and published the final contract report on "The release of white spruce from trembling aspen overstoreys - A review of available information and silvicultural guidelines". Contractor: Johnson Forestry Services.
2. Cooperated in organizing and acted as resource person and tour guide (Bella) for workshop on stand tending techniques for jP under Canada-Manitoba agreement; Winnipeg, Oct. 1986.

11. Goals for 1987-88:

1. Act as scientific authority for a R&D contract to assess the costs of various release treatments for white spruce from aspen (4-3MA Ondro, Waldron)
2. Prepare a remeasurement plan to assess fertilization studies in bS and jp in Manitoba and Saskatchewan (4-40, Yang).

12. Publications 1986-87:

Johnson, H.J. 1987. The release of white spruce from trembling aspen overstoreys - A review of available information and silvicultural guidelines. Mimeo. 109 pp. Johnson Forestry Services, Calgary.

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 1987-88:

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

O & M:

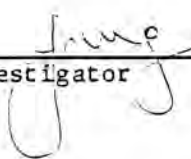
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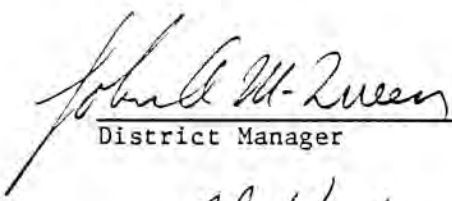
Grants & Contributions:

16. Signatures:


Investigator


Supervisor


Investigator


District Manager

Technical Advisor


Program Director Development


Program Director, Resources


Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	Total \$
1.	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.				\$50 K CS
2.		Hold a workshop on stand tending techniques for jack pine and releasing white spruce from aspen. \$8 K CS (see 4-2MA). Terminate.			\$8 K CS
3.			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.		\$90 K CS

OPERATIONAL PLAN
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	Total \$
4.				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 CS
Total:	\$50 K CS	\$8 K CS	\$90 K CS	\$70 K CS	\$218 K CS

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Fire Management (Manitoba)
3. New: Cont.: X
4. No.: NOR-36-01-3
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.
 3. To collect pertinent information on a variety of fire management subject areas, permitting the development and application of models to assist fire managers in their decision-making process.
9. 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 organization.
 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 and 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.
 10. Continue to provide advice and services on various fire management topics, especially to the provincial fire management organization.
10. Accomplishments in 1986-87:
1. a) Participated in:
 - regional Fire Control Officers meetings (3)
 - provincial fire weather committee meetings (4)
 - fire alert review committee meeting.
 - b) Made personal contact with individuals at all levels of the fire management organization in 7 of the 8 regions.
 - c) Provided instruction at:
 - a regional fire weather training course
 - a fire behavior prediction course for regional duty officers
 - conducted 7 training session on how to use the FWI/PC program (developed by B. Lee)
 2. With the assistance of a part-time person (D. Witt) the database for the detection study was constructed. C. Ogilvie produced seen area maps for all the manned lookout towers in the province. This information has been turned over to a consultant for analysis of the present detection system.

3. - The first edition of a fire management newsletter was written and distributed to approximately 150 people in Manitoba Natural Resources who have a connection with fire management.
 - Publications on a variety of fire related topics were distributed to fire management personnel as requested.
 - The Central Region Fire Weather Committee Scientific and Technical Seminar was held in Winnipeg (M.E. Alexander was the coordinator). Funding for the speakers and other seminar expenses were covered by the agreements.
4. Dick Barney began the process by conducting meetings at two locations in the province. The process for creating a formal fire research working group in the province has begun.
5. - A report on the use of bird-dog aircraft was completed by PNFI staff (E. Stechishen and W. Murray) and presented to the province.
 - Fuel-type maps for the highest priority areas have been completed by R. Dixon (Manitoba Centre for Remote Sensing) and a pilot study linking LANDSAT and forest inventory data is in progress.
6. - An interim report on the relationship of fire weather and fire danger to fire activity was completed for the northwest section of Manitoba. A presentation of the results was made at the 1986 CRFWC Scientific and Technical Seminar.
 - Fire weather data was compiled for the provincial fire weather stations for 1980-86 and for AES stations for 1976-84.
7. Initial plans for a 3 day workshop on fire planning were made however it was decided not to conduct it at this time.
8. - Photographs for all but two fuel types (grass and spruce slash) have been taken.
 - Available information on a large wildfire has been compiled and with provincial assistance is being analyzed for use in training courses on the FBP System.
9. Assisted the province in establishing the use of the 500 mb system at regional offices and headquarters.
10. - Conducted a survey and evaluation of the provincial fire weather stations. A file report was completed and the results were presented to representatives from the province.
 - In cooperation with AES a test was conducted on the accuracy of the thermohygrometer. This instrument is being used in the province to measure temperature and humidity. As a member of the CRFWC.

- Instructed at two fire behavior workshops in Prince Albert, Saskatchewan.
- Acted as a reviewer on three unsolicited manuscripts.

11. Goals for 1987-88:

1. Continue to enhance the relationship between fire research and operations in Manitoba by: (5-1MA)
 - 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.
2. In cooperation with the Province, develop and conduct training courses on fire behavior. (5-3MA)
3. Establish a formal research working group within the province which could provide input to the regional technical subcommittee. (5-4MA)
4. Continue to monitor and provide input and direction to research projects being conducted under the agreement. This includes: fuel-type mapping, detection study, damage appraisal, and expert systems. (5-5MA)
5. Continue the analysis of the relationship of fire weather and fire danger to fire activity in Manitoba. (5-6MA)
6. Transfer the latest technology on the FBP System by:
 - a) finishing the fuel-type photo series and producing a poster for use in Manitoba, (5-8MA)
 - b) completing a case study on extreme fire behavior in Manitoba, (5-12MA)
 - c) if possible, obtain field observations of extreme wildfire behavior. (5-13MA)
7. Produce and distribute (within Manitoba) three bulletins on various fire management topics. (5-3MA)
8. Continue to provide advice and services on various fire management topics, especially to the provincial fire management organization. (5-2MA)

12. Publications 1986-87:

- Hirsch, K.G. 1986a. An evaluation of the fire weather station in Manitoba. Govt. Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man., Study NOR-36-01-3 File Rep. No. 1. 24 p. + appendix.

Hirsch, K.G. 1986b. Wildfire activity in relation to fire weather and fire danger in northwestern Manitoba - an interim report. In, Proc. Third Central Region Fire Weather Committee Technical and Scientific Seminar (April 3, 1986, Winnipeg, Man.). Govt. Can., For. Serv., North. For. Cent., Edmonton, Alta. Study NOR-5-05 File Rep. No. 1 .

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.

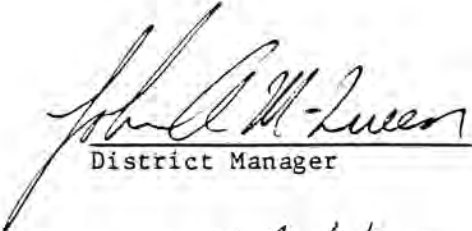
14. Resources 1987-88:

PY's: Prof:	Hirsch	1.0
	Tech:	0.0
	Total:	1.0

O & M: \$11,080

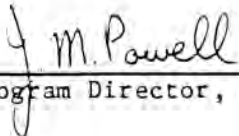
15. Signatures:


Investigator


District Manager


Technical Advisor


Program Director, Development


Program Director, Extension


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

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
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. Problem:

There is considerable evidence from general observations and plot assessments that hares can pose a serious risk to new forests in Manitoba, especially at peak populations, which occur at approximately 10 year intervals. Degree of hare damage varies from one location to another and R&D is required to determine if there are measurable factors which can be used to assign risk to specific areas, thus enabling managers to reduce hare damage, either through control measures in high risk areas or by avoidance of such areas in planting programs if control measures are not available.

9. 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.

10. 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.

11. Accomplishments in 1986-87:

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.

12. Goals for 1987-88:

1. Hold RRTC meeting in Alberta focussing on "Tree-to-grow".
2. Prepare and act as scientific authority for an R&D contract to assess stand susceptibility to hare damage of artificial and natural seedlings.

13. Publications 1986-87:

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 1987-88:

PYs:	Prof.:	0.0	(Brace - A-base 0.1)
	Tech.:	0.0	
	Total:	0.0	
	Term/Student:	0.0	

O & M:

Capital:

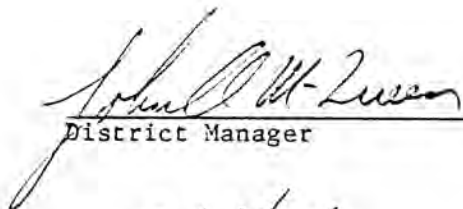
Grants & Contributions: CFS 30 K/30 K Manitoba - hare contract
CFS 1.25/1.25 K Manitoba - RRTC

16. Signatures:


Investigator

Technical Advisor


Program Director, Resources


District Manager


Program Director, Development


Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1986-87	1987-88	1988-89	Total
1.	Hold RRTC workshop in P.A. Saskatchewan, focussing on testing highly productive mixedwood NSR backlog.	Continue.	Continue and <u>Terminate.</u>	
	2.5 K CS	\$2.5 K CS	\$2.5 K CS	\$ 5 K CS
2.		Act as a Scientific authority for a R&D contract to assess stand susceptibility to hare damage of natural and artificial seedlings (see 10-1MA). \$60 K CS	Continue and Terminate \$60 K CS	\$120 K CS
Total:	2.5 K CS	\$62.5 K CS	\$62.5 K CS	\$125 K CS

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Establishment of jack pine seed orchards in Manitoba
3. New: Cont.: X 4. No.: NOR-36-01-5
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 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.

Added Goal

9. Prepare for the Interlake mass selection seed orchard (IMSSO) locations of jack pine stands from Forest Inventory Data, collect seed from 32 stands (320 trees) extract/process seed and commence rearing. Select locations for 2 orchard sites.
10. Accomplishments in 1986-87:
1. In cooperation with Manitoba Forestry Branch (MFB) operated jointly the Tree Improvement Facility (TIF), consisting of a common headerhouse and separate greenhouses (one CFS and one MFB) at Pineland Forest Nursery (PFN). CFS greenhouse has been operating since May 15 using timed control system. On Nov. 1st the climatic control system was fully automated.
 2. Worked towards the establishment of the eastern breeding district (ebd) (based on 10 year selection) pedigreed seed orchard by harvesting approx. 1500 cones from 1985 control breeding. Pedigreed

seed extraction, processing and seedling rearing has been rescheduled to goals for 1987-88 as shown on Greenhouse Calendar presented to monitoring committee Oct. 86. The selected seed orchard site at Oakbank Tree Improvement Site (OTIS) has been scrubbed clean of stumps and elevation profile maps prepared. Irrigation was not initiated because MFB expressed interest in locating orchard at Birds Hill Provincial Nursery (BPN). The proposed site was evaluated as unsuitable (soil profile examination revealed highly calcareous material within 25-35 cm of surface), Oakbank site development will continue as planned into 1987-88.

3. There was no requirement to do site selection work on the central breeding district. Inventory of grafts has been completed but not compiled. Grafts were pruned, restaked were necessary and rootstocks cutback with NOR-36-01-5 resources.
4. Established Northern Region mass selection seed orchards by rearing 32 source collections, intensively preparing two 2-ha sites, planting 20 000 trees on the two sites, fencing the sites. Documentation remains to be done (writing a comprehensive establishment report).
5. MFB has been informed that the 1972 mass selection orchard at Oakbank has a cone crop which could yield approximately 2 million seed. Based on Forest Management Note 24 (10 year family-test results), seven seed production stands were located and posted with MFB-Southeast Regional staff.
6. Assisted NOR-12-02 and NOR-12-03 by measuring the jack pine provenance plantation and ebd family-test plantations at 15 years. Resources were not available to undertake thinning operations.
7. Special report of maps and source lists for the jack pine breeding program will be completed by January 30/87.
8. No requirements for stated goal.
9. Prepared for the Interlake mass selection seed orchard (IMSSO) locations of jack pine stands collected seed from 320 trees/32 stands, extracted/processed seed and commenced rearing 40,000 seedlings on January 15/87 selected two - 2 ha orchard sites.

11. Goals for 1987-88:

1. In cooperation with Manitoba Forestry Branch (MFB) operate and share the use of Tree Improvement Facility (TIP) consisting a common headerhouse and separate greenhouse for CFS and MFB at Pineland Forest Nursery (PFN).
2. Prepare a comprehensive establishment report for the Northern mass selection seed orchard (NMSSO) monitor growth and maintain orchards NMSSO with MFB Regional staff.

3. Continue working toward the establishment of the eastern breeding district (ebd) pedigreed seed orchard by extracting/processing seed and commence rearing pedigreed stock. Complete orchard site development (levelling and installing irrigation) at Oakbank.
4. Provide update (based on 15 year assessment) to South-east Regional staff on seed production areas and seed yield on mass selection orchard (1972) at Oakbank.
5. Establish the Interlake mass selection seed orchards by rearing 40 000 seedling, initiate and complete site development, plant two orchards and establish fences and fireguards.
6. Select potential seed orchard sites for the central breeding district with MFB-Western Regional staff. Procure orchard stock based on 10 year family assessment data if resources are available.

12. Publications 1986-87:

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 1987-88:

P/Ys: Prof:		0.0
Tech:	Nanka	1.0
Total:		1.0
Term/Student:		0.0

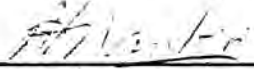
O & M: \$35,000 (+ 15,000 contracts)

Capital:

Grants & Contributions:


O & M for (TIF/PFN) - CFS \$55,000/55,000 MFB


15. Signatures:

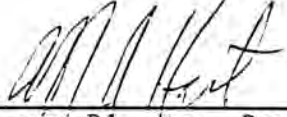

Investigator


Supervisor


Technical Advisor


District Manager


Program Director, Resources


Program Director, Development


Regional Director General

OPERATIONAL PLANS
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	
Northern Breeding District					
1.	Select jack pine stands, collect cones and begin rearing	Complete rearing of seedlings and plant	Tend seed orchards	Tend seed orchards	Approach based on "mass selection" from 20 source stand. Grow 40,000 seedlings 30-cm tall. Plant 10,000 seedlings/ha in 2 seed orchards. Thin in 1989-90 (?) removing 1/2 of the trees. Genetic gain 15%
2.	Select and develop seed orchard sites	Contract fencing			
Central Breeding District					
2.	Tend existing grafts at Pineland Tree Nursery	Tend existing grafts	Tend existing grafts. Graft additional stock based on selected families	Plant and tend seed orchard	See Eastern Breeding District notes
3.	Remeasure family test plantations	Compile inventory of grafts	Implement site selection for orchard	Select and develop seed orchard sites including fencing	

OPERATIONAL PLANS*
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	
Eastern Breeding District					
1.	Mate selected trees (i.e. cross pollination)	Collect cones and process seed	Begin rearing	Complete rearing, plant seedlings and tend seed orchard	Selection based on 40 best families at 10 years. Grow 10,000 seedlings 1-m tall. Plant 400 seedlings/ha at 5-m spacing. 2000 trees in final orchard to produce approximately 2 million seeds annually in 1995. Genetic gain 30%
2.	Purchase vehicle. Erect greenhouse	Purchase seed orchard maintenance vehicle			
3	Initiate irrigation system - Birds Hill	Clear, level and fence Birds Hill planting site	Complete irrigation system		
4.		Remeasure family test plantations			
5.	Tend jP mass selection seed orchard at Birds Hill	Continue	Continue	Continue	
6.	Prepare special reports, maps, and source list of jP breeding plantations				

OPERATIONAL PLANS
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89
Interlake Breeding District				
1.		Select orchard sites	Initiate development of seed orchard sites Complete site development including fencing	
2.		Select jack pine stands, collect cones process seed, and begin rearing seedlings		
All Breeding District				Prepa re a complete and c omprehensive estab lishment report for e ach of the jack pine seed orchards for M FB

OPERATIONAL PLANS
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	
\$ BUDGET					
\$ FEDERAL					
Capital	\$522 K	\$52 K	---	---	\$546 K
O&M-Travel	\$35 K	\$20.7 K	\$35 K	\$30 K	\$130 K
-Contracts & -Supplies	\$66 K	\$62 K	\$15 K	\$43 K	\$186 K
COST SHARED					
Capital	\$159 K	---	---	---	\$159 K
O&M	\$70 K	\$113 K	\$110 K	\$22 K	\$295 K
TOTAL:	\$852 K	\$247.7 K	\$160 K	\$95 K	\$1316 K

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Forest site classification (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-6
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, Northern Forestry Centre, Edmonton, forests of Manitoba.
8. Problem:

Over the past 40 years a variety of studies have been conducted in Manitoba, with the objective of relating some aspect of forest productivity to site. The applicability of these studies to present forest inventory and silviculture concerns and their compatibility with the new ARC-INFO geo-information system (GIS) is unknown.
9. 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.
10. 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.

11. Accomplishments in 1986-87:

1. Acted as scientific authority for site classification project, travelled with contractor and Manitoba Forestry Branch staff across Manitoba and have been developing an appropriate methodology with contractor.

12. Goals for 1987-88:

1. Obtain formal approval for the proposed site classification system.
2. Act as Scientific Authority for a R&D contract designed to collect field data for the development of the approved Manitoba site classification system.

13. Publications 1986-87:

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 1987-88:

PYs: Prof.:	0.0	(A-base - Corns 0.1)
Tech.:	0.0	
Total:	0.0	
Term/Student:	0.0	

O & M (Contract):

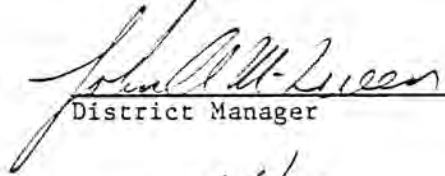
Capital:

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

16. Signatures:




Investigator



District Manager



Technical Advisor



Program Director, Development



Program Director, Resources



Regional Director General

OPERATIONAL PLAN
1987-1989

Goals	1986-87	1987-88	1988-89	Total \$
1.	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.	
2.	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:	\$105 K CS	\$105 K CS	\$130 K CS	\$415 K CS
PY				
O & M	\$7 K	\$7 K	\$7 K	\$28 K
Salary	\$36 K	\$36 K	\$36 K	\$144 K

Note: It is proposed to issue a personal services contract as follows:

\$148 K	\$148 K	\$173 K	\$469 K
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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Forest Nurseries (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-7
5. Study Leader: I. Dymock (see NOR-12-01)
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 1986-87:
 1. Organize and contribute to a nursery management workshop which specifically focuses on current Manitoba forest nursery problems. Edwards, Cameron, and Tornblom 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.
10. Accomplishments in 1986-87:
 1. Organized and contributed to a nursery management workshop to be held in Winnipeg, Man. February 25-26, 1987. Suggestions for topics were

solicited from Cameron and Tornblom and speakers were contacted accordingly. An agenda has been prepared (Edwards). Manitoba Forestry Branch have designated F. McKinney to be in charge of local (Winnipeg) arrangements.

2. Reviewed study plan prepared by Segaran and provided technical advice through discussion (Dymock). On recommendation of the Monitoring Committee (Waldron, Yarn, Cameron, and Dymock), the study was scaled down, initially, to 40,000 seedlings, to be comprised of bS, wS, and jP. An evaluation of the study is scheduled for February 1987 at which time a decision on future work will be made. A progress report by Segaran is required by March 31, 1987.

11. Goals for 1987-88:

1. Review, edit, and circulate the proceedings (notes) of the workshop and solicit feedback from Manitoba Forestry Branch (Edwards).
2. Monitor progress of the study on accelerated growth and provide technical advice as requested (Dymock). Evaluate progress and set new goals as deemed necessary (Monitoring Committee).

12. Publications in 1986-87:

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 1987-88:

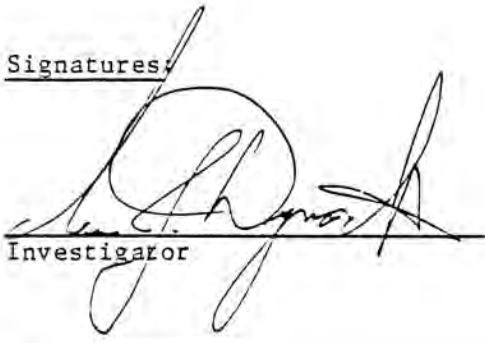
PYs: Prof.:	0.0
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M: Resources included in NOR-36-01

Capital:


Grants and Contributions:

15. Signatures



Investigator


Technical Advisor



Program Director, Resources



Supervisor



District Manager



Program Director, Development



Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	Total \$
1.		Forest nursery management workshop (see 12-4MA). \$10K CS			\$10 K CS
2.		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	\$210 K CS
Total \$:		\$80 K CS	\$70 K CS	\$70 K CS	\$220 K CS

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Forest economics (Manitoba)
3. New: Cont.: X
4. No.: NOR-36-01-08
5. Study Leader: T. Steele

N.B. See also separate study statements for Forestry Resource Economics and Statistics:

- i) NOR-3-01
- ii) NOR-3-03

6. Key Words: Economics of intensive forest management; cost effectiveness; forest resource values; regulations and incentives; industrial structure; computer modeling and decision-making aids; 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 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.
2. To implement a damage appraisal and valuation system for the purpose of assessing values at risk and post fire economic impact.
3. To assess the effect of various existing and potential incentives and regulations upon the forest industry within Manitoba.
4. To determine the current size, structure, and economic impact of the primary wood-using industries in Manitoba.
5. 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 1986-87:

1. Continue interdisciplinary economic/silvicultural studies to provide guidelines for cost-effective use of funds in intensive forest management. (Objective 1)
2. Prepare a File Report presenting background information and preliminary results for pre-commercial thinning cost of production studies. (Objective 1)
3. Prepare a File Report presenting background information and preliminary results for shear blading site preparation cost of production studies. (Objective 1)
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 2)
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." (Objective 4)
6. Become familiar with the models used and being developed by FEPA for future economic analyses of Manitoba wood supply. (Objective 5)
7. Coordinate and conduct a wood-using industry tour for Manitoba entrepreneurs of of Lake States forest products plants. (Objective 5)
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 5)
9. Complete interim evaluation of Canada/Manitoba Forest Renewal Agreement.

Added Goal:

10. Assist Saskatchewan Agreement economist with the preparation of a report on the size, structure, and economic impact of Saskatchewan's forest industry.

10. Accomplishments in 1986-87:

1. Continued interdisciplinary economic/silvicultural studies to provide guidelines for cost-effective use of funds in intensive forest management. Collected detailed site and machine/labor productivity data for the following treatments:
 - i) Tree planting - 272 plots
 - ii) Disc trenching - 65 plots

- iii) Drum chopping - 37 plots
- iv) Bracke scarification - 12 plots

Data entry initiated. (Objective 1)

2. Prepared with J. De Franceschi a File Report entitled "Labor Productivity for Pre-commercial Selection Thinning in Young Coniferous Stands in Manitoba." File Report was distributed on 28 November 1986. (Objective 1)
 3. Prepared with J. De Franceschi a File Report entitled "Machine Productivity for Shear Blade Site Preparation in Manitoba." File Report was distributed on 15 April 1986. (Objective 1)
 4. Reviewed and provided comments on a study proposal prepared by T. Williamson entitled "Determining Forest Values for Strategic Fire Response in Manitoba." (Objective 2)
 5. Completed a report on the size, structure, and economic impact of Manitoba's forest industry. Submitted report for review and publication. Distributed the publication entitled "Directory of Primary Wood-using Industries in Manitoba - 1985." Assisted R. Bohning with the preparation of an updated "Manitoba Forestry Report." (Objective 4)
 6. Became familiar with the forest sector models used and being developed by FEPA. (Objective 5)
 7. DID NOT coordinate and conduct a Lake States forest industries tour for Manitoba mill owners/managers. The tour was not conducted due to i) the Canada-US trade environment, and ii) a lack of commitment on the part of Manitoba Natural Resources. Did prepare a brief summary report detailing the history of this project. (Objective 5)
 8. Developed contacts with forest economists in Canada and the United States through attendance at Mid-Western Forest Economists meeting and Resource Information Systems, Inc. annual conference. Prepared and distributed with T. Williamson a detailed conference report entitled "The Continuing Challenge: Competition and New Products in the World Forest Products Markets." (Objective 5)
 9. Assisted J. McQueen with the interim evaluation of the Canada/Manitoba Forest Renewal Agreement.
 10. Assisted with the preparation of a report on the size, structure, and economic impact of Saskatchewan's forest industry.
 11. Prepared a summary report on the termination of Project C/M-7.1 Northern Employment Development.
11. Goals for 1987-88:
- i. Continue interdisciplinary economic/silvicultural studies to provide guidelines for cost-effective use of funds in intensive forest management. (Objective 1)

2. Prepare with J. De Franceschi a File Report presenting background information and preliminary results for disc trenching, drum chopping, and bracke scarification studies. (Objective 1)
3. Prepare with J. De Franceschi a File Report presenting background information and preliminary results for tree planting studies. (Objective 1)
4. Assist T. Williamson with a study to determine timber values in Manitoba. (Objective 2)
5. Coordinate and conduct a two-day workshop on computer decision-making aids for interested staff of Manitoba Natural Resources. (Objective 5)

12. Publications 1986-87:

None

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 1987-88:

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 \$30,500/\$30,500 MFB

15. Signatures:

T. B. Starks
Investigator

Robert W. Green
District Manager

Stanis M. Boyler
Technical Advisor

P. M. Hart
Program Director, Development

G. R. Hill
Regional Director General

11. Goals for 1987-88:

1. Continue to provide technical advice to Manitoba on PSP establishment and growth models for both natural and managed stands, and provide leadership and advise in the regional growth and yield coop.

12. Publications 1986-87:

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 1987-88:

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

O & M: \$100,000 Provincial funding

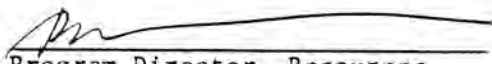
Capital:

Grants & Contributions:

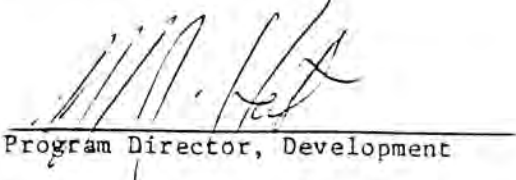
15. Signatures:



Investigator

Technical Advisor


Program Director, Resources


District Manager


Program Director, Development


Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1987-88	1988-89	Total \$
1.	Provide advise on forecasting yields for natural stands (see 4-5MA). \$60 K P	Continue and terminate. \$60 K P	\$120 K P
2.	Provide advice on establishing and measuring PSPs to obtain growth data. (see 4-5MA) \$10 K P	Continue and terminate. \$10 K P	\$10 K CS \$30 K P
3.	Provide advice on evaluating growth models for natural and managed stands. (see 4-5MA) \$30 K P	Continue and terminate. \$25 K P	\$30 K CS \$85 K P
Total	\$100 K P	\$95 K P	\$235 K P \$ 40 K CS

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Tree Improvement (Manitoba)
3. New: Cont.: X 4. No.: NOR-36-01-10
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 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.
10. Accomplishments in 1986-87:
 1. The proposed tree improvement workshop was deferred until 1987-88.
 2. Reviewed study plan related to an operational program on rooted cutting systems for jack pine and white spruce.
11. Goals for 1987-88:
 1. Contribute to the planning and organizing of a tree improvement workshop to be held in Manitoba.

12. Publications 1986-87:

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 1987-88:

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

O & M:

Capital:

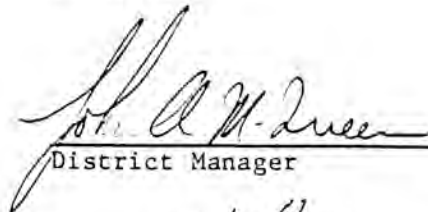
Grants & Contributions: CFS \$2,500/\$2,500 Manitoba

15. Signatures:



Investigator




Supervisor



District Manager



Technical Advisor



Program Director, Resources



Program Director, Development



Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	Total \$
1.	Conduct a workshop on tree improvement techniques (see 12-1MA). \$5 K CS		Conduct a workshop on tree improvement techniques. (see 12- \$5 K CS		\$10 K CS
2.		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) \$55 K CS	Continue and terminate. (see 12-3MA) \$55 K CS		\$110 K CS
Total \$:	\$5 K CS	\$55 K CS	\$60 K CS		\$120 K CS

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Silvicultural research and technology transfer, Manitoba.
3. New: Cont.: X 4. No.: NOR-36-01-11 (NOR-10-05)
5. Study Leader: J. Ball
6. Key Words: Silviculture, research, demonstrations, appraisals, liaison, technology transfer, spruce, pine, poplar, vegetation management
7. Location of Work: Manitoba
8. Study Objectives:
 1. To establish strong lines of communication with various forest management agencies in Manitoba.
 2. To assess, maintain and conduct silvicultural research, field trials, and demonstrations in Manitoba.
 3. To observe forest management in the field, providing up-to-date silvicultural information directly to the agencies involved, identifying forest management problems requiring research.
9. Goals for 1986-87:
 1. Publish:
 - a. FMN "Fertilization improves red pine seed production". (Dyck) (10-44)
 - b. IR "Performance of container and bare-root stock on prescribed burns, Saskatchewan." (10-18)
 - c. IR "Planting and seeding of white spruce" (30 case histories--MS 226, 227, and 190). (10-40)
 - d. FMN "Growth and survival of container seedlings after 10 years". (Walker and Ball) (10-18)

2. Prepare:

- a. FMN "Seeding and planting on shallow, rocky sites, Pine Falls, Manitoba (MS-238). (10-53)
 - b. FMN " 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-36-01-3 and NOR-36-01-4 under the Canada-Manitoba Forest Renewal Agreement.
 4. Cooperate with the 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 Nova clientele. (10-42). E.g. A field trip to Pine Falls in May to assess plantation survival problems is planned. (10-79)

Added Goals

6. Participate in a number of Public Awareness Activities.
7. Analyse MS-182 remeasurement data and prepare a report.
8. Carry out field remeasurements for studies MS-211, MS-216.

10. Accomplishments in 1986-87:

1. Publications:

- a. The FMN "Fertilization improves red pine seed production" was published in December 1985.
- b. The IR "Performance of container and bare-root stock on prescribed burns in Saskatchewan" was published.
- c. A draft MS "Converting aspen stands to white spruce by planting and seeding on scalped strips, Manitoba" has been prepared.
- d. The revised FMN "Growth and survival of container seedlings after 10 years" was returned to the reviewers in November.

2. In Preparation:

- a. A draft FMN describing seeding and planting performance on shallow rocky soil sites, Manitoba is in preparation.
- b. 1986 data (height, diameter, survival) have been collected and compiled for the 30 plots. A draft FMN on the effects of spading and blading on growth and survival of white spruce transplants at Riding Mountain National Park is in preparation.

3. Supervised Study Leaders for NOR-36-01-3 and NOR-36-01-4 under the Canada-Manitoba Forest Renewal Agreement.
4. No further data on silvicultural costs have been collected from the province. T. Steele and D. Boylen have done some preliminary analysis.
5. Several meetings were held with Abitibi-Price re seedling performance on clay sites. Literature was reviewed and 3 binders of mimeographed literature were provided to the company.

Acted as Scientific Authority for the Day-Bell PRUF grant (herbicide research) and organized a trip to the Porcupine site with Manitoba foresters, CFS project leader and W. Bell. This work will terminate in April, 1987. Cooperated with Site Classification Scientific Authority and contractor (Corns and Wells) and toured the Spruce Woods with them. Cooperated with CFS/Manitoba organizers of a Stand Tending Workshop and participated in field trips in the SFR and Eastern Region. Participated in the Regional Reforestation Technical Committee meeting in Saskatchewan. Attended a workshop at Hadashville on Extended Greenhouse Culture. Attended the November meeting in Edmonton of the Regional Technical Subcommittee on Fire Research. Served on the executive of the Manitoba Section of the CIF. Served on the MFA Forestry Week and Manitoba Heritage Tree Committees. Presented a workshop to the Manitoba Naturalist Society on Native Trees of Manitoba. Participated in Fort Richmond Collegiate Careers Day.

6. 12 Public Awareness Exhibits were organized by J. Dyck; this involved making arrangements with community organizers, ordering literature, posters and trees as well as handling displays and scheduling staff. A summary of events showing distribution of contacts, literature and posters, and seedlings is appended. Many requests for forestry literature were provided to students and the general public. All CFS Winnipeg staff participated in manning the displays.
7. MS-182 remeasurement data was compiled and analyzed; a manuscript "Cutting methods for the management of black spruce, Duck Mountain Forest Reserve, Manitoba" has been prepared. (NOR-36-01-4; goals 1 & 2) A proposal outlining details for selection and establishment of a demonstrational area will be completed in January.
8. Field measurements in Saskatchewan were carried out and completed for:

MS-211 "Clear cutting alternate strips and scarifying in pure white spruce stands to induce white spruce regeneration--Saskatchewan". (Areas 3,4 and 6--Christopher Lake, Montreal Lake, Dore Lake).

MS-216 "Clear cutting alternate strips in white spruce-aspen stands to induce white spruce regeneration, Manitoba and Saskatchewan" (Area 3--Carrot River)

MS-228 "Shelterwood cutting and mechanical seedbed treatment in white spruce regeneration, Manitoba and Saskatchewan. (Area 3 Big River)

A plan similar to that used for MS-211 using 4, 5 and 10-square metre quadrats for the assessment of white spruce regeneration on scarified, unscarified and logged-over areas is being used. (NOR-36-01-04; goals 3--5)

11. Goals for 1987-88:

1. To act as leader for a spruce stock trial at Pine Falls. After experimental design has been approved site selection will commence in the summer of 1987--followed by block layout. (tech transfer)
2. To examine first-year field performance of a variety of container seedling stock types currently being outplanted in the 6 provincial forest regions including those of Manfor Ltd. and Abitibi-Price Inc. by destructive assessment in fall 1987 of material outplanted in spring 1987 and prepare a report. (tech transfer)
3. To supervise study NOR-36-01-3 (Fire Management, Manitoba).
4. To perform liaison and technology transfer with Manitoba and CFS personnel.
5. To participate in a number of public awareness activities.
6. Publish two Forest Management Notes:
 - a. FMN "The effect of three methods of soil treatment on the survival and growth of white spruce transplants. (MS-229)
 - b. FMN "Seeding and planting on shallow rocky soils, Manitoba". (MS-238)
7. To make a reconnaissance of four MS-228 study areas located in the Porcupine Mountains. It is suspected that these may have been partly burned or disturbed by logging. (Kolabinski)
8. To complete field measurements for MS-211 (Area 5, Little Swan River), MS-216 (Area 1, RMNP), and MS-228 (Area 1, RMNP). (Kolabinski)
9. To assess white spruce regeneration (using 4, 5, and 10-square metre quadrats) on Haig's "Operational harvesting and scarification techniques to induce white spruce regeneration"--RMNP. (Kolabinski)
10. To compile and analyze MS-211, MS-216, MS-228 data. (Kolabinski)

12. Publications 1986-87:

Ball, W.J. and Kolabinski, V.S. 1986. Performance of container and bare-root stock on prescribed burns in Saskatchewan. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-283.

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 1987-88:

PY's:	Prof.:	Ball	1.0
	Tech.:	Dyck	1.0
		Kolabinski	1.0
	Total:		3.0

O & M:	\$6,400	Ball & Dyck
	\$11,073	Kolabinski
	\$17,473	Total

Capital:
Grants & Contributions:

15. Signatures:


Investigator


District Manager


Technical Advisor

Program Director, Development


Program Director, Resources


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre : NORTHERN FORESTRY CENTRE

Date : February 3, 1987

1. Project: Development Agreements
2. Title: Forest Renewal and Intensive Forest Management (Manitoba)
3. New: X Cont.: 4. No. NOR-36-01-12
5. Study Leader: N. Cataldo
6. Key Words: Forest renewal, intensive forest management, industrial forest management license area (Abitibi & Manfor), federal lands, agreement, pine, spruce, planting, seeding, thinning, release cutting
7. Location of Work: Manitoba District Office, Abitibi-Price Inc. limits Pine Falls, Manfor Ltd. limits The Pas, Crossing Bay Indian Reserve, Sandilands Forest Reserve, Duck, Riding and Turtle Mountains, Interlake, Manitoba
8. Study Objectives:
 1. To monitor, under the Canada-Manitoba Forest Renewal Agreement, the use of federal funds relating to:
 - a) Program A: Forest Renewal, Subprogram 2 : Forest Renewal on Industrial Forest Management License Areas, Private Woodlots and Federal Lands; and
 - b) Program B: Intensive Forest Management, Subprogram 4: Stand Tending on Industrial Forest Management License Areas, Private Woodlots and Federal Lands.
 2. To assist Abitibi-Price Inc. and Manfor Ltd. with their:
 - a) Project proposals under Programs A-2 and B-4; and
 - b) Implementation of approved projects under Programs A-2 and B-4.
 3. To monitor, assess and evaluate all projects performed by Abitibi-Price Inc. and Manfor Ltd. under Programs A-2 and B-4.
 4. To provide advice and technical assistance, as required, in relation to Programs A-2 and B-4.

5. To promote and monitor forest renewal and stand tending projects on federal lands and, to assist Native Bands with the implementation of such projects.
 6. To establish Demonstration Areas in order to demonstrate forest management techniques and practices for the establishment and tending of pine and spruce stands.
 7. To remeasure and maintain Demonstration Areas and prepare appropriate reports on treatments and obtained results for use by practicing foresters and whenever for the general public.
9. Goals for 1986-87:
1. Review, approve and monitor reforestation and stand tending projects developed by industry (Manfor and Abitibi-Price).
 2. Fund and monitor seedling growing contracts to meet Industry and where applicable Band requirements in relation to Agreement reforestation activities.
 3. Identify Native Bands for silvicultural project involvement and administer and implement suitable renewal and/or stand tending operations.
 4. In close co-operation 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.
 5. Remeasure, as appropriate, selected Demonstration Areas and prepare appropriate short reports outlining treatments and updated results.
 6. Prepare appropriate maps at suitable scales indicating demonstration plot location(s) and ensure that the selected Demonstration Areas are duly recorded by the Manitoba Land Titles Branch.
 7. Develop a publication format incorporating the short reports, appropriate maps, and references for distribution to provincial foresters.
 8. 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 of jack pine and white spruce from harvest through regeneration, stand tending, and utilization.
10. Accomplishments in 1986-87:
1. The two major forest industry companies in the Province (Abitibi-Price and Manfor) are involved in a variety of reforestation and stand tending activities during the year. These include surveys (5261 ha),

site preparation (1327 ha), cone collections (150 hl), tree planting (1536890t), herbicide treatments (190 ha), and juvenile spacing (100 ha).

2. A review of work being done at Dakota Plains and Dakota Tipi greenhouses was done with Abitibi-Price being funded to purchase seedlings from Dakota Ventures (800000 seedlings).
3. A field inspection and assessment was done at the Crossing Bay Indian Reserve resulting in a stand tending project proposed to the Moose Lake Band.
4. Based on a review of recommendations contained in Johnson Forestry Services' report on Manitoba-Saskatchewan R & D plots established between 1904 and 1970 the following additional field plots were chosen for possible use as demonstration areas in Manitoba.

M S-508 Provenance experiment, sP, Sandilands
 M S-112 Artificial reforestation, planting, Turtle Mountain
 M S-113 Artificial reforestation, planting, Spruce Woods
 M S-238 Planting and seeding, Abitibi-Price Inc. limits
 M S-190 Planting spruce and pine, Interlake Region
 M S-236 Coniferous plantations with different initial spacings
 D -MS-093 Silvicultural operations, Riding Mountain
 O DC-242 Mechanical thinning, Pj, Sandilands

Field assessments were conducted on some of these as well as on other potential areas.

5. The following studies were remeasured in 1986-87:

M S-90 Artificial reforestation, seeding, Duck Mountain
 M S-103 Artificial reforestation, planting, Duck Mountain
 D -MS-093 Silvicultural operations, Riding Mountain

Short final reports have been prepared for 4 of the selected Demonstration Areas. Short draft reports have been prepared for 2 of the demonstrations.

6. Appropriate maps indicating demonstration plot locations have been prepared for 6 of the plots. Three of these have been recorded by the Manitoba Land Titles Branch and the other three are located within Riding Mountain National Park.
7. A publication format, Forest Management Demonstration Notes, incorporating the short reports, appropriate maps and references has been developed for distribution to provincial foresters.
8. This goal has not been fully achieved. Some form of information package utilizing the Forest Management Demonstration Notes for transfer to the general public is being considered.

Added Accomplishments:

9. A private white spruce plantation established in 1902 at Grandview was measured and included as a Demonstration Area and a short report has been completed.
 10. Appropriate demonstration plot signs (55 signs) for 3 completed Demonstration Areas have been prepared and will be erected in the summer of 1987.
11. Goals for 1987-88:
1. Review, approve and monitor reforestation and stand tending projects developed by industry (Manfor Ltd. and Abitibi-Price Inc.).
 2. Fund and monitor seedling growing contracts to meet industry and, where applicable, Band requirements in relation to Agreement reforestation activities.
 3. Identify Native Bands for silvicultural project involvement and where applicable administer and implement suitable renewal and stand tending operations.
 4. In close co-operation 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 1904-1970, plus any other suitable study plots, select additional field plots for use as Demonstration Areas in Manitoba.
 5. Remeasure, as appropriate, selected Demonstration Areas and prepare appropriate short reports (1-2 pages in length) outlining treatments and updated results.
 6. Prepare appropriate maps at suitable scales indicating demonstration plot locations and ensure that the selected Demonstration Areas are duly recorded by the Manitoba Land Titles Branch.
 7. In co-operation with the Manitoba Forestry Branch and the Forestry Relations officer (NoFC) erect appropriate signage.
 8. Distribute the Forest Management Demonstration Manual and Notes to provincial foresters and update as required.
 9. Transfer the Forest Management Demonstration Notes, and change as required, to the general public.
12. Publications 1986-87:
- Walker, N.R.; Witt, D.R. 1987. White spruce sawlogs produced sixty-eight years after planting. Forest Management Demonstration Note
- Walker, N.R.; Witt, D.R. 1987. White spruce transplant stock grading increases yields, 59 years after planting. Forest Management Demonstration Note

Walker, N.R. 1987. Elk browsing prevents the growth of a new trembling aspen/balsam poplar forest. Forest Management Demonstration Note

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 1987-88:

P Ys:	Prof.: Cataldo	1.0
	Tech.: Walker	1.0
	Total:	2.0
	Term/Student:	0.0


O & M \$22,000

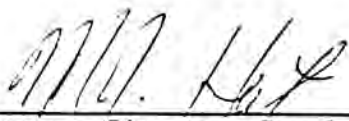
Capital: 0.00

Grants & Contributions: \$1,492,000

15. Signatures:


Investigator


District Manager


Program/Director, Development


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1987

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
ix) Boreal risk factor modelling	NOR-36-02-9
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. Problem:
 N/A
9. 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.
10. Goals for 1986-87:
- A. Alberta Agreement:
 1. Establish rapport with Indian Bands and provide assistance to the Bands with project proposal preparation.
 2. Manage the implementation of federal activities under the Canada-Alberta FRDA.
 3. Maintain liaison and communication with provincial government to assist and make recommendation for further \$ expansion of the Agreement.
 - B. Program Activities:
 - 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;

- solicit, 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 utilization 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.

C. 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.

11. Accomplishments in 1986-87:

A. Alberta Agreement:

1. Utilized standards and procedures for the Canada-Alberta Forest Resource Development Agreement.
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;
 - 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;
 - supervising the implementation of Agreement projects.
 - monitoring 92 Agreement projects:

1 Reforestation:

- 8 project on Indian lands
- 1 project - provincial direct funding

2. Forestry Research, Development and Demonstration

- 27 projects - federal direct funding.

3. Hardwoods and Related R&D

- 10 projects - federal direct funding
- 28 projects - 50/50
- 11 projects - provincial direct funding

4. Public Information

- 5 projects - federal direct funding
- 2 projects - provincial direct funding

B. Development general:

1. Provided staff support as requested by District Managers in Saskatchewan and Manitoba and by the Program Director, Regional Development and provided assistance as required in staffing Agreement positions.
2. 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.
3. MIS is successfully used in Edmotnon (Due to line problems MIS cannot be utilized in Saskatchewan and Manitoba. All summaries from the region are processed in Edmotnon and directed to Ottawa).
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.

12. Goals for 1987-88:

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;
 - solicit, 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 utilization of a management information system (MIS) (which is compatible with Devmís 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.

C. 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. This will include assisting in the orientation of the new manager in P.A.
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. Continue the conceptual planning for post agreement development programming.

13. Publications 1986-87:

Technical Reports

Bonding Wood Composites with Isocyanates.

Review of Chemical Products produced from the Tigney exploded Aspen wood process.

Evaluation of Kiln Drying Characteristics of 8/4 Canadian Aspen Lumber in a Commercial Kiln.

Value added opportunities for Alberta Lodgepole Pine Solid Wood Products.

World Market pulp demand with special reference to Eucalyptus.

Study of Chemo thermomechanical pulp (CTMP) production potential for Alberta (in publication).

Improving fibre utilization in the aspen structural panelboard industry. (In publication).

Corns, I.G.W.; Annas, R.M. 1986. Field guide to forest ecosystems of west-central Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alta.

McAlpine, R.S. 1986. Forest fire growth calculator. Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note 35.

Hiratsuka, Y. 1987. Forest tree diseases of the prairie provinces. Can. For. Serv., North. For. Cent., Edmonton, Alta. Inf. Rep. NOR-X-286.

14. 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.

15. Resources 1987-88:

PYs: Prof:	Price	1.0	(A-Base)
	Côté	1.0	
Support:	Vacant	1.0	
	Brisco Adams	1.0	
Total:		5.0	
Term:	Mrklas	0.2	

Contracts/O & M: \$2,037,500 + \$6,200 A-base

Capital: \$60,000

Grants & Contributions: \$500,000

16. Signatures:

Steve Price
Alberta Agreement Manager

[Signature]
Program Director, Development

[Signature]
Regional Director General

Canada-Alberta Forest Resource
Development Agreement

1987-88

	PYs	O&M	Contracts/ Supplies	G & C	Capital
NOR-36-02					
Reforestation	1.0	\$9,000	42,000	\$157,000	-
B.3 Contingency	-	-	328,300	-	-
Technical Publications	-	-	30,000	-	-
Hardwood R&D	-	-	836,500	343,000	-
Evaluation	-	-	10,000	-	-
Administration	2.0	12,000	18,000	-	60,000
NOR-36-02-1					
Vegetation Management	1.0	6,000	173,000	-	-
NOR-36-02-2					
Tree Improvement	-	-	200,000	-	-
NOR-36-02-3					
Wetland Drainage	-	-	91,000	-	-
NOR-36-02-4					
Insect & Disease	1.0	6,000	61,000	-	-
NOR-36-02-5					
Yields	1.0	12,000	21,200	-	-
NOR-36-02-6					
Demonstration Project	-	-	109,000	-	-
NOR-36-02-7					
Economics	-	-	86,500	-	-
NOR-36-02-8					
Public Information	-	-	72,500	-	-
TOTALS:	6.0	45,000	1,992,500	500,000	60,000

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

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: Cont.: X 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. Problem:

Aspen management is an important issue for the future of forestry in Alberta. On one hand there is an abundant and often decadent resource which is currently under utilized but has great future promise as a source of fibre. From this perspective there is an urgent need for management strategies to promote the development and utilization of aspen stands. On the other hand Alberta has a well developed softwood industry and must aggressively support and promote softwood reforestation aimed at maintaining the coniferous AAC. In cases where aspen is a serious competitor on productive softwood sites there are serious problems in controlling or suppressing aspen in order to establish the new softwood crop and bring it through to a free-to-grow state. examples of such problems are found in recent cutover designated for softwood regeneration in mixedwood areas, and in aspen stands which have been converted to softwood plantations, such as the 40,000 ha. of MOF plantations recently established. From this perspective there is an urgent need for management strategies to effectively suppress aspen. This aspect of the aspen management problem is seen as currently very urgent and deserving of immediate research.

There are a variety of mechanical, manual and chemical methods, and combination of these, which have potential as tools for suppressing aspen at various critical stages of softwood reforestation and stand tending. A full evaluation of selected methods and their combinations (e.g., mechanical-chemical) in terms of silvicultural effectiveness, economics

and environmental impacts, especially where chemicals are concerned, would provide a sound basis for comparing treatment alternatives for management use, and for satisfying public concern about chemical treatment effects. Research undertaken with the objective of understanding aspen sucker and seedling development for purposes of suppressing aspen may well provide information useful in management strategies to promote aspen.

9. 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).

10. 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.

11. Accomplishments in 1986-87:

1. Co-ordinating job fulfilled as specified by work plan and facilitating term.

2. Attended open house in Grande Prairie in May 1986 and provided interviews for public and press. Further public contact has been maintained throughout 1986, including correspondence with Alberta Environmental Law Society and environmental groups. Also provided press article to Science Journal in fall 1986.
 3. Completed all silviculture sub-plot establishments and iron centre pin on project - Grande Prairie test site (joint silviculture - environment crew).
 4. All ID tagging of blocks and plots complete on Grande Prairie site. Tagging of silviculture sub-plots done only on chemical and controls.
 5. Pre-treatment assessment of silviculture R&D plots included pinning all crop tree locations by quadrant and tagging and assessing target shrub species on all chemical and control plots.
 6. Co-operated in obtaining, repairing and calibrating equipment and supervised chemical application on Method II area.
 7. Automatic recording stations established with assistance from watershed research group.
 8. Marker set up delayed to spring 1987.
 9. Progress reports prepared and submitted to Senior Development Officer - Agreements.
12. Goals for 1987-88:
1. Coordinate all aspects of project field work on Grande Prairie test site as specified by work plan and facilitating team.
 2. Continue involvement in public information program relevant to project.
 3. Complete tagging and 1st year assessment of crop trees on all sub-plots (silviculture and environment) and tagging and assessment of all competitors in shrub class as done for silviculture control and chemical sub-plots previously. Complete all plot centre tagging on mechanically treated sub-plots and summarize plot data.
 4. Cooperate in layout and supervision of mechanical treatment and planting phases of Grande Prairie project, including set-up of markers for treatment control.
 5. Operate automatic recording stations on Method II area.
 6. Act as Scientific Authority for AFS-R&R regarding development and executive of 1987 planting and site treatment contracts on Method I and II areas - Grande Prairie Site (see letter of Agreement).
 7. Prepare quarterly progress reports to Senior Development Officer - Agreements.

13. Publications 1986-87:

Nil

14. 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.

15. Resources 1987-88:

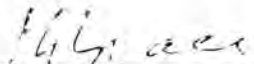
PYs: Prof.:	0.0	(Brace A-Base 0.4)
Tech.:	0.0	(vice Walker A-Base 0.1)
Total:	0.0	(A-Base 1.4)
Term/Student:		(2 contract students) (Agreement)
Total	0.0	

O & M: \$44,000 (+ \$25,000 for AFS - R&R)

Capital:

Grants & Contributions: Nil

16. Signatures:



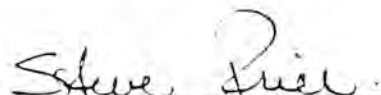
 Investigator

 Supervisor

 Technical Advisor



 Program Director, Forest Resources



 Alberta Agreement Manager



 Program Director, Development



 Regional Director General

OPERATIONAL PLANS
1986-1991

Goals	1987-88	1988-89	1989-90	1990-91
1.	Coordinate all aspects of field work on Grande Prairie project, as designated by work plan and Facilitating Team.	Continue.	Continue.	Terminate.
2.	Continue involvement in public information program (e.g., Forestry week 1987-Grande Prairie)	Continue.	Continue.	Terminate.
3.	Complete <u>first-year</u> silviculture assessment of all sub-plots on Method I and II areas - Aug./Sept. Includes tagging and assessing crop trees and competitors on both environmental and silviculture sub-plots. Summarize plot data.	Complete <u>second-year</u> silviculture assessment of all sub-plots on Method I and II area - August/Sept. Summarize and analyse plot data.	Complete <u>third-year</u> silviculture assessment on Method I and II areas - first year assessment for release on Method I area. Summarize, analyze and report plot results.	Terminate.
4.	Cooperate in field application and supervision of mechanical treatment and planting on Method II areas. Includes setting up special markers for control of mechanical treatment.		Cooperate in field application of chemical and manual release treatments on Method I - area - May/June and do first year silvicultural assessment Aug/Sept. Summarize plot data.	Terminate.
5.	Operate automatic recording stations on Method I & II areas.	Continue.	Continue.	Terminate.
6.	Act as Scientific Authority for work line by AFS - R&R on planting and site treatment contracts - Grande Prairie Site.			

OPERATIONAL PLANS
1986-1991

Goals	1987-88	1988-89	1989-90	1990-91
7. Prepare progress reports for Senior Development Officer - Agreements.		Continue.	Prepare progress reports and final report for Senior Development Officer - Agreement.	Terminate.
PY's O&M Capital	\$44,000	\$15,000	\$20,000	

PROJECTED RESOURCES (AGREEMENT)
BY BUDGET YEAR

	1986-87	1987-88	1988-89	1989-90	TOTAL
PY Tech	--	--	--	--	--
PY Contract	0.7	0.35	0.35	0.35	1.75
O&M	12.5	9.0	4.5	9.0	35.0
Seasonal PY	23.5	10.0	10.0	10.0	53.5
Term Salary	--	--	--	--	--
Capital	--	--	--	--	--
TOTAL	36.0	19.0	14.5	19.0	88.5

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Forest Vegetation Management: Control of aspen development in areas designated for softwood production in Alberta
3. New: Cont.: X 4. No.: NOR-36-02-1A
5. Study Leader: L. Brace (in cooperation with Dr. S. Navratil, AFS)
6. Key Words: Vegetation Management, manual, mechanical, chemical, site preparation, release, suckers, seedlings
7. Location of Work: AFS Research Branch, Spruce Grove, Alberta.
Grande Prairie Forest, Whitecourt Forest, Slave Lake Forest, Lac La Biche Forest, Peace River Forest and Edson Forest.
8. Problem:

Aspen management is an important issue for the future of forestry in Alberta. On one hand there is an abundant and often decadent resource which is currently underutilized but has great future promise as a source of fibre. From this perspective there is an urgent need for management strategies to promote the development and utilization of aspen stands. On the other hand Alberta has a well developed softwood industry and must aggressively support and promote softwood reforestation aimed at maintaining the coniferous AAC. In cases where aspen is a serious competitor on productive softwood sites there are serious problems in controlling or suppressing aspen in order to establish the new softwood crop and bring it through to a free-to-grow state. Examples of such problems are found in recent cutover designated for softwood regeneration in mixedwood areas, and in aspen stands which have been converted to softwood plantations, such as the 40,000 ha. of MOF plantations recently established. There is an urgent need for management strategies to effectively suppress aspen. This aspect of the aspen management problem is seen as currently very urgent and deserving of immediate research.

There are a variety of mechanical, manual and chemical methods, and combination of these, which have potential as tools for suppressing aspen at various critical stages of softwood reforestation and stand tending. A full evaluation of selected methods and their combination

(e.g., mechanical-chemical) in terms of silvicultural effectiveness, economics and environmental impacts, would provide a sound basis for comparing treatment alternatives for management use thus satisfying public concern about the effects of chemical treatment.

9. Study Objectives:

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

10. Goals for 1986-87:

1. Conduct pre-treatment assessment of aspen sucker and root characteristics (Aug. 1986) on the Method I and Method II blocks and post-treatment assessment on mechanically treated blocks (Oct. 1986) of the main trial at Grande Prairie.
2. Supervise, jointly with CFS participants; chemical application at Grande Prairie trial.
3. Coordinate storage/handling and tests of physiological quality of planting stock to be used for the main trial.
4. Prepare, jointly with implementation committee, planting contracts for the main trial.
5. Initiate Satellite trial A at Calling Lake, Lac La Biche Forest, with the following steps to be accomplished in 1986-87 as per the attached workplan: plot lay-out assessment of aspen sucker and root characteristics prior to and following mechanical treatments, supervision of mechanical treatments, ground application of herbicide (one treatment, hexazinone).
6. Initiate Satellite trial B at Weberville Demonstration area, Peace River Forest, with the following steps to be accomplished in 1986-87 as per the attached work-plan: plot lay-out, chemical application (single-tree treatments), assessment of target-tree mortality, coordination of clearing and site preparation.
7. Initiated Satellite trial C, Peace River Forest, with the following steps to be accomplished in 1986-87 as per the attached workplan: site selection and plot lay-out, chemical application (first set of single tree treatments in August 1986).
8. Continue laboratory and greenhouse studies on the effects of segmentation, moisture stress and low temperature exposure on suckering ability of aspen roots and prepare a report/publication on the results.
9. Continue monitoring of soil temperature and moisture levels on selected mechanically prepared sites.

10. Prepare for publication/internal review the annotated bibliography on aspen regeneration and the report "Environmental factors and site preparation and harvest methods for control of aspen suckering; a review of present day knowledge". (a suggested title)
 11. Define the scope, conditions of and need for investigating aspen ingress by seeding in softwood regenerated areas, through a reconnaissance of young stands of lodgepole pine and white spruce in Alberta.
11. Accomplishments in 1986-87:
1. Main trial area pretreatment assessments of aspen sucker and root characteristics completed on Method I and Method II:
 - a) 707 circular plots evaluated for aspen sucker density and condition.
 - b) 55 transect plots excavated and assessed for aspen root diameter, length, orientation and number of suckers.
 2. Plots established were on satellite trails A, B and C with treatments and assessment as follows:
 - a) Satellite A (chemical and mechanical site preparation treatments for control of aspen suckering) was laid out and all pre-treatment assessment and site preparation treatments were completed by fall 1986. The treatment included: Rome disc, marttini plow, straight blade, aerial simulated hexazinone application, and a marttini treatment that will be chemically released when needed in the future. Soil profile temperatures are being monitored on the mechanically treated sites and soil residue monitoring will be continued on the chemical treatment.
 - b) Satellite B (pre-harvest chemical applications and post-harvest discing to control aspen sucker density) was modified to test 6 pre-harvest chemical applications (2 with glyphosate, 4 with hexazinone) and 3 Rome discing trials (single, double, and 2 passes at different times in the same year.) The pre-assessment was completed but the treatments were postponed to 1987 due to delay in obtaining herbicide permit.
 - c) Satellite C (pre-harvest single tree chemical application on mature aspen in a mixed wood area) was established but treatments were due to delay in obtaining herbicide permits.
 3. Greenhouse tests of environmental factors affecting aspen root suckering continued:
 - a) segmentation and dehydration trials were repeated 5 times during the summer/fall 1986. The collected data is to be analyzed.
 - b) low-temperatures exposure trials are in progress (winter 1986-87) and the data will be analyzed.

4. Stock quality physiology tests coordinated.
 5. Contract prepared for planting main trial area.
 6. Aspen seedling ingress studies were conducted as follows:
 - a) present day knowledge on aspen seed biology and ingress by seeding was reviewed and annotated.
 - b) Reconnaissance of lodgepole pine and white spruce regenerated stands completed in the Edson Forest and Whitecourt Forests.
 - c) The problem areas were defined and 50 monitoring plots were established in the Edson Forest.
 7. Annual Progress Report completed.
 8. Assisted in equipment calibration and pronone application in Grande Prairie test site.
 9. Moisture/temperature monitoring continued on Satellite A site for mechanical treatments.
 10. An extensive literature review on the current knowledge of environmental factors and forestry practices that effect aspen suckering will be prepared in a draft form by the end of the fiscal year.
12. Goals for 1987-88:
1. In Grande Prairie main trial area the following will be undertaken:
 - a) Supervise planting contract on Method I and II areas.
 - b) Post-treatment assessment of rectangular excavation plots to determine the effect of the treatments on aspen suckers.
 - c) Post-treatment assessment of rectangular excavation plots to determine the effect of mechanical treatment upon aspen roots.
 - d) Initial measurement of crop trees within vegetation plots.
 2. Satellite trials tentative plans:
 - a) Satellite A post-treatment assessment of all treatment plots. Plant crop trees and assess. Continued monitoring of temperature and moisture levels in soil profiles of selected mechanical site preparation treatments. Continue monitoring of soil for hexazinone residue.
 - b) Satellite B, chemical treatment followed by mortality assessment. Cutting and piling during winter (subject to change).
 - c) Satellite C, single-tree chemical treatments followed by mortality assessment and harvesting (subject to change).

- 3. Continue aspen seedling ingress study by remeasuring existing plots in Edson and establishing additional plots in the Whitecourt Forest.
- 4. Evaluate and interpret results of physiological tests of planting stock for Grande Prairie site.
- 5. Prepare annual progress report.
- 6. Pending interpretation after 1986-87 work, continue greenhouse and field study on effects of root segmentation and moisture stress on suckering ability and survival of suckers.

13. Publications 1986-87:

1987. Environmental factors, site preparation and harvesting methods for control of aspen suckering: A review of present day knowledge. A first draft.

14. 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:

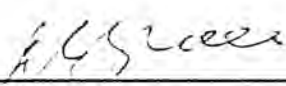
The project has been reviewed by a CFS Peer Review Panel (Jan./Nov. 1985) and by the Research Management Division and the Chemicals Branch, Pollution Control Division of Environmental Alberta and can only proceed after satisfying both Federal and Provincial permit requirements, which address environmental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

15. Resources 1987-88:

PYs: Prof.: 0.0 (FRB 0.2)
 Tech.: 0.0 (FRB 0.1)
 Total: 0.0
 Term/Student: 1.5 (Agreement)

O & M: \$62,000
 Capital: -
 Grants & Contributions:

16. Signatures:



 Investigator

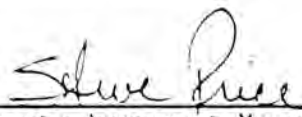


 Program Director, Development


 Technical Advisor



 Program Director, Forest Resources



 Alberta Agreement Manager



 Regional Director General

Goals:

	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>
1.	First season treatment assessment of aspen suckers and roots on the Method I and Method II blocks at Grande Prairie.	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.
2a.	One-year-after treatment assessment of plots on the Satellite Trial A. Planting of crop trees.	Two-year after treatment assessments of Satellite Trials A.	Three-year after treatment assessment of the Satellite Trials A.
2b.	Apply treatment on Satellite trial B & C. (Tentative)	One-year after treatment assessments on Satellite Trial B and C. (tentative)	Two-year after treatment assessment of the Satellite Trials B and C (tentative).
3a.	Continue laboratory and greenhouse tests of environmental factors affecting suckering ability of aspen roots.	Data processing and interpretation of two-year results on aspen suckering from the main and satellite trials.	Data processing and interpretation of three-year results on aspen suckering from the main and satellite trials.
3b.	Summarization and interpretation of the 1986-87 studies on suppression of suckering by environmental factors.		
4.	Evaluate and interpret tests of physiological and morphological quality of planting stock.	Prepare stock quality report and <u>terminate</u> .	

Goals:

	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>
5.	Supervise planting contracts in co-op. with CFS. Terminate		
6a.	Monitor Aspen Ingress plots and establish additional plots as necessary.	Continue monitoring of Aspen Ingress plots.	Continue monitoring and maintenance of Aspen Ingress plots.
6b.			Data processing and interpretation of the result from Aspen Ingress by seeding-in plots.
7.	Prepare progress reports on 1,2,3(a),4 and 6 and final report on 3(b).	Continue report preparation.	Prepare final reports on 3 and 6 above.
8.	Continue soil moisture and temperature collection mechanically treated sites.	Continue.	Continue.
P.Y			
O&M	\$62,000	\$60,000	\$58,000
CAP.			

Projected Resources Agreement by Budget years (\$ K)

	<u>1986-87</u>	<u>1987-88</u>	<u>1988-89</u>	<u>1989-90</u>	<u>1990-91</u>
PY's (Tech.) Term	1.0	1.0	1.0	-	3.0
PY (con- tract)	0.6	0.6	-	0.4	1.6
O & M	40.0	30.0	20.0	20.0	110.0
S P.Y.	18.0	18.0	-	10.0	46.0
Term Salary	38.8	38.8	38.8	38.8	155.2
Capital	110.0 ¹	-	-	-	-
Total	196.8	86.8	58.8	68.8	411.2

¹1986/87 \$100 K capital for purchasing HPLC and accessories.

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Forest Vegetation Management: Environmental impacts and residue chemistry of forestry herbicides
3. New: Cont.: X 4. No.: NOR-36-02-1B
5. Study Leader: S. Sidhu
6. Key Words: Vegetation management, manual, chemical, mechanical, herbicide residues, persistence adsorption, residue chemistry.
7. Location of Work: NoFC, Grande Prairie Forest
8. Problem:

Several hundreds of thousands of hectares of forest land in Alberta are only marginally productive because they are either inadequately stocked or have regenerated as less valued hardwoods. An important step in rehabilitating problem forest areas is to control weedy vegetation at or before planting and during years of early growth. Herbicides may be one of the most effective and economic means to achieve this objective.

Public confidence is important to the use of herbicides. This can only be achieved by developing sound scientific data on the environmental impacts of herbicides. Long-term studies on a variety of forest sites are required to determine the effects of herbicides on crop, target and non-target species, changes in structure and function of herbicide treated forests, and herbicide residues in soils and vegetation.

A fundamental part of any environmental impact study is the measurement of the stress agent--in this case the herbicide itself as well as the breakdown products. Large numbers of plant and soil samples need to be collected, processed and analyzed for extremely small quantities of herbicides using complex methods and sophisticated instrumentation. The Federal/Provincial agreement provides a means and an opportunity to develop much needed data. This is an essential prerequisite if operational herbicide use in forestry in Alberta is to proceed on a sound basis.

The potential benefits of the research in environmental impact of herbicides on forest ecosystems and their residue chemistry include:

1. Provision of scientific information on the environmental impact of herbicides that would provide a sound basis for the wise use of herbicides in the management of forests in Alberta.
2. Closing of important data gaps in understanding the fate (residue chemistry and accountability) of selected herbicides entering the ecosystem.

9. Study Objectives:

1. Develop environmental impact and residue data on herbicides used operationally for vegetation control in Alberta.
2. Determine the fate of herbicides in the forest ecosystem, by studying persistence, lateral and downward movement, degradation, and absorption/desorption characteristics in selected forest soils under field and laboratory conditions;
3. Evaluate the influence of herbicide application and other silvicultural practices on the structure, composition and dynamics of forest plant communities;
4. Determine the influence of herbicide application and other silvicultural practices on the long term stability of nutrient balance and the biological (mycorrhizal associates, N-fixation, decomposition) control of tree nutrition.

10. 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.

11. Accomplishments in 1986-87:

1. Completed layout of sample plots and subplots in Method I and Method II blocks.

2. Sampled vegetation and soils for pretreatment data in Method I and Method II.
3. Designed a method to collect herbicide data and soil residue data specific to a selected herbicide (Pronone).
4. Sampled vegetation, soils and water for residue analysis as required for Method II.
5. Established a herbicide residue analysis laboratory and initiated analysis of vegetation, soil and water samples.
6. Entered 1 part of 1986-87 field data (vegetation) on the computer and preferred field plans for 1987-88.

12. Goals for 1987-88:

1. Sample vegetation plots (density, cover and species) for post-herbicide treatments in Method II and Method I. Enter 1987-88 data on computer and synthesize 1986-87 data.
2. Collect post-herbicide treatment field samples of water, sediments, foliage and soils for herbicide residue analysis.
3. Perform residue analysis on 1986-87 samples and begin analysis of 1987-88 samples from Method II plots.
4. Summarize field data from 1986-88 and prepare plans for 1988-89.

13. Publications 1986-87:

New study - 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.

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.

15. Resources 1987-88:

PYs: Prof.:	Sidhu, S.	0.0	(A-base 0.7)
	Feng, J.	0.0	(A-base 0.9)
	Total:	0.0	

Tech.: Milward, A 0.0 (A-base 1.0)
 Fairbarns, M. 0.0 (A-base 0.8)
 Feng, C. 1.0 (Agreement)
 Total: 0.0
 Term/Student: 0.6 (Agreement \$18 K for 2 skilled contractors for 3.7 months)

Total:

O & M: 30.0 K (Agreement)

Term PY \$ C. Feng, 2 contractors 56.8 K

Capital:

Grants & Contributions:

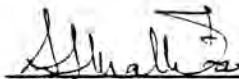
16. Signatures:



 Investigator

 Supervisor


 Technical Advisor



 Program Director, Forest Protection



 Alberta Agreement Manager



 Program Director, Forest Resources



 Regional Director General

OPERATIONAL PLANS - NOR-36-02-03
1986-1991

Goals	1987-88	1988-89	1989-90	1990-1991
1.	Completed.			
2.	Sample plots (Method II) for 1 year post-treatment data. Synthesize post-treatment data for 1st year.	Continue. Sample plots for 2nd year post-treatment data. Synthesize post-treatment data for 2nd year.	Continue. Sample plots for 3rd year post-treatment data, synthesize post-treatment data for 3rd year. Terminate.	Report (A-Base and terminate.
3.	Summarize herbicide deposition data and soil residue data. and evaluate methods. to study herbicide deposition and soil residue.	Report on methodology		
4.	Continue sample and synthesize preliminary results of vegetation and soils samples for residue analysis as required for Method II. Begin analysis.	Continue, report early results.	Continue, report on 2 years' data. Terminate.	Final report-terminate. (A-Base).
5.	Summarize field data and prepare plans for 1988-89.	Continue and prepare plans for 1989-90.	Prepare 1st draft of final report. Terminate.	Report and terminate. (A-Base).

Projected Resources Agreement by Budget years (\$ K)

	1986-87	1987-88	1988-89	1989-90	Total
PY's (Tech.) Term	1.0	1.0	1.0	-	3.0
PY (con- tract)	0.6	0.6	-	0.4	1.6
O & M	40.0	30.0	20.0	20.0	110.0
S P.Y.	18.0	18.0	-	10.0	46.0
Term Salary	38.8	38.8	38.8	38.6	155.2
Capital	36.0	-	-	-	36.0
Total	132.8	86.8	58.8	68.6	347.2

1986/87 \$100K capital for purchasing HPLC and accessories.

10. Accomplishments 1986-87:

1. The literature review for economics of forest herbicide useage was initiated and progress made in collection and synthesis.
2. After discussion with AFS officials and in consideration of the number of application rates, it was decided a methodology was not necessary. The Alberta Forest Service collected cost data during the field operation.
3. Incumbent was on leave for approximately four months, April-August.

11. Goals for 1987-88:

1. Complete literature synthesis on economics of forest vegetation management. Prepare an Information Report for review.
2. Complete a preliminary cost analysis of data.

12. Publications 1986-87:

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 1987-88:

PYs:	Prof.:	0.0	(A-Base Boylen 0.3)
	Tech.:	0.0	(A-Base Bohning 0.1)
	Total:	0.0	
	Term/Student:	0.0	

O & M:

Capital: Nil

15. Signature:


Investigator

Program Director, Development


Alberta Agreement Manager


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 29, 1987

1. Project: Development Agreements
2. Title: Tree Improvement (Alberta)
3. New: Cont.: X 4. No.: NOR-36-02-2
5. Study Leader: R. Waldron
6. Key Words: Tree improvement, genetics, seed orchards, grafting, seed collection areas, lodgepole pine, white spruce
7. Location of Work: Alberta
8. Problem Analysis:

Tree improvement program in Alberta is in its early stages of development. The program is province-wide in scope and efforts are directed in three areas: 1) locating and designating superior forest stands as cone collection or gene pool reserves; 2) genetic improvement of lodgepole pine and white spruce and production of improved seed; 3) applied research, primarily on species and provenance testing, and seed production technology. Much of the work is carried out jointly with the FMA industry which participates in the program through cost and work sharing arrangements with the AFS. AFS, in addition, is responsible for tree improvement projects on the non-FMA areas; applied research; nursery-greenhouse production and lab support for both its own and cooperative program with the industry.

The value and benefits of tree improvement to practical forestry are substantial, resulting in sizable improvements in yield, wood quality and pest resistance of forest plantings. Therefore, it is necessary to make possible the continuation of tree improvement program in Alberta at an expanded and accelerated level, than is possible under the regular AFS budgets, so that these benefits can be realized for reforestation plantings in Alberta starting at an earlier date.

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 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.

11. Accomplishments in 1986-87:

Contract signed. Work completed by AFS as per items of contract.

12. Goal for 1987-88:

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 1986-87:

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 1987-88:

PYs: Prof.: 0.0

Tech.: 0.0

Total: 0.0

Term/Student: 0.0

O & M: \$200,000 (contract)

16. Signatures:

Investigator

Program Director, Resources

Steve Price

Alberta Agreement Manager

W. V. Hat

Program Director, Development

C. D. Hunt

Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1987-88	1988-89	1989-90
1.	Act as a Scientific Authority for a contract with AFS to undertake IP and wS tree improvement programs. (see 12-1AA)	Continue.	Continue and Terminate.
Total \$:	\$200 K F	\$200 K F	\$ 75 K F

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Wetland Drainage (Alberta)
3. New: Cont.: X 4. No.: NOR-36-02-3
5. Study Leader: G.R. Hillman (see NOR-28-03)
6. Key Words: Wetlands, peatlands, regeneration, forest growth, ditches, groundwater, soil water, hydrology, hydrodynamics, site preparation.
7. Location of Work: Boreal forest in Alberta
8. Problem:

As world demand for wood increases, so does the need for more intensive forest management. It is possible that forest land presently classed as non-productive can be economically treated to increase productivity of existing stagnant forest stands, to enhance forest regeneration and to produce new forests. Carefully draining wetlands to control the depth to groundwater table is one way of achieving this.

The purpose of this study is to obtain a body of knowledge that can be used to provide guidelines for dewatering forest land with the intent of increasing wood production on poorly drained lands in Alberta's boreal forest.

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) study area descriptions e.g., vegetation and peat types, topography, peat depth, chemical and physical properties of peat and groundwater;
- ii) drainage ditch network design and ditch construction methods for controlling groundwater table levels;

- 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 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.

Added Goals:

7. Attend Forest Drainage Workshop in Northern Ontario.

11. Accomplishments in 1986-87:

1. Four transects were established on each study area. On each transect, 1 data logger, 1 ground temperature probe, 2 pressure transducers and 3 13 mm reinforcing rods were installed. A total of 97 5 cm dia. and 6 15 cm dia. groundwater wells were installed on the three experimental areas. Data collection commenced May 1986.
2. The peat survey and sampling program was completed on each transect 270 peat samples and 50 water samples were collected and analyzed.
3. 150 ground vegetation permanent sample plots, 1 m² were installed and measured on the three experimental areas.
4. 55 tree growth permanent sample plots were established and measured on the Wolf Creek treatment and control sites. There was no progress on the other two sites.
5. The annual report required by the Agreement will be ready before the end of March 1987.
6. 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.
7. Attended Forest Drainage Workshop in northern Ontario, October, 1986 and made a presentation on the Alberta Wetland Drainage and Improvement Program

12. Goals for 1987-88:

1. On each experimental area, install instrumentation as required to complete instrumentation networks. Continue program of data collection from these networks.
2. On each experimental area, remeasure ground vegetation permanent sample plots.
3. On the Goose River and McLennan experimental areas, establish and measure tree growth permanent sample plots, on both treatment and control sites.
4. Organize field tour of wetlands drainage experimental areas as part of the wetlands '87 Symposium (Edmonton) and prepare a paper entitled Improving Wetlands for Forestry in Alberta for presentation at the Symposium.
5. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada/Alberta Forest Resource Development Agreement.

6. Collect tree disks from the Athabasca Forest, Goose River, McLennan and Wolf Creek experimental areas, and carry out tree ring and stem analyses on them to obtain pre- and post-drainage growth rates.

13. Publications 1986-87:

NIL

14. 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.

15. Resources 1987-88:

PYs: Prof.: (Hillman, Johnson - all A-base - see NOR-28-03)

Tech.: (Robson, Ali - all A-base - see NOR-28-03)

O & M: \$91,000

Capital:

Contributions:

16. Signatures:



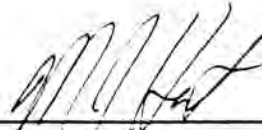
Investigator



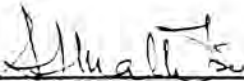
Alberta Agreement Manager



Supervisor



Program Director, Development



Program Director, Protection



Regional Director General

A project to test the feasibility of conducting forest pest impact and damage appraisal studies on forest inventory permanent sample plots has been initiated and a preliminary report nears completion. Plots (26) have been established in young stands to develop a data base for impact and damage appraisal studies in regenerating areas.

Permanent sample plots have been established in six jack pine stands containing dwarf mistletoe infections. The distribution and intensity of mistletoe infections within these stands have been mapped. Many other stands have been examined with no mistletoe encountered. These observations and measurements will be applied to assessing the impact and distribution of mistletoe on jack pine in Alberta.

Technology transfer efforts include the creation of a slide-tape show on the major forest pests of Alberta and many information exchange sessions between the study leader and provincial personnel.

Surveys of the spruce and jack pine budworms (using pheromone traps) have been expanded in Alberta by using agreement funds/personnel. Funds have been committed to the development of an improved pheromone lure for the jack pine budworm.

Diagnostic and advisory services have been provided on request, since the beginning of the project.

10. 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.

11. Goals for 1986-87:

1. To measure (up to 20 more) stands as part of the mountain pine beetle hazard-rating programme and to analyze data from these and previous measurements. The results could 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 was begun by the AFS in the Bow-Crow Forest.
3. To implement the use and assess the operability of damage codes, developed for the AFS (Timber Management Branch), to assess tree conditions when remeasuring permanent sample plots in mature stands. To give instruction in the identification of insect and disease problems, to those doing the remeasurements.

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 assistants during the (86-87) field season.
5. To assist AFS personnel in initiating surveys to detect and appraise population levels of the spruce and jack pine budworms.
6. To maintain contact with forestry personnel in the province and to help them become 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 service as requested.

12. Accomplishments in 1986-87:

1. The field work associated with the mountain pine beetle hazard rating program was completed. The process of summarizing and analyzing data has begun in conjunction with Dr. B. Moody.
2. The dwarf mistletoe detection programme begun by AFS, was completed with the assistance of six man/weeks of field work provided by agreement personnel.
3. The process of assessing insect and disease damage in mature stands, by making observations on AFS permanent sample plots, was begun. A preliminary report of findings is near completion.
4. Twenty-six temporary sample plots were established in regenerating areas (most identified by Research Branch of AFS). Preliminary findings will be summarized into a succinct report.
5. Spruce and jack pine budworm surveys were discussed by AFS and CFS personnel and the number of sample stands was increased Alberta-wide. Agreement personnel conducted this additional sampling, as well as a good deal of the laboratory work (e.g. egg mass counts, L-2 washes).
6. Made several visits to provincial offices to discuss insect and disease problems and ways in which provincial personnel could be involved with surveys and damage assessment.
7. Identified several samples of insect or disease damaged trees.
8. Initiated a project to adapt forest inventory techniques to map the distribution of dwarf mistletoe within jack pine stands in Alberta. Established plots (in six stands) which will be used to assess the impact of mistletoe on jack pine.
9. Detected an endemic population of Dendroctonus punctatus in the Ram Falls area. Conducted field trips to collect specimens of this beetle in response to a request from the Biosystematics Research Institute .

10. Became scientific authority for a contract to develop an improved pheromone lure for the jack pine budworm. The proposal was developed by The Research and Productivity Council (in Fredericton). It was summarized and submitted for review by the Canada-Alberta Joint Forest Research Committee.
11. Participated in various FIDS activities such as ARNEWS plot establishment and pinewood nematode surveys.

13. Goals 1987-88:

1. To continue the mountain pine beetle hazard-rating programme by assisting with the development of a report on the suitability of various systems, and by attempting to adapt a system to the provincial forest inventory.
2. To continue to assess insect and disease damage in mature stands (by using inventory permanent sample plots). Will involve reviewing the first year of the project to determine if modifications are in order.
3. To continue to assess the impact of insect and disease problems in regenerating areas by establishing more temporary plots and remeasuring some of those already established.
4. To continue with spruce and jack pine budworm surveys and to explore avenues to expand said surveys. To incorporate a potential assessment of pest impact into these stands by establishing permanent sample plots at the trap sites.
5. To, possibly, assist Dr. H. Cerezke in expanding his spruce beetle pheromone trapping studies.
6. To, possibly, investigate the distribution of the pine budworms in Alberta.
7. To continue to offer diagnoses and advice on insect and disease problems to provincial personnel and to promote their involvement in forest insect and disease surveys.
8. To continue to study the distribution and impact of dwarf mistletoe on jack pine in Alberta.
9. To continue to investigate the presence and biology of Dendroctonus punctatus.
10. To continue as scientific authority for the jack pine budworm pheromone lure proposal.
11. To explore the feasibility of employing the forest tent caterpillar to control aspen competition in spruce plantations, and to possibly implement field trials with that goal in mind.

12. To participate in a pilot project which attempts to employ satellite imagery to survey forest tent caterpillar defoliation (other participants; R. Hall (CFS), AFS, and Resource Evaluation and Planning Branch (REAP)).

14. Publications 1986-87:

Amirault, P.A.; N.R. Brown. 1986. Cone and seed insects of tamarack, Larix laricina (DuRoi) K. Koch, and attempts to control damage using chemical insecticides. Can. Ent. 118: 589-596.

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 1987-88:

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

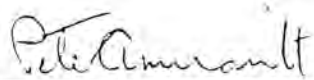
O & M: 6.0

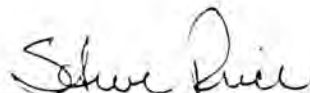
O & M: Contract 61.0

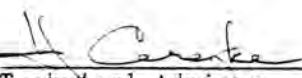
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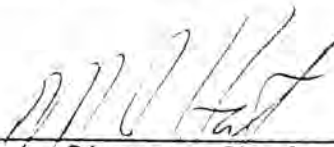
Grants & Contributions:

17. Signatures:


Investigator


Alberta Agreement Manager


Technical Advisor


Program Director, Development


Program Director, Protection


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Managed stand yield tables for lodgepole pine and white spruce
3. New: Cont.: X 4. No.: NOR-36-02-5
5. Study Leader: C.J. Cieszewski
6. Key Words: Seeded or planted stands, second growth, site framework, AAC calculations
7. Location of Work: Alberta
8. Problem Analysis:

With the continued and accelerating forest harvest in Alberta, there are ever increasing areas of second growth coniferous stands that are established through either natural regeneration or by planting. Even casual observations reveal substantial differences between various characteristics of this regeneration--especially in stocking density--compared to regeneration of fire origin. These differences cause related differences in tree growth and stand development, and thus in the length of time required to grow the next merchantable crop, i.e., rotation. Yield tables are available to forecast yields of old growth stands, but no yield tables are available for second growth stands. For these, any quantitative information is rather scarce and even potential data for Alberta is limited to the first 30 years of growth. Therefore, related mensurational research is urgently needed to remedy this situation by developing suitable yield predicting systems for second growth lodgepole pine and white spruce stands.

9. Study Objectives:

To develop a growth and yield prediction system for second growth lodgepole pine and white spruce--i.e., new stands that follow harvest and are being established through either natural regeneration or planting--within an appropriate and available site classification framework. Yield from such a system should provide suitable input for timber management system models (e.g., TIMPLAN) for AAC calculations.

10. 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.

11. Accomplishments in 1986-87:

1. Definition of input-output requirements for LP managed stand growth model is in progress in cooperation with AFS.
2. Main data sources have been identified; data editing, reformation and basic compilation are in progress.
3. Data gaps and problems have been identified and plans are formulated for additional data acquisition.
4. Different site classification systems, mostly variants of SI, are being explored as potential framework for G + Y models. Initiated study on suitable site classification which may include an elevation index as a major factor.
5. Reviewed yield models for old growth LP and initiated review of available managed stand yield models. Submodels for a volume increment and a mortality has been tested and being under further development.

12. Goals for 1987-88:

1. Develop or adapt a suitable site classification, which may include elevation as a factor.
2. Continue the review of available managed stand yield models and assess their potential suitability.
3. Verify data, delete extreme values if warranted. Identify data gaps and develop plans for additional data acquisition.
4. Explore the use of potentially suitable growth hypotheses which enable the model to simulate stand responses to various silviculture treatments.

13. Publications 1986-87:

Nil

14. Environmental Implications:

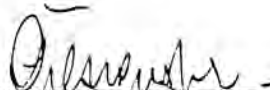
The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

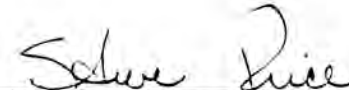
15. Resources 1987-88:

PYs: Prof: 1.0
Term: 1.0
Total: 2.0
Term/Student: 0.0

O & M: \$33,200

16. Signatures:


Investigator


Alberta Agreement Manager


Technical Advisor


Program Director, Development


Program Director, Resources


Regional Director General

MANAGED STAND YIELD TABLES FOR IP 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

Goals	1985-86	1986-87	1987-88	1988-89	1989-90
1.	Undertake R&D designed to develop intensive management yield tables for wS and 1P in Alberta.	Continue	Continue.	Continue.	Continue and terminate.
Total \$:	\$28 K F	\$28 K F	\$33.2 K F	\$28 K F	\$28 K F

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreements
2. Title: Demonstration project (Alberta)
3. New: Cont.: X 4. No.: NOR-36-02-6
5. Study Leader: Margaret Upton (see NOR-10-04)
6. Key Words: Stand release, selective harvesting, stand conversion, spacing, technology transfer
7. Location of Work: Weberville and Jumping Pound, Alberta

8. Problem:

The public and even some resource managers and practising foresters have difficulty in visualizing the relative merits of the different levels and types of forest management practices because good examples in the field are lacking. The ones that exist are scattered throughout the province and are very seldom seen. There is a general public apathy towards forest management because of a lack of understanding the forest management process and its potential benefits. In fact, the lack of information and understanding often results in opposition to progressive (intensive) reforestation and stand management activities, by some segments of society.

9. Study Objectives:

1. Provide a visual concentration of intensive forest management and silviculture projects in an area of high accessibility for both public and professional demonstrational purposes.
2. Apply existing research information and/or develop new scientific research results on various intensive silvicultural practices.
3. Promote the transfer of technology of forest research to practicing foresters in the area of intensive forest management.

10. Goals for 1986-87:Weberville

1. Finalize work plans by May 1, 1986.
2. Undertake demonstration field work as approved.

Jumping Pound

1. Undertake, by contract, a site and vegetation survey of the demonstration area; to be complete by the end of June.
2. Finalize detailed planning of demonstration areas.
3. Undertake demonstration trials as approved.

11. Accomplishments in 1986-87:Weberville

1. The work plan was completed and submitted (AFS).
2. A 5 km hiking trail was cleared manually (AFS).

Treatment 1. w.s. release from mature aspen (30 ha)
 10 ha were released mechanically
 10 ha were released chemically (Velpar-hack and squirt)

Treatment 2. shelterwood cutting (20 ha) (AFS)
 20 ha were logged

Treatment 3. w.s. release from immature aspen (40 ha)
 plot boundaries were marked

Jumping Pound

1. A site and vegetation survey was completed by June (AFS).
2. A detailed plan was submitted (February/87) (AFS)
3. The subsidiary hiking trails (1.7 km) were cleared mechanically.
 - The genetics site (stop 10) (3 ha) was cleared.
 - Three walk-bridges, 8 picnic tables and 3 outhouses were built (AFS).
4. Construction of 8 km of one-way gravel road and 10 parking lots was begun (Alberta Transportation).
5. Logging was completed (9.7 ha) (stop 2b, 4a, 4b) (AFS Spray Lakes).

12. Goals for 1987-88:

1. Participate in revision of letters of Agreement as necessary.

2. Weberville

- a) (Treatment 1) w.s. release from mature aspen (30 ha) (AFS)
 - 10 ha will be released chemically (Round-up - hack and squirt)
 - PSP's will be established.
- b) (Treatment 2) Shelterwood cutting (20 ha) (AFS)
 - PSP's will be established.
- c) (Treatment 3) w.s. release form immature aspen (40 ha) (AFS)
 - 4 ha will be released manually
 - a total of 40 ha will be released chemically using aerial-liquid (Round-up & Velpar), ground-liquid spot application (Round-up and Velpar) and ground-granular application (Pronone).
- d) - signage will be completed (AFS)
- e) Quarterly progress reports will be submitted to the Scientific Authority.

3. Jumping Pound

- a) The welcome shelter will be constructed (AFS).
- b) An antique sawmill will be installed (AFS).
- c) Construction of 8 km of one-way gravel road and 10 parking lots will be completed (Alberta Transportation).
- d) Signage landscaping, and minor interpretive trails will be completed (AFS).
- e) Scarification & reforestation will be completed (stops 2b, 4a, 4b)
- f) The day use area will be constructed (clearing, viewpoint, viewing tubes installed, and facility node installed).
- g) Quarterly progress reports will be submitted to Scientific Authority (AFS).

13. Publications 1986-87:

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 1987-88:

PYs: Prof.: 0.0 (A-Base 0.2)

Tech.:

Total: 0.0

Term/Student:

O & M: \$109,000 (contract with AFS)
6,000 (CFS operating)

Capital: Nil

16. Signatures:

M. Mpton
Investigator

Steve Price
Alberta Agreement Manager

J. J. S. S. S.
Supervisor

M. H. H.
Program Director, Development

[Signature]
Program Director, Resources

[Signature]
Regional Director General

OPERATIONAL PLAN
1985-1989

Goals	1985-86	1986-87	1987-88	1988-89	1989-90
1.	Act as a Scientific authority for a contract to undertake intensive forest management demonstrations in Alberta (see 10-3AA).	Continue.	Continue.	Continue and terminate.	
Total \$:	\$20 K F	\$136 K F	\$109 K F	\$85 K F	
					<u>Total \$350 K F</u>

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1987

1. Project: Development Agreements
2. Title: Forest Economics, Statistics and Timber Supply Modelling (Alberta)
3. New: Cont.: X
4. No.: NOR-36-02-7
5. Study Leader: D.M. Boylen
6. Key Words: Interdisciplinary forest management economics, integrated resource management plans, forest statistics, timber supply models, decision-making models.
7. Location of Work: NoFC, Alberta
8. Study Objectives:
 1. To provide evaluations of the costs of integrated forest management practices, the socio-economic benefits and impacts of forest sector activities.
 2. To develop and interpret forestry statistics at stand provincial and regional levels.
 3. To develop an economic timber supply model for Alberta.
9. 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. (Boylen)
10. Accomplishments in 1986-87:
 1. Continued to act as Scientific Authority for PSP catalogue project. This included extension of the contract to include development of software, provincial PSP conversion and subcontracting of data entry.
 2. Continued to act as Scientific Authority for project entitled Alberta Economic Timber Supply with University of Alberta. Project was reviewed, tendered and supervised.

11. Goals for 1987-88:

1. Completion of contract supervision and liaison for the PSP Catalogue project. Publish and distribute a user's package incorporating the final report, an operator's manual and two diskettes. (Kuhnke)
2. Continue to act as Scientific Authority for Alberta Economic Timber Supply. Prepare with contractor a final report for publication. (Boylen)

12. Publications 1986-87:

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 1987-88:

PYs: Prof.:	0.0 (A-base Boylen, Kuhnke - see NOR-3-01 & NOR-3-02)
Tech.:	0.0
Total:	0.0
Term/Student:	0.0

O & M: \$75,000 (+ roll-over \$11,500)

Capital:

15. Signatures:


Investigator

Program Director, Development


Alberta Agreement Manager


Regional Director General

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.

11. Accomplishments in 1986-87:

1. Continued in an active capacity as Public Information sub-committee co-chairman.
2.
 - a. Assisted in the operational planning, inauguration, and cooperative funding of "Alberta's Managed Forests" mobile exhibit trailer that saw 30,000 visitations from May to September, 1986.
 - b. Developed a 5-panel FRDA information exhibit and presented same at several Alberta exhibitions including the Vegetation Management Project "open-house" Calgary Stampede, AFPA annual meeting, Edmonton Sportsman's Show, and Alta. Science Teacher's annual meeting.
 - c. Participated in the writing, translation, and publication of a four-color exhibit trailer interpretive brochure, roadside and site signs for the Vegetation Management project at Grande Prairie.
 - d. Produced a supply of CFS lapel pins and Canada-Alberta FRDA note pad holders.
 - e. Administered agreement-related contracts including AFA "Trees of Renown" reprint, AFA Speakers Bureau program enhancement and tree seedling production for public distribution.
3. Provided media and public relations services to ongoing Agreement programs such as the Vegetation Management project "open-house" at Grande Prairie, support for a Northern Alberta Forestry Show, promotion and presentation proposal, "Alberta's Managed Forests" exhibit trailer inauguration, a forest sector media tour of central Alberta forest products facilities, attended the AFPA annual meeting with the Canada-Alberta FRDA exhibit, and participated in the organization and presentation of a joint federal-provincial GIS workshop in Winnipeg.

12. Goals for 1987-88:

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 and cooperative funding of mobile forestry exhibit trailer; b) presentation of portable FRDA 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.

13. Publications 1986-87:

Alberta's Managed Forests. 1986. Brochure. Canada-Alberta Forest Resource Development Agreement.

14. 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.

15. Resources 1987-88:

PYs: Prof.: (Newstead, Ascher A-base)

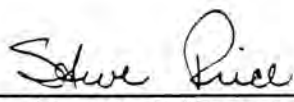
Tech.: (Stewart, H. A-base)


Total:

O & M: \$72,500

16. Signatures:


Investigator


Alberta Agreement Manager


Program-Director, Development


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 3, 1987

1. Project: Development Agreement
2. Title: Boreal forest risk factor modelling
3. New: x Cont. 4. No.: NOR-36-02-9
5. Study leader: T. Singh
6. Key words: Fire hazard, insect and disease incidence, forest growth, timber yield prediction, annual allowable cut, Boreal Forest Region
7. Location of work: Alberta
8. Problem:

Boreal forest is a major forest region of Canada and comprises approximately 82% of the forest land in the country. In Alberta, the boreal tree species are of vital importance in the production of sawlogs and pulpwood. Fires which frequently result in destruction of large areas comprising the future growing stock are a common occurrence. In addition, there is mortality due to insects and diseases. All these risk factors can cause considerable errors in prediction and realization of annual allowable cuts.

Improved techniques are needed to enable realistic projections of future timber supplies. The fire, insect, and disease risk losses must be included in projected expectations as these are predictable for large areas within a given time frame.

A risk factor model for forest yield prediction will be developed based on Alberta data. Because of readily available data, McLeod working circle in the leasehold of Champion Forest Products Ltd. was selected for modelling. Other ecoregions in the boreal forest of Alberta will be accessed subsequently to extend the general scope of the model.

9. Study Objectives:
 1. To model the risk of fire at the stand and forest level to aid management decisions on allowable cut and future timber supplies.

2. To determine the frequency of large-scale insect and disease occurrences and assess their effect on the present and future forest yields.
 3. To test/modify the fire and disease risk factor model and extend its application over other boreal forest ecoregions of Alberta.
10. Goals for 1986-87:
1. Initiate review of literature on current status of risk factor models in forestry.
 2. Examine McLeod Working Circle risk factors and growth and yield data from permanent sample plots of Champion Forest Products Ltd., Hinton, for preliminary work on a conceptual model.
11. Accomplishments in 1986-87:
1. Literature review information is being compiled for preparing a paper entitled "Risk factor modelling in forestry".
 2. A contract to undertake initial modelling work was granted to W.R. Dempster & Associates Ltd. Report describing the preliminary conceptual model, and the input data files, will be made available for future work in adjoining ecoregions of the boreal in Alberta.
12. Goals for 1987-88:
1. Locate/collect risk factor data for disjunct outliers and ecoregions adjoining McLeod Working Circle in Alberta. Data bases to be created will include a) fire risk data, b) insect and disease data, c) site and growth data, and d) any other data essential for extending the application of harvesting scheduling and risk factor model.
 2. Initiate work on computing the probabilities of short- and long-term timber losses in the boreal forest ecoregions in and around McLeod Working Circle, and study the effects of simulated changes in risk factor levels on timber supplies.
 3. Determine depletions/accumulations in growing stock at various risk level probabilities and initiate work on suggesting correction procedures for reconciling discrepancies.
 4. Initiate preparation of risk factor maps for selected ecoregions.
 5. Prepare a review paper on "Risk factor modelling in forestry".
13. Publications 1986-87:
- Nil

14. Environmental Implications:

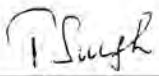
The agreement manager has been directed by management committee to include all pertinent environmental related information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

15. Resources 1987-88:

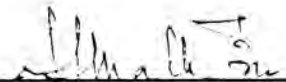
PYs: Prof.: Singh 1.0 (A-Base)
Tech.: 1.0 (A-Base)

O & M: Canada-Alberta Agreement \$25,000

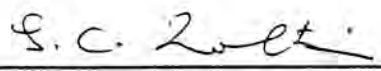
16. Signatures:



Investigator


Alberta Agreement Manager


Program Director, Protection


Program Director Development


Supervisor


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Development Agreements
2. Title: Canada-Saskatchewan Forest Resource Development Agreement
3. New: Cont.: X 4. No.: NOR-36-03
5. Study Leader: R. Fautley

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, Prince Albert and Saskatchewan wide
 8. Study Objectives:
 1. To manage and co-ordinate 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 the general public.
 5. To facilitate the maximization of funding available to the forestry sector in Saskatchewan from other funding agencies.
9. 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, co-ordinate and host a two-day forest soils field workshop in Saskatchewan in late summer, 1986;
 - plan, co-ordinate and implement a silvicultural equipment field trial for summer, 1986;
 - liaise and co-ordinate with the other administrative and research activities in the District and regional office (Supervisor: F02, Renewal and Intensive Management Co-ordinator (RIM); 2 EG-ESS-06's, RIM specialists).
 2. Agreement Co-ordination 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 co-ordinate with other federal agencies having impacts in regional development including DRIE (NEDSA), INAC (Indian forestry, job creation), CEIC (Jobs Strategy, training), FEDC (ERDA co-ordination), PFRA/PWC (construction services);
- direct, co-ordinate and consult with sub-committees of the PMC including Nursery Development, Public Information, GIS;
- co-ordinate 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;
- co-ordinate 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;
- co-ordinate and liaise with agents and contractors responsible for design, construction and monitoring of Nursery Development including PWC and PFRA (FO2 RIM Co-ordinator).

4. Geographic Information System:

- co-ordinate 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 co-ordinate 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 co-ordination 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 co-ordination, advice, liaison and monitoring on federally-funded job development projects in forestry in 1986-87.

10. Accomplishments for 1986-87:

1. Forest Renewal/Growth Enhancement and Stand Tending:

- solicited, developed and discussed 40 forestry project proposals from forest industry, Indian Bands and private woodlot owners;
- developed and processed for approval multi-year operational plans for Meadow Lake Sawmill, L&M Wood Products, Saskatchewan Forest Products Corporation and Weyerhaeuser Canada Ltd.;
- reviewed, amended and processed for approval 25 Project Authorization Forms (PAF's) for forestry projects under the FRDA in conformance to the annual work plan;
- planned, implemented, monitored and audited 25 federal direct delivery forestry projects;
- reviewed and monitored five provincially-delivered cost-shared projects (\$1.3 MM) which were undertaken on a wide range of locations scattered across the northern portion of the province;
- planned, co-ordinated and hosted a successful two-day soils course/field workshop in and around Prince Albert hosting 30 participants;

- initiated discussion with Weyerhaeuser Canada on the topic of site classification and mapping in co-operation with the Saskatchewan Institute of Pedology;
- planned, co-ordinated and implemented a silvicultural field trial of the Delta Disc Trencher and the Donaren Disc Trencher involving the client agencies of the Province of Saskatchewan, Weyerhaeuser Canada and Saskatchewan Forest Products Corp; hosted a 1/2-day field tour of trial activities for the Regional Reforestation Technical Committee and evening supplier seminar at Candle Lake; initiated shear blade site preparation trial with Saskatchewan Forest Products Corporation; developed interim report on summer 1986 mechanical equipment trial; provided advice and assistance to clients involved in mechanical site preparation;
- co-ordinated with administrative and R&D activities in District and regional office through jointly developing projects to address the problems associated with site preparation of 'wet' sites; acquiring and loading statistical software on IBM-AT and analyzing equipment trial results; jointly implementing a project to develop the CFS-Lizzard Lake Plantation into a Demonstration site.

2. Agreement Co-ordination and Management:

- represented the CFS at 12 Program Management Committee meetings to plan, review, administer and monitor over 50 federal direct projects, 14 cost-shared projects and 10 provincial direct projects;
- ensured consultation and liaison with other federal agencies involved in regional development through meetings with representatives from DRIE, INAC, PFRA, CEIC, Agriculture Canada and FEDC, as well as other groups seeking involvement in agreement activities including AMNSIS, National Indian Forestry Institute, Northern Institute of Technology, National Research Council, New Careers Corporation and other non-governmental agencies;
 - a) provided representation on forestry committee of the Tripartite Negotiating Committee involving the federal and provincial governments and the Association of Metis and Non-Status Indians of Saskatchewan (AMNSIS),
 - b) with the federal department DRIE and the provincial Social Services Department, jointly funded the provincial crown corporation New Careers Corp. (NCC) to undertake a winter forest stand improvement job creation program;
- directed and co-ordinated activities of the following sub-committees--Public Information (NOR-36-03-7) Nursery Development (Goal 3), GIS (Goal 4) and Evaluation (Goal 5);

- developed and distributed quarterly reports and work plans to the agreement Directorate and undertook two formal meetings with the Program Management Committee and the Directorate (May and November), co-ordinated and undertook two meetings of the joint committee on forest research (MOU) and negotiated and re-drafted a new MOU for joint forest research;
 - arranged meetings, site visits and presentations under agreement program with representatives of industry, Indian Bands, the Province and other governmental and non-governmental agencies;
 - attendance at CIF Annual Meeting in Victoria; attendance at Silvilog in Petawawa; attendance at UIFRO Working Group Meeting on Silviculture in Grande Prairie; attendance at GIS Workshop in Winnipeg; attendance at Stand Tending Workshop in Winnipeg; participating in NRC - Biotechnology Workshop and field tour of Melfort Research Station; providing computer training for all staff; have endeavoured to facilitate technology transfer and training through all FRDA programs and projects.
3. Nursery Development:
- completed construction of the Big River Forest Nursery Irrigation Pumphouse and Cold Storage and Packing Facility (\$2.5 MM) and the Prince Albert Forest Nursery Irrigation Pumphouse.
4. Geographic Information System:
- completed the DPRR Functional Requirement Study Request for Proposals, evaluation of proposals, benchmarking vendors, identification of recommended vendor, negotiated final acquisition through SSC of software and hardware and completed delivery of a GIS and acceptance testing;
 - provided Saskatchewan liaison for a GIS Workshop sponsored by Manitoba, Saskatchewan and Alberta and the CFS, held in Winnipeg, February 16-19, 1987.
5. Evaluation:
- developed a framework and draft Request for Proposals terms of reference for the completion of an agreement evaluation of the FRDA in consultation with DPRR, CFS (HQ and regional office) and the agreement Directorate;
 - provided input into regional MIS as requested.
6. Administration:
- directed staff and co-ordinated functional direction from NoFC through monthly staff meetings with guest speakers and special presentations; arranging for attendance by staff at Program Review; hosting Regional Management Committee Meeting and full staff meeting (May, 1986); instituted monthly financial and

project progress reporting system and by developing individual study statements and program objectives for all staff;

- assured full signing (Sec. 27) authority for agreement financial responsibilities and arranged for the required training of administrative and clerical personnel to successfully complete responsibilities; initiated word processing in Prince Albert office;
- received, processed and paid over 60 PAF's/Progress Claims during 1986-87 in compliance with the regulations contained in the Procedures Manual;
- provided co-ordination for renovations at Candle Lake Cabins (roof and sewage system); rationalization of office computer system including new IBM-AT, installation of Data Pac, office renovations (addition of two offices).

7. Job Creation:

- co-ordinated the CFS technical monitoring of over \$1.2 MM in CEIC funded Job Development forestry projects in Saskatchewan.

11. Goals for 1987-88:

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, revised and updated, 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 with the work plan;
- plan, implement (directly or indirectly), monitor and audit federally delivered forestry projects;
- review and monitor provincially implemented cost-shared projects in Program 1 and 2;
- plan, co-ordinate and implement a silvicultural equipment field trial for summer 1987, the second phase/treatment of areas shear bladed in winter 1986; arrange for the planting and monitoring of trial areas treated in summer 1986 in co-operation with GLFC;
- produce report on silviculture equipment trial undertaken in 1986 in co-operation with GLFC and NoFC entitled "Field trials of Donaren 180, TTS Delta Powered Disc Trenchers in the Boreal Mixedwoods of Saskatchewan";

- liaise and co-ordinate with the other administrative and research activities in the District and Regional office (Supervisor: F02, Renewal and Intensive Management Co-ordinator (RIM); 2 EG-ESS-06's, RIM specialists).
2. Agreement Co-ordination 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 co-ordinate with other federal agencies having impacts in regional development including DRIE (NEDSA), INAC (Indian forestry, job creation), CEIC (Jobs Strategy, training), FEDC (ERDA co-ordination), PFRA/PWC (construction services);
 - direct, co-ordinate and consult with sub-committee of the PMC including Nursery Development, Public Information, GIS and Evaluation;
 - co-ordinate 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;
 - co-ordinate 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 and final acceptance of the nursery capital projects--Big River Pumphouse and Cold Storage Facility and Prince Albert Pumphouse.
4. Geographic Information System:
- ensure completion and final acceptance of the federally purchased GIS.
5. Evaluation:
- submit for review to the provincial and federal Intergovernmental Affairs and Federal Co-ordinator offices, the evaluation report framework and review and approval by the Agreement Directorate.
6. Administration:
- direct District staff and co-ordinate 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 PAF's/Progress Claims for agreement projects;
- provide co-ordination and direction on 11 other administrative matters related to a District Office including accommodation, renovation, camps, vehicles, computerization, equipment, inventory and stores.

7. Job Creation:

- continue to provide co-ordination, advice, liaison and monitoring on federally funded job development projects in forestry in 1987-88.

12. Publications:

- Draft Report of TTS Delta Disc Trencher and Donaren Disc Trencher Trial, Saskatchewan 1986;
- Montreal Lake Indian Band, Business Management Plan for on-reserve and off-reserve Forest Resources, 1986 (Silviba Services Ltd.);
- Birch Portage Reserve #184A, 5-Year Forest Development/Management Plan (Silviba Services Ltd.);
- English River Indian Band - Inventory and Forest Management Plan (International Forestsearch) 1986;
- Waterhen Lake Indian Band - Forestry Sector Development Inventory and Forest Management Plan (International Forestsearch) 1986;
- Mixedwood Section in an Ecological Perspective. Kabzems, A.A.L. Kosowan and W.C. Harris, 2nd Edition 1986;
- Statement of Functional Requirements for a Geographic Information System for SPRR; Request for Proposals for GIS for SPRR and GIS Evaluation for SPRR (Tomlinson Associates) 1986;
- Evaluation Framework of Can.-Sask. F.R.D.A., 1986;
- 1986-87 Workplan and quarterly updates and quarterly reports of F.R.D.A. progress;
- 1985-86 Can.-Sask. F.R.D.A. Annual Report;
- 1986-87 M.O.U. Report of Activities to Date, November 30, 1986.

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:

PY's Prof.:	Faucley (A-base)	1.0
	Newman	1.0
Tech.:	Sidders	1.0
	Johnston	1.0
Support:	Urquhart	1.0
	Taylor	1.0
	Bacon	1.0
Total:		7.0

Contracts/O&M: \$ 506,100.00 + \$6,000.00 A-base

Capital: 20,000.00

G&C: 1,420,000.00

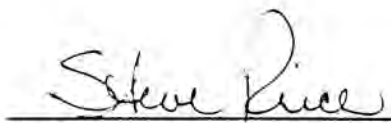
15. Signatures:



 District Manager



 Program Director, Development



 Senior Implementation Officer



 Regional Director General

Canada-Saskatchewan Forest Resource

Development Agreement

1987-88

PY's	O&M	A-Base	Agr. Contracts	G&C Capital
NOR-36-03: Development Agreement				
2.0	5.0	\$178,100.00	\$1,239,000.00	\$20,000.00
*Includes \$6.000. A-base				
NOR-36-03-1: Forest Mensuration				
-	1.1	15,500.00	106,000.00	-
NOR-36-03-2: Silviculture Investigations				
-	1.3	75,000.00	65,000.00	-
NOR-36-03-3: Nursery Investigations				
-	0.1	42,000.00	-	-
NOR-36-03-4: Fire Management				
-	1.1	57,500.00	-	-
NOR-36-03-5: Stem Injection				
-	0.2	4,000.00	-	-
NOR-36-03-6: Vegetation Management				
-	0.2	2,000.00	-	-
NOR-36-03-7: Public Information				
-	0.8	40,000.00	10,000.00	-
NOR-36-03-8: Insects and Disease				
1.5	0.2	71,000.00	-	-
NOR-36-03-9: Forest Economics				
-	-	27,000.00	-	-
<hr/> (Federal) Total				
3.5	10.0	\$512,100.00	\$1,420,000.00	\$20,000.00

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 co-ordination relating to growth and yield research project to be initiated by Prince Albert Pulpwood.
10. Accomplishments in 1986-87:
1. Saskatchewan Forest Mensurationist hired 19 November, 1986. Orientation in Saskatchewan and at NoFC has been completed and contact has been initiated with provincial, regional and private agencies engaged in growth and yield, forest inventory and forest growth projection projects.
 2. Completed a review of existing data sets within the CFS, Saskatchewan, DPRR and Weyerhaeuser Canada Ltd. (Papco), with applicability to the development of further growth and yield programs in Saskatchewan. Recommendations were made for the establishment of additional plots in order to provide a comprehensive data-set applicable to all species types and management regimes in Saskatchewan.
 3. Initiated discussions with DPRR and Weyerhaeuser Canada Ltd. in order to identify the sources and magnitudes of suspected bias in provincial inventory yield data.
 4. Held initial discussions with DPRR in order to determine the schedule of events necessary to incorporate managed stand yields into timber supply projections.
 5. Identification of forest cover types in which past harvesting practices are suspected of adversely affecting average stand volumes commenced.
 6. Provided advice and technical services to Weyerhaeuser Canada Ltd. relating to the establishment of growth and yield projects which will be undertaken in order to provide required information for their High Yield Forestry program.
 7. Completed technical review of the inventory portion of several management plans for Indian Reserve lands funded under FRDA.
 8. Provided technical advice to other federal, provincial and industrial agencies on geographic information systems. Acted as CFS-Saskatchewan co-ordinator for GIS workshop in Winnipeg.
 9. Acted as CFS-Saskatchewan representative to the Prairie Region growth and yield co-operative.

11. Goals for 1987-88:

1. Maintain liaison with Project Leader, Stand Productivity and Forest Inventory, other CFS regional centres and various provincial and industrial agencies in order to provide technology transfer information.
2. Initiate capture of data in areas identified as having weaknesses in current information so as to provide a comprehensive data-set for managed stand yield development work.
3. Continue to provide advice and technical services to Weyerhaeuser Canada Ltd. in their development of the required database for their High Yield Forestry program. Such work is expected to be in the areas of site productivity classification and managed stand growth and yield. Provide similar services to other agencies when requested subject to time availability.
4. Continue work to allow the incorporation of managed stand yields into timber supply projections. Examine available growth simulators for compatibility with proposed timber harvest schedule models and compare yield outputs with available permanent sample plot data.
5. Initiate the establishment of guidelines to determine product type and maximum yield from specific stands based on correlation with stand density and site.
6. In co-operation with DPRR and Weyerhaeuser Canada Ltd., develop methodology to remove the identified sources of bias in provincial inventory yield data.
7. Commence project to determine effects of past harvesting on average volumes and yields of selected forest cover types.
8. Continue to provide liaison with GIS special interest groups and the Prairie Growth and Yield co-operative.
9. Initiate development of a micro-computer based data bank to summarize projects carried out under the terms of the agreements in Alberta, Saskatchewan and Manitoba, in order to provide for efficient dissemination of results to interested clients.

12. Publications for 1986-87:

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 1987-88:

PY's: Prof.:	(Shortreid)	1.0
	(Bella - A Base)	
Tech.:	Barth	0.1
Term/Student		0.0
Total:		1.1

O&M: \$ 15,500.00

Contract: Nil

Capital: Nil


G&C: 106,000.00 (Weyerhaeuser Canada - G&Y Program)

15. Signatures:


Investigator


Supervisor


District Manager


Program Director, Resources


Program Director, Development


Regional Director General

9. 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 established by Silviculture Branch.
3. To provide advice and services and co-ordinating role with respect to acquisition and interpretation of large-scale aerial photography for coniferous regeneration assessment in co-operation 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 co-ordinate 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 co-ordinate 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.

10. Accomplishments 1986/87:

1. Review of DPRR first and fifth plantation assessment forms has been completed and preliminary discussions held with appropriate DPRR staff regarding content and format of a third level assessment form to be applied 10-20 years following initial stand establishment.
2. Analysis of a data-set pertaining to a 10-year-old plantation established by Silviculture Section has been completed and made available to DPRR.

3. A contract was let to Dendron Resource Surveys Inc., of Ottawa, by Weyerhaeuser Canada Inc. (funded through FRDA Direct Delivery) to evaluate Large Scale Aerial photography for conifer regeneration assessment. The first phase of the contract has been completed.

Assessment areas have been located and flown for stratification photography. Stratification of the area has been completed and flight lines for 1987 large scale photography have been located.

4. A contract was let to Industrial Forestry Services of Prince George, B.C., to undertake a review of provincial stock handling procedures, planting quality, planting quality assessment procedures and the provincial planting contract. The contract has been completed and a report submitted to the Saskatchewan District Office.
 5. Field sites and treatments have been selected for a trial to address stand establishment problems on high water table, brushy, problem access sites. V-blade use patterns were not pursued as V-blade equipment development was not completed.
 6. See Study Statement NOR-36-03-3. Activity moved to Nursery program.
 7. A workshop on jack pine and white spruce spacing and thinning was conducted in Winnipeg, Manitoba, in October 1986. Notification and program information was sent to all client groups with relevant interest in the subject. Six participants attended from Saskatchewan representing two levels of government and two of the major industrial companies.
 8. Developed, initiated and supervised a contract which established a 5.3 kilometre, self-guiding, demonstration trail, northeast of Candle Lake. The trail provides demonstrations of eight silvicultural treatments as well as experiments in growth and yield and examples of natural forest cover types.
 9. A literature review on direct seeding of white spruce (historical and current perspectives) was completed and submitted to DPRR. Following review and discussion of the report it has been determined that direct seeding would not be appropriate for the site types contemplated. Methodologies for these sites will be considered under (5) above.
11. Goals for 1987/88:

1. Continue discussions on format and content of third-level plantation assessment form to be applied subsequent to fifth year assessments. Conduct field test of form if necessary.
2. Continue to acquire and analyze provincial data-sets relevant to plantation establishments and/or stock type trials.
3. Continue to provide advice and services, project co-ordination and funding for large scale aerial photography project until contract completion, fall 1987.

4. Initiate field trial of recommended stand establishment methodology for high-water, problem access sites.
5. Assist in promotion and co-ordination of Saskatchewan forestry participation in a workshop on releasing white spruce from aspen overstory.
6. Continue to develop self-guiding demonstration trail by establishing signage and writing a pamphlet relevant to trail content. Additional areas for public awareness trails will be investigated.
7. Develop and initiate follow-up actions relevant to recommendations of stock handling report.

12. Publication and Reports:

Barth, G.R. 1986. Direct seeding of white spruce *Picea glauca* (Moench) Voss: A critical review of the inherent requirements and limitations of this reforestation option. Can. For. Serv.; Sask. District Office. File Report. 52 p.

Moss, I.S. 1986. Review of planting, stock handling procedures, standards, quality and quality assessment methods employed by the Province of Saskatchewan. Industrial Forestry Service Inc.; Prince George, B.C. Contract Report.

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 1987/88:

PY's: Prof. (Prince Albert): 0.9 (Gardner 0.7; Lee 0.2)

(Hall A-Base)

Tech. - Barth 0.4

Term/Student: 0.0

Total: 1.3

O&M: \$38,000.00

Contract: 37,000.00 (12,000. demonstration trails; 25,000. silviculture trial)

G&C: 40,000.00 - WCL--LSP
25,000.00 - WCL--Site Classification


15. Signatures:



Investigator


Investigator


Investigator


District Manager


Program Director, Resources


Program Director, Development


Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Forestry Development Agreements
2. Title: Forest Nursery Investigations (Saskatchewan)
3. New: Cont.: X 4. No.: NOR-36-03-3
5. Study Leaders: A. Gardner, E. Harvey
6. Key Words: Forest nurseries, technology transfer, seedlot quality, lifting dates, storage temperatures
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To improve quality and utilization of seedlots used for nursery sowing operations.
 2. To determine optimum lifting dates and storage temperatures for spring lifted nursery stock.
 3. To contribute, through technology transfer and research projects, to the continued development of nursery stock production operations and procedures with special reference to cultural regimes, stock physiology and nursery pest management.
9. Goals for 1986-87:
 1. Initiate and supervise a contract to evaluate and report on current nursery procedures for acquiring, processing and testing of forest tree seed intended for nursery sowing operations and to make recommendation on components of a forest nursery seed program.
 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.

10. Accomplishments in 1986-87:

1. A contract was awarded to Woodland Resources Inc. of Edmonton, Alberta, entitled: "Review of white spruce and jack pine seed collection, processing and utilization procedures used in Saskatchewan". The final report was submitted January 31, 1987.
2. Preliminary discussion and a draft terms of reference have been completed for a contract to review and make recommendations on nursery seedling growth regimes and seedling lifting dates and storage temperatures.

11. Goals for 1987-88:

To initiate and supervise a contract to evaluate and report on current nursery stock production procedures and related cultural treatments.

12. Publications and Reports:

1. Woodland Resources Services Inc. 1987. Review of white spruce and jack pine seed collection processing and utilization procedures used in Saskatchewan. (Contract Report.)

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:

PY's: Prof. Prince Albert 0.1

(Harvey - A-Base)

Tech. 0.0

Term/Student: 0.0


Total: 0.1

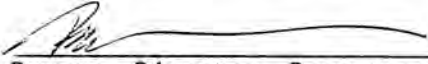
O&M: \$ 2,000.00

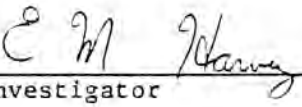
Contract: 40,000.00

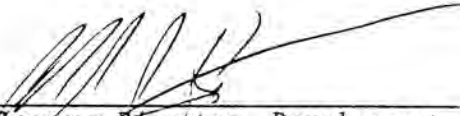
Capital: Nil

15. Signatures:


Investigator


Program Director, Resources


Investigator


Program Director, Development


District Manager


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Forestry Development Agreements
2. Title: Fire Management (Saskatchewan)
3. New: Cont.: X
4. No.: NOR-36-03-4
5. Study Leader: W.J. De Groot
6. Key Words: Fire management, technology transfer, development, training, intelligence systems, information data base
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To provide fire management information to Saskatchewan through research and technology transfer that will assist in the development and advancement of fire management in the province.
 2. To promote the continued fire research effort in Saskatchewan by participating in problem/need identification and analysis with provincial personnel and NoFC fire research staff to aid in the development of a comprehensive fire management program for the province.
9. 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 personal 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 from 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 the efficiency and effectiveness.
7. Complete the Canadian Forest Fire Behavior 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.

Added Goals:

12. Initiate a process to record fire report data.
13. Supervise an agreement to support a study for a Climate Service Centre in Saskatchewan.
14. Initiate a technical newsletter dealing with research products and their applications.
15. Act as project officer for cost-shared projects and capital purchases.

10. Accomplishments in 1986-87:

1. Maintained consultations with the Fire Research Group on all fire management activities in Saskatchewan being done under the agreement.
2. a) Attended a three-day Advanced Fire Behavior Course at Hinton, Alberta, in April.
b) Assisted on the Big Fish Lake experimental burning project in northern Alberta for three weeks in July.
c) Attended a three-day fire weather course at Prince Albert in January.
d) Attended a two-week Fire and Resource Management for Line Officers and Program Managers course held in Marana, Arizona, during February and March.

3. a) Attended the Central Region Fire Weather Committee (CRFWC) technical subcommittee meeting at Winnipeg in April, and the 12th Annual CRFWC meeting in December in Prince Albert.
 - b) Attended the annual general meeting of the Saskatchewan Climate Advisory Committee (SCAC) at Saskatoon in October, and the SCAC workshop on Computer Applications of Climate Data held the same day.
 - c) Assisted in organizing, and attended, the Regional Technical Subcommittee on Fire Research meeting held at Edmonton in November.
 - d) Presented a one-day workshop on the Canadian Forest Fire Danger Rating System (CFFDRS) at a seminar on New Concepts in Forest Fire Management held in Prince Albert in April.
 - e) Presented a paper entitled 'Wildfire behavior on the Canadian Shield: a case study of the 1980 Chachukew fire, east-central Saskatchewan' at the Third CRFWC Scientific and Technical Seminar at Winnipeg in April, and at the seminar on New Concepts in Forest Fire Management in Prince Albert.
 - f) Presented a short course on use of the Fire Growth Calculator to the Regional Field Supervisors (duty-officers) in August in Prince Albert.
 - g) Acted as reviewer on the following manuscripts:
 - Development of forest regeneration on burned, planted, and seeded clear-cut areas in central Saskatchewan (NoFC Info. Rep.) by Z. Chrosciewicz;
 - LAPFBP and LAPFWI: two BASIC computer programs to evaluate fire danger and assess potential fire behavior (FM Note) by R.S. McAlpine.
 - h) Assisted in providing information during public displays at local exhibitions.
 - i) Instructed at a three-day course on Fire Behavior Manitoba during February.
4. Supervised the completion of a contract with the Atmospheric Environment Service to record daily fire weather observations from the synoptic network in Saskatchewan (during the period 1976-86) for use as a permanent data base.
 5. Responsibility for final evaluation and subsequent modification to the Saskatchewan fire weather station network were assumed by the Province.

6. The study of the provincial detection system was deferred one year until the required data has been stored on computer.
7. The poster with photographic examples of Canadian Forest Fire Behavior Prediction System fuel types in Saskatchewan was completed.
8.
 - a) Participated on the Saskatchewan Prescribed Burn Committee which met in October and December to develop a provincial prescribed burn manual.
 - b) Provided classroom and field instruction on fuel sampling methods to various provincial staff, and assisted in field sampling.
 - c) Supplied for the Province, and maintained, the portable remote fire weather station for the proposed wildfire burn in the Fort a la Corne Forest.
 - d) Participated during numerous field trips with provincial personnel to the three proposed burn sites for 1987.
9.
 - a) Attended the Intermountain Fire Council annual meeting and symposium on 'Fire management in the rural/urban interface' held in Salt Lake City in October.
 - b) Continued building a file of information material being used by other fire agencies on fire protection in the rural/forest interface that could be used for a similar booklet in Saskatchewan.
10.
 - a) Provided partial funding for three provincial staff to attend the Regional Technical Subcommittee on Fire Research meeting.
 - b) Provided partial funding for 60 regional and district staff members with the provincial government to attend a three-day course on fire weather and a two-day course on the CFFDRS in Prince Albert.
11. Organized and conducted three 2-day workshops on the CFFDRS with other CFS staff in Prince Albert during January and February.
12. Initiated a process to record provincial fire report information for use in a permanent data base.
13. Supervised an agreement with the Saskatchewan Research Council and Saskatchewan Climate Advisory Committee for the CFS to partially fund a feasibility study (done under contract) for a Climate Service Centre in Saskatchewan.
14. Initiated the 'Saskatchewan Forest Fire Notes' newsletter and completed the first issue.

15. Served as project officer for the acquisition of six automatic, remote fire weather stations for the Province (capital purchases) and during the following cost-shared projects:
 - i) Meteorologist Contract (to September, 1986).
 - ii) Contract to evaluate the use of weather radar for forest fire management in Saskatchewan.
 - iii) Contract to provide three fire weather courses for Provincial staff in Prince Albert.
 - iv) Contract to record and evaluate historical lightning data.
 - v) Meteorologist Contract (starting January, 1987).
11. Goals for 1987-88:
 1. Provide information transfer through communication with Fire Research staff, the 'Saskatchewan Forest Fire Notes' technical newsletter, participation on committees, training workshops, seminars, field work, and personal contact.
 2. Organize and conduct a local workshop/seminar dealing with a specific fire management topic.
 3. Develop fire management expertise through courses and field experience.
 4. Initiate and supervise a contract to evaluate the efficiency of the Saskatchewan detection system.
 5. Continue development of an information package for rural homeowners on protecting property from fire in the rural/forest interface.
 6. Initiate a pilot study of fuel-type mapping in Saskatchewan.
 7. Complete the data base containing the fire weather observations from the Saskatchewan fire weather station network for the period 1978-82.
 8. Complete the data base containing individual fire report information for 1981-86, and establish a procedure for new records to be annually transferred to the data base.
 9. Continue to provide provincial personnel the opportunity to attend training courses and seminars on various aspects of fire management.
 10. Continue to act as project officer on cost-shared projects and capital purchases.

12. Publications:

De Groot, W.J.; Alexander, M.E. 1986. Wildfire behavior on the Canadian Shield: a case study of the 1980 Chachukew fire, east-central Saskatchewan. Pages 23-45. IN Proceedings of the Third Central Region Fire Weather Committee scientific and technical seminar (April 3, Winnipeg, Man.), M.E. Alexander (compiler and ed.). Government of Canada, Canadian Forestry Service, Northern Forestry Centre, Edmonton, Alberta. Study NOR-5-05.

De Groot, W.J. 1987a. Examples of Canadian Forest Fire Behavior Prediction System Fuel Types in Saskatchewan. Government of Canada, Canadian Forestry Service, Prince Albert, Saskatchewan. (Poster),

De Groot, W.J. 1987b. Technology Transfer Notes: Forest Fire Management in Saskatchewan. Government of Canada, Canadian Forestry Service, Prince Albert, Saskatchewan. 1(1) 4 p.

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.

This study does not involve any chemical or biological agents. The Province may initiate three prescribed burns in 1987. Any CFS assistance will be in the form of fire behavior prediction, on-site weather monitoring, and documentation. The Province may request to use cost-shared funds for air-tanker/helicopter time during the burns; otherwise, there will not be a PAF associated with any prescribed burns.

14. Resources:

PY's: Prof. (De Groot) 1.0

A-base - Lee

A-base - Ogilvie

Tech. (Barth) 0.1


Total 1.1

O&M: \$32,500.00


Contract: 25,000.00

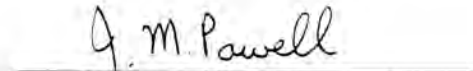
Capital: Nil

15. Signatures:



Investigator - W.J. De Groot


Technical Advisor


Investigator - G.R. Barth


Program Director, Extension


Supervisor


Program Director, Development


District Manager


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: Northern Forestry Centre

Date: February 4, 1987

1. Project: Forestry Development Agreement
2. Title: Stem Injection of Residual Aspen
3. New: Cont.: X
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 (Weyerhaeuser Limit Area)
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 herbicides 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 1986-87:
 1. Conduct review of literature and past operational and research activities with respect to control of aspen suckering.
 2. Examine available chemicals and implements for individual stem control techniques and select appropriate combination.
 3. Select appropriate reserach 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.

10. Accomplishments 1986-87:

1. Compiled partial literature source relative to aspen sucker control.
2. Acquired appropriate chemical (glyphosate) and application equipment (punch hammer and spot-gun applicator) for single stem aspen control.
3. Established replicated trial consisting of control, manual girdle and chemical stem control on residual mature aspen on 9 hectare site near Clearsand Lake. Activities included plot establishment, pre-treatment assessment and treatment application.

11. Goals for 1987-88:

1. Continue to accumulate literature on aspen management techniques including sucker control and sucker density manipulation.
2. Conduct first-year post-treatment assessment relating to aspen sucker density and developing vegetation.
3. Prepare file report pertaining to preliminary efficacy of treatments and submit to ECW (Western) Silviculture Group and to Project Leader NOR-10-09.

12. Publications:

None

13. Environmental Implications:

The agreement manager has been directed by Management Committee to include all pertinent 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:

PY's: Prof. (Prince Albert) 0.1

Tech. (Barth) 0.1

Term/Student 0.0

Total 0.2

O&M: \$4,000.00

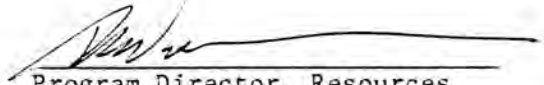
Contract: Nil

Capital: Nil

15. Signatures:



Investigator



Program Director, Resources



District Manager



Program Director, Development



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Forestry Development Agreement
2. Title: Crop tree and vegetation response to various vegetation control treatments in boreal/mixedwood sites in Saskatchewan.
3. New: Cont.: X 4. No.: NOR-36-03-6
5. Study Leader: A. Gardner
6. Key Words: Weyerhaeuser Canada, vegetation response, crop tree response, efficacy, crop tolerance, chemical and non-chemical vegetation.
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. To provide advice to Weyerhaeuser Canada in an experimental vegetation control project involving chemical and non-chemical treatments on mixedwood forest sites in Saskatchewan with respect to assessing crop tree and vegetation response, efficacy and crop tolerance.
 2. To contribute findings to Regional Vegetation Control Project (NOR-10-09) and to ECW Silvicultural Abstracts.
 3. To provide liaison and technology transfer advice and services to other government and industrial clients in Saskatchewan on forest vegetation management options as required.
9. Goals for 1986-87:
 1. Conduct a review of appropriate literature and research protocols for vegetation and crop-tree assessments and select
 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.

10. Accomplishments 1986-87:

1. to 4. The Prince Albert Pulp Company was acquired by Weyerhaeuser Canada Ltd., and the proposed forest vegetation management project developed by the Company did not proceed. Use of chemicals and other treatments in forest management operations are currently under internal review.
5. Status of herbicide use and other vegetation management treatments in Saskatchewan have been communicated to the project leader NOR-10-09 through ongoing information exchange.
6. Served as recording secretary to the annual meeting of Expert Committee on Weeds (Western) Silviculture Section. Compiled minutes and distributed to group membership (+ 70 members). Served as Forestry Representative to organization committee for 1986 annual ECW meeting held in Saskatoon.
7. Provided ongoing, general advice and services, information exchange to government and industry clients as required.

11. Goals for 1987-88:

1. Continue to provide advice and services, information exchange on forest vegetation management practices and statistics as required to other government and industrial clients.
2. Provide specific advice and technical information relating to experimental design, vegetation and crop-tree assessments, treatment applications as required for potential vegetation management projects on Weyerhaeuser lease area. CFS component of project would be reviewed by Environmental Screening Committee and personnel of Vegetation Management Project at NoFC.
3. Maintain liaison with Vegetation Management Project at NoFC on status of forest vegetation management activities in Saskatchewan.
4. Serve as recording secretary to the ECW Silviculture Group at the Annual Meeting, Victoria, B.C.

12. Publications:

None

13. Environmental Implications:

The agreement manager has been directed by Management Committee to include all pertinent environmental 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:


PY's: Prof. (Prince Albert)	0.1
Prof. (A-base - Brace)	
Tech. (Barth)	0.1
Term/Student	0.0
Total	0.2

O&M: \$2,000.00


Contract: Nil

Capital: Nil

15. Signatures:


Investigator


District Manager


Program Director, Resources


Program Director, Development


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Forestry Development Agreement
2. Title: Forestry Public Information
3. New: Cont.: X 4. No.: NOR-36-03-7
5. Study Leaders: C.A. Lee, R.G. Newstead
6. Key Words: Communications, public information, public relations, press releases, media, ceremonies, liaison.
7. Location of Work: Saskatchewan
8. Study Objectives:
 1. Co-ordinate 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 co-ordinate the agreement-related media activities for the CFS in Saskatchewan.
9. Goals for 1986-87:
 1. Co-ordinate CFS and FRDA public information programming and activities within Saskatchewan.
 2. Co-chairman of the Canada-Saskatchewan Forest Resource Development Agreement public information subcommittee.
 3. Develop with provincial consultation, 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 co-ordinate 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. Provide input into the development of a CFS National Advertising Campaign by reviewing proposals and liaison with NoFC (Technology Transfer and Information) and CFS HQ.
 9. Co-ordinate (with NoFC, NOR-33-02/03/04) and conduct the 1986-87 public information exhibit schedule for Saskatchewan including National Forest Week, Pioneer Days (Saskatoon), Prince Albert Exhibition, Buffalo Days (Regina).
 10. Maintain liaison between CFS Saskatchewan and other forestry organizations and associations including the SFA, CFA, CIF.
 11. Organize and co-ordinate opening ceremonies for the Prince Albert Pumphouse and the Big River Pumphouse and Cold Storage and Packing Facility.
10. Accomplishments 1986-87:
1. Co-ordinated CFS and FRDA public information programming and activities within Sask.
 2. Acted as co-chairman of Can.-Sask. FRDA public information subcommittee.
 3. Developed with provincial consultation, a program of public information for the FRDA for 1986-87.
 4. Served as Scientific Authority on the standing offer (with Sask. public relations firm) for production of FRDA-related public information publications.
 5. Arranged for a maximum of media focus on FRDA-related activities including a press tour, interviews and a feature article.
 6. Provided for press clipping service of small local daily and weekly Sask. newspapers.
 7. Co-ordinated (with NoFC, NOR-33-02/03/04) and conducted the 1986-87 public information exhibit schedule for Sask., including National Forest Week, Saskatoon Exhibition, Prince Albert Exhibition, PFRA and North Battleford Exhibition.
 8. Maintained liaison between CFS Sask. and other forestry organizations and associations including the SFA, CFA, CIF.

Additional Accomplishments in 1986-87:

9. Co-ordinate the production of a slide/tape showing agreement accomplishments to date.
10. Up-date display on general CFS activities in Sask.
11. Expanded exhibit schedule (#7 above) to include PFRA (Indian Head) and North Battleford.

11. Goals for 1987-88:

1. Co-ordinate CFS and FRDA public information programming and activities within Saskatchewan.
2. Co-chairman of the Canada-Saskatchewan Forest Resource Development Agreement public information subcommittee.
3. Develop with provincial consultation, program of public information for the FRDA for 1987-88.
4. Serve as Scientific Authority on the standing offer (with Sask. public relations firm) for production of FRDA-related public information publications.
5. Develop and co-ordinate 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. Provide input into the development of the CFS National Awareness Campaign, Phase II, through liaison with NoFC (Technology Transfer and Information) and CFS HQ.
9. Co-ordinate (with NoFC, NOR-33-02/-03/04) and conduct the 1986-87 public information exhibit schedule for Saskatchewan including National Forest Week, Saskatoon Exhibition, Prince Albert Exhibition, Regina Exhibition, North Battleford Exhibition.
10. Maintain liaison between CFS Saskatchewan and other forestry organizations and associations including the SFA, CFA, CIF.
11. Organize and co-ordinate opening ceremonies for the Prince Albert Pumphouse and the Big River Pumphouse and Cold Storage and Packing Facility.
12. Produce a publication jointly with the Province describing Agreement accomplishments to date.

13. Distribute and promote the use of a slide/tape (and video) to be produced in 1986-87, describing agreement accomplishments to date.
14. Provide input for national and regional newsletters.
12. Publications:
1. Forever Forests Brochure (joint with Province). July, 1986.
 2. Commercial Trees of Sask. Poster. May, 1986.
 3. Forever Forests pamphlet series:
 - Research - March, 1987
 - Protection - March, 1987.
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:
- | | | |
|------------|---------------------------|-----|
| PY's: | Prof. (Prince Albert) | 0.8 |
| | Prof. (A-Base - Newstead) | |
| | Total | 0.8 |
| O&M: | \$11,500.00 | |
| G&C: | 10,000.00 | |
| Contracts: | 28,500.00 | |
15. Signatures:



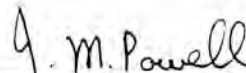
 Investigator (Lee)



 Program Director, Development



 Investigator (Newstead)



 Program Director, Extension



 District Manager



 Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Forestry Development Agreements
2. Title: Insect and disease investigations (Saskatchewan)
3. New: Cont.: X 4. No.: NOR-36-03-8
5. Study Leaders: W.J.A. Volney and B.H. Moody
6. Key Words: Damage appraisal, impact, host, forest pests, special surveys, management, mortality, growth loss.
7. Location of Work: Saskatchewan wide
8. Background:

Forest productivity can be severely impaired by a variety of inimical agents including insect pests and diseases. The goal of forest pest management is to minimize the adverse effects of pests on forest productivity using cost-effective and managerially acceptable methods. This implies that steps to minimize damage must be integrated in the design of forest management systems.

This study addresses the need to develop methods to manage forest pests in Saskatchewan while maintaining an information base on current pest conditions and advising forest resource users on methods currently available to deal with problems.

9. Progress to Date:

This study was initiated in 1986/87 and has concentrated on technology transfer so far. Several pest management workshops and information sessions were conducted for forestry personnel in Saskatchewan. In addition, several meetings were held with staff from the various forestry agencies in Saskatchewan to advise them of current pest conditions and techniques available to them for pest management. An intensive impact survey of the effects of jack pine budworm defoliation on jack pine stands in the Torch River Provincial Forest has been instituted by the Saskatchewan Department of Parks and Renewable Resources (D.P.R.R.).

Research studies have been instituted in three stands of jack pine to elucidate the interaction between the jack pine budworm and its host-

10. Study Objectives:

1. To develop methods for predicting short- and long-term impacts of pests, including damage appraisal; on forest resource uses, values, management plans, and operations. To determine how and to what extent pest damage affects forest resource users and management plans. To evaluate or develop methods to manage pest susceptible forests and pest populations to limit forest damage to tolerable levels.
2. To provide diagnostic and advisory services regarding tree and shrub insects and diseases in Saskatchewan.
3. To conduct special surveys and studies of particular pests or of designated areas.

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, Volney)
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, Moody)
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 D.P.R.R. Plantation Permanent Assessment Plots. (ID-3 Special Pest Surveys) (Tidsbury)
7. Conduct workshops and training sessions on forest pests for D.P.R.R. field staff. (ID-2 Advisory) (Moody, Volney)
8. Provide financial support to the production of a Disease Pictorial Guide (ID-2)
9. Provide scientific authority for outside contract on jack pine budworm pheromone development. (Volney)
10. Identify the resource managers and coordinate joint D.P.R.R. - CFS and Weyerhaeuser - CFS jack pine budworm damage assessment surveys. (Volney)
11. Provide diagnostic and advisory services on tree and shrub pests and other surveys performed under NOR-11-01. (Volney, Moody, Tidsbury)

12. Accomplishments 1986-87:

1. Ground surveys were conducted in plantations and young stands adjacent to budworm infested stands and residual host trees in the Nisbet and Fort a La Corne Provincial Forests
2. Fifteen permanent plots were established in young stands or plantations to evaluate forest pest impacts on stand growth and development. This includes five plots in a 1962 jack pine plantation, Nisbet Provincial Forest; five in jack pine regeneration, Piprell Lake thinning project; and five in white spruce at Grassy Lake. Each plot consists of 20 trees and each tree was numbered, measured and examined for pest damage.
3. Forty five permanent prism plots were established in semi-mature mature jack pine stands: one stand in the Nisbet, five in the Torch River, and two in the Fort a La Corne Provincial Forests. Five plots were established in a white spruce stand. Each tree in these prism plots was labelled, measured, assessed for pest damage, increment cores taken to age and assess pest impacts on tree growth, and branch samples taken for insect population estimates.
 - Thirty five trees have been sectioned for detailed stem analysis and sample branches removed from them for detailed analysis of the effects of jack pine budworm feeding on individual tree volume increment and cone production. The annual increments on all disks have been measured and the data files readied for processing.
4. Nine intensive study plots (three in each of the Torch River, Nisbet, and Fort a La Corne Provincial Forests) were established and all trees in the plots labelled and measured. These plots are to be used to investigate the population and feeding processes of the jack pine budworm and relate these to the impact on forest productivity.
 - Branch samples were collected from nine trees in each of the intensive study plots to study the distribution of egg-masses and feeding by the jack pine budworm. These samples have been processed and the data made machine readable.
 - Sticky traps, baited with artificial sex attractants of the jack pine budworm, were deployed in each of the nine study plots (mentioned in 5 above) to study the relationship between trap catch and population densities. This experiment also seeks to evaluate the efficacy of two types of lures loaded with three concentrations of the attractant.
5. The F.I.D.S. annual reports for the past 49 years have been inspected and summaries made of the information pertaining to jack pine budworm outbreaks. Other historical information is being gathered to relate these to the pattern of outbreaks.
6. Forty permanent plots established in thinned and un-thinned jack pine regeneration at White Gull and Montreal Lakes were re-measured and assessed for pest damage.

7. Four work shops were presented to forestry personnel of the Saskatchewan Department of Parks and Renewable Resources, C.F.S. and forestry consulting firms in Meadow Lake, Hudson Bay, and Prince Albert. These sessions included information on the identification, diagnosis, control, and management of pests in formal presentations and similar descriptions in the field.
 - A full day session on pest management was presented to the upper class of the National Indian Forestry Institute.
 - An egg-mass survey workshop was held for D.P.R.R. and Weyerhaeuser personnel in Prince Albert.
 - A damage assessment workshop was held for field workers participating in the jack pine budworm damage survey of the Torch River Forest being conducted jointly by D.P.R.R. and C.F.S..
8. Financial support was provided for the preparation of a pictorial guide of forest diseases of the region.
9. Acted as scientific authority for a contract to identify the pheromone components of the jack pine budworm. This contract is with the Research Productivity Council of New Brunswick.
10. Acted as project officer for the joint D.P.R.R.-C.F.S. jack pine budworm damage appraisal survey of the Torch River Forest. The 600 increment cores collected in this survey have been measured and the data files prepared for analysis.
 - Consulted and advised Weyerhaeuser forestry personnel on surveys to assess the jack pine budworm situation on their lease limits.
11. Provided assistance in the pinewood nematode, forest tent caterpillar, and jack pine budworm egg-mass surveys performed under NOR-11-01.
13. Goals for 1987-88:
 1. Complete analysis of jack pine budworm impact survey of the Torch River Forest and write report. (Volney)
 2. Complete Stem analysis of trees grown in the Torch River Forests and prepare draft of publication. (Volney)
 3. Monitor 600 impact plots in the Torch river plots for tree mortality. (Volney)
 4. Sample the nine intensive study plots in the Torch River, Nisbet, and Fort a La Corne Provincial Forests for jack pine budworm populations and defoliation. (Volney)
 5. Deploy pheromone traps in areas suspected of harboring incipient jack pine budworm populations to acquire data relating trap catch to defoliation levels under different stand conditions. (Volney)

6. Summarize F.I.D.S. records on jack pine budworm out breaks and acquire maps of fire history and weather data. (Volney)
 7. Initiate studies to describe the interaction between jack pine budworm feeding, mistletoe infection, and tree growth. (Volney)
 8. Initiate studies to determine the nature of the resistance of mistletoe broom foliage to feeding by the jack pine budworm. (Volney).
 9. Continue pest surveys in plantations or young stands adjacent to spruce budworm and jack pine budworm infestations. (Tidsbury)
 10. Conduct pest surveys in a limited number of D.P.R.R. plantation permanent assessment plots. (Tidsbury)
 11. Provide financial support to the production of a Forest Insect Pictorial Guide.
 12. Provide diagnostic and advisory services on tree and shrub pests. (Volney)
14. Publications 1986-87:

Volney, W.J.A., B.H. Moody, H.F. Cerezke 1986. Accomplishments under the insect and disease program of the Canada-Saskatchewan Forest Resource Development Agreement. File Report. 4 pp

15. Environmental Implications:

The Northern Forestry Centre's Environmental Screening Committee has evaluated the proposed study activity. On the basis of the information by the study leaders, the committee concludes that these activities are not potentially detrimental to the environment.

16. Resources 1987-88:

PYs:	Prof.:	0.0	(Volney 0.5, Moody 0.2 A-base)
	Tech.:	0.0	(Tidsbury 0.3, Szlabey 0.5)
	Total:	0.0	
	Term/Student:	0.0	

O & M: \$23,000

Contract: \$18,000
\$30,000 Publ. on insects

Grants & Contributions:

17. Signatures:

J. T. Alvey
Investigator

A. C. [unclear]
District Manager

B. H. Moody
Investigator

M. J. Hart
Program Director, Development

[unclear]
Program Director, Forest Protection

C. D. [unclear]
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Development Agreements
2. Title: Forest Economics (Saskatchewan)
3. New: Cont.: X 4. No.: NOR-36-03-9
5. Study Leader:
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 speciality 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 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)

Added Goals:

7. Develop draft profile reports on Saskatchewan and NWT for inclusion in the national "Forestry Perspectives 1986".

10. Accomplishments for 1986-87:

1. Preliminary analyses and draft material for report on size, structure, and economic impact of the primary wood using industry in Saskatchewan. No activity report on the Forestry Report.
2. Preliminary meetings on the evaluation framework for the Canada-Saskatchewan Forest Resource Development Agreement.
3. No activity report.
4. No activity report
5. Development of terms and conditions for integrated land use management plan (Greenwater Lake) contract with DPRR. Tenders were evaluated and contract not let.

6. No activity report.
7. Draft profile reports on Saskatchewan and NWT were prepared.
8. A number of extension/information duties were performed: distribution of Directory, job development proposals, transportation costs data in Saskatchewan, bagging trees, CFS fair representative.
9. Incumbent was seconded to FEDC on 1 October, 1986, to 31, March, 1987.

11. Goals for 1987-88:

1. Completion of analyses and report on the size, structure, and economic impact of the primary wood using industry in Saskatchewan.
2. Assist in development of an evaluation framework for the Canada-Saskatchewan Forest Resource Development Agreement.
3. Develop and present a seminar on FEPA activities and in particular, wood supply modelling.
4. Develop and present a seminar on financial/economic decision-making models in silviculture investments.
5. Develop a method to analyze private land inventory data to determine the economic accessibility of the timber.
6. Assist in labour productivity and cost of production studies for site preparation, planting, thinning.
7. Assist as requested, in the calibration, validation and analysis of the High Yield Weyerhaeuser model.

12. Publications 1986-87:

Giles, D.R. 1986. A Directory of Primary Wood-Using Industries in Saskatchewan, 1985 Canadian Forestry Service, Prince Albert, Saskatchewan. 137. pp.

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 1987-88:

PY's: Prof.:	Mauch	1.0
	Tech.:	0.0
	Total:	1.0
	Term/Student:	0.0

O&M:

Contract:

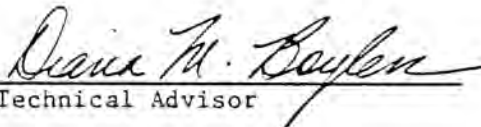
Capital:

15. Signatures:

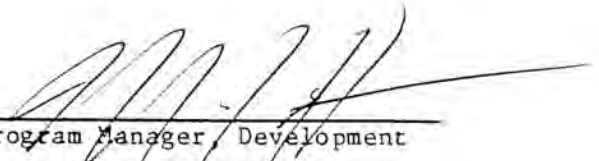
Investigator



District Manager



Technical Advisor



Program Manager, Development



Regional Director General

NOR-51

FINANCIAL, ADMINISTRATIVE AND SUPPORT SERVICES

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Financial, Administrative and Support Services
2. Title: Financial Services
3. New: Cont.: X 4. No.: NOR-51-01
5. Study Leader: D. Benke
6. Key Words: Finance
7. Location of Work: NoFC, Edmonton
8. Problem:
N/A
9. Study Objectives:
To supply financial services and advice to NoFC, Saskatchewan District Office and Manitoba District Office.
10. 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:
 - a. turnaround time
 - b. No. of invoices
 - c. No. of Travel claims
 - d. 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.
11. Accomplishments in 1986-87:
1. Invoice turnaround time was approximately 9.2 days, The total number of invoices processed between July 1 - Dec. 31 was 3118 (including district offices).
 2. Travel claims were processed within 7.5 working days of being received. The total number of claims between July 1 and Dec. 31 was approximately 1013 (including district office).
 3. All requestors received their advancers on the day required.
 4. Monthly records of number of invoices, travel claims and travel advances, and turn around times was maintained. These were provided to the Manager, Management Services on a monthly basis.
 5. J.V.'s for gas, stores and other chargebacks were processed within 5 working days under normal circumstances. During periods when the unit was short staffed emphasis was placed on processing the J.V.'s prior to month end reporting.

6. An accurate and effective commitment system was maintained. Commitments were input to FINCON within 2 days of receipt in Finance. Commitments were reviewed monthly and with the support of project leaders and managers subsequent changes were actioned promptly.
7. Monthly batch reconciliation between FINCON and DRS will be implemented January, 1987. Financial statements were reconciled monthly beginning August 1986.
8. Requests for adjustment to the financial system were actioned within 2 working days of the request.
9. Information requests by managers and project leaders was provided within the same day or at a maximum within 24 hours. Requests from H.Q. were met within deadlines indicated.
10. Monthly financial statements were provided within 5 working days of monthly close off. A monthly financial report was designed and implemented for the Alberta Agreement. This report reflects FINCON commitments.
11. The problem of blanket commitments was resolved by having the employee indicate on the request for blanket travel authority the study against which to commit it and the amount of funds to commit. Individual travel authorities were committed separately.
12. The problem of using PAF's as commitments was resolved by using the PAF as an allotment and recording individual commitment as they occur inside the PAF.

Added Accomplishments:

13. The implementation of the Payment On Due Date System (P.O.D.D.).
 14. The switch over to Marlin travel.
 15. Filling of the FI-1 position.
 16. Filling of the CR-4 Accounts Payable clerk position.
 17. New FI-3 became familiar with the Finance functions.
12. Goals for 1987-88:
1. Process all invoices within 10 days of receipt in finance unless written evidence of problems is on the file, with the exception of major utilities which will be processed within two days of receipt in finance so no late payment charges incurred.
 2. Process all travel claims within 10 days of receipt in finance.
 3. When it is not possible to travel with the use of individual travel cards, 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:

- a) turnaround time
- b) No. of invoices
- c) No. of travel claims
- d) No. of travel advances.

Provide this information to the Manager, Management Services by the fifth working day of the following month.

- 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 analyzed monthly in finance to ensure only "good" commitments are in the system.
- 7. Increase integrity of commitments and useability by improving description, decreasing use of "X" commitments, and exercising better control over commitment numbers.
- 8. DSS statements, FINCON statements, Batch ledger and monthly financial statements will be reconciled monthly.
- 9. Requests for adjustments to the system will be performed within 2 working days of the request.
- 10. 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.
- 11. Accurate financial statements will be provided to Program Directors within 5 working days of monthly close off.
- 12. Establish uniformity within monthly agreement reporting and thereby provide E.D.P. roll-up capabilities. Produce financial statements for 1987/88 by July 7, 1988.
- 13. Allocate capital resources by study.
- 14. Resolve the problem of double commitments on travel when advances are requested and issued.
- 15. Reconcile agreement reporting and systems to ensure proper control and integrity in numbers used and communicated.
- 16. Know at all times, the total agreement funds by province and be able to reconcile all information (received from headquarters) on funding within this total.

17. Input allotments for Edmonton to FINCON by May 1, 1987 and coordinate the inputs for the District Offices by the same date.

13. Publications 1986-87:

Nil

14. Environmental Implications:

N/A

15. Resources 1987-88:

PYs:	Benke	1.0
	Iskra	1.0
	Ross	1.0 (Manitoba Agreement)
	Owens	1.0
	Cooper	1.0

Total: 5.0 (1 Agreement)

O & M: \$20,800

Capital: Nil


16. Signatures:



Investigator



Manager, Management Services



Regional Director General

7. Within resources provided under minor capital, upgrade public areas in the building.

11. Accomplishments in 1986-87:

1. Oversaw financial, administrative, materiel management, vehicles and building operations (see other study statements).
2. Refilled FI-3 position in July, 1986.
3. Collected monthly data on functions under Management Services.
4. Users handbook partially finished. It will be distributed by March 31, 1987.
5. Participated in Management of NoFC; took minutes at Management Committee and circulated the typed minutes within three (3) working days of the meeting.
6. Monitored NoFC resources on a monthly basis and drew attention to problem areas. Prepared P.Y. forecasts by July 31. Monitored monthly after that.
7. Attended three Managers, Management Services Meetings in Victoria, Halifax and Sault Ste. Marie.
8. Audited the Saskatchewan and Manitoba District offices and issued reports.
9. Assisted in the set-up of financial reports for the Saskatchewan District Office.
10. Renovated Boardroom. Purchased new chairs for conference room. Set up small conference rooms on each floor.
11. Negotiated the move of the Canadian Grain Commission office to NoFC.
12. Negotiated the agreement to have veterinarian inspection lab, Agriculture Canada, move to NoFC on or before April 1, 1987.

12. Goals for 1987-88:

1. Oversee financial, administrative, materiel management, vehicles and building operations (see other study statements).
2. Refill PG position by June 30, 1987.
3. Collect monthly data on functions under Management Services.
4. Update 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. Provide monthly financial statements.
 7. Visit each District Office once during the year.
 8. Attend two (2) meetings of Manager, Management Services.
 9. Monitor capital budget.
 10. Liaise with tenants in the building.
13. Publications 1986-87:
N/A
14. Environmental Implications:
N/A
15. Resources 1987-88:
- | | | |
|------|------------|-----|
| PYs: | P. Stewart | 1.0 |
| | Total: | 1.0 |
- O & M: 16,200
- Capital:
16. Signatures:



Manager, Management Services



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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. Problem: N/A
9. Study Objectives:

To provide reception, word processing, record management, mail, telecommunications and general administrative service to NoFC.

10. 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 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 quarterly 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.

11. Accomplishments for 1986-87:

Word Processing:

- 1. Provided the following turn around time to clients:

1 - 5 pages	1 working day
5 - 25 pages	3 working days

Jobs - Jan 1/86 - Dec 31/86 = 2,107.
 - Res. - 296, Pro. - 254, Per. - 56, F&A - 603, Ext. - 400,
 Dev. - 249

- 2. Provided training to AES operators to ensure they understood and could use the capabilities of the system. Joyce Simunkovic attended training courses in the areas of Advanced Operator Training and Supervisory System Skills. Joyce Simunkovic instructed junior operator re new 7300 software program.
- 3. Ensured an even distribution of workload among all operators.
- 4. Implemented junior trainee position for 6 month period.
- 5. In conjunction with Computer Services Section, interconnected between VAX/AES.

Records and Photocopying:

- 1. Opened and recorded all incoming mail and affixed date stamp, with the exception of advertisements, newspapers, magazines, invoices.

pieces mail received = 39,979

2. Distributed all incoming mail within one hour of receipt as per routing.
3. Hand-delivered upon receipt to addressee's office or put in mail box all DEX and telex messages.

DEX messages received: 1,162/sent: 1,241

Telex messages received: 230/sent: 69

4. Prepared and forwarded 3 times a week mail to the District Offices and Ottawa by Priority Post.

Priority Post envelopes sent = 302

5. Prepared mail for pick-up each day by Canada Post.
6. Ensured photocopier in mail room is working and properly supplied; called maintenance within one hour of machine being reported as malfunctioning.

service calls = 14

copies made Jan - Dec/86 = 413,337 (mail room only)

Monthly average = 34,445 copies

7. Maintained counts of item as presently being done.
8. Maintained and operated a BF system.
9. Reviewed process and made changes. Both clerks are present when mail opened.
10. Final evaluation of material in scientific records.
boxes catalogued and stored = 189 for 6 staff members.
11. Catalogued and stored maps.
12. Added scientific records to the clearance form; 189 boxes packed for 6 staff retirees.
13. From July 1/86 provided distribution service 2 afternoons per week. This service was not always consistent due to staff availability.
14. Purchased and installed electronic mail meter, trip kit and precision scale. This acquisition will save on postage costs.
15. Arranged to have NoFC publications mailed under Canada Post Book Rate, which is considerably cheaper than Printed Matter Rate.

Telecommunications:

1. Reviewed rental charges each month to ensure they are accurate and correct. Problems with Edmonton Telephone billing system often made this difficult.

2. Placed orders for repair or change within two days of receiving the order.
orders placed Jan - Dec/86 = 27 (does not include 151 touch-tone sets replaced)
3. Implemented chargeback system for long-distance calls. Operator intercept was time consuming and not satisfactory to staff. A computerized system was ordered.
4. CNCP Telex rental service discontinued as a cost saving measure. Alternate telex service was arranged and is working satisfactorily. Estimated saving \$3,100/yr commencing 1987-88.

Reception:

1. Greeted visitors, referred to the appropriate employee in NoFC.
2. Answered the telephone switchboard, took messages, forwarded calls.
3. Prepared requisitions, correspondence, contracts within 24 hours of receiving them. Maintained a log of all typing.
pages typed Jan - Dec/86 = 1,956 (does not include labels/cards)
4. Placed all long-distance calls starting Aug. 26/86; input data to VAX after training course.
5. Arranged for airvelope pickup and sending.

Administration:

1. Prepared the 1987-88 Conference Plan for the deadline set by Ottawa.
2. Monitored the 1986-87 Conference Plan:
 - a. to ensure approved attendee's knew they were on the plan and made their arrangements;
 - b. made changes and substitutions as necessary.
 - c. submitted quarterly reports to HQ.
3. Actioned classification and staffing requests within 1 day of receiving them, as long as there were no extenuating circumstances. Ensured all packages forwarded to Personnel are complete.
4. Actioned purchase of ergonomic furniture for Prince Albert District Office and NoFC.
5. Arranged with Agriculture Canada Word Processing Technology Centre, Ottawa for on-site DECMATE III training of NoFC and district office staff.

6. Monitored 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. Ensured all necessary documentation is completed, forwarded and filed within 2 weeks of the course completion.
 - d. Prepared 1987/88 training plan for presentation to Management Committee Meeting on January 19, 1987.
7. Prepared, monitored, and did not exceed budget for administration without specific approval from Manager, Management Services.

12. Goals for 1987-88:

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 four (4) half days of on-site training to AES operators.
3. Ensure an even distribution of workload among all operators.
4. Purchase Magnetic Tape Backup for the system to reduce the downtime when performing back-up to between 30 mins. - 1 hr.

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 mal-functioning.

7. Renew contract before March 1/88 on the main copier in the mail room.
8. Maintain and operate a BF system.
9. Continue to maintain scientific records room.
10. Provide assistance to distribution.

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.
3. Finalize installation of computer to directly bill long-distance charges to studies, by March 31, 1987.

Reception:

1. Greet visitors, refer to the appropriate employee in NoFC.
2. Answer the telephone switchboard, take messages, forward calls.
3. Prepare correspondence and contracts within 24 hours of receiving them. Maintain a log of all typing.
4. Produce quarterly, a telephone directory for NoFC, using the VAX. Distribute to staff. Provide information to Word Processing Unit for semi-annual directory.

Administration:

1. Prepare the 1988-89 Conference Plan for the deadline set by HQ.
2. Monitor the 1987-88 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 quarterly reports 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. Keep record of actions completed. Keep record of actions completed.
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 1988/89 training plan by December 1987.
5. Prepare, monitor, and do not exceed budget for administration without specific approval from Manager, Management Services.
 6. Compile monthly statistics and provide to Manager, Management Services.
 7. Prepare, monitor and maintain organization charts for region.

13. Publications 1986-87:

N/A

14. Environmental Implications:

N/A

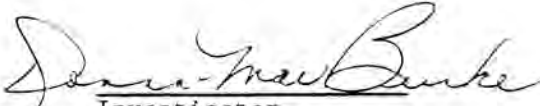
15. Resources 1987-88:

PYs:	Burke	1.0
	Fulton	1.0
	Schiewe	0.75
	Simunkovic	1.0
	Ratansi	1.0
	Phillips, T.	1.0
	Sampson, M.	1.0
	Total:	6.75

O & M: \$138,100

Capital: \$ 4,000 - Magnetic Tape Back-up

16. Signatures:


Investigator


Manager, Management Services


Regional Director General

513

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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. Problems
N/A
9. Study Objectives:
To provide purchasing, removal, stores, inventory and Material Management Services to NoFC including functional guidance to the District Offices.
10. 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:
 - a. within 10 working days of issuing if delivery date is not known (10440's);
 - b. 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.

II. Accomplishments in 1986-87:

Purchasing

1. Provided 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. Number of purchase orders including petty cash processed from January 1 - December 31, 1986 was 2450.

2. Ensured proper signing authority was on each requisition before actioning.
3. Followed 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. Total hastened were 210.
4. Records were maintained of all documents issued and received.
5. Monthly reports were prepared on the above.
6. Necessary documentation was kept on file for all exceptional purchasing (e.g., emergencies).
7. MMIS is in the process of being implemented. J. Hodgins attended an orientation meeting at GLFC in April, 1986.
8. Learned how to process contracts directly without going through DSS where appropriate.

Stores

1. An inventory of all store items was maintained. An inventory of stores items was performed in August and February and reports written.
2. Items requested were available. If not available, they were 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 was maintained and reported monthly. The number of issues was 2274 from January 1 - December 31, 1986.
3. A minimum/maximum system was maintained and stores supply was within these.
4. Requested office supplies were available. The expenditures for non-chargeable supplies from January 1 - December 31 was 20,233.01.
5. Monthly costs for chargeback items were provided to Finance by the second (2) working day of the following month for J Ving back to projects.
6. Set up an individual Bar Code Card system for issuing stock from stores.
7. Programmed HP computer to allow Bar Code charging and to maintain the stock level system.
8. Set up the new storage shed for stores items and moved out of basement of main building.

9. Set up system for allocating and identifying shelving in the storage shed.
10. G. Fawcett attended 2 week material Management Course.

Inventory

1. All equipment and attractive items were tagged and furniture, equipment and attractive items were entered into the inventory before the item is released from stores.
 2. Performed the inventory of equipment, furniture and attractive items. This project will be completed by March 31, 1987.
 3. Arranged for disposal of surplus equipment. the total amount disposed of was 49 items for \$77,005.19.
 4. The procedure for chemical disposal was changed in July 1986. J. Shuya now performs this function. One disposal was arranged in May, 1986.
12. Goals for 1987-88:

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. code all requisitions except for line objects.
3. Following up on all documents issued:
 - a) within 10 working days of issuing if delivery date is not known (9200's).
 - b) 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. Implement MMIS into the present purchasing system if computing capability available.
8. Train T. Avenell in use of terminal and in maintaining purchasing end of MMIS.

Stores

1. An inventory of all stores items will be maintained. An inventory of expendables and stationary 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 Jving back to projects.
6. The individual bar code card system will be maintained.
7. MMIS will be fully implemented, if feasible.
8. Finalize the set up of the stores area in the storage shed.
9. Ensure proper warehousing and storage in the areas where assigned shelving is located.
10. Ensure proper warehousing of all parts of the storage shed so space is used most efficiently.

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. Assigned holders will sign for all equipment issued.
 2. Compile furniture and equipment inventory and issue "clean" listing by April 30, 1987.
 3. Arrange disposal of surplus equipment.
13. Publications 1986-87:
Nil

14. Environmental Implications:

N/A

15. Resources 1987-88:

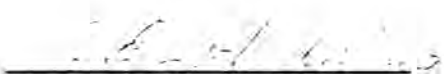
PYs: Hodgins 0.5
Fawcett 1.0
Avenell 1.0

Total: 2.5

O & M: \$17,400

Capital: Nil

16. Signatures:


Investigator


Manager, Management Services


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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, major renovations
7. Location of Work: NoFC
8. Problem:
N/A
9. Study Objectives:
To conduct maintenance and repairs to the NoFC facilities to ensure they are in a superior state of upkeep and repair, supervise the construction or renovation of major facilities at NoFC.
10. 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.

11. Accomplishments in 1986-87:

1. Provided general maintenance in the building. Painted 28 rooms plus janitor rooms (6), loading dock, kitchen walk-in cooler, hallways.
2. Cleared snow as required from the parking lot and walkways. Still in the process of snow and ice removal.
3. Maintained the grounds during the summer including cutting the grass, planting flowers and maintaining flowers and shrubs.
4. Did not oversee the installation of a new lawn. Postponed. No funds available in 86/87.
5. Installed shelving in the new storage shed, Library, Room 2042 and chemical storage.
6. Oversaw the cleaning contract in the building. Changed contractors once because of poor performance. Lots to be desired regarding quality of work.
7. Budget overdrawn due to formerly unknown work that had to be executed. (Deficit \$8,500).
8. Continued regular preventative maintenance program.
9. Upgraded 10 fume hoods. Installed stainless steel bottoms and replaced wiring..
10. Temporarily repaired the leak over the administration wing but were unsuccessful in repairing the leak in 3053 in southwest corner.
11. Replaced fan boots with teflon flex boot by July 31, 1986 to meet safety inspection requirements.
12. Replaced janitor's sinks in 8 locations. Completed by November 30, 1986.
13. Modified rooms 3075, 77, 79, 72, 74, and 69 to accomplish moves in the building.
14. Modified room M108, M076, 109, 095, 135, 2064 2061, 2062 to accommodate changed needs.

15. Installed wall in FIDS Lab (2063).
 16. Modified Photography shop and installed dark room door.
 17. Set up new soil grinding room in B102. Built drying room and map room.
 18. Installed self-contained climate controls in B074, 75, 76.
 19. Moved chemical stores shelving from M118 to storage shed and moved shelves from B054 to M118 for dry chemicals.
 20. Installed carpet in M035, 2042, 2064, and Boardroom M007.
 21. Built 2 computer tables for temporary use for economics group.
 22. Installed irrigation system in the nursery and built up the roadway.
 23. Oversaw the construction of the parking lot and completed the hard and soft landscaping after contractor left. Drainage problem appears to have been resolved.
 24. Drew up, let and oversaw the construction of the new storage shed including driveways and redoing fencing.
 25. Completed landscaping in relation to the weeping tile replacement by the end of the summer.
 26. Installed cooling coils for conference room B009.
 27. Oversaw electrical contractor, janitorial contractor and all other contractors associated with building work.
 28. Transplanted 30 trees from nursery to grounds.
 29. Picked up tractor from Chip Lake and sent out for minor repairs.
11. Goals for 1987-88:
1. Overhaul MF-tractor.
 2. Replace main roof at cost of appr. \$200,000.00 and add extra insulation as required.
 3. Replace #1 to #4 unit water sumps. appr. \$16,000.00.
 4. Replacement sump pumps related to #4 @ \$450.00 ea-\$1,800.00.
 5. Replace Special Cooling Tower @ \$8,000.00.
 6. Ultrasound all unfired pressure vessels in the boiler room.

7. Repair/repaint all the lagging in the penthouse.
8. Replace power units on #1 to #4 A/C units.
9. Replace TORO push lawn mower @ \$475.00.
10. Provide glass canopy for both northside entrances @ \$8,000.00.
11. Provide general maintenance in the building.
12. Clear snow as required from the parking lot and walkways.
13. Maintain the grounds during the summer including cutting the grass, planting flowers and maintaining flowers and shrubs.
14. Oversee the installation of a new lawn.
15. Oversee cleaning contract, electrical contract and all other maintenance contracts (in building).
16. Live within budget provided.
17. Continue regular preventative maintenance program.
18. Overhaul # 30 air compressor.
19. Install darkroom door in photography shop.
20. Plant trees on west fence on university property.

12. Publications 1986-87:

N/A

13. Environmental Implications:

N/A

14. Resources 1987-88:

PYs:	Schoendube	-	0.5
	Colistro	-	0.9
	Schmidt	-	1.0
	Burton	-	1.0
	Total	-	3.4

O & M: \$23,300

Capital:	200,000	-	New roof on building
	15,000	-	Emergency maintenance
	8,000	-	Replace cooling tower
	16,000	-	Power packs on air circulation units #1-4
	7,000	-	Canopies over entry ways
	<u>246,000</u>		

15. Signatures:

H. Silvanelli
Investigator

Paul H. Stone
Manager, Management Services

Chris West
Regional Director General

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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
7. Location of Work: NoFC
8. Problem:
N/A
9. Study Objectives:
To maintain the heating, ventilation, and air conditioning systems at NoFC.
10. Goals for 1986-87:
Operations:
 1. Daily monitor the operation of the boilers and equipment.
 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.
11. Accomplishments in 1986-87:

Operations:

1. Daily monitored the operation of the boilers.
2. When boilers were not operational, conducted annual prescribed maintenance. Overhauled boiler #2.
3. Daily checked the greenhouses and adjusted temperatures, air, etc. to meet specifications set out by greenhouse users.
4. Performed other operational maintenance as required such as heating and ventilation.
5. Devised means to save funds in gas and electricity budgets in the building by constantly monitoring temperature to decide whether large or small boiler to be used; monitoring air conditioning, noting use of fume hood fans.
6. Controlled work by issuing work orders for all projects undertaken.
7. Conducted four (4) basic First Aid courses during the year and trained 22 employees.
8. Produced an up-to-date safety manual for NoFC.
9. Conducted four (4) CPR courses in conjunction with #7 above and issued 18 certificates.
10. Assisted in completing 5105 accomplishments.
11. Overhauled brakes and guide tracks on the elevators.

12. Supervised the commissionaires contract.
 13. Installed plug-ins for front end and north side of parking lot.
 14. Installed emergency power to the storage shed.
 15. Installed power to the nursery.
12. Goals for 1987-88:
1. Monitor energy saving and effect cost saving in relation to laboratory operations with the respect to air quality and heat distribution.
 2. Replace Simplex Fire Alarm Panel in room M123 @ \$8,000.00
 3. Daily monitor the operation of the boilers and equipment to ensure safe and efficient operation.
 4. Carry out preventative maintenance on boilers and associated equipment as required.
 5. Overhaul Boiler #1 including rebricking.
 6. Daily check the greenhouses and adjust temperatures, air, etc. to meet specifications set out by the greenhouse users.
 7. Carry out complete building checks daily and make adjustments as required to heating, ventilation, air conditioning, safety systems, to ensure safe and efficient operations.
 8. Control work and materials by issuing work orders for all projects undertaken.
 9. Supervise cleaning, waste management, elevator maintenance, and commissionaire's contracts and ensure a high quality of service.
 10. Provide heat, light, natural gas, water, and air conditioning services to the building.
13. Publications 1986-87:
- Nil
14. Environmental Implications:
- N/A

15. Resources 1987-88:

PYs:	Schoendube	-	0.4
	Fisher	-	0.75
	Lybbert	-	1.0
	De Costa	-	0.9
			<hr/>
			3.05

O & M: \$249,200

Capital:

- 38.0 K - 2nd Chemical storage shed
- 6.0 - Rebrick boiler #1

16. Signatures:

H. Si... ..
Investigator

Paul H.
Manager, Management Services

C. D.
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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. Problem:
N/A
9. 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.
10. 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 lightning system.
 3. Build soil sampler for Dr. Sidhu on request.
 4. Build a pot scrubber for E. Harvey in greenhouse.
11. Accomplishments in 1986-87:
P. Bihuniak was ill from June until the end of the year. For this reason the study was dormant for most of the year.
12. Goals for 1987-88:
This study will terminate in 1986-87.

13. Publications:

N/A

14. Environmental Implications

N/A

15. Resources 1987-88:

PYs: 0.0

Total: 0.0

O & M: 0.0 K

Capital:

16. Signatures:

Investigator



Manager, Management Services



Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Financial, Administrative and Support Services
2. Title: Camps
3. New: Cont.: X
4. No.: NOR-51-08
5. Study Leader: H. Schoendube
6. Key Words: Camps
7. Location of Work: Hinton, Chip Lake, (Alberta), Candle Lake, Nesbitt Duplex, Prince Albert, (Saskatchewan)
8. Problem:
N/A
9. Study Objectives:
To maintain the Physical Facilities of the NoFC camps at Hinton, Candle Lake, Chip Lake and Prince Albert.
10. 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.
11. Accomplishments in 1986-87:
1. Opened the Hinton camp in May and closed it in October. Performed repairs that were necessary to keep the camp in working order. Connected trailers 448 and 447 with gas, water and power. Recaulked 5 trailers and replaced one trailer (735) with a newer trailer (743).
 2. Coordinated with J. Hodgins the replacement of worn-out furniture in the camps.
 3. Installed the required sewage units at the Candle Lake camp.
 4. Arranged through C. Rentz for the cutting of grass at Hinton. Provided him with a sit-on tractor.
 5. Arranged for the supply of gas and electricity to Hinton, Candle Lake (only electricity) and Kananaskis.
 6. Arranged for the upgrade of the roads at Hinton.
 7. Repaired, instead of replaced, furnaces in trailers 424 and 425.
 8. Did not install government signs at Hinton and Candle Lake.
 9. Did not wire pump house at Chip Lake.
 10. Visited and assessed conditions of camps during the year.
 11. Completed the roofing of one (1) log building in Candle Lake.
 12. Removed all leaf catching eavestroughing from buildings in Candle Lake.
12. Goals for 1987-88:
1. Open camps and close in the spring and fall. Four (4) trips will be required.
 2. Repair trailer roofs where required.
 3. Replace two (2) shower cabinets in trailers at Hinton.
 4. Replace three (3) wall mounted gas heaters at Hinton.
 5. Put correct wiring in Hinton.

6. Complete the roofing in Candle Lake; one bungalow is left to reroof.
7. Arrange for the supply of propane, power and water to Chip Lake, Hinton, Candle Lake, and Duplex's in P.A..
8. Finalize the closing of Kananaskas.
13. Publications 1986-87:
Nil
14. Environmental Implications:
N/A
15. Resources 1987-88:
- | | | | |
|------|------------|---|-----|
| PYs: | Schoendube | - | 0.1 |
| | Colistro | - | 0.1 |
| | De Costa | - | 0.1 |
| | Total: | - | 0.3 |
- O & M: \$5,050
- Capital:
16. Signatures:

H. Schoendube
Investigator

Richard H. [Signature]
Manager, Management Services

C. D. [Signature]
Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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. Problem

N/A

9. 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.

10. 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.
11. Accomplishments in 1986-87:
1. Assigned vehicles for the 1986 field season by May 1, 1986.
 2. Received 16 replacement vehicles and integrated these into the fleet. Disposed of 12 vehicles the new ones are replacing and will arrange the disposal of 4 additional ones.
 3. Ensured all vehicles in the fleet have the required maintenance performed on them per a written maintenance schedule. Performed scheduled safety maintenance requirements.
 4. Provided monthly the required FMIS information by the 10th of the following month.
 5. Developed by June 1, 1986 the kilometer charges for 1986/87. By the tenth (10) working day of the following month provided to Finance the charges by study for the previous month.
 6. Within reason satisfied all requests for vehicles during the fiscal year. Overall with the new vehicles, the pool functioned well in 1986/87.
 7. This job was only done sporadically because of time constraints.
 8. Moved the trailer from Chip Lake to Manitoba as requested by J. McQueen.
 9. Did not exceed the budget provided.
 10. Implemented a computerized fleet Management System for completing FMIS documents and for vehicle reservations.
 11. Replaced one trailer at Hinton with a newer one.
 12. Brought Massey-Ferguson Trailer, bush cutter and other equipment from Chip Lake.
 13. Developed and have available for issue five (5) winter emergency kits.
 14. Had built and installed safety screens in five (5) vehicles.

12. Goals for 1987-88:

1. Assign vehicles for the 1987 field season by May 1, 1987.
2. Integrate 1987/88 replacement vehicles into the fleet. Dispose of the vehicles the new one are replacing.
3. Order vehicles (requested 12) for 1988/89 in October 1987. (Anticipated 7).
4. Ensure all vehicles in the fleet have the required maintenance performed on them per a written maintenance schedule. Perform scheduled safety maintenance requirements.
5. Provide monthly the required FMIS information by the 10th of the following month. Attempts will be made to use the computerized vehicle system to satisfy FMIS needs so time to provide this information is saved.
6. Develop by June 1, 1987 the kilometer charges for 1987/88. By the tenth (10) working day of the following month provide to Finance the charges by study for the previous month.
7. Within reason satisfy all requests for vehicles during the fiscal year.
8. Do not exceed the budget provided without permission from the Manager, Management Services.
9. Implement and manage the new parking policy.
10. Dispose in conjunction with stores the surplus equipment related to vehicles.
11. Ensure proper safety and winter emergency kits are available in vehicles stores.

13. Publications 1986-87:

Nil

14. Environmental Implications:

N/A

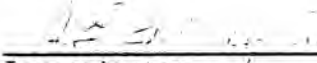
15. Resources 1987-88:

PYs:	Hodgins	0.5
	Wake	1.0
	Total:	1.5

O & M: \$41,300

Capital: \$ 66,000 - 5 vehicles

16. Signatures:


Investigator


Manager, Management Services


Regional Director General

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

1. Project: Financial, Administrative and Support Services
2. Title: Safety
3. New: X Cont.: 4. No.: NOR-51-10
5. Study Leader: H. Schoendube
6. Key Words:
7. Location of Work: NoFC
8. Problem:
N/A
9. Study Objectives:
To provide safety training to NoFC employees.
10. Goals for 1986-87:
 1. Conduct four (4) basic First Aid courses during the year with the aim of training 30-40 employees.
 2. Conduct four (4) CPR courses in conjunction with #1 above.
 3. Produce an up-to-date safety manual for NoFC.
11. Accomplishments 1986-87:
 1. See 51-06 # 7, 8, 9.
 2. Trained 16 people for chemical response team.
12. Goals for 1987-88:
 1. Conduct four (4) standard First Aid course with the aim of training 50 employees.

2. Conduct four (4) CPR courses with the aim of training 24 employees.
3. Update the safety manual but do not issue a revised copy in 87/88.
4. Put on safety films once a month for NoFC building occupants.
5. Put on one defensive driving course.
6. Train chemical response team in SCBA use.

13. Publications 1986-87:

N/A

14. Environmental Implications:

N/A

15. Resources 1987-88:

PYs: Fisher 0.25
Total: 0.25

O & M: \$2,000

Capital: Nil

16. Signatures:

H. Silver
Investigator

Pat H. H. H.
Manager, Management Services

C. D. H. T.
Regional Director General

538A

NOR-53

COMPUTING AND DATA PROCESSING SERVICES

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. Assistance was also provided for SAS and BMDP users. WPS + users accounts were set so so they could use the computer aided instruction courses available on the VAX. Assistance was given to people who wished to use the Polaroid palette slides and picture systems.
 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.
11. Goals for 1987-88:
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 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. Assist with the installation of the various information systems.
 3. Prepare orders for the new VAX system when approval is obtained. Prepare the site to receive the new VAX so there will be a minimum of disruption for users. Set up the PC network with ETHERNET.
 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.
 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. Assist with the new statistical packages as received, INGRES and the new information systems when required.
 16. Assist, when needed, with the software packages for the various personal computers. Assist with installation of both the finance section's new version of the FINCON pipeline system here and in the district offices; set up the PC's to interact properly with the VAX and DATPAC.
12. Publications 1986-87:
- Moore, W.; W. Chow. 1987. A Mapping and Analysis of Resources System application. Can. For. Serv., North. For. Cent., Edmonton, Alta. Info. Rep. NOR-X-285.
13. Environmental Implications:

14. Resources 1987-88:

PYs: Prof.:	Chow	1.0
	Paradis	1.0
	Irwin	1.0

Tech.:	Hai	1.0
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Total:		4.0
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Term/Student:		0.9
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O & M: \$70,000

Capital:

15. Signatures:

W. Chow
Investigator

J. M. Powell
Program Director, Extension

A. D. Hunt
Regional Director General

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NOR-54

MANAGEMENT OF REGIONAL DEVELOPMENT PROGRAM

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1987-88

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 4, 1987

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 1986-87:
 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.
 5. To develop initial strategies for the next set of Agreements.

10. Accomplishments in 1986-87:

1. Helped to develop a national 5 year plan for FORSTATS.
2. Developed and implemented the programs under Canada-Manitoba, Canada-Saskatchewan, and Canada-Alberta Agreement Programs. The discretion of same is included in NOR-36.
3. Developed, monitored and cooperated with CEIC, the job creation programs for Manitoba, Saskatchewan, Alberta and NWT which are forestry related.
4. Cooperated with Ottawa directed efforts in the national Economic Plan, Forestry Countervail related issues, Trade and industry, public information, economic intelligence gathering efforts inventory 86 and a number of other Ottawa-Regional efforts.
5. Managed the NOR-3 Economics study statements.
6. Directed the computerization and office of the Future efforts of the Development Program.
7. Co-authored papers on the next round of program related efforts including Agreements.
8. Entered into preliminary negotiations with Alberta's Agreement enhancement.
9. Negotiated fiscal program arrangements related to Weyhauser's purchase of P.A. Pulp Company.
10. Wrote a terms and conditions document on industrial incentives for consideration of Alberta's new thrust in forestry development.
11. Participated in NoFC management team's efforts related to the management of NoFC such as Strategic Planning, Capital acquisition, O&M budget management and personnel management.
12. Served as chairperson of Alberta Forestry Association's Membership drive and director of same.
13. Participated in interdepartment exercises such as DRIE and FEDC.

11. Goals for 1987-88:

1. To deliver the large array of programs associated with NOR-36.
2. To manage, through the District Managers the Winnipeg and P.A. offices.
3. To develop long term strategies for the future of district offices along the scenarios a) Agreements renewed b) Agreements not renewed.
4. To advocate forestry's interest to CEIC, DRIE and other related Government departments and agencies.

5. To manage the programs, through the project leader of Economics, the NOR 3 programs.
6. To cooperate with the various Ottawa DG's directed programs which have a regional expression.
7. To cooperate with various corporate government exercises such as ERDA'S and Western Initiatives.

12. Publications 1986-87:

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 1987-88:

PYs: Prof.: Heit 1.0

Tech.: Nil

Total: 1.0

Term/Student: Nil

O & M: \$15,500

Capital: Nil

15. Signatures:


 Program Director, Development


 Regional Director General

