

STUDY WORK PLANS

1988-89

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MARCH 1988

NORTHERN FORESTRY CENTRE  
STUDY WORK PLANS, 1988-89

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NOR-3

FOREST RESOURCE ECONOMICS AND STATISTICS

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 9, 1988

1. Project: Forestry Resource Economics and Statistics
2. Title: Forestry Resource Economics and Statistics Research and Coordination.
3. New: Cont.: X
4. No.: NOR-3-01
5. Study leader: D.M. Boylen
6. Key Words: Economics of forest resource management, production costs, marketing systems, forest industry, employment/economic impacts, economic development, forest statistics.
7. Location of Work: Prairie provinces, NWT, Ottawa
8. Study objectives:
  1. To provide socio-economic and statistical data, analyses and documentation for policy and program development of regional and national forestry research, development and technology transfer programs.
  2. To provide evaluations of the costs of integrated forest management practices, the socio-economic benefits and impact of forest sector activities in the region, to be used for development and programs such as job creation and federal-provincial Agreements.
  3. To co-ordinate CFS forest economics research activities in the region, as well as promote and develop support and cooperation for forest economics and statistics programs.
9. Goals for 1987-88:  
Scientific Authority for Contract Research
  1. Continue to act as Scientific Authority for PRUF project An Assessment of Non-market Benefits in a Value-At-Risk Framework for Fire Management.
  2. Continue to act as Scientific Authority for Alberta Agreement project. Alberta Economic Timber Supply. Prepare with contractor a final report for publication.

3. 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.

Regional Development Analysis, Policy and Planning, Evaluation Documentation

4. Continue to participate in evaluation task forces for Saskatchewan and Alberta agreements, as requested.

Economics Research, Reports and Publications

5. Assist in development and implementation of the national timber supply project.
6. Lead and coordinate a research project on Silviculture Investment Analysis for NFEP program.
7. Complete literature synthesis on economics of forest vegetation management. Prepare an Information Report for review.
8. Complete a preliminary cost analysis of data for vegetation management project.

Reviews, Comments, Briefings

9. Continue to provide reviews/comments of journal articles, reports, proposals and briefings.

Miscellaneous

10. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, as required.
11. 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.

Added Goals:

Scientific Authority for Contract Research

12. Develop and supervise a contract of an attitudinal survey of Alberta farm woodlot owners.
13. Develop and supervise a contract for a report on RISI annual conference meeting and material.

Regional Development Analysis, Policy and Planning, Evaluation Documentation

14. Preparation of need documentation and program descriptions for an extended Alberta Forest Resource Development Agreement (with NOR-36).

15. Preparations of policy and program documentation for Western Diversification Initiatives. Program development activities for the Western Diversification Office (with NOR-36).
16. Preparation of program proposal for an Alberta farm woodlot proposal (with NOR-54).
17. Prepare the Information Report entitled "Saskatchewan's Forest Industry, 1985".

Economics Research, Reports and Publications

18. Prepare bi-weekly reports on the Impact of the 15% Export Charge based on telephone calls, news clippings and statistical data.
19. Supervise a study of data from the Alberta Secondary Wood-Industry Directory.

10. Accomplishments in 1987-88:

Scientific Authority for Contract Research

1. PRUF project An Assessment of Non-Market Benefits in a Value-At-Risk Framework for Fire Management was completed as a MSc. thesis, U. of Alberta. Acted as External examiner for thesis. Journal paper is now being prepared.
2. Final report on Alberta Economic Timber Supply was received. It was reviewed by federal and provincial personnel, and comments are being incorporated for publication under the Alberta Agreement. Some three journal papers are anticipated (was previously listed as NOR-36-02-7).
3. Attended one meeting and monitored activities on the project/contract An Uncertainty Model and Evaluation Framework for Intensive Forest Management Decisions.
4. Developed and initiated contract for a socio-economic, attitudinal survey of Alberta farm woodlot owners. Reviewed and commented on survey and questionnaire design.
5. Developed and initiated contract for a report on RISI annual conference on Forest Products Demand in the Pacific Rim. Currently, evaluating and reviewing report for Alberta Agreement publication.

Regional Development Analysis, Policy and Planning, Evaluation Documentation

6. Reviewed evaluation framework proposal for Saskatchewan. Prepared an evaluation framework "Terms of reference" for the Alberta Agreement (with NOR-54).
7. Prepared several program descriptions as well as policy and program documentation for extended Alberta Forest Resource Development Agreement (with NOR-36).



8. Prepared policy and program documentation for Western Diversification Initiatives. Provided analyses of Alberta economic development statements for Western Diversification office.
9. Prepared program proposal for an Alberta farm woodlot program.
10. Wrote major revisions after the first review of the "Saskatchewan Forest Industry, 1985" report. Incorporated comments from second review of this report.

#### Economics Research, Reports and Publications

11. Monitored and commented on initial planning activities of the national timber supply project and became somewhat familiar with the TRIM model. Arranged liaison with provincial representatives.
12. Research project on Silviculture Investment for National Forest Economics Program was put "on hold" on 11 May 1987. (was also listed as NOR-3-05).
13. Literature synthesis on economics of forest vegetation management was continued. A problem analysis component was added.
14. A file report on operational logarithmic spraying is being prepared. Assistance was given in planning project as well as in pre-spraying vegetation measurement. Due to various regulatory constraints, spraying did not take place until early fall; effectiveness ratings will not be available until summer 1988. (was also listed as NOR-36-02-1C)
15. Prepared bi-weekly reports on the Impact of the 15% Export Charge based on telephone calls, news clippings and statistical data.

Reports are monthly starting November 1987 and will continue for a very long time.

16. Analytical data was prepared from the Alberta Secondary Wood-using Directory. This is currently being synthesized and a short draft report completed (Bohning with NOR-54).

#### Reviews, Comments, Briefings

17. Reviews were provided for numerous internal and external manuscripts:  
Economic Returns from Fertilization of 70- and 30-year-old lodgepole pine - Info. Report; Risk Management in Forest Planning; AWA. Hidden Creek Recreation study; Secondary Wood-Industry Directory; Alberta Agreement; Forestry Chronicle Articles; Chronicle and Description of the PSP Catalogue project - journal article.

#### Miscellaneous

18. Forest industry related statistical data, analysis and information for numerous diverse information requests were provided.



Analytical responses for various regional (CFS, FEDC) policy and program development activities were provided.

19. Continued to act as Project Leader for NOR-3 and inherited some activities of Manitoba economist NOR-36-01-8.
20. Participated on the executive of the Alberta Forestry Association and its Adult Education Committee.

11. Goals for 1988-89:

Scientific Authority for Contract Research

1. Complete activities associated with 5 research contracts, e.g., appropriate publications; seminars.

Regional Development Analysis, Policy and Planning, Evaluation Documentation

2. Provide socio-economic and statistical data, analysis and documentation for policy and program development for new forestry development agreements in Manitoba, Saskatchewan, Alberta and N.W.T.
3. Continue to participate in evaluation task forces as requested.
4. Provide comments/reviews, as requested, on proposals for the Western Diversification Office.

Economics Research, Reports and Publications

5. Provide regional input to the CFS national study on Canada's timber supply.
6. Prepare monthly reports for CFS on Impact of the 15% Export charge on Northern region producers.

Reviews, Comments, Briefings

7. Continue to provide reviews/comments of journal articles, reports, proposals as well as briefings.

Miscellaneous

8. Continue to act as Project Leader for NOR-3.

12. Present Status of Study:

- Objective 1: On-going discussion papers, legal agreements, and facilitating Cabinet and Treasury Board documents were prepared for the development, negotiation, and implementation of the Alberta, Manitoba and Saskatchewan forestry renewal agreements. A large number of reviews and comments were prepared for various policy, planning and development activities. Several articles and speeches prepared.

Objective 2: On-going study proposals for economic research projects under the Canada-Manitoba and Canada-Saskatchewan research MOU committees have been developed and approved. They are being jointly implemented with NoFC and agreement staff. Some major projects under the three agreements which have been implemented are: the provincial forest industry reports, directories and forestry reports; evaluation frameworks for Agreements; and contracts on fire damage appraisals; economic timber supply determinations and PSP catalogue development.

Objective 3: On-going research study in forest resource economic needs for region was conducted with University of Alberta. Its recommendations are being implemented. The study was utilized for regional input into the planning of the CFS National Forest Economics Program.

Three research projects under PRUF have been directly supervised, as well as other contracts with the University of Alberta. Three interdisciplinary studies have been started on fire economics, vegetation management and forest management practices.

An information report on a 11 year summary (1975-86) for silvicultural statistics in Canada has been started.

Inventory data from 3 prairie provinces for the national inventory of 1986 was collected, converted to national standards, and has been checked for quality control and aggregated.

13. Publications 1987-88:

DeFranceschi, J.P.; Boylen, D.M. 1987. Costs and benefits of precommercial thinning: An overview and case study. Pages 252-268 in Proc. IUFRO International Interdivisional Conference on Thinning. Moscow-Riga, September 9-17, 1985. Part 2.

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. Duration:

Started: 1984

Completion: Continuing

16. Resources 1988-89:

PYs:	Prof:	Boylen	1.0
	Tech:	Bohning	0.1
	Total:		1.1
	Term/Student:		0.3

O&amp;M: \$15,000

Capital: 0

17. Signature:

Diana M. Boylen  
Investigator

Steve Price  
Program Director, Development

C. D. Tuttle  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 9, 1988

1. Project: Resource Economics and Statistics
2. Title: Forestry and socio-economic statistics and analysis/DEVMIS
3. New:                      Cont.: X                      4. No.: NOR-3-02
5. Study Leader: D.H. Kuhnke
6. Key Words: Provincial, regional and national forest statistics (e.g., silviculture, growth, depletion, accrual and inventory), socio-economic statistics, database management, evaluation frameworks, DEVMIS
7. Location of Work: Prairie provinces, NWT, Petawawa NFI
8. Study Objectives:
  1. To develop and interpret forestry and socio-economic statistics at the stand, provincial, regional and national levels in order to provide advice and guidelines for improved forest management decision-making by resource managers and researchers.
  2. To assist in the development and implementation of management information systems and evaluation frameworks for the forest renewal agreements.
9. 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.

10. Accomplishments in 1987-88:

1. Completed delivery of national forest inventory data for NATINV86 to the FORSTATS national inventory program at PNFI. Made recommendations with respect to this exercise and completed formal documentation for one of four inventories requiring documentation. Documentation for the other three inventories are in non-report form. Also continued to act in a liaison and problem-solving capacity for NATINV86 following delivery of the above national inventory data. This function largely involved devising solutions to unforeseeable problems that became apparent as analyses and summaries of these data were conducted at PNFI for use in publications.
2. Continued preparation of the 10-year national silviculture statistics Information Report. The combined effects of the NATINV86 exercise and a one-year update to have the reporting period coincide with the joint CFS/CPA forest management expenditures report have delayed publication to 198-89. (The management expenditures and the silviculture reports are to be merged into one report following publication of the next separate reports).
3. Completed contract supervision and liaison for the PSP Catalogue project. This included assisting in the development and refinement of catalogue search and browse software and the software user's manual. Also distributed the user's package that consisted of the manual and two diskettes containing the database and the software.
4. Publication of a booklet for establishing standard silviculture terminology was terminated during a national FORSTATS meeting in April 1987. A decision was made at this meeting to transfer this goal to PNFI.

Added Goals:

5. Participated in the operation of the regional growth and yield co-operative by providing input to short and long term project proposals, delivering presentations at co-op meetings, and preparing a report, in conjunction with AFS personnel, comparing member PSP establishment and maintenance procedures. This report is one of the co-op's short term projects.
6. Prepared a journal article that chronicles the background of PSP catalogues in western North American and summarizes the NoFC's PSP Catalogue Project with its two database components.
7. Fulfilled information and data requests such as i) FERIC request concerning private woodlots in Alberta, ii) a forestry geographic



information systems update for Alberta for use in a briefing note,  
iii) regional forest management expenditures for 1984-85 and 1985-86.

8. Participated in the Computer Requirements Committee that studied and set the NoFC's computing direction for the next five years.
9. Developed two proposals, and composed a summary of these two proposals plus a third proposal, for submission to the Western Diversification Office for possible funding under the Western Diversification Initiative.

11. Goals for 1988-89:

1. Publish the 11-year national silviculture statistics Information Report, and participate in planning for the integrated silviculture and forest management expenditures reports.
2. Initiate forest economics studies related to timber supply analysis modelling, economics of intensive forest management, and/or studies of forest products marketing trends and their impacts on the forestry sector and the general economy. These studies are particularly relevant in light of the forest industries rapid and substantial growth in Alberta. They may also involve use of geographic information systems.
3. Perform contract supervision and liaison for an extended PSP Catalogue project.
4. Perform functions related to and involving technical transfer and participate in preparing briefing notes, proposals, etc.

12. Present Status of Study:

1. The data conversion phase of the 1986 national inventory project began in December 1985 and was completed in April 1987. Follow-up functions were performed well into the fall. Miscellaneous requests for assistance in preparing PNFI publications will continue into 1988-89.

Ten of 12 jurisdictions have responded to requests for updates of silvicultural information. Preparation of the report has progressed as far as is possible with incomplete data. Report completion is expected by the summer of 1988. The first and second national silviculture statistics reports were published in 1982 and 1986.

The first portion of the PSP Catalogue Project began in December 1986 and was completed in October 1987. The PSP Catalogue project has been extended into 1988-89 to incorporate more information from CFS work conducted in Alberta.

2. Started preliminary work February 1987, expected completion February 1989.

13. Publications 1987-88:

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. Duration:

Started: 1982

Completion: 1989

16. Resources 1988-89:

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

O & M: \$5,000

Capital:

17. Signature:

Dieter Kuhnke  
Investigator

Steve Price  
Program Director, Development

C. D. Hunt  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 9, 1988

1. Project: Resource Economics and Statistics
2. Title: Forestry development and fire management economics
3. New:                      Cont.: X
4. No.: NOR-3-03
5. Study Leader: T.B. Williamson
6. Key Words: Wildland fire management planning economics, cost plus net-value-change, 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 1987-88:  
Scientific Authority for Contract Research
  1. Act as Scientific Authority for the contract study entitled Determining Forest Values for Strategic Fire Response in Manitoba. (Williamson)



Regional Development Analysis, Policy and Planning, Evaluation Documentation

2. 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)
3. Provide information and assistance for activities under Forestry Perspectives '87. (Williamson, Bohning)
4. 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)

Economics Research, Reports and Publications

5. 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)
6. Participate in the development and implementation of the NFEP project entitled Canada's Timber Supply: Current Status and Mid-Term Outlook. (Williamson)

Reviews, Comments, Briefings

7. Continue to provide review/comments of journal articles, reports, proposals and briefings.

Miscellaneous

8. Continue to provide socio-economic and statistical data, analysis and documentation for policy and program development, and regional development activities as required.

Added Goals:

9. Prepare the information report entitled: Manitoba's forest industry, 1985. (Williamson)
10. Provide recommendations to Sask. Parks Tourism and Culture re: optimum harvesting and manufacturing options in Cypress Hills Provincial Park. (Bohning)

Economics Research, Reports and Publications

11. Identify fire economics research needs and priorities with AFS personnel. (Williamson)
12. Initiate damage appraisal study for the May 1987 Elan fire. (Williamson)

10. Accomplishments in 1987-88:

Scientific Authority for Contract Research

1. Residual value timber appraisal methodology was developed. Preliminary harvesting productivity and machine cost data was collected. Draft report was prepared. Additional field data will be collected this spring.

Regional Development Analysis, Policy and Planning

2. Manitoba and Saskatchewan forestry reports were published. (Bohning)
3. Forestry perspectives 87 was not undertaken.
4. Alberta agreement report entitled "The continuing challenge: competition and new products in the world forest products markets" was published. (Williamson)
5. Major revisions to the proposed information report "Manitoba's forest industry, 1985" have been incorporated. Report is in the final draft stage. (Williamson)
6. Recommendations regarding harvesting, manufacturing, and marketing practises in Saskatchewan's Cypress Hills Provincial Park were provided. (Bohning)

Economics Research, Reports and Publications

7. Fire economics research concept paper was not completed. Strategic framework for fire economics research was not developed. (Williamson)
8. Became familiarized with PC-TRIM model. Monitored initial planning activities. Major involvement in 88-89. (Williamson)
9. In response to research needs originally expressed by the AFS, a proposal entitled "Expert assessment of relative resource values for evaluating strategic fire response" was prepared. (Williamson)
10. A methodology for fire damage appraisal in Saskatchewan has been developed. The approach will be demonstrated using the Elan fire as a case study. (Williamson)
11. Reviews were provided for numerous internal and external manuscripts including; Manitoba and Saskatchewan primary wood-using industry reports, AWA Hidden Creek Rec. Study, CJFR articles, "Utilization of poplars in Alberta", and the Alberta agreement report titled "Secondary Wood-Industry Directory. Analytical support for various regional policy and program development activities was provided.

Miscellaneous

12. Forest industry related statistical data, analysis, and information for numerous diverse information requests were provided.

13. Participated on the executive and various subcommittees of the CIF - RMS including the Renewable Resources Subcommittee of the ECA which is currently preparing the Alberta Conservation Strategy.

11. Goals for 1988-89:

Scientific Authority for Contract Research

1. Document the theory, procedures, results, and conclusions of the study: Commercial timber default values in Manitoba. (Williamson)

Regional Development Analysis, Policy & Planning, Evaluation Documentation

2. Provide socio-economic and statistical data, analysis and documentation for policy and program development for new forestry development agreements in Manitoba, Saskatchewan, Alberta and NWT.
3. Prepare Alberta agreement report on the Secondary wood-using industry in Alberta. (Bohning)
4. Develop terms of reference and act as scientific authority for a small study of marketing opportunities for wood products from Saskatchewan's Cypress Hills Provincial Park. (Bohning)

Economics Research, Reports and Publications

5. Provide regional input to the CFS national study on Canada's timber supply.
6. Develop economic and fire effects models required for fire damage appraisal. Complete Elan fire study.

Reviews, Comments, Briefings

7. Continue to provide reviews/comments on journal articles, CFS reports, proposals, and briefings.

12. Present Status of Study:

Each of the three objectives stated in section eight continue to be relevant to the past and proposed activities undertaken within the sphere of study 03-03. Objective one captures those ongoing activities undertaken in support of program development (i.e., Federal - Provincial Agreements). Objective two relates to the provision of regional input into national level analyses such as Forestry Perspectives and the National Timber Supply Project. Objective three applies to activities related to the development of decision aids in wildland fire management. Activities related to this objective include; The Elan Fire damage appraisal study, the Manitoba commercial timber default values study, and the fire economics concept paper.

13. Publications 1987-88:

Bohning, R.A. 1987. Manitoba's forests. Can. For. Serv., North.  
For. Cent., Edmonton, Alberta. Forestry Report 32.

Bohning, R.A. 1987. Saskatchewan's forests. Can. For. Serv., North.  
For. Cent. Edmonton, Alberta. Forestry Report 33.

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. Duration:

Started: 1980

Completion: Continuing

16. Resources 1988-89:

Prof.:	Williamson	1.0
Tech.:	Bohning	0.9
Total:		1.9

Term/Student:	0.3
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O & M: \$5,000

17. Signatures:

  
Investigator

  
Program Director, Development

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 9, 1988

1. Project: Forestry Resource Economics and Statistics
2. Title: Economic analyses of forest management practices
3. New: X                      Cont:                                      4. No.: NOR-3-04
5. Study Leader: J. De Franceschi
6. Key Words: Economics, interdisciplinary forest management, cost-effectiveness, benefit:cost, risk:benefit, decision-making models, production costs, employment/economic impacts, silviculture.
7. Location of Work: Prairie provinces, NWT, Ottawa.
8. 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.
9. Goals for 1987-88:  
Regional Development Analysis, Policy and Planning, Evaluation Documentation
  1. Provide information and assistance for activities under Forestry Perspectives '87. (with Boylen and Williamson)



Economics Research, Reports and Publications

2. 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.
3. 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.
4. Prepare a File Report summarizing productivity data collected from all silvicultural treatments sampled in Manitoba during the 1987 season of field operations.

Reviews, Comments, Briefings

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.

Added Goals:

6. Initiate a study to determine costs of mechanical (manual) release of white spruce from an aspen overstory.

10. Accomplishments in 1987-88:

Regional Development Analysis, Policy and Planning, Evaluation Documentation

1. No action required.

Economics Research, Reports and Publications

2. No action was required under the National Forest Economics Project. Silviculture cost studies were restricted to Manitoba under the Canada/Manitoba agreement.
3. Two File Reports were prepared entitled: Labor Productivity for Manual Tree Planting in Manitoba; and Machine Productivity for Disc Trenchers, Drum Choppers and Buckle Scarifiers in Manitoba. These reports are based on field data collected during 1986.
4. Summary tables are being completed for labor/machine productivity data collected during 1987. These summaries which include pre-commercial thinning, manual tree planting and mechanical site preparation, will be combined in one File Report.

Reviews, Comments, Briefings

5. Provided information and reviews as required. Provided assistance in preparing briefings, proposals, etc.

Added Accomplishments 1987-88:

6. The study was initiated and filed observations on labor productivity were completed. The study description and preliminary labor production rates have been summarized and presented in a Manitoba Forestry Branch internal file report. (with W. Bell, Manitoba Forestry Branch).

11. Goals for 1988-89:

Economics Research, Reports and Publications

1. Prepare an information report on labor requirements for mechanical (Manual) release of white spruce from competing aspen.
2. Initiate analysis of labor/machine productivity data from silvicultural treatments in Manitoba to determine costs for treating different sites.
3. Explore the possibilities of providing a two - three day work shop on the business aspects of operating a small silviculture contracting company. The workshop would be held in Manitoba and presented by a consulting firm.
4. Provide regional input to the national study on Canada's timber supply (Phase 1).

12. Present Status of Study:

Objective 1. On-going

Objective 2. Time studies have been completed for several silvicultural treatments in Manitoba. Analytical work will commence early in fiscal year 1988/89.

Objective 3. No action. This objective depends on meeting objective number 2.

13. Publications 1987-88:

Bell, F.W.; DeFranceschi, J.P. Labour Productivity for the Manual Cleaning of Natural Established White Spruce Stands in the Duck Mountain Provincial Forest of Manitoba. Canada-Manitoba Forest Renewal Agreement, Winnipeg, Man. File Report. November 1987.

DeFranceschi, J.P.; Boylen, D.M. 1987. Costs and Benefits of Precommercial Thinning: An Overview and Case Study. Pages 252-268 in Proc. IUFRO International Interdivisional Conference on Thinning. Moscow-Riga, September 9-17, 1985. Part 2.

DeFranceschi, J.P.; Steele, T. Labor Productivity for Manual Tree Planting in Manitoba. Can-Man. For. Renewal Agreement, Winnipeg, Man., File Report. March 1987.

De Franceschi J.P.; Steele, T. Machine Productivity for Disc Trenchers, Drum Choppers and Bracke Scarifiers in Manitoba. Can.-Man. For. Renewal Agreement, Winnipeg, Man. File Report. November 1987.

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. Duration:

Start: 1985

Completion: 1992

16. Resources 1988-89:

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

O & M: \$5,000

Capital:

17. Signature:

Joe De Franceschi  
Investigator

Shirley Rice  
Program Director, Development

G. D. McIntyre  
Regional Director General



NOR-4

STAND PRODUCTIVITY AND FOREST INVENTORY

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Analysis of growth and yield of important tree species in the prairie provinces (revised).
3. New:                      Cont.: X                      4. No.: NOR-4-01
5. Study Leader: I.E. Bella
6. Key Words: Tree and stand growth and development, yield, thinning, tending.
7. Location of Work: Data originates from various locations in Alberta, Saskatchewan, and Manitoba
8. Problem
8. Problem:

As forestry activity and demand for wood fibre increases in the region, so does demand for information on growth and yield of the major commercial tree species, whether they are growing in old growth, fire origin stands or in second growth stands following harvesting. The most important problems include: predicting growth and yield in natural, unmanaged stands; predicting growth and yield of managed, planted, seeded stands that were spaced, thinned and possibly fertilized; the effect of insects, diseases and other agents on growth and yield; species selection for optimum growth and development on a given site; and synthesizing tree and stand growth information into a suitable predicting model.

Progress to 1987:

1. A series of PSPs were established to monitor growth and development of old growth stands of LP, jP, wS, and tA. Some of these plots date back to 30 years or more (see summary table in NOR-4-02). Many of these plots--most of them LP--are still intact, periodically remeasured and provide useful information. Data were analysed as became available, and yield tables published for jP, LP, wS and tA.
2. Thinning experiments and some growth monitoring plots in operational thinning trials, have been established in jP, LP, tA, and wS. Results

are published as became available, and the studies provide important information on managed stand yield. Thinning equipment performance trials were also conducted, analysed and published.

3. Spacing experiments have been established in jP, rP, lP, and wS. 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. Studies have been initiated to determine the impact of insects, diseases and other agents on growth and yield, particularly in stands following harvest. Preliminary results and recommendations have been presented at symposiums and/or published.
6. 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 1986.

#### 9. Study Objectives:

1. Provide project leadership, advice and technical transfer to project and regional development staff, clients and the Growth and Yield Cooperative in 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 growth and yield 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 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.
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, Univ. of Idaho; (2) "Strategies for reducing damage impact from stem diseases" by S. Navratil and I.E.B.

3. Publish a journal paper on "Western gall rust dynamics and impact" by I.E.B. and S. Navratil.
4. Publish a journal paper on "red belt" impact on LP growth in the eastern Rockies, Alberta; I.E.B. and S. Navratil.
5. Cooperate with the Alberta Agreement Mensurationist to develop managed stand yield tables for LP and WS.
6. Provide technical input and leadership in the regional Growth and Yield Coop.
7. Publish an Information Report on "Guidelines for spacing/thinning LP in Alberta" combining all results from LP spacing/thinning studies.
8. Determine the feasibility and plan LP spacing trials for a range of conditions in cooperation with Champion Forest Products at Hinton.
9. Participate in the 1987 meeting of IUFRO Economic of Thinning Working Groups in Scandinavia.

Added Goals:

10. Provide advice and guidance to PDF on studies (a) to improve the accuracy and reduce cost of stand volume estimation; (b) to develop an improved model of mortality for lodgepole pine; (c) to define the effect of stand density on height growth of lodgepole pine, and (d) cooperate as coauthor in preparing manuscripts for publication from these studies as warranted.
11. Cooperate with W. Ondro in preparing a paper for the Can.-Am. Poplar Council 1987 Annual Meeting on the market potential of poplars in Alberta.
12. Prepare contract specifications for a review of problems and needs of Alberta members of the Regional Growth and Yield Cooperative.

11. Accomplishments 1987-88:

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 carried out technology transfer in thinning, growth and yield and stand modelling; yield forecasting; acted as a scientific authority on related contracts as required.
2. Published 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.
3. Submitted a paper for publication to the CJFR on "Western gall rust dynamics and impact" by I.E.B. and S. Navratil.

4. A paper on "red belt" impact on LP growth in the eastern Rockies, Alberta; by I.E.B. and S. Navratil was accepted for publication in the CJFR.
5. Cooperated with the Alberta Agreement Mensurationist to develop managed stand yield tables for LP and WS.
6. Provided technical input and leadership in the regional Growth and Yield Coop; an annual meeting was organized; an action plan developed and implemented for the current year.
7. Information Report on guidelines or prescriptions for spacing/thinning LP in Alberta combining all results from LP spacing/thinning studies has been postponed.
8. Explored the feasibility of LP spacing trials for a range of conditions, in cooperation with Champion Forest Products at Hinton. Progress was limited due to organizational changes in that company.
9. Participated in the 1987 meeting of IUFRO Economic of Thinning Working Groups in Scandinavia, and prepared summary report of the meeting.
10. Provided advice and guidance to PDF on studies (a) to improve the accuracy and reduce cost of stand volume estimation, a joint paper on this was accepted for publication by the CJFR; (b) to develop an improved model of mortality for lodgepole pine; (c) to define the effect of stand density on height growth of lodgepole pine; and (d) cooperated as coauthor in preparing manuscripts for publication from these studies.
11. Cooperated with W. Ondro in preparing a paper for the Can.-Am. Poplar Council 1987 Annual Meeting on the market potential of poplars in Alberta.
12. A contract was prepared and let (to Dempster and Assoc.) to identify urgent growth and yield needs in the region. A report has been submitted by the consultant to the Growth and Yield Coop members.

12. Present Status of Study:

1. Leadership function and technical transfer are important and continuing activities under this study, with an added new trust being initiated through the Regional Growth and Yield Cooperative.
2. Most work in growth and yield model evaluation and development is currently centered on our effort to develop managed stand yield tables (models) for LP and WS through Can.-Alta. agreement funding.
3. Treatment prescriptions, particularly for spacing and thinning, are developed as data becomes available and are passed to the user through workshops, field tours and printed form.



4. Under intensive short term studies, note current efforts in evaluating the effect and impact of various damaging agents and climatic factors. Several symposium and journal papers have been published recently on these problems.

13. Goals for 1988-89:

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.
2. Cooperate with the Alberta Agreement Mensurationist to develop managed stand yield tables for LP and WS.
3. Provide technical input and leadership in the regional Growth and Yield Coop.
4. Publish a paper in the CJFR on "Western gall rust dynamics and impact in young LP stands in Alberta"; I.E.B. and S. Navratil.
5. Publish an Information Report on guidelines or prescriptions for spacing/thinning LP in Alberta, combining all results from LP spacing/thinning studies following consultation with clients.
6. Initiate and plan LP and WS spacing trials for a range of conditions, in cooperation with the forest industry in Alberta.
7. Provide advice and guidance to PDF on (a) refining a mortality model for LP; (b) analysis of height growth suppression; and (c) development of a preliminary yield model for old growth stands. Cooperate as coauthor in preparing manuscripts for publication.
8. Assess the usefulness of the Swan River, Manitoba aspen pruning study 20 years after establishment and remeasure disease conditions if warranted.

14. Publications 1987-88:

- Bella, I.E.; Stoszek, K. 1987. Strategies for reducing leader damage from insects. In Proc. "Future Forests of the Mountain West; a stand culture symposium". Missoula, Montana, Sept. 1986.
- Navratil, S.; Bella, I.E. 1987. Strategies for reducing damage impact for stem diseases. In Proc. "Future Forests of the Mountain West; a stand culture symposium". Missoula, Montana, Sept. 1986.
- Bella, I.E.; Navratil, S. 1987. Growth losses from winter drying (red belt damage) in lodgepole pine stands on the east slopes of the Rockies in Alberta. Can. J. For. Res. 17:1289-1292.

Zakrzewski, W.T.; Bella, I. E. 1988. Two new height models for volume estimation of lodgepole pine stands. Can. J. For. Res. 18:(in press).

Ondro, W.J.; Bella, I.E. 1987. Market potential for Alberta's Poplar products. In Proc. Can.-Amer. Poplar Council 1987 Annual Meeting. (in press).

Dempster, W.R. and Associates. 1987. Problems and needs of Alberta members of the Regional Growth and Yield Cooperative. A consultant report, unpublished.

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. Duration:

Start: 1986

Completion: 1991


17. Resources 1988-89:

PYs: Prof.: Bella	1.0
Tech.: Vice Kolabinski	1.0
Total	2.0
Term/Student	0

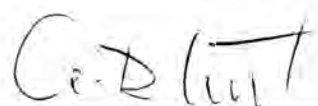
O&M: \$11,200

Capital

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Data base development for growth and yield of important forest types in the prairie provinces.
3. New:                      Cont.: X
4. No.: NOR-4-02
5. Study Leader: Vacant
6. Key Words: Computerized database, tree and stand growth, treated and untreated stands, thinning, spacing, site yields, stocking, models, aspen, jack pine, black and white spruce, red pine, lodgepole pine.
7. Location of Work: Manitoba, Saskatchewan and Alberta
8. Problem Analysis:

Growth and yield information is required for the efficient management of forest resources in the prairie provinces. Such information is needed for both treated and untreated stands. Silvicultural options and treatments can be evaluated by establishing and periodically re-examining permanent sample plots in the important forest types in the region. Growth and yield information thus obtained will form the basis of developing and improving growth and yield forecasting models both for old growth and managed stands. Computerizing such data bases increases their usefulness in-house and to clients.

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 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 1P spacing study at Tepee Pole Creek in May, analyze 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)

11. Accomplishments in 1987-88:

1. A draft Information Report entitled 'Guidelines for the use of STEMS in the management of jack pine and aspen' was prepared. A copy of the report was independently reviewed by two Manitoba Foresters both of whom recommended that the report needed to be revised to enhance clarity of the STEMS model background and its utilization by field foresters in carrying out thinning operations in jack pine.
2. The demonstration of the STEMS model to G. Ardron, silviculture forester, Manitoba Dept. Natural Resources was not undertaken.
3. The bibliography of lodgepole pine initially prepared by Reid Collins Ltd. and updated by H. Grewel was published as Information Report NOR-X-291.
4. The field remeasurement of the thinned bs-jp stand (Ms-7) in Duck Mountain, Manitoba was not undertaken.
5. The jp multiple thinning plot in the Sandilands Forest Reserve (MS-154) were remeasured in the autumn of 1987 by S. Lux.

6. S. Lux supervised the remeasurement of the IP spring study at Teepee Pole Creek. Data analysis has not yet been initiated due to the fact that the study leader (H. Grewal) was transferred to another position within the Centre.
7. Growth and yield models (eg Morton's) were used to assess growth and yield of wS-tA stands in relation to species mix, release of white spruce, and other variable. The results achieved were inconclusive in the sense that the model evaluated did not accurately predict growth and yield. (See Yang 04-09).
8. PSPs were not established in white spruce plantations in the Turtle Mountains of Manitoba due to the reassignment of the Study Leader.
9. Assistance was not provided to D. Kuhnke with respect to the development and maintenance of a computerized PSP data base of regional forest productivity data.

## 12. Current Status of Study:

1. A series of permanent sample plots were established for monitoring old growth stands in lP, jP, wS, and tA. Many of these plots, some date back more than 30 years - are still periodically remeasured and provide useful information. Thinning (in jP, lP, tA, and wS) and spacing (in jP, rP, lP, and wS) experiments were established and these studies provide useful information on managed stands (see summary table). Progress and accomplishments on these studies were previously mentioned under NOR-04-01.
2. A regional PSP catalogue containing CFS as well as provincial and industrial PSPs has been developed and distributed to clientele by D. Kuhnke (NOR 03-02). In addition individual tree and plot information has been computerized to ensure effective utilization by CFS staff and clients.
3. Appropriate reports - both Information Reports and Forest Management Notes - are published as information relating to additional remeasurement becomes available or new analytical techniques come on stream.

## 13. Goals for 1988-89:

1. Remeasure Pelly, Saskatchewan thinned aspen PSPs in the spring of 1988 before growth is initiated.
2. In the autumn of 1988 remeasure 20 PSPs (MS-189) associated with a merchantable selection thinning in jack pine east of Piney, Manitoba, and the red pine, jack pine, and white spruce spacing experiments at Moodie, Manitoba (64, variable size plots).
3. Analyze data collected in 1987 and draft a FMN on spacing lodgepole pine at Teepee Pole Creek, and analyze the results of the 1986 remeasurement of the 1964 Gregg Burn lodgepole pine spacing study.

4. Analyze data collected in the autumn of 1987 and prepare a FMN on thinning jack pine (MS-154) in the Sandilands Forest Reserve.
5. Publish an Information Report on management guidelines on the use of STEMS in single species stands.
6. Analyze all data collected to date on mechanical strip thinning of jack pine in the Sandilands Forest Reserve between 1964 and 1988. Draft a FMN for peer review.
7. Maintain a computerized data base of regional forest productivity PSPs in cooperation with D. Kuhnke.

14. Publications 1987-88:

Grewal, H., editor. 1987. Bibliography of lodgepole pine literature. Can. For. Serv., North. For. Cent.; Edmonton, Alberta, Info. Rep. NOR-X-291.

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. Duration:

Start: 1948

Completion: Ongoing

17. Resources 1988-89:


PYs	Prof: Vacant	1.0
	Tech:	
	Total:	1.0
	Term/Student:	0.3

O&M: \$9,800

Capital: Nil

18. Signatures:

\_\_\_\_\_  
Investigator

  
\_\_\_\_\_  
Program Director, Resources

  
\_\_\_\_\_  
Regional Director General

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS  
1988

Study No.	Location	Soil and Site	Stand age at establishment	Date of establishment	Date of remeas.*	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	Sandilands, 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	Sandilands, 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	Sandilands Forest Res., Man.	a. Sand, fresh (Tougas Kd.)	9	1964	1965 1968 1973 1978 1983 Spr. (1987 A) (1998 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

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS  
1988 (continued)

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of re meas.*	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 - .007	Mechanical Strip-thinning	Control: 5 plots
					1968				Thinned 1-way: 5 plots
					1973				Thinned 2-way: 5 plots
					1978				
					1983 Spr.				
					(1987 A)				
					(1998 Spr.)				
		d. Sand, moist	11	1967	1969	5	.002 - .007	Mechanical Strip-thinning	Thinned 1-way: 5 plots
					1976				
					1981				
					1986 A				
					(1996 A)				
					1965				
					1967				
		e. Sandy till, fresh	13	1965	1970	10	.002 - .007	Mechanical Strip-thinning	Control: 5 plots
					1974				Thinned 1-way: 5 plots
					1979				
					1984 A				
					(1994 A)				
					1966				
					1968				
		f. Sandy till, fresh	17	1966	1970	10	.002 - .007	Mechanical Strip-thinning	Control: 5 plots
					1975				Thinned 1-way: 5 plots
					1980 A				
					1985 A				
					(west of Piney)				
					(1995 A)				
					1965				
		g. Sand, dry	13	1965	1967	10	.002 - .007	Mechanical Strip-thinning	Control: 5 plots
					1970				Thinned 1-way: 5 plots
					1974				
					1979				
					1984 A				
					(Badger)				
					(1994 A)				
5-1P	McKay, Alberta	Silt loam to sandy loam	22	1954	1960	16	.20 - .738	Low selection thinning	Control: 3 plots
					1969				1.5m spacing: 3 plots
					1979				1.8m spacing: 3 plots
					(1989)				1.8m spacing: rethinned. 3 plot
									2.4m spacing: 3 plots
									3.7m spacing: 1 plot



SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS  
1988 (continued)

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
6-jP -rP	Sandilands, 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	Sandilands	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. Sandilands	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)	3 areas; in each 1 control, 1 thinned.	
-jP	c. Hadash.	N/A	N/A	1981	1985A (1990A)		20 x 20 m		
All									



SUMMARY OF ACTIVE THINNING AND OTHER GROWTH STUDIES IN ASPEN  
1988 (Concluded)

Study No.	Location	Soil and Site	Stand age at establishment	Date of establishment	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.

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Transformation and movement of applied fertilizer elements (N, P, S) in selected lodgepole pine stands
3. New:                      Cont.: X                      4. No.: NOR-4-03
5. Study Leader: J. Baker
6. Key Words: Acid soluble-alkali labile nitrogen, acid soluble alkali stable nitrogen, acid insoluble humin nitrogen, aluminum sulfur, sulfate-sulfur
7. Location of Work: Edmonton, Hinton, Alberta (Edson map sheet 83F)
8. Problem Analysis:

Soils of the foothills are suspected of being deficient in N-S-P. A fertilizer study was initiated on two common soil types of the area supporting various aged stands of lodgepole pine. Fertilizer responses (N, S and P) in both soils and stands have been monitored over a 10-year period.

Progress to 1986

The response of the two Luvisols to fertilization was markedly different. Both Physical and chemical properties of the soils had a marked influence on the distribution pattern of N, S, and P observed. The differences in soil chemistry of the soils were seen in the retention of nutrient within the profile. While certain complex organic substances containing essential nutrients are taken up by roots, available nutrients predominantly are found in the mineral fractions of the soil. Results to date have been presented in 2 published reports and 4 - file reports.

9. Study Objectives:

1. To determine the influence of soil physical and chemical properties on the transformation of N, P and S fertilizers and the accumulation and distribution of these in the various inorganic and organic soil fractions.

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

10. Goals for 1987-88:

1. Publish FMN of 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.

Added Goals:

6. A written response (6 pp) was given to the P.D. (R. Waldron) regarding a statement made by Sacks and Sollins, "yield is extremely sensitive to the rate of mineralization of soil organic matter (S.O.M.) variation in S.O.M., C/N ratio, available N ratio ( $\text{NO}_3^-/\text{NH}_4^+$ ) etc.", (For. Ecol. and Manag. 17:25-36, 1986).
7. As a result of (6) further investigation was undertaken relative to organic C and N relationships in fertilized and unfertilized coalspur and mercoal soil samples.
8. A report, "An approach to balanced applications of N, P and S in the fertilization of lodgepole pine in the foothills" was completed and submitted for outside peer review.
9. An application for a patent for a constant-level-constant-temperature water bath was submitted to C.P.D.L. (M. Steven).

11. Present Status:

Both physical and chemical properties of these soils have influenced the transformation of added N, P and S, their accumulation and distribution both within the soil profiles and the arbitrarily designated nutrient fraction. Soil properties such as hydrated Al and Fe oxides silicate clay contents, C/N ratios, soil O.M. contents and mineralization rates, ratios between inorganic and organic nutrient sources, etc. play a role in stand and soil responses to fertilization. Thus far, these properties showed a greater impact in the Podsollic Gray Luvisol (Mercoal) than that in the Orthic Luvisol (Coalspur).

12. Accomplishments in 1987-88:

1. A FMN on fertilization effects on two Luvisols of the foothills is under review by the P.D.
2. A file report, "Current information on the fertilization of lodgepole pine and suggestions for future research", has been submitted to the P.D.
3. A Inf. Rpt, "The status of 3 N-fractions in the profile of a Podsolc Gray Luvisol 6 and 12 weeks after fertilization with urea,  $\text{NH}_4\text{NO}_3$  and  $(\text{NH}_4)\text{SO}_4$ ", is under review by the P.D.
4. Advice and assistance relative to soils problems have been provided both within and outside this laboratory.
5. All activity in 1987-88 was undertaken with the aim of terminating study 04-03.
6. The written reply to the P.D. along with the formal article, is on file in the Central Registry under study 04-03.
7. Further examination and analyses on the two Luvisols (Coalspur and Mercoal) confirm the observation of Sachs and Sollins (see statement in goal 6).
8. The proposed report, "An approach to balanced applications of N, P and S in the fertilization of lodgepole pine in the foothills", received outside peer review and was submitted to the Can. J. For. Res.
9. A constant-level-constant-temperature water bath was developed for which a patent is being sought through the C.P.D.L.

13. Goals for 1988-89:

1. Termination of study. Completion of all reports.

14. Publications 1987-88:

- Baker, J. 1987. Distribution of N in a simulated profile of a Podsolc Gray Luvisol following urea fertilization. Can. J. Soil Sci. 67:271-280.
- Baker, J. 1987. Fertilization effects on Orthic and Podsolc Gray Luvisols in the foothills. Prepared for FMN.
- Baker, J. 1987. Current information regarding fertilization of lodgepole pine and suggestions for future research - file report.

Baker, J. 1987. The status of 3-N fractions in the profile of a Podsolc Gray Luvisol 6 and 12 weeks after fertilization with urea,  $\text{NH}_4\text{NO}_3$  and  $(\text{NH}_4)_2\text{SO}_4$ . Prepared for Inf. Rpt.

Baker, J. 1987. A reply to a request from the P.D. to elaborate on the statement "yield is extremely sensitive to the rate of mineralization of soil organic matter (S.O.M.) variation in S.O.M., C/N ratio, available N ratio ( $\text{NO}_3^-/\text{NH}_4^+$ ) etc. (Central Registry).

Baker, J. 1988. An approach to balanced applications of N, P and S in the fertilization of lodgepole pine in the foothills. Submitted to the Can. J. For. Res.

Baker, J. 1987. Development of a constant-level-constant-temperature water bath - an application for a patent has been submitted to the C.P.D.L. - drawings and notes are filed with M. Steven.

15. Environment Implications:

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

16. Duration:

Start: 1972

Completion: 1988

17. Resources 1988-89:

PYs: Prof.: 1.0  
Tech.: 1.0


Total: 1.0

O & M: \$0

Capital:

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

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.

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 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).

Added Goal:

8. Develop a computer program for the AFS Research Branch to process site productivity plot data.

11. Accomplishments in 1987-88:

1. A manuscript entitled "Effects of fertilization on wood density and tracheid length of 70-year-old lodgepole pine in west-central Alberta" has been submitted to a journal. (4-15)
2. Scheduled sampling for soils and foliages to monitor nutritional and dimensional changes following fertilization and thinning has been completed. Laboratory analyses to determine nutrient concentrations in soils and foliages are in progress. (4-19)
3. Laboratory nutrient analyses on soil, ground vegetation, and foliar sampled in 1986 are complete. Statistical analyses on treatment effects are in progress. (4-19)
4. A tentative plan to assess fertilization trials in bS and jP in Alberta, Saskatchewan and Manitoba was drafted. (4-40)

5. Increment cores were taken from all survival trees in the South of Mercoal 70-year-old fertilization trial plots. Ring measurement to assess radial growth before and after treatment was complete. (4-88)
6. A manuscript for a research note on nutrient status of 40-year-old lodgepole pine needles was drafted. (4-61)
7. Provided advice on fertilization and foliar sampling methods to CanFor and AFS. (4-18)
8. A microcomputer program to compile plot data was developed and used by the Research Branch, AFS.

12. Present Status of Study:

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, 1987 for nutrient analyses. Laboratory analyses of pre-fertilization and 1986 samples have been completed and determinations of 1987 samples are in progress.

Dimensional changes in current needles in thinned and fertilized plots become visually noticeable two years after treatment. The information on needle length and weight in combination with nutrient status in soil and foliages following treatment provide needed data for predicting growth response and diagnosing nutrient requirement of lodgepole pine.

13. Goals for 1988-89:

1. Publish the manuscript entitled "Effects of fertilization on wood density and tracheid length of 70-year-old lodgepole pine in west-central Alberta".
2. Continue sampling for soils, ground vegetation and foliage to monitor nutritional and dimensional changes following fertilization and thinning; conduct data analyses.
3. Sample Interprovincial Fertilization Trial plots in Slave Lake, Alberta and Candle Lake, Saskatchewan to assess changes in stem bole from following fertilization.
4. Carry out analysis on the Mercoal plot samples to verify N, P, and S effects on growth of 70-year-old lodgepole pine by the Solonius method.
5. Prepare and submit a research note on nutrient status of 40-year-old lodgepole pine needles for journal publication.
6. Provide advice and carry out technology transfer on mensurational problems relating to forest fertilization.

14. Publications 1987-88:

Nil

15. 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.

16. Duration:

Start: 1984                      Completion: 1996

17. Resources 1988-89:

PYs: Prof.: Yang 0.5  
Tech.: Lux 0.5

Total: 1.0


Term/Student:

O & M: \$3,000 (+ \$3,000 Alberta Agreement)

Capital:

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Interpretation and mapping
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), Canada Centre for Remote Sensing (CCRS) Geographic Information System (GIS), and Research and Development Accomplishments (RDA)
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 research is particularly appropriate for determining optimum means of producing up-to-date area information for GIS data bases, and for developing new information for the monitoring and appraisal of forest resources in cooperation with governments, industries and academic institutions. An important part of this process consists of benefit and cost documentation and analyses.
9. Study Objectives:
  1. To provide advice and prescriptions by analyzing, developing, coordinating and applying regionally unique forest interpretation and mapping methods for appraising and monitoring changes in the forest resource in an efficient manner in collaboration with NoFC 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 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)

Added Goals:

8. Participate with R. Newstead in R&D Evaluation study at NoFC.
9. Act as Scientific Authority for hardwood species differentiation contract under the Canada/Alberta Forest Resources Development Agreement.

11. Accomplishments in 1987-88:

1. Paper, "Mapping of burned forest lands in the Northwest Territories" was presented to the 5th Annual Northwest Conference on Survey and Mapping at Whistler, B.C., in June; it is now a File Report at NoFC.
2. The provision of advisory services, seminars and presentations to clients and colleagues was as follows:
  - a) consulted with REAP, and made facilities available, for a Parklands reconnaissance survey;
  - b) participated in Alberta "White Zone" vegetation mapping planning;
  - c) to present the Procom-2 in a Northwest Territories Remote Sensing Workshop in Yellowknife in January, 1988;



- d) completed inventory of NoFC Landsat imagery at the request of the CFS Remote Sensing Working Group and other interested parties; and
  - e) arranged USDA Forest Service presentation on ER-2 aircraft/Itek optical bar panoramic camera for AFS and Industry under the Canada/Alberta Forest Resources Development Agreement.
3. Information has been derived on Landsat Thematic Mapper imagery spectral combinations for applications to forest mapping in the Region, but report writing has been deferred (see "8" below).
  4. Satellite imagery/Procom-2 information generation for cooperative cut-over analysis with R. Hall completed (see Hall work plan, NOR-4-07).
  5. Analyses of Landsat imagery for Alberta Phase 3 inventory map updating in cooperation with AFS, CCRS and PNFI is in progress for the Whitecourt test area, and the following accomplishments are related:
    - a) proposed paper on the interpretability of Mosaics products (Goal 3).
    - b) comparison of clearcut area statistics with R. Hall (Goal 4);
    - c) documentation as a test site for CFS Remote Sensing Working Group;
    - d) Alberta/CCRS airborne Synthetic Aperture Radar trial set (Goal 6);
    - e) however, Alberta changing emphasis to Aspen in "White Zone" (Goal 2b).
  6. CCRS airborne Synthetic Aperture Radar servicability problems have postponed the trial until 1988.
  7. The writing of a co-authored Journal paper has begun, and it should be completed by May 1, 1988.
  8. The Research and Development Evaluation study is in progress.
  9. A detailed hardwood species differentiation contract report has been reviewed and accepted by Forest Resources Regional Development Program.
12. Present Status of Study:
1. Initiate development of GIS processing of forestry data and demonstrate practical utility for the automated conversion of forest inventory themes to biomass inventory classifications under the CFS ENFOR Program.  
Start: 1980    Finish: 1985    Revised: 1987
  2. Develop, demonstrate and transfer Procom-2 image interpretation and mapping system technology to Regional authorities for economic forest reconnaissance mapping and/or forest inventory area depletion updating in a timely and efficient manner.  
Start: 1983    Finish: 1986    Revised: 1988



3. Assist in the completion of NoFC research and development evaluation.  
Start: 1987    Finish: 1989

Progress to 1987:

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. Information Report, NOR-X-285, "A mapping and analysis of resources system application", was published in 1987.
2. Initiated a GIS information exchange meeting for regional forest inventory authorities in Prince Albert with Regional Development Program support, which enhanced provincial GIS implementation for forestry.
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 recommendations for the Final Report.
4. Completed ENFOR contract supervision for non-inventoried forest land sampling across the Region, and proposed/completed supplementary work for prairie forest land area determinations from Landsat imagery.
5. Demonstrated change monitoring techniques with Procom-2 Landsat imagery interpretation and mapping equipment at Alberta and Saskatchewan work-shops in Edmonton and Saskatoon, as well as presenting such techniques to international visitors at NoFC. Presentations in Winnipeg and Yellowknife followed (1987/88). Forest Management Note, No. 32, Procom-2 mapping technique for monitoring depletion", was published in 1986.
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 and to provide manpower assistance for joint project at AFS and NoFC.
7. Participated as an active member of both the CFS Working Group on Remote Sensing and the Alberta Advisory Committee on Remote Sensing, which included serving on the Organizing Committee for the Tenth Canadian Symposium on Remote Sensing.

13. Goals for 1988-89:

1. Assist R. Newstead for one-half year in the development and completion of the Research and Development Evaluation Study.
2. Provide advisory services, seminars and presentations to colleagues and clients as required on remote sensing and mapping.

3. Co-author a Journal paper with R. Hall on cutover analyses using Procom with satellite imagery, digitizer and microcomputer combination.
4. Publish a co-authored Journal paper with K. Nesby on reconnaissance mapping of Aspen Parklands.
5. Co-author and publish Journal paper on hardwood species differentiation from aerial photography based on contractor's report.
6. Evaluate TM and other sensors for a high level of stratification for the next phase of natural resources inventory.
7. Publish a Journal paper on Landsat TM imagery band combinations for interpretation for forestry in the Region.

14. Publications 1987-88:

Moore, W.C. 1987. Mapping of burned forest lands in the Northwest Territories. File Report:

Silvacom Ltd. 1987. Hardwood differentiation on aerial photos: an evaluation of multiscale color, black and white and color infrared imagery. Contract Report:

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. Duration:

Start:                      Completion:


17. Resources 1988-89:

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

O & M: \$5,000

Capital: \$13,000 (Stereo/Charge Module for Procom-2 \$8 K;  
Roll Film Scan Module for Procom-2 \$5 K)

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Development and application of large-scale photo and image analysis techniques to forest inventories
3. New:                      Cont.: X                      4. No.: NOR-4-07
5. Study Leader: R.J. Hall
6. Key Words: inventory, mensuration, remote sensing, geographic information systems, pest damage, vegetation damage, yield, large-scale photography (LSP), aerial photography, photogrammetry, satellite imagery, digital image analysis, statistical analysis, technology transfer, microcomputers,
7. Location of Work: Alberta, Saskatchewan, Manitoba, Northwest Territories and Yukon Territory
8. Problem Analysis:

Rising costs in acquiring inventory data for both mensuration and monitoring of pest damage, have resulted in a need to develop cost-effective systems or techniques, to replace or augment conventional ground surveys. This calls for the development, regional adaptation, and modification of systems, both hardware and software, to provide user agencies with the tools to more efficiently acquire and interpret resource inventory data. Remote sensing techniques, particularly the use of large-scale aerial photos and digital analyses, are playing increasing roles in inventory surveys. In addition, beyond investigations of image data from new resource satellites and airborne scanners, consideration needs to be given for possible integration into Geographic Information Systems (GIS). Challenges are in integrating systems design and adapting new techniques for regional inventory applications and technology transfer.

Progress and Achievements: Up to Prior Year

1. A computer-based, large-scale, aerial camera system has been developed. A second system was built for Yukon NAP and training & assistance was provided. The computer camera control system is now being marketed.

2. LSP applications development work have included regeneration assessments, timber inventory, slash volumes on cutovers, log pile volumes on millyards, and comparison of existing models for estimating dbh. Regeneration assessment methodology was adapted for Sask/Weyerhaeuser project, and work on optimizing exposure/processing parameters has been initiated.
3. Computer-based photo measurement system constructed and much measurement/analysis software has been written. Several programs have been transferred to client agencies upon request.
4. Both analogue and digital image analysis techniques have been developed or applied to regional projects: pest damage (tent caterpillar), clearcut mapping, and broad forest covertype mapping. Special image enhancements using MEIS data for cover type discrimination has been completed, with adaptation for bpop/taspen initiated. There is increasing activity and enquiries for applications as these high technology developments continue.
5. There has been participation in numerous seminars, workshops, courses, symposia, and committees. Examples of committee participation have included the Forestry Working Group of the Canadian Advisory Committee on Remote Sensing, CFS Remote Sensing Working Group, Scientific & Technical Committee of 9th Cdn. Symposium on Remote Sensing, and Organizing Committee of 10th Cdn. Symposium on Remote Sensing. 14 reports have been published and 5 file reports written.

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 assess and apply digital image analysis techniques using satellite and airborne digital data, for the interpretation, classification and monitoring of forest resources in the region, with consideration for integration into Geographic Information Systems.
3. To maintain an air photo/image acquisition and analysis laboratory for cooperative studies.
4. 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.
5. To design and develop photo acquisition and measurement/interpretation system components as required for regional applications.

10. Goals for 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 Alberta. (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].
11. Accomplishments in 1987-88:
  1. Frequent contact with Yukon and troubleshooted several camera and control system problems which arose. Hardware refinements not pursued due to staff changes and operation difficulties in their first year of



operation. A second workshop is being planned. Lesson: continuous contact for the first year of operation is necessary. Camera control system paper in preparation to be finalized by fiscal year end.

2. Proposed journal paper "A comparison of existing models for dbh estimation from large-scale photos" in m/s review process. Light meter modified for LSP and multifilms were exposed in Sept/87. Alberta forestry interpreters will analyze the photos and a nonparametric ANOVA will be conducted for a m/s on optimizing exposure/processing parameters for LSP.
3. Paper "Spectral classes and forest classification" completed and submitted to journal.
4. Forest cover enhancements and field checking completed. Interpretation test to be undertaken in March/88 followed by analysis of results and drafting of paper. Preliminary enhancements for bp/ta discriminations completed but much refinement needed. Special scene and cover type variability are posing difficulties.
5. Saskatchewan regeneration project completed, and final reviews and contract report assessments were conducted in Prince Albert. A summary Forestry Chronicle paper on the study is being planned.
6. Withdrawn by Program Director for Agreement funding due to the retirement of R. Miyagawa (AFS), and lack of AFS direction to participate in the study.
7. Advice and assistance provided to clients and colleagues as required, and 5 manuscripts were reviewed. Provided detail and attended CFS Remote Sensing Working Group meeting, and presented seminar on remote sensing to the FRI section of OMNR. Contributed many terms on remote sensing, statistics, computer science, and GIS to the 3rd edition of the Guide to Forest Inventory Terminology. Reviewed AFS 35-mm air photo program, and assessed Stereo MEIS images for PNFI. Several discussions on adapting the digitized thermal IR video data acquired by Compuheat onto a 5 1/4 floppy for subsequent density slicing, and area/spread rate computation on a micro image analysis system.  
  
Used flight planning program and assisted Parks Canada with update photography for monitoring impact on alpine vegetation. Responded to camera system request form CASB with invitation to visit NoFC and develop formal MOU. No further action received. Fire History Maps published.
8. LSP review paper with Spencer accepted for publication.
9. Data compilation, field work and image interpretation completed. Data analysis and draft journal paper to be completed by March 31/88.
10. Data acquired from Lakehead University and further testing of 2-stage sampling program in progress. Revisions made to survey traverse and sun angle programs. Flight planning used in advisory services. [Inf. Rep. in prep. but not a high priority due to resources required for other goals.]

## 12. Present Status of Study:

Camera system development work essentially completed and commercial capability being sought. LSP applications work: regeneration assessment methodology developed and adapted for Saskatchewan, and update report planned; dbh estimation from comparing existing models completed and follow-through with contract planned; new application for estimating volume loss/damage from jack pine budworm planned. Image analysis techniques developed/applied to tent caterpillar defoliation mapping, and accuracy of cutover estimates. Future work planned for application to jack pine budworm. Remote sensing laboratory is being maintained with upgrade being sought for IBM compatible for photo measurements, and an image analysis/GIS system.

## 13. Goals for 1988-89:

1. LSP applications work with Alberta Forestry: Handle m/s reviews from paper "A comparison of existing models for dbh estimation from large-scale photos." From light meter project, complete data compilation/analysis, and prepare m/s on optimizing exposure/parameters for LSP. (-07, -08)
2. M/S reviews from paper "Spectral classes and forest classification".
3. M/S reviews from paper "Accuracy of cutover areas from Landsat imagery", and extend same cutovers to evaluation of positional accuracy. (0407-00-02)
4. Camera system activity: handle m/s reviews of camera control system paper. Undertake 1 further week of training to Yukon on LSP camera system, and provide final year of troubleshooting as required. Maintain NoFC camera control system. (0407-00-01)
5. Prepare research proposal on modelling jack pine damage for Sask. Agreement Funding with J. Volney. Initiate project if funds approved under Canada/Saskatchewan Agreement: acquire LSP and conduct field work for estimating volume loss & Stem analysis; order multigate Landsat TM data and prepare flight plan for contract aerial photography. This project is basis for PhD plans in 1989 - submit leave request to NoFC Program Director. (0407-88-10)
6. Analyse interpreter results and draft m/s on mixedwood forest cover discrimination with MEIS II data. Continue follow-through work for balsam poplar/trembling aspen discrimination if micro system approved.
7. Prepare Forestry Chronicle paper on results from Sask. regeneration project with Dendron. Duplicate ground/LSP plots for NoFC record and conduct technology transfer if warranted.
8. Final preparations for LSP review paper with Spencer.
9. Provide advisory services in remote sensing and forest inventory to NoFC clients and colleagues as required.

10. Continue to write, update, and modify microcomputer programs for in-house use and for clients in cooperative projects (e.g., modify LSP program for jack pine budworm project). Maintain photo measurement system [Inf. Rep. on programs in preparation but not high priority].

14. Publications 1987-88:

Delisle, G.P.; Hall, R.J. 1987. Forest fire history maps of Alberta, 1931 to 1983. 55 pages + 6 maps.

Dendron Resource Surveys. 1987. Weyerhaeuser cutover survey. Canada/Saskatchewan FRDA Contract Report.

Morton, R.T.; Hall, R.J.; Nesby, R.K.; Sutherland, I. 1987. Large-scale black and white and color aerial photographs for the measurement of tree crown areas. Proc. 10th Canadian Symposium on Remote Sensing. pp. 133-140.

Spencer, R.; Hall, R.J. 1988. Canadian large-scale aerial photographic systems (LSP). Photogramm. Eng. & Remote Sensing (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. Duration:

Start: 1981

Completion: 1995

17. Resources 1988-89:

PYs:	Prof.: Hall	1.0
	Tech.: Patterson	1.0
	Total:	2.0
	Term/Student:	0.3

O & M: \$18,000

Capital: 122 K (386-based image analysis/GIS system)

18. Signatures:

\_\_\_\_\_  
Investigator

\_\_\_\_\_  
Program Director, Resources

\_\_\_\_\_  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Economic evaluation of intensive forest management practices
3. New:                      Cont.: X                                      4. No.: NOR-4-08
5. Study Leader: W. Ondro
6. Key Words: Financial and economic returns, financial, economic and marginal evaluation and analyses, costs, benefits, financing, investment, decisions, cost effectiveness, pruning, spacing, conifer release, tree improvement, thinning, fertilization
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta, Saskatchewan and Manitoba
8. Problem Analysis:  
  
Biological responses to intensive forest management practices are fairly well documented and understood, but we are lagging behind in economic analyses of such treatments. This study is to fill that gap.
9. Study Objectives:
  1. Determine economic returns from increased growth after spacing, fertilization and other intensive management practices.
  2. Evaluate cost-effectiveness of different intensity, mix and sequence of forest management treatments.
10. Goals for 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).

Added Goals:

4. Prepare and review information report on present utilization of poplars in Alberta.
5. Prepare and present paper on market potential for Alberta's poplar products at Annual Meeting of Can/Am Poplar Councils at Cornwall, Ontario.

11. Accomplishments in 1987-88:

1. Manuscript on financial returns from fertilizing in 70- and 30-year-old lodgepole pine was reviewed. The revised report was re-submitted via the project leader to the chairman of the review committee for review and final approval.
2. A report on the cost/benefit of spacing in dense naturally regenerated LP was prepared. It will be submitted for review by the end of March 1988.
3. A review of the study proposal for R&D contract to assess costs of various release treatments for WS from TA was provided. The comments to various aspects of the study were given, when requested.
4. Information report on present utilization of poplars in Alberta was prepared and reviewed.
5. Paper on market potential for Alberta's poplar products was prepared, and presented at Annual Meeting of Can/Am Poplar Councils at Cornwall, Ontario.

12. Present Status of Study:

1. Completed financial returns from fertilization in mature LP stand. Evaluation of returns from increased growth after spacing LP is in progress.
2. Evaluated cost-effectiveness of different fertilization treatments in LP. Assessment of cost-effectiveness of LP spacing is in progress.

13. Goals for 1988-89:

1. Publish information report on the financial returns from fertilizing 70-year-old lodgepole pine.
2. Publish information report on present utilization of poplars in Alberta. (see also NOR-28-06)
3. Complete review and publish information report on economics of spacing in naturally regenerated lodgepole pine.
4. Prepare and present poster on costs and financial returns from fertilizing pre-harvest lodgepole pine at the workshop on "Improving forest fertilization decision-making", Vancouver, B.C.



5. Continue R&D study on the cost-benefits of spacing in naturally regenerated jack pine. Prepare information report.
6. Initiate discussion and develop a plan of approaches to cost/benefit study of releasing white spruce from aspen.

14. Publications 1987-88:

Ondro, W.J.; Bella, I.E. 1987. "Market potential for Alberta's poplar products" In Proceedings of Can/Am 1987 Annual Meeting of the Poplar Councils, State Univ. of New York, Syracuse, NY

15. 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.

16. Duration:

Start: 1985                      Completion: continuing

17. Resources 1988-89:

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

O & M: \$3,000

Capital: Nil

18. Signatures:

*Ann. auirio*

Investigator

*[Signature]*  
 Program Director, Resources

*[Signature]*  
 Regional Director General



## 1988-89

Date: January 12, 1988

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 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).
4. Conduct field tours of spruce-aspen release in mixedwood forests to interested groups.

11. Accomplishments in 1987-88:

1. A total of 369 sample trees in 23 stands were located and measured; data analysis on growth response to release is in progress. A manuscript on growth aspect of individual tree response has been prepared and currently under review. (4-72)
2. The manuscript entitled "Growth response of white spruce to release from trembling aspen in spruce-aspen mixedwood forest" is under revision. (4-63)
3. Data analysis on growth and yield of wS-tA stands in relation to species mixture and other variables is in progress.
4. Conducted three tours of A-13 study plots to Slave Lake Forest superintendent, foresters, district rangers, and members of Regional Reforestation Technical Committee.

12. Present Status of Study:

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

Field work to assess growth response of white spruce after release from aspen competition in Boreal Mixedwood Forests in the prairie provinces has been completed. Data analysis on individual tree release in Slave Lake, Alberta (A-13) is in progress. Three reports (two manuscripts have been prepared and under review) will provide needed information set forth in the study objectives.

13. Goals for 1988-89:

1. Revise and submit for journal publication the manuscript entitled "Growth of white spruce following release from aspen competition". (A-13)
2. Revise and publish Information Report "Growth response of white spruce ot release from trembling aspen competition in spruce-aspen mixedwood forest". (MS-153 and MS-8)
3. Continue analyses on wS-tA release data and prepare ms for inforamtion report on silvicultural prescription for releaseing white spruce from saspem in mixedwood stands based on ecological factors and memsurational response derived from experimetn and operational trials carried out in this region.
4. Continue data analysis on growth and yield of wS-tA stands in relation to silvicultural, mensurational and ecological variables and provide information on "Understanding the understory" for Mixedwood Symposium paper.

14. Publications 1987-88:

Nil

15. 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.

16. Duration:

Start: 1985

Completion: 1989

17. Resources 1988-89:

PYs:	Prof.:	Yang	0.5
	Tech.:	Lux	0.3

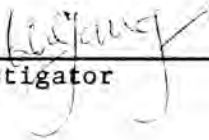
Total:	0.8
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Term/Student:	0.3
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O & M: \$0 A-base (\$7,000 Alberta Agreement)

Capital:

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 12, 1988

1. Project: Stand Productivity and Forest Inventory
2. Title: Managed stand yield tables for lodgepole pine and white spruce
3. New:                      Cont.:    X                      4. No.:    NOR-4-10
5. Study Leader:    C.J. Cieszewski
6. Keywords:    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 estimates thus obtained should be suitable input for timber management system models (e.g., TIMPLAN) for AAC calculations.

#### 10. 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.

#### 11. Accomplishments in 1987-88:

1. Work has been initiated on developing consistent SI curves that includes elevation and density as variables, using stem analysis data and non-linear regression techniques. Three approaches are pursued:
  - i) developing a family of height growth (SI) curves using more than one height measurement;
  - ii) developing a height model using one measurement;
  - iii) developing of an interim height growth (SI) model;
2. Arnie's SPS model has been reviewed, and is being calibrated for 1P.
3. Data have been verified and extreme values deleted. Software has been developed to display data and identify gaps. Need more data on development of high density stands and on top height growth at different elevations and various densities. Plans for data acquisition are being prepared.
4. Several potentially suitable growth hypotheses have been explored. The most useful were Reineke's DBH-Density relationship, Yoda's  $-3/2$  power law, and Bartalanffy's growth theory.

#### 12. Present Status of Study:

Two approaches for modelling managed stand growth and yield have been chosen and pursued. Mortality, a most critical model component has been defined in terms of quadratic mean DBH and number of trees/ha, following Reineke's relationship. A top height growth model has been developed using Czarnowski's stand dynamics theory.

#### 13. Goals for 1988-89:

1. Complete the development of a stand level density-based model using diameter-density relationship, differential diameter growth and height-diameter regression sub-models, diameter distribution sub-model and volume regression sub-model.



2. Develop individual tree diameter, height growth, and mortality sub-models for SPS and initiate its calibration and testing for LP.
3. Develop new height growth curves for LP based on stem analysis data using the two point principle. Also include elevation and density influence.
4. Publish journal paper (Tait, Cieszewski, Bella) on stand level model; continue refinements and testing of this model.
5. Prepare draft for journal paper on improvement of regression analysis techniques (Cieszewski, Bella).
6. Give talks and demonstrations on LP managed stand yield models to the Growth and Yield coop and other clients, and solicit their input.

14. Publications 1987-88:

Nil

15. 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.

16. Duration:

Start: 1986                      Completion: 1989

17. Resources 1988-89:

PYs: Prof.: Cieszewski 1.0 Alberta Agreement  
Tech.:

Total: 1.0  
Term/Student:

O & M: \$53.6 (Alberta Agreement)  
Capital:

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

NOR-5

FIRE MANAGEMENT SYSTEMS AND GUIDELINES

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

1. Project: Fire Management Systems and Guidelines
2. Title: Fire behavior in boreal forest fuels
3. New:                      Cont.: X                      4. No.: NOR-5-01
5. Study Leader: Z. Chrosciewicz
6. Key Words: Canadian Forest Fire Weather Index, fire behavior, fire effects, danger rating
7. Location of Work: Various areas within the Western and Northern Region
8. Problem:

Intensive fire management requires improved methods of assessing and forecasting fire danger for all major fuel types over a wide range of weather and site conditions. A good start in the development of such methods was made with the introduction of the new Canadian Forest Fire Weather Index tables in 1970. The main index as well as the component codes are designed to summarize and rate the important weather variables that affect the ignition and spread of forest fires. In its daily rating of fire danger, the system uses primarily weather-dependent scales, and so it does not really provide means for rating fire behavior and effects in specific fuels. A thorough knowledge of fuel types, their characteristics and their ultimate interactions with fire is, therefore, essential for both proper control and proper use of fire on problem areas.

Specifically, the research in this study is aimed at (a) developing suitable techniques for assessing spatial distribution and loading of dimensionally categorized total biomass in any forest ecosystem, (b) delineating basic relationships between weather, moisture codes, and actual moisture contents of various dead components of that biomass, (c) documenting seasonal changes in moisture content, dry-weight content, chemical content, and heat content of some more important living biomass components present, (d) determining microclimatic differences between major forest ecosystems and the open in terms of solar radiation, temperature, relative humidity, wind speed, and rainfall, (e) measuring

and analyzing various fire-behaviour parameters, and fire effects, over a range of diverse forest weather, fuel, and landform conditions, (f) devising seasonally differentiated fire-hazard rating for major forest 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 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". (5-7)

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)

Added Goals:

10. Prepare a proceedings article on "Site conditions for jack pine seeding". This was an invited contribution to a symposium re: "Towards prime site management", Ont. Min. Nat. Resour., March 23-25, 1987, Thunder Bay, Ont.
  11. Prepare a Forest Management Demonstration Note on "Burning for black spruce regeneration on a lowland cutover site in southeastern Manitoba".
  12. Remeasure postburn jack pine stand growth on a seed-tree area in central Saskatchewan.
  13. Analyze humus consumption and mineral soil exposure data for predicting silvicultural effects of burning on jack pine cutovers.
11. Accomplishments in 1987-88:
1. The journal article on "Jack pine regeneration following postcut burning under seed trees in central Saskatchewan" was prepared, revised, and approved for publication.
  2. The Information Report on "Forest regeneration on burned, planted, and seeded clear-cuts in central Saskatchewan" was prepared, revised, and approved for publication.
  3. The journal article on "Regressions between weather-based moisture codes and the actual moisture contents of mor humus on a clear-cut jack pine site, central Saskatchewan" was prepared and it is about ready for review.
  4. The journal article on "Metric roundwood classification and dry-weight regression equations in jack pine stand biomass studies, central Alberta" is in preparation.
  5. This is being combined with the article under Item 4 above.
  6. The Information Report on "Fire behavior and effects in semimature jack pine stands, central Alberta" is in preparation.

7. The journal article on "Regressions between weather-based moisture codes and actual moisture contents of mor humus under diverse forest conditions, central Alberta" is in preparation.
  8. No free time was left to commence work on this report.
  9. (a) On request, provided advisory services, and also critically refereed or otherwise reviewed papers for publication by various authors (six manuscripts).
  - (b) Gave an illustrated talk re: "Site conditions for jack pine seeding" during (March 23-25, 1987) Ont. Min. Nat. Resour. Symposium, Thunder Bay, Ont.
  - (c) Participated in Dempster and Associates' risk modelling (January 21, March 4, and May 1, 1987).
  10. The proceedings article on "Site conditions for jack pine seeding" was prepared and approved for publication.
  11. The Forest Management Demonstration Note on "Burning for black spruce regeneration on a lowland cutover site in southeastern Manitoba" was prepared and approved for publication.
  12. Jack pine stand growth was remeasured on five 0.04-ha plots within the burned seed-tree area in central Saskatchewan.
  13. Some 24 regression is were produced for predicting silvicultural effects of burning on jack pine cutovers.
12. Present Status of Study:

The new Canadian Fire Weather Index was introduced to the Region in 1970 through a series of training sessions for the user agencies. Since then, fire behavior and fire effects were studied by means of experimental burning on a number of cutover sites and in uncut stands.

Varying in area from 0.09 to 33.35 ha, the tests included: 2 burns of black spruce slash, plus 17 burns of jack pine slash in Manitoba; 31 burns of jack pine slash in Saskatchewan; and 22 burns of lodgepole pine slash, 2 burns of undisturbed black spruce stands, plus 20 burns of undisturbed jack pine stands in Alberta.

While this work was nearing completion, variations in moisture content, dry-weight content, chemical content, and heat content of green conifer foliage (jack pine, black spruce, white spruce and balsam fir) were studied in Alberta to determine their seasonal lows and highs that may contribute substantially to the incidence and the spread of crown fires.

Postburn treatments such as seed-tree systems, direct seeding, and planting were routinely tested in conjunction with all experimental fires on cutover areas to provide authentic prescription data for silvicultural purposes.



applied retardant will provide basic data for use in upgrading the materials composition and rates of application. This goal is to be conducted in cooperation with PNFI, the Canada-Saskatchewan Forestry Development Agreement and the province of Saskatchewan.

7. In cooperation with GLFC and contractor further develop methods of observing wild and prescribed fires to study rates of spread, fire intensity, fire spotting, fire whirlwinds and other aspects of fire behavior.
8. Act as technical representative for detection study contracts of Manitoba and Saskatchewan.
9. Provide technical services and training to client agencies.

14. Publications 1987-88:

[Ogilvie, C.J.]. 1988. Lightning fires in Canada. Forest Fire News No. 25:24.

Ogilvie, C.J.; Skrenek, J.; Young, R.W.; 1988. Daedalus line scanner trials in Alberta, 1985. Ag. Can., Can. For. Serv., Edmonton, Alberta Inf. Rep. NOR-X-00 (in preparation).

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. Duration:

Start: 1971. Completion: 1993

17. Resources 1988-89:

PYs: Prof.:

Tech.: Ogilvie 1.0

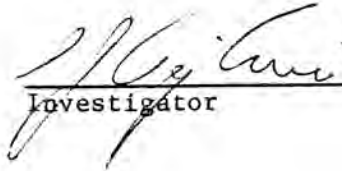
Total: 1.0


Term/Student: 0.0

O & M: \$5,600.00

Capital: Nil

18. Signatures:

  
Investigator

  
Program Director, Environment

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

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 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)

11. Accomplishments in 1987-88:

1. Both papers have been prepared, accepted and are at the final stage of the publication process (see section 14).
2. Contract completed and report received. Data now available in project files for future analysis and application.
3. Agreement consummated, data analysed, paper reviewed and accepted for publication, under title "Sample size and variation of fuel estimates in natural stands of Pinus contorta Dougl."
4. Evaluation begun but not completed due to delays in overall planning activities.
5. A 500+ page draft report entitled "Forest Fire Environment of Pukaskwa National Park: Analysis, Evaluation, and Assessment Guides" was submitted to Environment Canada-Parks, Ontario Region through GLFC. The manuscript was reviewed by HQ and regional office staff. The response was very positive. The draft requires final typing to complete report.

A 100+ page draft report entitled "Forest Fire Management of Pukaskwa National Park: An Interim Planning Guide" was submitted to Environment Canada-Parks, Ontario Region through GLFC. No comments have been received to-date.

6. Plots not sampled in FY. Interest is still there and plans are to resample next FY possibly in cooperation with Parks Canada and the Boreal Institute at University of Alberta.

12. Present Status of Study:

Currently both objectives are in limbo, although advice is continuing to be provided to Parks Canada personnel. Efforts are now attempting to clean up ongoing projects. If the study is approved to continue possibly new objectives will be formulated. Existing projects will be completed following the summer 1988 field season. Recent publications are reported on the following pages.

13. Goals for 1988-89:

1. Supervise completion of all pending publications.
2. Remeasure Vermillion Pass plots with Parks Canada and University, Boreal Institute or other personnel.
3. Complete project continuation assessment and formulate recommendations for future direction of study including personnel recommendations.
4. Present recommendations to senior management for approval prior to next FY planning cycle.

14. Publications 1987-88:

Delisle, G.P.; Woodard, P.M. 1988. Constants for calculating fuel loads in Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alberta, For. Manage. Note 45. (In press).

Woodard, P.M.; Delisle, G.P. 1988. Biomass regression equations for common shrubs and tree seedlings native to Jasper National Park, Alberta. U. of Alberta, Occasional Forestry Note. (In press).

Delisle, G.P.; Woodard, P.M.; Titus, S.J.; Johnson, A.F. 1988. Sample size and variation of fuel estimates in natural stands of Pinus contorta Dougl. Can. J. For. Res. (In press).

Alexander, M.E. 1987. Forest Fire Environment of Pukaskwa National Park. Analysis, Evaluation and Assessment Guides. Can. For. Serv., submitted to Environ. Can. Parks, Ont. Region. 500+ pp. (Draft Rept.).

Alexander, M.E. 1987. Forest Fire Management of Pukaskwa National Park: An Interim Planning Guide. Can. For. Serv., submitted to Environ. Can. Parks, Ont. Reg. 100+ pp. (Draft Rept.).

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. Duration:

Start: 1974. Estimated Completion: 1984. Revised: 1989.

17. Resources 1988-89:

PYs: Prof.: vice Delisle 1.0 (Part used for S.T.E.P. appointment of Dr. S.G. Pickford (0.25) in study NOR-05-04)

Barney 0.1  
Tech.: 0.0  
Total: 1.1

Term/Student: 0.0

O & M: \$2,500

Capital: Nil

18. Signatures:

Richard Barney  
Investigator

J. M. Powell  
Program Director, Environment

C. D. Hill  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

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, as well as hosts 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 decisions. 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 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 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)
4. 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)
5. Develop and initiate co-op 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)

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

Added Goals:

8. Prepare a paper on the use of expert systems for dispatching fire suppression resources to wildfires for presentation at the 9th Conf. Fire For. Meteorology. (B.L., S.P.)
9. Provide advisory services to client agencies, universities, and others as required. (B.L., S.P.)

11. Accomplishments in 1987-88:

1. Western and Northern Region Fire Weather Data Library accomplishments: (B.L.) (5-23)

a. Processing of fire weather data:

AES - No new data was added to the library.

Sask. - 42 station/years (1978-82) were returned to Saskatchewan for their use and validation.

Man. - The capture of annual FWI/PC data has been transferred to the Winnipeg District Office. No new data added to the NoFC library.

Alta. - Cypress Hills Provincial Park data for 1986-87 entered and data summary prepared. Alberta Forest Protection Branch continued to archive their own FWI data.

Parks Canada - Majority of parks in both the Prairie and Western Regions are using NoFC's FWI/PC program to calculate and archive FWI system data. No new data added to our library.

NOTE: Only limited progress was made on archiving and processing of 1986 fire weather data due to:

1. B. Lee being on development leave, and
2. Processing and data storage constraints of NoFC's VAX computer system.

- b. No additional VAX utility software developed due to lack of summer student programming support.
  - c. No progress made on user's guide due to development leave.
- 2. A proposed Information Report on initial attack planning was revised and will be submitted for review prior to March 31, 1988. (B.L.) (5-40)
- 3. The FWI/PC program was adopted by Parks Canada in spring of 1987 for use in national parks and national historic parks nation wide. The program has also been in use in Manitoba since 1986. Due to requests for modifications to the program by Manitoba, Parks Canada, and Saskatchewan, the preparation of the Information Report has been delayed until version 2.0 of the software can be completed. A "User's Guide to FWI/PC: version 1.1" has been provided on disk in the interim. (B.L.) (5-88)
- 4. Course work towards a Master's degree in operations research was completed in June 1987. B. Lee returned to NoFC from the University of Washington on July 1987. (B.L.) (5-87)
- 5. New initiatives in the "high technology" areas of expert systems, mathematical programming, and microcomputer-based geographic information systems were initiated as follows: (5-109)
  - a. Planning to develop prototype microcomputer-based expert systems for initial attack dispatching was initiated for the provinces of Saskatchewan and Manitoba. (B.L.)
  - b. Cooperative work on GIS applications in fire and natural resource management were initiated with two private sector firms using data from the Whitecourt Forest, Alberta. A geographic data base for the forest was developed. Spatial analysis techniques were used to demonstrate fire management applications using GIS. (B.L.)
  - c. An interactive computer program of Ryan's WNDCOM surface wind model was developed for the Northwest Territories. (S.P.)
- 6. Dr. S.G. Pickford from the University of Washington arrived in July 1987 to begin a year-long sabbatical at NoFC under the STEP program. (S.P.) (5-110)
- 7. The knowledge acquisition and program development for a prototype expert system for initial attack dispatching on the Whitecourt Forest, Alberta continued. This expert system is being developed as a M.Sc. thesis in Management Science. The first draft is to be completed by March 1988. (B.L.) (5-87)
- 8. Prepared a paper entitled: 'An expert system for use in dispatching suppression resources to wildfires', for presentation at the 9th Conf. Fire For. Meteorol. and for publishing in the proceedings.

9. Provided advisory services as follows:

- a. Gave three technical presentations on the "Application of expert systems to forest fire initial attack dispatching" as follows:
  - Graduate level course in artificial intelligence and expert systems, Surveying Engineering Dept., Univ. of Calgary, Sept. 22, 1987. (B.L., S.P.)
  - GNWT Fall Fire Conference, Inuvik, Dec. 9, 1987. (B.L.)
  - Alberta Forest Protection Officer's Conference, Edmonton, Dec. 22, 1987. (B.L.)
- b) Gave a presentation entitled "Applications research: microcomputer- based GIS for fire and natural resource management" at the Workshop on Remote Sensing for Forestry sponsored by the GNWT Dept. of Natural Resources and held in Yellowknife, NWT on January 26, 1988. (B.L.)
- c) A paper entitled "Estimating winds in mountainous terrain for predicting fire behavior" will be presented to the Fourth Western Region Fire Weather Committee (WRFWC) Scientific & Technical Seminar, March 1, 1988. (S.P.)
- d) Gave a technical presentation entitled "Computer-based fire management information systems" at the Univ. of Alberta Forestry Seminar, Nov. 2, 1987. (S.P.)
- e) Served as a member of the Alberta Presuppression Preparedness System (PPRS) review committee. (S.P.)
- f) Conducted field work in the GNWT's Norman Wells district to establish RAWs network for fire danger forecasting and testing of the WNDCOM surface wind model. (S.P., B.L.)

12. Present Status of Study:

Fire management in the Western and Northern Region is becoming increasingly more sophisticated. All clients in the region have deployed microcomputers at their HQ and forest level operations, with minicomputers also being considered. Similarly, with the advent of this computing capability, is a new and budding demand for the so-called "high technologies". These technologies include mathematical programming, artificial intelligence, expert systems, computer graphics and GIS, along with others to numerous to mention. It would appear that the timing is right for this study to capitalize on applications research opportunities in these new technology areas.

Specific contributions by study objectives listed can be summarized as follows:



1. Knowledge engineering approaches, currently underway with client agencies will serve to identify key factors related to fire management as well as to develop conceptual models of fire management systems, both existing and in the future.
  2. Computer-based decision aid models developed at NoFC such as FWI/PC and the Initial Attack Planning Model are being used by client agencies. Planned expert systems for initial attack along with mathematical models for optimal allocation and deployment of suppression resources are nearing completion. Future initiatives in GIS along with expert systems for prescribed fire and fire effects will also contribute to fire management in the region.
  3. A large historical fire weather data library has been developed for clients of the Western and Northern Region. This data library has assisted clients in developing the data bases required to evaluate fire management effectiveness and will provide the data bases essential for future fire occurrence prediction models.
13. Goals for 1988-89:
1. Complete a M.Sc. thesis entitled 'An evaluation of the application of expert systems for dispatching initial attack resources to wildfires. (B.L.)
  2. Prepare and present a paper entitled "Use of advanced concepts in dispatching fire control resources" at the 1988 Interior West Fire Council Annual Meeting and Workshop, to be held October 24-27, 1988 at Kananaskis Valley, Alberta. (B.L.)
  3. Prepare and present a paper entitled "Application of computer-based information systems to fire management" at the 1988 Interior West Fire Council Annual Meeting and Workshop, to be held October 24-27, 1988 at Kananaskis Valley, Alberta. (S.P.)
  4. Prepare a report entitled "Implementing Ryan's WNDCOM model for predicting winds in mountainous terrain". (S.P.)
  5. Revise version 1.1 of the FWI/PC program as per client requests and publish "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.)
  6. Continue applied research in expert systems for initial attack dispatching by:
    - a. Conducting field trials of a prototype expert system in Whitecourt Forest during the 1988 fire season.
    - b. Conduct knowledge engineering/acquisition in the provinces of Saskatchewan (contract) and Manitoba (agreement) for similar prototype expert systems. (B.L.)



7. Prepare a paper on estimating winds in mountainous terrain for predicting fire behaviour for presentation at the Fourth West. Reg. Fire Weather Comm. Sci. Tech. Seminar. (S.P.)
  8. Test the WNDKOM surface wind model prediction against observed surface winds at a site near 67° N, and determine its usability in the sub arctic. (S.P.)
  9. Continue development of the Western and Northern Fire Weather Data Library by: (B.L.)
    - a. Capturing and archiving fire weather data from client agencies who voluntarily make their data available to the library.
    - b. Preparing a File Report summarizing the fire weather stations, years of record, and quality of the data currently in the library.
  10. Explore and initiate cooperative research and development opportunities with P. Kourtz at PNFI and the Manawaki Technology Transfer Centre in the area of Fire Management Systems. (B.L.)
  11. Provide advisory services to client agencies, universities, and others as required. (B.L., S.P.)
14. Publications 1987-88:
- Lee, B.S.; Pickford, S.G. 1987. An expert system for use in dispatching suppression resources to wildfires. Pages 245-248 in 9th Conf. Fire For. Meteorol., April 21-24, 1987. Am. Meteorol. Soc., Boston, Mass.
- Pickford, S.G. 1987. Using the 'WNDKOM' wind prediction model in a fire dispatching system. Pages 222-226 in the 9th Conf. Fire For. Meteorol., April 21-24, 1987. Am. Meteorol. Soc., Boston, Mass.
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. Duration:
- Start: 1984. Completion: Continuing.
17. Resources 1988-89:
- |      |          |          |                             |
|------|----------|----------|-----------------------------|
| PYs: | Prof.:   | Lee      | 1.00                        |
|      | Tech.:   | Smith    | 1.00                        |
|      | Total:   |          | 2.00                        |
|      | Student: |          | 0.25                        |
|      | Others:  |          |                             |
|      |          | Pickford | 0.25 (S.T.E.P. appointment) |
|      |          | Analyst  | 0.75 (contract)             |

O & M: \$6,000.00  
Capital: Nil  
Contract: \$10,000 (Saskatchewan)  
Agreement: \$10,000 (Manitoba proposed)

18. Signatures:

  
Investigator

  
Program Director, Environment

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

1. Project: Fire Management Systems and Guidelines
2. Title: Fire danger and behavior rating in forest and rangeland environments
3. New:                      Cont.: X                      4. No.: NOR-5-05
5. Study Leaders: M.E. Alexander and R.S. McAlpine
6. Key Words: Canadian Forest Fire Danger Rating System, wildfire case histories and studies, fire behavior estimation, fire environment
7. Location of Work: Regional
8. Problem:

Embedded in nearly every fire management decision is the need to accurately evaluate fire danger and/or predict fire behavior for a variety of fuel types/topographic situations over a range of possible fire weather conditions. The goal of fire danger/fire behavior research should be to provide fire managers with simple, timely answers to the following questions given an actual or potential wild fire occurrence: What will be the head fire rate of spread? What will be the area, perimeter length, and forward spread distance at 1 hour, 2 hours, 3 hours and so on after it starts?

Will it be a high-intensity or low-intensity fire? Will it be a crown fire or a surface fire? How difficult will it be to control? Will mechanical equipment and/or airtankers be required or can it be handled by a suppression crew?

Is there a possibility of it "blowing-up"? If so, will it produce a towering convection column or have a wind-driven smoke plume? What will be the spotting potential? -- short-or long-range? Are fire whirls likely to develop? If so, when and where?

The Canadian Forest Fire Danger Rating System (CFFDRS) represents the practical output of the continuing CFS fire behavior research programme (i.e., experimental burning projects and wildfire investigations.).

The CFFDRS is the national system of rating fire danger in Canada. The CFFDRS includes all guides to the evaluation of fire danger and the prediction of fire behavior such as the Canadian Forest Fire Behavior Prediction (FBP) System and Canadian Forest Fire Weather Index (FWI) System. This study formalizes the need for the continuing development, evaluation, interpretation, and application of the CFFDRS in the region serviced by the Northern Forestry Centre (NoFC) in order to further extend its usefulness in fire management planning and operational decision-making. Secondly, it recognizes the opportunity to formulate improved methods for the assessment and prediction of wildfire behavior in terms which are useful to fire management agencies by regional adaptation of existing and new knowledge, techniques, etc. The principal aim or thrust of Study NOR-5-05 is to develop practical systems or schemes for evaluating fire danger and predicting fire behavior for use in fire management and fire suppression programs. Note that this study is designed to compliment rather than duplicate some of the RD&A efforts covered under Studies NOR-5-01 and NOR-5-04.

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 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)

## 11. Accomplishments in 1987-88:

1. A draft FMN manuscript "Relationship between the Fire Fuel Moisture Code and the Cladonia Fire Hazard Index" will be ready for review on or before Feb. 1. Delay in earlier submission in March 1987 due to technology transfer activities (i.e., Advanced Fire Behavior Course at Hinton and CFFDRS seminars in eastern Canada).
2.
  - a. Attended two working sessions of the CFS Fire Danger Group in 1987 (officially recognized as a national CFS Working Group in Feb. 1987): Mar. 16-20, CIFFC, Winnipeg [M.E.A. & R.S.M.], Oct. 15-23, Toronto, Ont. [M.E.A.].
  - b. Presented five highly successful 1-day information sessions on the CFFDRS in Quebec and the four Atlantic Canada provinces between Mar. 31-Apr. 8. (see Alexander, Stocks, Dubé 1988).
  - c. Draft of a "Strategic and Operational Plan for Forest Fire Danger Rating Research and Development in Canada, 1987-1992" was prepared for review by CFS management and user agencies.
  - d. The first version of the very popular CFFDRS Users' Guide (see Canadian Forestry Service, 1987) was completed and released. A distribution plan for the Western & Northern Region and a limited number of international contacts has been completed.
  - e. Prepared poster paper entitled "Wildfires as a Source of Fire Behavior Data: A Case Study from Northwest Territories, Canada" for Ninth Conference on Fire and Forest Meteorology held Apr. 21-24 at San Diego, California (see Alexander and Lanoville 1987). This contribution was intended to provide an example of the documentation section in the 1984 interim edition of the FBP System User Guide and also exemplified the conference theme of 'Research and Management -- Partners in the Future'. [M.E.A.]
  - f. A NoFC Forest Management Note advertising the availability of BASIC programs for the FWI and FBP Systems was published (see McAlpine 1987a). A poster paper on the same subject, presented by W.J. De Groot (SDO), was prepared for the Ninth Conference on Fire and Forest Meteorology. (see McAlpine 1987b). [R.S.M.]
  - g. A prototype FBP System field reference (similar in format to a planned Forestry Technical Report for the CFFDRS Users' Guide) was distributed informally across Canada for review, comment and use (see Alexander and McAlpine 1987). The report was prepared in part on the basis of lectures given since 1984 on the mechanics of the FBP System at the Advanced Fire Behavior Courses held at AFTS in Hinton.



3. A 85-page draft IR manuscript "Fire behavior in black spruce-lichen woodland: the Porter Lake Project" will be ready for review on or very shortly after Feb. 1. Delay in earlier submission due to technology transfer activities.
4. a) Attended the annual business meeting of the Western Region Fire Weather Committee (WRFWC) held Mar. 3 at the AES Western Region office in Edmonton. Developed program for bi-annual WRFWC scientific and technical seminar to be held Mar. 1 at NoFC. [M.E.A.]
- b) Presented a paper entitled "Recent developments in the Canadian Forest Fire Danger Rating System" at the 4th Central Region Fire Weather Committee scientific and technical seminar held Apr. 2 at AES Central Region office in Winnipeg. [R.S.M.] Paper for proceedings co-authored with M.E.A.
- c) Served as instructor at the sixth annual AFS Advanced Fire Behavior Course held at AFTS in Hinton Feb. 24-27 (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.]
- d) Attended workshop at NoFC on "Risk modelling for yield forecasting in the boreal forest of Alberta" as 'forest fire expert' at request of W.R. Dempster & Associates. Provided supplemental information and reviewed sections of Canada/Alberta FRDA report. [M.E.A.]
- e) Served as the moderator for the Fire Behavior session at the Ninth Conference on Fire and Forest Meteorology held at San Diego, California, Apr. 21-24. Served as the group spokesperson and co-reporter for the Fire Occurrence & Behavior Analysis futuring at the Wildland Fire 2000 Symposium held at South Lake Tahoe, California (see Alexander and other 1987). Reports were prepared on both meetings and distributed to user agencies in the Western & Northern Region. [M.E.A.]
- f) Attended meeting at NoFC on "federal forest fire issues" as Western & Northern Region representative at request of Program Director. Meeting initiated by J. Hayes (Special Advisory to CFS Assoc. DM) and D.E. Dubé (CFS-HQ), and attended by senior CFS fire researchers. [M.E.A.]
- g) Made a presentation on Sept. 30 entitled "A Review of Canadian Forestry Service prescribed Fire Research in Alberta: 1965-1969" at the Prescribed Burning Workshop (Forest Management Application) held at AFTS in Hinton, Sept. 28 - Oct. 2. [M.E.A.]
- h) Attended Symposium and workshop on Protecting People and Homes from Wildfire in the Interior West held at Missoula, Montana, Oct. 6-8. Presented a poster paper entitled "Help With Making Crown Fire Hazard Assessments" (see Alexander 1988) as a result of interest expressed in use by Alberta Forest Service and



Environment Canada- Parks (Western Region). Paper submitted for publication in proceedings. Meeting report prepared in cooperation with W.J. DeGroot (SDO). [M.E.A.]

- i) Served on committee to participate in review of the AFS Presuppression Preparedness System (PPRS) at request of Alberta Forest Service, principally with respect to CFFDRS applications and fire behavior expertise. Attended two meetings in Edmonton (Dec. 21 and Jan. 27-28). Provided tabulated material on the fire growth and difficulty of control modelling. [M.E.A.]
  - j) Consulted with Snyder & Company on several occasions in 1987, at request of Western & Northern Regional Director General, with respect to a hold-over fire situation/ wildfire investigation near Westlock. [M.E.A.]
  - k) At the request of the Program Director, met with Dr. P.J. Finn (Program Evaluation Branch, Audit and Evaluation Division, Agriculture Canada HQ) at NoFC on Jan. 12 to discuss the "Evaluation of Major Forest Fire Research Technologies developed by the Canadian Forestry Service" and specifically in regards to the use of the FWI System in Alberta as a specific case study. Provided much background information and wildfire statistics, including an analysis of FWI Severity ratings for 1982-86. Reviewed draft report of the evaluation exercise. [M.E.A.]
  - l) Initiated and developed program for the first Interior West Fire Council meeting to be held at Kananaskis Valley, Alta. in October 1988. Met with AFS officials on numerous occasions in regards to planning (Aug. 31, Nov. 5 & 16, Dec. 1 & 15 and Jan. 12). [M.E.A.]
  - m) Reviewed 6 external and 9 internal manuscripts on a variety of fire related topics [M.E.A.].
  - n) Served as Scientific Authority on former CFS-HQ PRUF sponsored project "Climatology of Atmospheric Conditions Related to Extreme Forest Fire Behavior in West-central and Northern Canada" undertaken by Dr. E.R. Reinelt Meteorology Division, Department of Geography, University of Alberta. Final report received. [M.E.A.]
5. Very little progress made towards completing the review draft IR of "Spring fires in a semi-mature trembling aspen stand, central Alberta". Suggest spending 3 days at AFTS Hinton with co-author D. Quintilio the week of Feb. 8-12 to finalize manuscript. [M.E.A.]
  6. Five successful point source fires were conducted and documented during the last two weeks of July 1987 (30 x 30 or 0.1 ha plots). Elapsed times varied from 9 to 26 minutes. Maximum spread rates varied from 2.4 to 4.4 m/min. None of the fires appeared to be approaching a equilibrium "stead-state" condition. Ponton Lookout (40 km south of the study area) was able to detect the associated smoke columns within 3-9 minutes of ignition. [M.E.A.]

Considerable time was taken in 1987 to satisfy several requests of the NoFC Information Officer regarding the Big Fish Lake experimental burning project, by reviewing three drafts of the popularized article on the project which appeared in the spring 1987 issue of Timberlines; by arranging/ outlining video documentary on the project and review of the script/ narration; and by review of a proposed newspaper article on the project. [M.E.A.]

A presentation on the results of the 1987 field season was made at the 1987 AFS Fall Fire Review at Slave Lake, Nov. 24-26. [M.E.M.]

The co-study leader is attending the University of Montana under CFS professional development leave during the 1987-88 academic year pursuing a M.Sc. degree in forestry. His thesis project deals with the acceleration of initiating fires to equilibrium "Steady-state" conditions. A draft proposal has been prepared and submitted to the USDA Forest Service's Intermountain Fire Sciences Laboratory to conduct some point source fires in the ISFL wind tunnel during the winter of 1988. This laboratory work will supplement the empirical field data in order to develop a workable adjustment in the simple elliptical fire growth model of the FBP System. [R.S.M.]

Other permanent CFS fire research staff participating in the project during the 1987 field season included: W.J. DeGroot (SDO) and B.D. Lawson (PFC) on a part-time basis.

7. The author, subject, and area indexes for the proposed IR "Twenty-five years of Canadian Forestry Service fire research in the prairie provinces and Far North, 1962-1987: An Annotated Bibliography" were completed. Copies were distributed at the Regional Technical Subcommittee on Fire Research meeting held at NoFC, Oct. 27-29. The first draft of the FOREWORD has been reviewed. The initial group of annotations ready for editorial review have been submitted. Target date for submission of review draft is early April. [M.E.A. & R.S.M.]

## 12. Present Status of Study:

The present project was initiated in early 1981 by M.E. Alexander who was joined in mid 1985 by R.S. McAlpine, on a part-time basis (0.5 PY at present), as a co-project leader. M.E. Maffey serves as the project technician. Both project leaders are currently members of the CFS Fire Danger Group. This group maintains liaison with regional, national, and international fire organizations, committees and agencies to ensure research, development and application of the CFFDRS continues in a timely and relevant manner.

The major accomplishments of the Group since 1981 have been:

- Production of an updated edition of the FWI System in 1984 (i.e., CFS Forestry Technical Reports dealing with Tables and Equations/FORTRAN Program).

- Distribution of an interim edition of a user guide to the rate of spread component of the Canadian Forest Fire Behavior Prediction (FBP) System in 1984 which also includes a simple elliptical fire growth model.
- Development of a CFFDRS Users' Guide (i.e., a three-ring binder designed to house all national publications and associated material documenting the technical aspects of the (CFFDRS)).

The study leaders have been involved directly or indirectly in the application of the CFFDRS in the "systems" of several user agencies in the region (e.g., AFS, Alberta Parks, GNWT).

A point worth emphasizing is the fact that the data base used in the development of the FBP System does include the various experimental fires documented by NoFC staff between 1965-1978. The principal field research activities since 1981 have been concerned with two experimental burning project coordinated by NoFC but involving fire staff from the other CFS research establishments:

- i) 1982: Porter Lake, Caribou Range, N.W.T. - upland black spruce-lichen woodland (FBP System Fuel Type C-1); a cooperative project with Indian and Northern Affairs Canada (INAC).
- ii) 1985-7: Big Fish Lake, Footner Lake Forest, Alta. - black spruce-Labrador tea-Cladonia fuel complex (FBP System Fuel Type C-2); a cooperative project with Alberta Forest Service (AFS).

Other notable achievements during the period 1981-7 include:

- Assistance with the regional implementation of spring Drought Code (DC) starting value determinations on a regular, yearly basis in 1981-82.
- Development of a 4-day advanced fire behavior course in cooperation with Alberta Forest Technology School and AFS Forest Protection Branch in 1982 (sustained participation has continued up to and including 1987). Fire management personnel from N.W.T., Manitoba and Parks Canada have also attended the course.
- Coordinated the development of a scientific and technical seminar series under the auspices of the Western and Central Region Fire Weather Committees beginning in 1983.
- Initiated and solicited support for a 3-yr. CFS-HQ sponsored PRUF (Program of Research of Alberta Meteorology Division) entitled "Climatology of Atmospheric Conditions Related to Extreme Forest Fire Behavior in West-Central and Northern Canada" in 1984. This work is related to the prediction of blowup fire occurrences.
- Preparation of several user-oriented aids which have been immediately utilized by AFS and INAC. (e.g., procedures and an adiabatic chart for plotting helicopter soundings of temperature, dew-point (DP) tables for fire weather stations with ventilated

thermometers, prototype chart/table for the fire intensity component of the FBP System); an excellent example of this is the AFS "Fire Behavior Officer Reference - 1986". The concepts currently incorporated into the WM-680 Wind Monitor produced by Forest Technology Systems Ltd. represents another practical example of an original study initiative.

- Production of a slide-rule device incorporating the existing information on the FBP System. The "Fire Growth Calculator" or FGC simply represents an alternative method of calculating area, perimeter length, etc. in lieu of manual, table or computer calculation.
- A variety of fire-related programs (e.g., RH and DP computations from dry-and wet-bulb temperatures, spring DC starting value) written in BASIC have been prepared including present versions of the FWI and FBP Systems. The current application involves the NEC PC-8201A portable computer which is ideally suited to district level use and by a fire behavior officer on campaign fires.
- Increased the interest and set standard for wildfire case histories or studies in the Western & Northern Region.

### 13. Goals for 1988-89:

1. Complete the publication of FMN on the "Relationship between the Fine Fuel Moisture Code and the Cladonia Fire Hazard Index". [M.E.A. & K.G.H.]
2. Continue to participate in cooperative activities of the national CFS Fire Danger Working Group as outlined in the "Strategic and Operating Plan for Forest Fire Danger Rating Research and Development in Canada 1987-82 (i.e., Completion of the first fuel edition of the FBP System). [M.E.A. & R.S.M.]
3. Complete the publication of IR on "Fire Behavior in Black Spruce-Lichen Woodland: the Porter Lake Project". [M.E.A.]
4. Continue to provide advice and services with respect to fire danger rating and fire behavior as required, including serving on the Central and Western Region Fire Weather Committees (e.g., compile/edit proceedings of the 4th WRFWC scientific and technical seminar). [M.E.A. & R.S.M.]
5. Complete the publication of IR on "Spring Fires in a Semi-mature Trembling Aspen Stand, central Alberta". [M.E.A.]
6. Burn the remaining plots (7) associated with the Big Fish Lake experimental burning project and begin preparation of IR on the project for publication in 1989. [M.E.A. & R.S.M.]
7. Begin preparation of M.Sc. thesis on the acceleration of point source fires to equilibrium spread from ignition. [R.S.M.]



8. Complete the publication of IR on "Twenty-five years of Canadian Forestry Service fire research in the prairie provinces and far north, 1962-1987: an annotated bibliography". [M.E.A. & R.S.M.]
9. Serve as program co-chairman of the 1988 Interior West Fire Council Annual Meeting and Workshop, including the compilation/editing of the proceedings as a IR. [M.E.A.]

14. Publications 1987-88:

- Alexander, M.E. 1988. Help with making crown fire hazard assessments. in Proc. Symp. and Workshop Protecting People and Homes from Wildfire in the Interior West (Oct. 6-8, 1987, Missoula, Mont.). USDA For. Serv., Intermt. Res. Stn., Ogden, Utah. Gen. Tech. Rep. INT-xxx. [in press].
- Alexander, M.E.; Andrews, P.L.; Davis, K.M.; Lynham, T.J.; Robinson, O.L.; Rothermel, R.C.; Van Wagner, C.E. 1987. Fire Occurrence and Behavior Analysis. Report of Futuring Group 9. Pages 253-255 in Proc. Symp. WILDLAND FIRE 2000 (Apr. 27-30, Tahoe, Calif.). USDA For. Serv., Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif. Gen. Tech. Rep. PSW-101.
- Alexander, M.E.; Lanoville, R.A. 1987. Wildfires as a source of fire behavior data: a case study from Northwest Territories, Canada. Pages 86-93 in Postprint Volume Ninth Conf. Fire and For. Meteor. (Apr. 21-24, San Diego, Calif.). Am. Meteor. Soc., Boston, Mass.
- Alexander, M.E.; McAlpine, R.S. 1987. Canadian Forest Fire Behavior Prediction (FBP) System Field Reference. Govt. Can., Can. For. Serv., West. and North. Reg., North. For. Cent., Edmonton, Alta. Study NOR-5-05 (NOR-5-191) File Rep. No. 17. 91 p.
- [Alexander, M.E.; Stocks, B.J.; Dubé, D.E.] 1988. Canadian Forest Fire Danger Rating System seminars. Forest Fire News No. 25:26.
- Canadian Forestry Service. 1987. Canadian Forest Fire Danger Rating System--Users' Guide. Produced by the Canadian Forestry Service Fire Danger Group. Three-ring binder (unnumbered publication). [Limited Distribution]
- McAlpine, R.S. 1987b. Two BASIC programs for fire danger and fire behavior computations. Govt. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. For. Manage. Note 43. 3 p.
- McAlpine, R.S. 1987b. LAPFWI and LAPFBP: Two 'BASIC' computer programs to assess fire danger and potential fire behavior. Pages 243-244 in Postprint Volume Ninth Conf. Fire and For. Meteor. (Apr. 21-24, San Diego Calif.). Am. Meteor. Soc., Boston, Mass.

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. Duration:

Started: 1982      Estimated Completion: 1992

17. Resources 1988-89:

PYs: Prof.: Alexander 1.0  
                  McAlpine 0.7 [Educational leave until July 88]

Tech.: Maffey 1.0

Total: 2.7

Term/Student: 0.6

O & M: \$11,000

Capital: \$4,300

18. Signatures:

Martin E. Alexander  
 Investigator

J. M. Powell  
 Program Director, Environment

Robert S. McAlpine *rsa*  
 Investigator

C. D. Hunt  
 Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

1. Project: Fire Management Systems and Guidelines
2. Title: Prescribed fire in forest and rangeland management
3. New:                      Cont.: X                      4. No.: NOR-5-06
5. Study Leaders: R.S. McAlpine
6. Key Words: Prescribed fire, fire use, Canadian Forest Fire Danger Rating System, fire behavior, fuels, fire effects, decision models
7. Location of Work: Regional
8. Problem:

An increase in the use of prescribed fire as a forest management tool is anticipated in the northern region where it is becoming a viable method of habitat management for wildlife, rangeland management, fuels management, site preparation, site conversion, and insect and disease infestation eradication.

This study has been created in an effort to provide better management guidelines in the use of prescribed fire for various purposes. Since many of the client agencies are now becoming involved in prescribed fire operations, it is an excellent opportunity to expand knowledge and design guidelines in response to user needs.

The results of the study will 1) Improve the ability with which prescribed fire is implemented by user agencies in the region through a better understanding of fuel and weather relationships; 2) Improve the implementation of prescribed fire for silvicultural uses, through a better understanding of prescribed fire effects and weather conditions necessary to achieve these effects; 3) Reduce losses due to wildfire through better guidelines for hazard reduction burning; 4) Increase wildlife population through improved habitat management.

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 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)

11. Accomplishments in 1987-88:

1. Transferred to National Prescribed Fire Working Group. A working meeting on the subject was postponed.
2. Attended meeting of the CFS Prescribed Fire Working Group (Petawawa, Ont., May 26-28, 1987).
3. Started development leave in September at University of Montana.
4. a) Attended USDA Forest Service course "Fire Management for Line Officers and Resource Managers" Feb. 27 - March 4, 1987, Marana, Arizona.
- b) Worked with T. Van Nest (Alberta Forest Service) on a section of a prescribed burn course for range and wildlife habitat enhancement in Hinton, Alberta May 12, 1987.
- c) Attended the Symposium and Workshop - Protecting People and Homes from Wildfire in the Interior West (Oct. 6-8, 1987, Missoula, Mont.).

12. Present Status of Study:

1. The development of fuels documentation and prescription preparation handbooks have been taken up by the recently formalized (1987) Prescribed Fire working group. The group felt that these two items

(among others) should be developed on a national basis and should take the highest priority of group work. Participants in this work include all members of the group and according to the current Strategic and Operational plan for the Canadian Forestry Service Prescribed Fire Working Group 1987-1990, completion dates are on or before FY 89/90. The prescription preparation handbook has highest priority within the group and the expected completion date FY 89/90. Fuels documentation has been broken down into 3 separate areas of endeavour; 1) develop a video demonstration line intersect methods, techniques and problems (due FY 88/89), 2) a slash inventory handbook - fuels and fire documentation (due 89/90), and 3) non-slash inventory handbook (1991+). The planned handbooks will provide all agencies within the region specific planning and inventory guidelines.

2. The Prescribed Fire Working Group met once, May 26-28 1987, at the Petawawa National Forestry Institute. At that time the Group's terms of reference, structure and operational procedures were decided upon as well as a Strategic and Operational Plan for 1987-1990 discussed. This was later written up and now is in the editorial stage. This document should be consulted for a more complete discussion of the groups planned activities. A second meeting planned for the fall of 1987 to begin work on a National Prescription Development Handbook was cancelled due to financial constraints. During the study leader's absence for educational leave it was determined that W. DeGroot (CFS, Saskatchewan) would represent the region in the group.

3. Development leave commenced in September 1987 and will continue until July, 1988.

13. Goals for 1988-89:

1. Participate in cooperative projects of the CFS Prescribed Fire Working Group. (R.S.M., W.J.D.).
2. Continue development leave until July and complete field work and thesis preparation after that to obtain a masters degree in fire research at the University of Montana. (R.S.M.)
3. Provide advice and services with respect to prescribed fire. (R.S.M.)

14. Publications 1987-88:

Nil

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. Duration:

Started: 1985

Estimated Completion: 1995

17. Resources 1988-89:

PYs:	Prof:	McAlpine	0.3	(Educational Leave until July 1988)
	Tech:		0.0	
	Total:		0.3	
	Term/Student:		0.0	

O & M: \$1,500  
Capital: Nil

18. Signatures:

Robert S. McAlpine  
Investigator *R/S*

J. M. Powell  
Program Director, Environment

G. D. Hill  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

1. Project: Fire Management Systems and Guidelines
2. Title: NoFC Forest Fire Research Coordination
3. New: X                      Cont.:
4. No.: NOR-5-07
5. Study Leaders: R.J. Barney
6. Key Words: Fire Research, Fire Programs, Research Management, Fire Research coordination
7. Location of Work: Region Wide
8. Problem:

The widespread nature of the fire research program at NoFC requires considerable effort in coordination and management. The problems, the size of the area which includes, Alberta, Saskatchewan, Manitoba and the NWT in itself presents severe coordination challenges, especially with the provincial/federal agreement program activities. The diverse nature of the fire problems, research program and wide variety of user needs all make for an extremely complex management task. The need to use existing funding, secure outside funding, extensive support and agency cooperation adds to the complex dimensions already encountered. There is a need for coordination to maximize productivity and wise use of all resources within the fire research project.

9. Study Objectives:

1. To coordinate NoFC fire research activities as an essential element of the overall forest fire management programs in the prairie provinces and NWT.
2. To enhance the regional, national and international perspectives of the Canadian Forestry Service fire research program through participation on committees, task forces, review boards and other service activities aimed at improving the protection of Canada's forestry.

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 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. Complete 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. Maintain cooperative relationships and studies with University of Alberta and other Canadian universities as appropriate. (R.B.) (5-99)
7. Make presentations at academic institutions throughout the year as appropriate. (R.B. and others) (5-99)
8. Provide technical services and training to client agencies. (R.B. and others) (5-56).
9. Provide guidance and assistance to forest economist for studies in fire management economics. (R.B. and others) (5-112)
10. Develop and propose research operational planning and documentation procedures including problem analysis and research/study documentation and process.

11. Accomplishments in 1987-88:

1. Met with park personnel at Kootenay National Park, Radium Hot Springs, B.C., discussing a wide array of research/management issues. Also met with regional personnel on several occasions.
2. Functioned in traditional management role as project leader. Held several project meetings on program activities.



3. Functioned on and attended several meetings throughout the year including CCFFM, Fish Cr. Provincial Park, UA committee to develop a centre of excellence, provincial committees and NoFC library committee.
4. Prepared and submitted two major versions of a regional strategic plan for fire research. Reviewed agreement efforts related to fire to insure relevance.
5. With the help of the program committee planned, conducted and summarized the 1987 Regional Fire Research Technical Committee.
6. No participation required, territory reorganized. This function currently not necessary. Independently project staff provided assistance to GNWT Fire Management staff when requested.
7. Promoted several cooperative ventures with the University of Alberta. Currently an adjunct faculty member.
8. Taught classes at University of Alberta and Forest Technology School, Hinton.
9. Continued to provide a wide array of technical services throughout the project.
10. Promoted initiation of a fire economic study on the Elan Fire in Saskatchewan. Provided consultation, support and encouragement to fire management economic activities.

12. Present Status of Study:

Under this new study we have been able to expand support in several areas. Work associated with federal-provincial agreements has increased this past year. New and stronger ties are in place with the University of Alberta and greater cooperative efforts are under way. An international agreement is being developed with the USDA Forest Service, Intermountain Research Station, Forestry Fire Sciences Laboratory. Good progress is being made on all objectives.

13. Goals for 1988-89:

1. Continue to provide advisory services to National Parks with emphasis on the management guidelines. (R.B.)
2. Supervise and coordinate the regional fire research program including that by the Fire Specialists in the District Offices. ((R.B.)).
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.)
4. Complete regional fire research strategy, including integration of studies under the Forestry Development Agreements and Memorandums of Understanding. (R.B.)

5. Conduct regional fire research technical subcommittee meeting. (R.B.)
6. Maintain cooperative relationships and studies with University of Alberta and other Canadian universities as appropriate. (R.B.)
7. Make presentations at academic institutions throughout the year as appropriate. (R.B. and others)
8. Provide technical services and training to client agencies. (R.B. and others).
9. Provide guidance and assistance to forest economist for studies in fire management economics. (R.B. and others)
10. Complete current International Assignment Agreement which expires July 1, 1988.
11. Make plans and develop process to replace the current project leader in a manner that meets long term goals and objectives of the Northern Forestry Centre and the fire research project.
12. Complete manuscripts currently in preparation prior to July 1, 1988.
  - a. Forest/Urban fire in the Prairie Provinces
  - b. The Fish Creek Provincial Park Challenge
  - c. Research - management relationships
14. Publications 1987-88:

Anon., 1987. Strategic Plan for forest fire research - Northern Forestry Centre, Edmonton, Alberta (Draft). 17 p.

Barney, Richard J. 1987. Fire Research Needs and Priorities - Field Survey. Northern Forestry Centre, Edmonton, Alberta. Fire Research File Report #1-0507, 31 p., w/Appendix.

Noste, Nonan V.; Barney, Richard J. 1987. Comparative vegetational recovery on fireline cleared with explosives and with handtools. USDA Forest Serv., Intermountain Res. Stn., Ogden, Utah. Res. Note. INT-370, 3 p.
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. Duration:

Start: 1987. Estimated Completion: Continuing.

17. Resources 1988-89:

PYs:	Prof:	Barney	0.9	(Exchange assignment until June 30, 1988)
	Tech:		0.0	
	Total:		0.9	

Term/Student:

O &amp; M: \$3,000

Capital:

18. Signatures:

Richard J. Barney  
Investigator

J. M. Powell  
Program Director, Environment

C. D. Hunt  
Regional Director General

NOR-7

ENVIRONMENTAL EFFECTS OF CHEMICAL SUBSTANCES  
AND VEGETATION MANAGEMENT

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: December 16, 1987

1. Project: Environmental Effects of Chemical Substances and Vegetation Management
2. Title: Assessment of air pollutant impact on forest systems and of industrial development in natural areas
3. New:                      Cont.: X
4. No.: NOR-7-01
5. Study Leaders: D.G. Maynard, S.S. Sidhu, S.C. Zoltai, J.C. Feng
6. Key Words: Sulfur gases, elemental sulfur, vegetation, lodgepole pine, AR-NEWS, biomonitoring, environmental impact assessment, advisory
7. Location of Work: Region wide, emphasis on Alberta
8. Problem Analysis:

Industrial development and emissions have real, imagined, or potentially deleterious effects on forest vegetation and soils. Government agencies and the general public have expressed concern. Industrial groups are apprehensive as to restrictions that may have been applied to their operations. Regulatory agencies in many cases lack essential scientific information describing cause and effect relationships. Provincial Government Agencies, industry, and the public request involvement by the Canadian Forestry Service in this environmental problem in the form of cooperative research projects, detection and assessment surveys and advisory services. Several studies have been carried out within the Prairie region to address the above mentioned concerns. Expert advice on the effects of air pollutants, uranium mining or northern development to forest systems is required to answer specific concerns in relationship to environmental effects of toxic substances within the region. In addition, potential effects of acid deposition on forest ecosystems could go unnoticed until considerable damage to the forest has occurred. Maintaining an advisory role and carrying out all aspects of the chemical analyses of soil and 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. Participate in the establishment and monitoring of AR-NEWS plots in collaboration with NOR-11 (FIDS).
2. Describe and assess changes in the forest ecosystem as a result of two sour gas processing plants in west-central Alberta.
3. 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.

## 10. 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 (includes involvement with the AR-NEWS sampling and analysis). Attend workshops and symposia. (Maynard, Sidhu, Apps, Zoltai, Feng)
2. Publish a journal 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. (Maynard, Sidhu)
6. Prepare and submit a baseline report on the chemical analysis of the soil and vegetation samples for the AR-NEWS plots for the prairie region. (Maynard)
7. Submit a journal article, 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. As a 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)

Added Goals:

12. Publish a journal article on "Effects of V and Ni separately and in combination with SO<sub>2</sub> in jack pine" by A.A. Khan and S.S. Malhotra. (Malhotra)
13. Publish a journal article entitled "Some considerations for the use of visual estimates of plant cover in biomonitoring" by K.A. Kennedy and P.A. Addison.

11. Accomplishments in 1987-88:

1. Consultative and advisory services were rendered to a variety of government (federal and provincial) agencies, industry (forestry, energy, and consulting companies) and university researchers. Contributed to the updating of the AR-NEWS protocols for field sampling and laboratory analysis.
2. An article was published in the proceedings of symposium/workshop in June.
3. The data was re-examined by D.G. Maynard and J.J. Germida (U. of Saskatchewan) and it was decided that there was insufficient data that provided further original information on elemental sulfur oxidation that warranted an additional publication. Some of the more pertinent results have been incorporated into the final Information Report (Goal #4).
4. A first draft of the Information Report has been completed, the figures have been drafted and the report will be sent to outside reviewers including representatives of the two gas companies. It is hoped that by the end of the fiscal year the report will be with the NoFC editors.
5. The AR-NEWS samples from B.C. and the Prairies have been completed. The B.C. data has been passed on to Dr. A. Van Sickle at PFC. The is collated and will be included in the baseline report (Goal #6) and the data passed on to designated CFS personal.
6. The first draft of the baseline report is nearing completion. All the vegetation cover information and chemical data (Goal # 5) has been collected and will be included in the report.

7. A journal article entitled "The effects of particulate elemental sulfur on vegetation" by K.A. Kennedy, P.A. Addison and D.G. Maynard has been submitted for review to Environmental Pollution. The original submission was returned with major revisions. The revisions were done and the article was resubmitted at the end of August. The editor requested a second review of the article and nothing as of October has been heard from the journal.
8. A summary report for the clients (Canterra Energy and Gulf Canada, Ltd.) has been outlined and presented to the clients. The report is to be of limited distribution and will include all the reports and journal articles produced from the five year project. An executive summary and overall conclusions still need to be completed. This will be done in conjunction with the final Information Report.
9. A survey for the Quality Assurance Working Group was completed and a summary report on recommended analyses for analyzing vegetation in air pollution monitoring studies was presented to the Working Group.
10. The report was reviewed and remains with the author. A decision still has to be made whether a review article for a journal can be prepared or whether it should remain as an Information Report.
11. The ICP-AES has been maintained with very little down time. Repairs to the Radio Frequency (RF) generator were done in April and a general preventative maintenance still has to be done by the company serviceman. Approximately 50 000 analyses will have been run on the ICP-AES during the fiscal year including 25 000 for the Analytical Services Laboratory. Analyses for people outside NoFC have almost been eliminated and the few hundred samples run for the U of A were done so on a cost recovery basis.
12. A journal article was published in Phytochemistry in 1987.
13. A journal article was published in Journal of Ecology in 1987.

12. Present Status of Study:

Descriptive studies on the pattern and impact of pollutant distribution have been carried out in the Athabasca Oil Sands area of Northern Alberta, in the vicinity of two mining and smelting operations in Flin Flon and Thompson, Manitoba and near two sour gas plants in west-central Alberta. The two former studies have been completed and several reports published. The study in west-central Alberta was completed in 1986. The initial findings have been reported on and the final report is in the draft stage. The consultative and advising services and the Environmental Screening Committee are on-going and requests in these areas have been dealt with as required.

13. Goals for 1988-89:

1. 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, carried over from 1987-88).

2. Publish a baseline report on the chemical analysis of the soil and vegetation samples for the AR-NEWS plots for the prairie region. (Maynard, carried over from 1987-88)
3. Publish a journal article entitled "The effects of particulate elemental sulfur on vegetation" by K.A. Kennedy, P.A. Addison, and D.G. Maynard. (carried over from 1987-88)
4. 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 (includes involvement with the AR-NEWS sampling and analysis and the Quality Assurance working group). Attend workshops and symposia. (Maynard, Sidhu, Apps, Zoltai, Feng)
5. Maintain the Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) by preventative maintenance checks and replacement of worn parts. (Radford)
6. Review of Projects/studies for environmental implications by the NoFC - Environmental Screening Committee. (Sidhu, Maynard, Feng, Zoltai)

14. Publications 1987-88::

- Kennedy, K.A.; Addison, P.A. 1987. Some considerations for the use of visual estimates of plant cover in biomonitoring. J. Ecol. 75:151-157.
- Khan, A.A.; Malhotra, S.S. 1987. Effects of vanadium, nickel and sulphur dioxide on polar lipid biosynthesis in jack pine. Phytochem. 26:1627-1630.
- Maynard, D.G.; Addison, P.A. 1986. Variability in forest systems as it relates to elemental sulfur effects. Pages 255-285 in Acid forming emissions in Alberta and their ecological effects: 2nd Symposium/ Workshop Proceedings. (Eds. Sandhu, H.S.; Legge, A.H.; Pringle, J.I.; Vance, S.). Res. Manag. Div., Alta. Dep. Environ. and Kananaskis Centre for Environ. Res., U. of Calgary, 1986 May 12-15; Calgary, Alberta. 478 pp.

15. 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.

16. Duration:

Start: 1970

Completion: on-going

17. Resources 1988-89:

PYs:	Prof.:	Feng, J.	0.1
		Maynard	0.3
		Sidhu	0.1
		Zoltai	0.1
	Tech.:	Radford	0.5
		Fairbarns	0.2
Total:			1.3
Term/Student:			0.0

O & M: \$8 000

Capital: NIL

18. Signatures:

Deey Maynard  
Investigator

M. S. Sullivan  
Investigator

SG Zelt  
Investigator

Investigator

Program Director, Protection

*A. D. Hunt*  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: December 16, 1987

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

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

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



One of the major areas of concern, with significant data gaps, is the fate of herbicides entering the forest 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 FPML, provincial governments, and the public. Also, the information obtained from this study will be integrated into vegetation management guidelines/prescriptions to be developed through a parallel study on "Field Testing and Evaluation of Forestry Herbicides" in NOR-10. Initially, three major herbicides, namely Roundup, Velpar, and Garlon, will be considered for study.

#### 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 1987-88:

1. Review literature on herbicides and report pertinent literature in specific publications. Prepare a review article on hexazinone and submit for review as an information report. (Sidhu, Feng)
2. Continue post-herbicide treatment vegetation sampling (Grande Prairie plots), enter 1986-87 field data on computer and analyze. (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. Initiate and 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 P. 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, Chakravarty)
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 (Sidhu, Feng)
11. Provide functional guidance and supervision in I&D projects initiated under agreements and prepare quarterly reports for study under the Canada-Alberta Agreement. (Sidhu, Feng)
12. Prepare report on 1986-87 studies of granules hexazinone release and distribution patterns of granules of PRONONE 10G. (Feng, Sidhu)

Additional Goals:

13. Study the release of hexazinone from PRONONE 10G formulation by using a laboratory rainfall simulator in order to establish the background information for field studies and investigation (in collaboration with Pro-Serve Inc. (Feng)
14. Participate in the study of "Log sprayer application of Velpar" (part of the FRDA Forest Vegetation Management program) by designing the experiment and analyzing residue samples in order to assess the actual deposition of hexazinone during Log-application. (Feng)
15. Study the granule distribution patterns of PRONONE 10G from aerial and ground applications. (Feng, Sidhu)
16. Assist FPMI in completing research work of the 1984-86 Carnation Creek Herbicide Project, and preparation of research papers for and platform presentation at the 1987 Carnation Creek Herbicide Workshop. (Feng)

# 11. Accomplishments in 1987-88:

1. Literature review for relevant data was complete. Manuscript preparation and submission for review will be delayed for 1 year due to time lost on lab reorganization, new staff training, processing samples for other goals, expansion of Goal 10, and the completion of additional goals (13-16).
2. Density counts of all woody species in three height classes ( 50 -150 cm, 150-500 cm, over 500 cm) were completed for 840 (5 X 5 m) plots. Also damage caused by mechanical treatments was recorded for all stems over 50 cm in height. Species presence and their cover ( woody, forbs, grasses and mosses) was visually estimated and recorded in 1080 chemically treated and control plots. In the other 2280 (mechanically treated) cover of dominant species and total cover were observed and recorded. Herbicide damage to foliage of all species in 5 sub-plots in each chemically treated plot was recorded every 2 weeks from 1 June to 1 September 1987.
3. Collected post-herbicide treatment samples from chemically treated and control plots for residue analysis in soil-water (73), stream water (51), stream bottom sediment (50), foliage (455) and soil (950) up to 13 months post-treatment. The foliage and stems were collected of selected grasses, herbs and woody species for residue analysis. The data generated will help to establish the relationship between residue levels and level of herbicide damage, patterns of foliar accumulation of hexazinone during the growing season and levels of residues in species browsed by the wildlife.
4. Nine hundred and fifty of soil samples were air-dried, homogenized, sifted, weighed, repackaged, and determined for moisture contents and bulk densities. Soil samples collected from one of the 18 stations were analyzed up to 10 months post-treatment. Results from one site were presented at the Project Peer Review and to the Grande Prairie Project cooperators as in goal 5.
5. The published method (Holt 1981) for hexazinone determination from alfalfa, asparagus and blueberries was tested by using aspen foliage samples and proved to be ineffective in removing chlorophyll, resin and other organic natural plant products. Development of new methodology for foliage residue analysis is in progress. Analysis of water and sediment samples collected in 1986 and 1987 was completed, and results were presented at the Project Peer Review and Grande Prairie Project Coopers (AFS, Alt. Env., Alberta Fish & Wildlife, Penner & Associates, CFS- NOR-10).
6. Analytical method for hexazinone and its metabolites from organic and mineral soils was developed and streamlined. Quality assurance program is continual. A paper "modified method of Holt in determining hexazinone residues using gas chromatography" by J. Feng and C. Feng was presented to the 15th workshop (chemistry & Biochemistry of Herbicides), Vegerville.

7. Consultations were provided to various government agencies, industries and other herbicide users. Participated in committees identified in Goal 7. Continued to serve as coordinator for forestry herbicide in the National Check Sample Program (formerly FlCP Check Sample Program), and initiated a check sample study on the analysis of hexazinone and its metabolites in organic and mineral soils by gas chromatography.
8. Published a paper "Effect of hexazinone on the seedling growth and mycorrhizal incidence of P. contorta var. latifolia and Picea glauca." Eur. J. For. Path. 17:282-291.
9. Data have been synthesized and a draft manuscript will be ready for review by 31 March, 1987. The paper will include field and laboratory information in addition to the aseptic growth conditions in the growth chambers.
10. A research proposal and options "Leachability of hexazinone in three different type of Alberta soils under controlled conditions by using soil column methods" was prepared by C. Feng (1-09-87); a work plan "Preliminary soil column study on leachability of hexazinone in three different types of Alberta soils under laboratory conditions" was prepared by J. Feng (15-09-87). A moderate plan will be prepared for the management's consideration by 31 March 1987.
11. Provided functional guidance and supervision on study goals related to the Canada-Alberta Agreement. Quarterly reports were prepared for the Development Section.
12. A paper "Rate of hexazinone release from a granular formulation" by J. Feng, C. Feng, and S. Sidhu is under review by NoFC - Review Board. The paper is related to the Grande Prairie field study and involved the use of inoculated PRONONE granules (a total of 600 samples).
13. A paper "Release of hexazinone from PRONONE 10G granules exposed to simulated rainfall under laboratory conditions" by J. Feng, and V. Stornes, and R. Rogers of Pro-Serve Inc. has been accepted for publication in J. Environ. Sci. Health B23(3), 1988.
14. Designed an experiment to assess hexazinone deposition and provided methodology and analysis of deposit and Velpar formulation samples from the log-application of Velpar in the Canada-Alberta Agreement Project "Control of aspen competition in areas designated for conifers production".
15. A paper "Distribution of PRONONE 10G granules from aerial and ground application" related to the size variation and distribution patterns of PRONONE granules in formulation and from a truck-mounted pellet applicator and a helicopter-mounted bucket spreader is in preparation. A total of 835 samples were taken for this study. A second related study on the operational (multiple swath) application of PRONONE (972 samples) is in process of being statistically analyzed.

8. Provide functional guidance and supervision in R&D projects initiated under agreements and prepare a report on the interim results for the Canada-Alberta Agreement study. A-Base, Alberta FRDA. (Sidhu, Feng)
9. Continue post-herbicide treatment vegetation sampling (Grande Prairie plots), enter 1986-87 field data on computer and analyze. Synthesize 1987-88 data and prepare a status report. Alberta FRDA. (Sidhu)
10. Collect post-herbicide treatment field samples of soil leachates, surface water and sediments (in collaboration with Alberta Environ.), foliage and soils for herbicide residue analysis. Alberta FRDA. (Feng, Sidhu)
11. Prepare soil samples for bulk density determinations. Perform residue analysis on field soil samples hand-planted with inoculated Pronone 10G granules. A-Base. (Feng)
12. Perform residue analysis on foliage samples and soil leachates collected in the treated area of Method-II, and water and sediment samples collected in the vicinity of Method-II areas. A-Base. (Feng)
13. Streamline and develop analytical methods for specific herbicides. Initiate and maintain Quality Assurance programs. A-Base. (Feng)
14. 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). A-Base, Alberta FRDA. (Sidhu, Feng)
15. Provide hexazinone analysis and a report for the AFS Log-application samples and interpret the data. A-Base. (Feng)
16. Participate in the National Check Sample Program as coordinator for forestry herbicides, conduct check sample studies, and publish results. A-Base. (Feng)
17. Initiate the preliminary study on hexazinone behaviour (leachability and degradation) in intact soil profiles from the field under greenhouse conditions. A-Base, Alberta FRDA. (Sidhu, Feng)
18. Develop methods to determine hexazinone residues in vegetation and soils. (Feng)

14. Publications 1987-88:

Journal:

- Chakravarty, P.; Sidhu, S.S. 1987. Effect of glyphosate, hexazinone, and triclopyr on in vitro growth of five species of ectomycorrhizal fungi. Eur. J. For. Path. 17:204-210.



16. Considerable time was spent in assisting FPMI to complete the related sample analysis (consultation only), preparation of three research papers and platform presentations at the Carnation Creek Herbicide Workshop.

## 12. Present Status of Study:

The study is still in its initial stages and most of the work to date has been in setting up the plots and in collection of samples. Pretreatment and one year post-treatment field data on vegetation changes have been collected and data collection and interpretation has started. Preliminary studies on deposition pattern of herbicide PRONONE by ground and helicopter application were completed and a Journal Article prepared for publication. Hexazinone residue analysis of surface and soil water has been completed and an article for publication prepared. Detailed greenhouse studies on the effect of hexazinone on mycorrhizal associates have been completed and research published in two journal articles. A new method for determining hexazinone in vegetation and soil is under development to improve efficiency and precision.

## 13. Goals for 1988-89:

1. Submit for review and publish a review article on hexazinone as an information report. Alberta FRDA. (Sidhu, Feng)
2. Publish a paper on the effect of hexazinone in mycorrhizae in pine and spruce under aseptic conditions. Alberta FRDA, A-Base. (Sidhu, Chakravarty)
3. Publish a paper "Release of hexazinone from PRONONE 10G granules exposed to simulated rainfall under laboratory conditions" by J. Feng, V. Stornes, and R. Rogers of Pro-Serve Inc. A-Base. (Feng)
4. Publish a paper "Rate of hexazinone release from a granule formulation" by J. Feng, C. Feng, and S. Sidhu. The work is related to the Grande Prairie field study using inoculated PRONONE granules. Alberta FRDA. (Feng, Sidhu)
5. Publish a paper "Distribution of PRONONE 10G granules from aerial and ground application" by J. Feng and S. Sidhu. The work is related to the size variation and distribution patterns of PRONONE granules in formulation and from a truck-mounted pellet applicator and a helicopter-mounted bucket spreader. Alberta FRDA.
6. Prepare and submit for review a paper "Distribution of PRONONE 10G granules in an operational aerial application by helicopter" by J. Feng, S. Sidhu, and C. Feng. The work is related to a study on the operational (multiple swath) application of PRONONE (972 samples). Alberta FRDA.
7. Prepare and submit a paper on the soil sampling method for 0-time pesticide residues after field application, in collaboration with AFS. A-Base. (Feng)

Chakravarty, P.; Sidhu, S.S. 1987. Effect of hexazinone (Pronone 5G) on the seedling growth and mycorrhizal incidence of Pinus contorta var. latifolia and Picea glauca. Eur. J. For. Path. 17:282-291.

Feng, J.C. 1987. Persistence, mobility and degradation of hexazinone in forest silt loam soils. J. Environ. Sci. Health B22(2):221-233.

Others:

Feng, J.C.; Sidhu, S.S. 1987. Size variation and distribution of PRONONE 10G granules from aerial and ground application. 1987 ECW-Western Canada Section Research Report. (Canada-Alberta Agreement)

Feng, J.; Stornes, V.; Rogers, R.; Sidhu, S. 1987. The rate of release of surface-coated hexazinone from PRONONE 10G granules under laboratory and field conditions. 1987 ECW-Western Canada Section Research Report. (in collaboration with Pro-Serve Inc.)

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. (For Environmental Implications of herbicide application, also see NOR-10 and NOR-36-02-01).

16. Duration:

Start: 1985

Completion: 1992

17. Resources 1988-89:

A-Base:

PYs: Prof.:	Sidhu	0.8
	Feng, J.	0.9
Tech.:	Fairbarns	0.8
	Vice Milward	1.0
Total:		3.5

Term/Student: 1.6 (students)

O & M: \$25 K

Capital: \$13.4 K (Varian IIM - 8 K; Honda Fantrax & Trailer - 5.4 K)

Alberta-FRDA (Canada Alberta Agreement)

PYs: Prof.:	Nil	
Tech.:	Feng, C.	1.0
Total:		1.0

O & M: \$20 K

Capital: Nil



18. Signatures:

*H. L. Liden*  
Investigator

*Joseph A. Liden*  
Investigator

*Shallin*  
Program Director, Protection

*Ce. D. Taylor*  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: December 16, 1987

1. Project: Environmental Effects of Chemical Substances and Vegetation Management
2. Title: Nutrient cycling and dynamics, in relation to toxic substances and silvicultural practices.
3. New:                      Cont.:    X
4. No.:    NOR-7-05
5. Study Leader:    D.G. Maynard
6. Key Words:    Nutrient cycling, nutrient uptake, herbicides, ecosystem stability, tree growth
7. Location of Work:    Region wide, emphasis on Alberta
8. Problem Analysis:

A number of environmental groups and public at large have been expressing concerns about the possible adverse environmental impacts caused by the use of herbicides in forestry and the deposition of air pollutants on forested lands.

Much of Canada's previously harvested forested lands are significantly understocked and the use of chemical control (herbicides) of weed species is seen as one of the major tools that can be used to establish a commercial forest. Environmental groups have expressed their concern about the spraying of herbicides and what effects may occur as a result. The forest industry and Provincial Regulatory Agencies would like to use this silvicultural tool but lack essential scientific information on either the direct effects on various ecosystem processes and components (e.g. decomposition of organic matter) or the long-term influence on fundamental ecosystem functioning (nutrient cycling and uptake). This information is essential if the forest resource is to be managed for sustained yields in an environmentally acceptable and ecologically stable manner.

There is considerable concern on the long-term effects of acid deposition on the forest ecosystem in Canada. One indirect effect related to acid deposition involves nutrient imbalances. Acid deposition has increased the cycling of nutrients in some of the forest ecosystems that have been examined in eastern Canada. The effect of the increased cycling on nutrient uptake by trees and the possible long-term effects on the forest ecosystem are presently unknown. If the optimum management and protection

of forest resources is to be assured, studies on the effects of acid deposition on nutrient cycles, especially their inorganic/organic transformations are required.

9. Study Objectives:

1. Determine the influence of herbicide applications on the decomposition of organic matter and nutrient cycling within forest soils.
2. Determine the transformations and fractionation of nitrogen, phosphorus and sulfur in relation to the cycling of these elements in forested ecosystems as affected by herbicide applications and air pollutants.
3. Provide federal, provincial, and industrial resource managers with advice on the environmental effects of the use of various silvicultural practices.

10. Goals for 1987-88:

1. Prepare and submit for review a report on the impact of silvicultural 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.
4. Chemical analyses of the soil samples collected in 1986 will be performed.
5. Continue to monitor the nutrient status of the soils in the three treatments of Block 2 in the operational herbicide study area.

11. Accomplishments in 1987-88:

1. Most of the relevant literature has been collected and a outline has been written. A conceptual model using information from C, N, P, and S models produced for grassland and parkland soils has been attempted. Forest soils are a special case and more difficult to assess because of the extreme differences between the organic surface horizon and the minerals soils below.
2. An additional field study adjacent to the operational herbicide field study was set up in May, 1987. There are 3 treatments to be applied in May 1988, zero, 2 and 4 kg h<sup>-1</sup> a.i. (hexazinone). Two sets of soil samples for pretreatment concentrations were collected. Zero-tension lysimeters and litter fall collectors have been located in the study area. The experiment is a nested block design with 5 blocks per treatment and 4 subsamples per block.

3. A growth chamber study has been designed and the experiment set up this winter. LFH samples were collected from the field study area. The objective of the study is to determine the effects of herbicide applications on the decomposition of organic matter and the effects on the transformation of the organic nutrients N, P, and S. The study will consist of 3 herbicide treatments and zero treatment, replicated 6 times. Samples will be taken destructively at various time intervals and the herbicide residue will be monitored using a biological indicator (oats).
4. The analyses of the 1986 soil samples is in progress. Most of the analyses for the organic surface litter samples have been completed but only a few for the mineral soils. Analysis of the remaining samples is continuing.
5. The three treatments of Block 2 were sampled in mid-August, after leaf fall in the herbicide treated plots had occurred. The samples are frozen and analysis will be begin when the analyses of last year's samples are completed.

12. Present Status of Study:

Samples for the vegetation analysis and soil nutrients were taken before and after the herbicide treatment to determine the impact of the herbicide hexazinone on native plant communities and soil nutrient balance. A smaller scale, more controlled field experiment was set up in 1987 to study the processes involved in any possible direct or indirect effects of Pronone on the interrelationship between vegetation and soil nutrients. Material was collected and a growth chamber study initiated to study the effects of hexazinone on decomposition and N, P, and S transformations under optimum conditions.

13. Goals for 1988-89:

1. Publish a report on the impact of silviculture practices on nutrient cycling. Continue to develop a model of nutrient cycling in forest systems using information from the literature and data collected. (Maynard, carried over from 1987-88)
2. A growth chamber study on the effect of hexazinone application to the cycling and transformations of nitrogen, phosphorus and sulfur will be completed. Prepare and submit a journal article for review. (Maynard)
3. Monitor the soils, zero-tension lysimeters and litter fall collectors in the soil nutrient cycling field site following the application of the herbicide. Install litter bags to monitor the decomposition rate of fresh litter after the application of the herbicide. (Maynard)
4. Continue to monitor the nutrient status of the soils in the three treatments of Block 2 in the herbicide study area, Grande Prairie. Complete chemical analysis of the soil samples from 1986 and 1987. Prepare a status report on the soils data comparing pre-herbicide and post-herbicide nutrient concentrations. (Maynard - Alberta FRDA and A-Base)

14. Publications:

Nil

15. 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.

16. Duration:

Start: 1986

Completion: 1992

17. Resources 1988-89:

PYs: Prof.: Maynard 0.6  
                     Sidhu 0.1

Tech.: Radford 0.3

Total: 1.0

Term/Student: 0.3

O & M: \$ 8 000

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

18. Signatures:

  
 Investigator

  
 Program Director, Protection

  
 Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: December 16, 1987

1. Project: Environmental Effects of Chemical 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. Develop analytical techniques as required by user request.

10. Goals for 1987-88:

1. Provide analytical services to research scientists and cooperators. (Kalra)

2. Prepare a File Report of the work performed during 1986-87. (Kalra)

3. 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)



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

11. Accomplishments in 1987-88:

1. Provided analytical services to research scientists and cooperators, in particular NOR-4, 7, 11, and 12. The estimated analyses is expected to be approximately 25 000 on 6000 samples.
2. A File Report on the operation of the Analytical Services Laboratory for 1986-87 has been completed.
3. A note on ammonium determination for cation exchange capacity was submitted to the Can. J. Soil Sci. but has since been withdrawn. A version of this note was presented at a workshop in Wageningen, The Netherlands and the proceedings were to be circulated only among the participants. However, the proceedings, were given more widespread circulation and we felt that to proceed with the note would be duplicating the publication.
4. A journal article was published in the Soil Sc. Soc. Am. J.
5. The first draft of the Information Report on methods used at NoFC is nearing completion. Many of the procedures have been rewritten and new ones have been included. There have been several delays as we awaited the outcome of our involvement in some of the check sample programs to determine the validity of some methods and other commitments were given higher priority. It is hoped that a first draft will be completed early in the next fiscal year.
6. Maintained an active role for NoFC in WEALA by attending bi-annual meetings and as 1987-88 president of the Association.
7. The Analytical Services Laboratory participated in the soil analysis check sample program of the LRRC. There were 8 soil samples and 11 analyses were done. The Laboratory performed very well and only 1 analyses from 1 soil was outside the range determined by the other laboratories. Related to this program, 8 tree foliage samples were analyzed for total elemental content in samples prepared by I.K. Morrison, GLFC.

8. Every Friday is given to disposal of waste chemicals and other related laboratory safety.
9. A procedure for the total digestion of foliage samples has been developed. The method eliminates the use of perchloric acid which can be a safety hazard, particularly when heated. The method is now being used routinely for plant material and the data is being collated and a journal article will be prepared.

12. Present Status of Study:

The analytical services is an on-going study that provides analytical support services to NOR-7 and all other research projects as required at NoFC. The laboratory has averaged 27,000 analysis on 6,000 samples per year over the last three years. Quality control was maintained and improved through involvement in provincial and national quality assurance check sample round robins.

13. Goals for 1988-89:

1. Provide analytical services to research scientists and cooperators as requested and approved by the Program Directors. (Kalra)
2. Submit for review an Information Report on the Analytical Methods used for soil, plant and water analysis in the Analytical Services Laboratory. (Kalra, Maynard, carried over from 1987-88)
3. Prepare for review a journal article entitled "The use of a microwave in the digestion of tree foliage and organic forest soils for total elemental determinations". (Kalra, Maynard)
4. Participate in inter-laboratory check sample programs on a national (Land Resource Research Centre, Ottawa and Long Range Transport of Air Pollutants, GLFC, CFS) and international (LABEX program and interlaboratory comparison for the National Acid Precipitation Assessment Program of the U.S. Environmental Protection Agency) level. (Kalra, Maynard)
5. Initiate a study to determine the changes in extractable S and other nutrient elements that occur with various storage practices. (Maynard, Kalra)
6. Maintain an active role in the activities of the Western Environmental Agricultural Association. (Kalra)
7. Set up the continuous vacuum extractor system for the determination of cation exchange capacity. (Kalra)
8. Management and disposal of old chemicals. (Shuya)

14. Publications 1987-88:

Kalra, Y.P.,; 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. Pages 67-76 in Proceedings of an International Workshop on the Laboratory Methods and Data Exchange Programme, (ed. L. K. Pleijsier) held at the International Soil Reference and Information Centre, Wageningen, The Netherlands, August 25-29, 1986; ISRIC Technical Paper No. 13.

Maynard, D.G.; Kalra, Y.P.; Radford, F.G. 1987. Extraction and determination of sulfur in organic horizons of forest soils. Soil Sci. Soc. Am. 51:801-806.

15. 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.

16. Duration:

Start: 1970

Completion: on-going

17. Resources 1988-89:

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:

18. Signatures:

Y. P. Kalra  
Investigator

D. G. Maynard  
Investigator

Shmaltz  
Program Director, Protection

C. D. Tut  
Regional Director General

NOR-10

REGENERATION AND PLANTATION MANAGEMENT

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

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 problems.

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 70 million seedlings annually. Once these trees are planted on mixedwood sites, brush and grass competition interfere with survival and growth. Mixedwoods constitute about 30 percent of productive forest land in the region (about 14,000,000 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 in turn represents over 1/3 of gross merchantable wood inventory in the region) was less than 10% utilized. Current plans 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 m<sup>3</sup>) 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 the area of non-chemical competition control in 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, early tending response, and performance, including both hardwood and softwood species.

## 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 (CFRDP), and mechanization of silviculture programs (NACMEC AND FERIC), emphasizing biological aspects of silviculture mechanization, and to promote the development and dissemination of silvicultural knowledge through work with national, regional, and local committees, workshops and other related techniques.
3. Supervise research contracts and develop in-house research studies as an outgrowth of contracts where appropriate.

10. 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 1P/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" (Radanyi) (10-85, 10-1MA).

Added Goal:

7. Act as Scientific Authority on study of cull in 80 year + aspen in Whitecourt Forest (Alberta Agreement).
8. Prepare and present paper on regional equipment trials under FRDA's to CPPA annual meeting on March 23, Montreal PQ (Coop with Sidders) (Gorman).

11. Accomplishments in 1987-88:

1. Continued as project leader of NOR-10 and as chairman of the Regional Reforestation Technical Committee. (10-14)
  - a) Organized-coordinated 1987 field meeting (RRTC) at Slave Lake, Alberta and provided tech. transfer & research communication. (see also NOR-36)
  - b) Participated in NACMEC, LOG, ECW and other committees as required.
2. In cooperation with Regional Resource Data Specialist collected National Silviculture Data for 1983-85. (10-15)
3.
  - a) Coordinated the regional forest vegetation management project in co-operation with NOR-7 and NOR-3. (10-5b)
  - b) Completed establishment and initial measurement of plots for silviculture R&D on forest vegetation management project under Alberta Agreement (see 36-02-1). This included all first-year post-treatment measurements and caging of crop trees to reduce hare damage. (10-1AA)
  - c) Acted as Scientific Authority for a study on the control of aspen suckers and seedlings. Navratil, AFS (see 36-02-1). (10-2AA)
  - d) Prepared but did not initiate contract to determine risk factors for hare damage, under Manitoba FRDA (see 36-01-4). (10-1MA)
  - e,f) Provided advice on forest vegetation management and silviculture to Gardner and Ball as required. Main input to experimental plan for vegetation management R&D at Torch River, and stock and site trials at Abitibi-Price. (10-1SA, 2SA)
  - g) Supervised demonstration of Wadell scarifier in 3 Prairie Provinces under FRDA's. (10-4AA)

4. Continued to contribute through consultation as member of Canada/USA IP/MPB Committee. (10-38)
5. Inventory and data bank responsibility transferred from CFS to FERIC in 1987. No co-op. with GLFC on evaluations and no workshop conducted as it was displaced by COJFRC workshop in Ontario (Gorman). (10-17)
6. Published Information Report on hares (Radvanyi). (10-85).
7. Visited field and laboratory sites of the aspen cull study and monitored progress. Study to be complete by March 31, 1988.
8. Paper being prepared for presentation at CPPA meeting (Gorman).

12. Present Status of Objectives:

1. Silviculture R&D and reporting on regeneration silviculture has continued under the study to date, with the competition control emphasis primarily on mechanical site preparation. This approach was altered in 1985 by the addition of both manual and chemical control studies under the Alberta Agreement, which is co-ordinated through study 10-03. Future A-base focus on competition control and early stand tending will lead to a focus on smaller equipment demonstrations for a variety of purposes, with less emphasis on site preparation with large equipment.
2. National program involvement in the CFRDP, through silviculture statistics reporting, and mechanization of silviculture, through NACMEC, are being reduced after 1987-88 because of changes in the focus and/or scope of these programs. NACMEC has been substantially de-emphasized with transfers of significant parts of the program to FERIC and our focus will switch to more involvement with FERIC west. New involvement is being initiated in the National Vegetation Management Working Group because of the continuing interest in vegetation management in this region.

Regional committee activity continues to focus on technical committees like RRTC, which have taken on a more important role recently in R&D planning strategy in this region.

3. Contracts are a particularly important part of the FRDA programs, where substantial funding has been available since 1985, and smaller contracts continue to be an important adjunct to staff R&D in this study.

13. Goals for 1988-89:

1. Coordinate the regional forest vegetation management project in co-op. with NOR-7 and NOR-3.
2. Remeasure silviculture R&D plots at Grande Prairie and prepare draft report on second-year results. Coordinate small mammal study under Wildlife Toxicology Fund (Alberta Agreement).

3. Plan and initiate a multi-disciplinary project in plantation establishment and management.
4. Act as chairman of the Regional Reforestation Technician Committee:
  - a) Organize-coordinate 1988 field meeting (RRTC) in Manitoba and provide technology transfer and research priority review.
  - b) Participate in ECW, LOG, FMG (CPPA) FERIC, National Vegetation Management Working Group and other committees as required. (Brace, Gorman)
5. Continue on Scientific Authority on aspen suckers and seedlings. Navratil AFS. (Alberta Agreement).
6. Continue as project leader of NOR-10 and provide advice on silviculture investigation and vegetation management studies in Saskatchewan (Gardner) and Manitoba (Ball).
7. Prepare an Information Report on Grande Prairie stock trials (AFS).
8. Cooperate with GLFC, FERIC and FRDA's in both small and large machine evaluations as appropriate. Plan mechanization of silviculture workshop for 1989-90 in Alberta (all regional agreements) (Gorman).
9. Act as Scientific Authority for the intensive forest management demonstration project at Whitecourt (Heustis) AFS. (Alberta Agreement (Waldron)).
10. Prepare and present joint paper for mixedwood management symposium in April, 1988 with Waldron and Bella.
11. Act on Scientific Authority on aspen cull study at Whitecourt (Alberta Agreement).
12. Prepare and present paper to CPPA annual meeting on regional site preparation work (Gorman) (Alberta Agreement).

14. Publications 1987-88:

Radvanyi, A. 1987. Snowshoe hares and forest plantations: a literature review and problem analysis. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-290.

Brace, L. 1987. Forest vegetation management research and development. Pages 82-93 in: Proc. Industries Vegetation Management Association of Alberta. March 18-19, 1987. Calgary, AB

Brace, L. 1987. (Compiler). Work plan for forest vegetation management R&D under the Canada/Alberta Agreement - 1985-90. NoFC.

Navratil, S.; Lane, J. 1987. Control of aspen development in areas designated for softwood productions - summary of trials A, B., C. Canada/Alberta Agreement progress report.

Todd, P.; Brace, L. 1987. Establishment report for Grande Prairie forest vegetation management study under Canada/Alberta Agreement. NoFC.

Penner, D. Preliminary draft report on effects of hexazinone on small mammal populations - 1986 investigations. McCourt Management Ltd., Edmonton.

Gorman, R. 1987. Progress report on Silva-Wadell trials under regional FRDA's in 1987. NoFC.

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. Duration:

Start: 1984

Completion: 1991

17. Resources 1988-89:

A-Base

FRDA's

Alberta

Manitoba

PYs: Prof.: 1.0

Tech.: 1.0 (Gorman)

Total: 2.0

Term/Student: 0.3 (Student)  
1.0 (Todd)

O & M: Contracts 15,000  
Other 10,000  
25,000

160,000

1,250.00

Capital: \$15,000 (Data Logger 5,000; Honda 4-track 10,800)

FRDA's Detail

1. Alberta - Vegetation Management Project

	<u>PY</u>	<u>O&amp;M</u>
	.3 (student)	
Brace	1.0 (Prof)	\$15,000
Navratil	.5 (Term)	60,000
Drew	.5 (Student)	
	2.3 (PY)	\$75,000

Huestis Demonstration Forest \$85,000

2. Manitoba

RRTC meeting  
in Winnipeg area

2 cost for 2 people \$1,250.00  
as cost-shared  
(Waldron and Brace)

18. Signatures:

Waldron  
Investigator

Waldron  
Program Director, Resources

G. D. Tut  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

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: Vacant
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 70 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.

Concurrent with herbicide R&D there is a critical 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 continues to grow.

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, with emphasis on aspen suckers and seedling management techniques.
2. To conduct related R&D on plantation establishment and performance, including stock trials.
3. To act as Scientific Authority on research contracts and to contribute to Resources R&D planning at NoFC.

10. 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 (Pfizer) (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 FPMI on priority rated herbicides using ECW protocols. (10-69)

11. Accomplishments in 1987-88:

1. Summarized draft Information Report on results of efficacy/crop tolerance experiments in Alberta and Manitoba. Publication deferred to 1988-89. (10-75)
2. Continued measurement of co-op. performance trial at Grande Prairie. Annual status report (1987) prepared. Final contract report for AFS prepared under NOR-10-03. (10-21)
3. Continued evaluation of herbicides for wS release at Calling Lake. (AFS and Dupont-Pfizer) with emphasis on Pronone as they relate to benchmark research of Grande Prairie. Three year results reported by Pfizer to ECW in December 1987. (10-71).
4. Acted as Scientific Authority for the intensive forest management project at Weberville and Jumping Pound, AFS. (see 36-02-6). Transfer to 10-03. (10-3AA) (Alberta Agreement)

5. Assisted completion of establishment and initial remeasurement of plots for silviculture R&D on forest vegetation project under Alberta Agreement (see 36-02-1).
6. No fieldwork undertaken in 1987-88. (10-69)

12. Present Status of Study Objectives:

1. The conduct of studies of chemical and non-chemical means of competition control initiated in 1980 are largely completed. The only ongoing function is the possible conduct of efficacy trial on priority rated herbicides from FPMI which has been minor in the past 3 years. Current R&D on vegetation management which originated with the Alberta Agreement in 1985 with emphasis on aspen sucker and seedling origin and control will be a more prominent activity in the study beginning in 1988.
2. Stock trial and plantation performance R&D originally assigned to the study is almost complete and although not reflected in current study goals, an increase in this activity may occur later in 1988 under new study leadership.
3. The contract supervision and R&D planning goal is a new emphasis in the study and may become increasingly significant under new study leadership.

13. Goals for 1988-89:

1. Publish Information Report on results of efficacy and crop tolerance experiments in Alberta and Manitoba.
2. Contribute to planning and initiation of multi-disciplinary project on plantation establishment and management.
3. Act as Scientific Authority on unsolicited proposal (UP) for an aspen monograph being done by Western Ecological Service Ltd.
4. Act as Scientific Authority on FRDA contract for report on aspen solid wood products (Alberta Agreement).
5. Continue field efficacy trials with FPMI priority-rated herbicides. Continue monitoring plot at 2, 3-5 and 10 years using ECW Protocols.

14. Publications and Reports 1987-88:

Upton, M. 1987. Progress report on Grande Prairie stock trial, 1986. NoFC (for AFS contract).

15. 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.
16. Duration:
- Start: 1980                      Completion: 1990
17. Resources 1988-89:
- A-Base:  
PYs: Prof.: 1.0 (Vacant)  
Tech.:  
Total: 1.0  
Term/Student: 0.6
- O & M: \$10,000 Unsolicited Proposal (\$37,800 - aspen monograph)
- Capital: Nil
18. Signatures:

Investigator

Program Director, Resources

Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

1. Project: Regeneration and Plantation Management
2. Title: Forest ecology and site productivity
3. New:                      Cont.: X                      4. No.: NOR-10-06
5. Study Leader: I.G.W. Corns
6. Key Words: Forest ecology, site productivity, forest soils, site modification, succession, ecological classification
7. Location of Work: Northern Forestry Centre, Edmonton, Alberta; Boreal Forest in Western and Northern Region
8. Problem:

In recent years a greater appreciation of forest land as a valuable natural resource has intensified interest in evaluation of variability in forest site productivity and in inventories of a rapidly changing landscape. There is an increasing awareness that our forested land must be carefully managed if it is to remain productive. Several information gaps are evident that will be addressed by this study:

1. There is need for information on factors influencing forest establishment and growth and for new methodology for site evaluation and classification of boreal forest ecosystems.
2. Large scale pulpwood clearcutting operations in Alberta foothills have resulted in large areas of young ( 25 yr.) forest. The rate and extent to which the productivity, structure and species composition of these forests is proceeding toward that of mature forest on similar situations is not well documented. An opportunity is thus available to increase our understanding of forest dynamics in the foothills. Such information can be used to interpret recently developed forest site classifications emphasizing mature forest vegetation.
3. The impact of logging and site preparation equipment upon soil properties (especially bulk density) and subsequent tree growth in the western boreal forest is unknown.



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.
6. To determine the effect of site upon major insect and disease agents upon lodgepole pine and jack pine survival in west-central Alberta and southeastern Manitoba respectively.

#### 10. 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, Rovaniemi, Finland, August 1987. (10-89)

Added Goals:

12. Provide site descriptions for Fawcett Lake white spruce release from aspen study in cooperation with Dr. R. Yang, NoFC.
13. Participate on editorial committee preparing CFS site classification working group papers for publication in Forestry Chronicle.
14. Initiate discussions with Dr. Frank Ahern, Canadian Centre for Remote Sensing re. pilot project to use radar imagery to discriminate forest sites in Whitecourt - Swan Hills area.

15. Act as Scientific Authority for small contract to Dr. R. Wells to prepare paper on the Manitoba Site Classification pilot project for inclusion in Forestry Chronicle site classification supplement.
16. Act as scientific authority under Canada-Manitoba FRDA contract to H. Veldhuis, Manitoba Soil Survey to evaluate forest productivity differences between soil map units, using Manitoba Forestry Branch forest inventory data. The study is complementary to the major Manitoba site classification contract and will attempt to discriminate some of the principal factors influencing forest productivity in Manitoba.
17. Participate as member of AFS-REAP site classification advisory committee to AFS Reforestation and Reclamation Branch regeneration performance monitoring project.

11. Accomplishments in 1987-88:

1. Technology transfer related to west-central Alberta field guide:
  - a) Four field workshops were conducted for Alberta Forestry Lands and Wildlife, forest industry and CFS personnel. Locations were in the vicinity of Grande Prairie, Whitecourt and Hinton. (10-34).
  - b) A invited seminar dealing with Alberta forest ecosystem classification was presented at the Dept. of Forest Science, January 28, 1987.
  - c) The Soil Conservation Society of America meeting was not attended. The poster paper was prepared and presented instead at another meeting (see goal 11).
2. Drafted a journal article on forest succession 24 years after clear-cutting (Edson Forest). It is presently in internal review at NoFC.
3. Continued data evaluation for analysis and characterization of highly productive forest sites in the Region with objective of determining potentially manageable chemical and physical factors - included evaluation of several trace elements. A draft report is in preparation. (10-22)
4. Published Journal Article on effects of soil compaction during harvesting and site preparation upon subsequent tree growth. Terminated. (10-35)
5. Supervised contract for the development and application of a forest site classification for Manitoba. The initial contract, "Development of a methodology and rationale for a forest management site classification system for Manitoba" was completed by Dr. R. Wells. A subsequent contract, "Forest site classification pilot project for the province of Manitoba" was initiated with Pedocan Land Evaluation of Edmonton. The first half of a two year contract has been completed.

The contractor's preliminary report is to be presented at a seminar in Winnipeg on February 25, 1988. (See 36-01-06). (10-2MA).

6. Provided site classification information as a basis for stratifying/analysing 1P mortality data on NOR-10-08 plots near Hinton. (10-86)
7. Initiated study of effect of four synthetic mulches as substitute for mechanical and chemical treatments to control grass competition around white spruce seedlings near Slave Lake, Alta. The treatments included 1m<sup>2</sup> patches of tarpaper, 6 mil black polyethylene film, two polypropylene materials - Typar (white) and Nylex C24 (black), 30 cm x 30 cm hand scalps to mineral soil and control. (10-82)
8. Acted as regional Scientific Authority for revised "Native Trees of Canada" book. (10-87)
9. Served as member of Alberta/Sask. vegetation Working Group of Canada E.L.C. Committee provided input to key for vegetation physiognomy. (10-88)
10. Acted as Scientific Authority for Biogeoclimatic classification for Alberta Agreement. An interim report suitable for distribution has been prepared. (10-SAA)
11. Attended meeting of IUFRO working party S.I.-05-12, Northern Forest Silviculture and Management, Rovaniemi, Finland. Aug. 1987. A poster paper was presented on the west-central Alberta site classification work. Terminated. (10-89)
12. Provided site classification descriptions for Fawcett Lake white spruce release plots. White spruce site index was related to the site types described. Provided site description input into Yang manuscript.
13. Participated on editorial committee preparing SCALE papers for publication in Forestry Chronicle. This work will continue until publication in late fall 1988.
14. Initiated discussions with Dr. Frank Ahern of CCRS re pilot project to use radar imagery to discriminate forest sites in the Whitecourt - Swan Hills area.
15. Acted as scientific authority for small contract to Dr. R. Wells to prepare paper for Forestry Chronicle site classification supplement. Terminate.
16. Acted as scientific authority for contract under Canada-Manitoba FRDA agreement to H. Veldhuis, Manitoba Soil Survey.
17. Participated as member of AFS-REAP site classification advisory committee to AFS Reforestation and Reclamation Branch regeneration performance monitoring project. Committee met monthly until June 1987.

## 12. Present Status of Objectives:

1. Stepwise multiple linear regression analyses are being conducted during the course of the investigation into factors controlling growth in highly productive white spruce stands in the western and northern region. Data were collected during field work in 1985 and from earlier Alberta Biogeoclimatic plot data. Report preparation completion anticipated during 1988.
2. The "Field guide to forest ecosystems of west-central Alberta" was published in August 1986. Technology transfer activities continue.
3. See #1 above.
4. A manuscript to be submitted to Can. J. For. Res. has been prepared entitled "Succession and tree biomass accumulation after clearcutting lodgepole pine in west-central Alberta the first 24 years". The manuscript is currently in internal review.
5. A paper entitled "Compaction by forestry equipment and effects on coniferous seedling growth on four soils in the Alberta foothills" is to be published in the January 1988 issue of Can. J. For. Res. Studied root development only in the greenhouse. Erosion and alteration of drainage appeared minimal and were not quantified. Methods of site "rehabilitation" were beyond the scope of this study but are I believe still worth addressing in future.
6. Pine mortality will be related to site in 1988. Anticipate completion of this work in 1989.

## 13. Goals for 1988-89:

1. Continue as Scientific Authority for Biogeoclimatic classification for Alberta Agreement. Terminate.
2. Supervise contract for the development and application of a forest site classification for Manitoba Agreement.
3. Prepare Journal article on characterization of highly productive white spruce sites in region. The study is focussing upon potentially manageable soil chemical and physical properties that might be modified on similar less productive sites.
4. Continue technology transfer related to field guide on Western Alberta Forest Ecosystems and their management.
5. Publish a journal article on forest succession 24 years after clear-cutting (Edson Forest). Terminate
6. Remeasure plots and prepare file report on study of effect of synthetic mulches to control grass. Initiated in Slave Lake Forest in 1987.
7. Serve as member of Alberta/Sask. Vegetation National Vegetation Working Group of Canada E.L.C. Committee.



8. Act as regional Scientific Authority for revised "Native Trees of Canada" book.
9. Cooperate with W. Ives in analysis of 1P mortality data on NOR-10-05 plots near Hinton.
10. Describe sites for remaining Fawcett Lake plots and provide input into data analysis as necessary.
11. Publish as member of editorial committee for SCALE, 13 papers in Forestry Chronicle including a paper authored by myself on the west-central Alberta site classification work.
12. Initiate a new study in cooperation with Canadian Centre for Remote Sensing using radar imagery to discriminate sites in Swan Hills Whitecourt area.
13. Prepare presentation on classification of aspen ecosystems for the Mixedwood Symposium in Edmonton, April 28, 1988.
14. Prepare presentation on aspen ecology for CIF annual meeting in Prince Albert, September 1988 and for subsequent publication in Forestry Chronicle.

14. Publications 1987-88:

Corns, I.G.W. 1988. Compaction by forestry equipment and effects on coniferous seedling growth on four soils in the Alberta foothills. Can. J. For. Res. 18:75-84.

Corns, I.G.W. 1987. Field guide to forest ecosystems of west-central Alberta. Poster presentation at meeting of IUFRO working party SI-05-12, Northern Forest Silviculture and Management, Rovaniemi, Finland. Aug. 1987.

Wells, R.E. 1987. Development of a methodology and rationale for a forest management site classification system for Manitoba. Contractor's report under Canada-Manitoba FRDA.

Sivak, B. 1987. Biogeoclimatic ecosystem classification of the forested portion of southwestern Alberta. Forest Research Branch, Alberta Forest Service Contractor's report under Canada-Alberta FRDA.

15. 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.

16. Duration:

Start: 1984

Completion: 1989

The following schedule is for Objectives items 1-6:

1. Paper to be completed during 1988. No further work in immediate future.
2. Completed Aug. 1986. Technology transfer continues.
3. Paper in preparation. Completion during 1988 (Same paper as 1 above).
4. Hope to publish paper in 1988.
5. Paper published January 1988.
6. Initiate analysis 1988, complete paper 1989.

17. Resources 1988-89:

A-base

Alberta

FRDA'S

Manitoba

PYs: Prof.: Corns 1.0  
Tech.: Allan 1.0

Total: 2.0

Term/Student: 0.0


O & M: 10,000


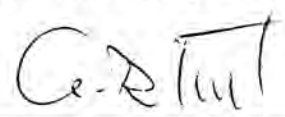
\$134,382

66,000 (contract  
and travel)

Capital: \$7,800

18. Signatures:

  
Investigator

  
Program Director, Resources  
  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

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

In recent years there has been an increased awareness that Canada's forests are not going to last forever without assistance from forest managers. Many of the areas that are harvested, or have been burned do not naturally regenerate themselves with the desired tree species and density, and require site preparation or planting in order to provide satisfactory stocking levels. Whatever the procedure used, the operation is expensive, especially if it has to be repeated on the same site. Surveys are therefore conducted in order to determine whether or not the area under consideration is adequately stocked. However, the standards for making this decision are somewhat arbitrary because of the tree mortality that will occur between the time when the survey is conducted and when the tree is finally ready for harvesting. At the moment, a value of 80% stocking is considered to be adequate, but this is not necessarily valid for all sites. With jack pine and lodgepole pine especially, there is every reason to believe that the amount of mortality will vary between sites. Some of this variability will be related to edaphic factors, but some will also be due to the differing effects of insect and disease attacks on trees in various sites.

What seems to be required, then, is an assessment of tree mortality from the time of establishment until crown-closure at age 25 to 35 years. An estimate of this mortality can be obtained by establishing plots in a number of different age classes, on a variety of sites, and assessing the

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 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)

#### 11.. Accomplishments in 1987-88:

1. Manuscript has been edited and the typesetting of the text has been completed. All needed photographs have been obtained, color prints have been made, and the plates have been prepared. The taxonomic, diagnostic and general indexes have been compiled and are ready for the insertion of page numbers. (10-72)
2. Sixth-year mortality was assessed in the lodgepole pine plots near Hinton, Alberta. Plot maintenance was done on 60 of 70 areas, leaving 10 areas to be completed next fiscal year. File report summarizing 1985-86 mortality was prepared. (10-63)

3. Five-year mortality of jack pine plots in the Sandilands Provincial forest, Manitoba, was assessed. Five-year height growth was measured on a sub-sample of trees and plot maintenance was done where needed. An information report was not prepared because of the amount of work required to achieve Goal 1. (10-64)

12. Present Status of Study:

Five-year growth and survival data have been collected. Analyses are currently underway to determine how these values are affected by site class, in preparation for the construction of composite survival curves.

13. Goals for 1988-89:

1. a) Co-ordinate the completion of plot maintenance in the 10 remaining lodgepole pine study areas near Hinton, Alberta.
- b) Assess seventh-year mortality in lodgepole pine plots near Hinton, Alberta.
- c) Collaborate with Dr. I. Corns to analyse accumulated data on growth and survival of lodgepole pine in the Hinton area to determine if they are related to the preliminary site classifications obtained in 1986.
- d) Prepare progress report on study to date.
2. Prepare information report summarizing the results of the Manitoba studies.

14. Publications 1987-88:

Ives, W.G.H; Wong, H.R. 1988. Tree and shrub insects of the prairie provinces. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-292.

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. Duration:

Start: 1981

Completion: 1992

17. Resources 1988-89:

PYs: Prof.: Ives 1.0  
Tech.: Rentz 1.0

Total: 2.0

Student: (2) 0.6

O & M: \$15,000

Capital: NIL

18. Signatures:

  
Investigator

\_\_\_\_\_  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

1. Project: Regeneration and Plantation Management
2. Title: Forest vegetation management techniques and tools for forestry
3. New:                      Cont.: X                      4. No.: NOR-10-09
5. Study Leader: L.G. Brace/Vacant/(A. Gardner)
6. Key Words: Vegetation management, nurseries, prescriptions, site preparation, stand maintenance, treatments, manual, mechanical, chemical, efficacy, tolerance, silvicultural response, survival, growth, environmental impact, economics, public consultation
7. Location of Work: Alberta, Saskatchewan, Manitoba
8. Problem Analysis:

Forestry has traditionally been a major provider of wealth in our economy and recently the Canadian Council of Resource and Environment Ministers (CCREM) established new goals for a 40% increase in the harvest and a doubling of forest productivity by the year 2000 is part of a plan for increasing employment and economic gain from forestry. These plans coincided with the realization that our reforestation and stand maintenance record across Canada is inadequate, with nonsatisfactorily restocked (NSR) stands totalling about 25 million hectares and vast areas of forest operating below their productive capability because of poor maintenance.

Regionally, the mixedwood forest illustrates the problem well. Mixedwoods occupy 50% of our regional forest land base and account for 300 000 of the 500 000 ha of nonsatisfactorily restocked NSR land in the region. Desirable softwood species are difficult to regenerate and grow because of competition from grass, brush, aspen suckers and damage from hares.

A new vegetation management strategy is needed to overcome these problems, including a plan for research to provide more information about the effectiveness and costs of an array of site preparation and stand maintenance tools, including manual, mechanical, and chemical treatments, prescribed fire and combinations thereof. Ideally this research requires a framework of treatment prescriptions set within an ecological classification system to facilitate technology transfer to operational use.



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 alternative 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 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.

11. Accomplishments in 1987-88:

1. Continued planning and coordination role in vegetation management under Alberta FRDA (ref. goal 10-56 NOR-10-03) the project to continue to 1989 under FRDA.
2. Work plan updated and summarized for use in FRDA review - January 1988.

3. Liaison continued. Minimal vegetation management R&D outside FRDA's. Only active program outside Alberta was Gardner - tracking River Trial and small continuing glyphosate trial on Weyerhaeuser area (NOR-36-03-2) and review of Ball proposal for "CFS-Abitibi-Price Stock Site Trial", in Manitoba.

12. Current Status of Study Objectives:

See component studies.

13. Goals for 1988-89:

1. Continue to plan and coordinate regional A-base forest vegetation management R&D (particularly NOR-10 silviculture), NOR-7 (Environmental Impact) and NOR-3 (Economics) and in Manitoba and Saskatchewan.
2. Continue as co-ordinator of FRDA R&D (including project work in silviculture) and act as Scientific Authority on related contracts under FRDA as required.
3. Maintain liaison with CFS, other federal departments, provincial agencies and companies involved in vegetation management R&D in region (Brace, Gardner, Ball).

14. Publications 1987-88:

Nil

15. 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.

16. Duration

Start: 1985

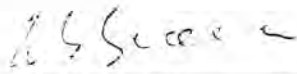
Completion: 1990

17. Resources 1988-89:

PYs: Prof.: (See individual studies)  
Tech.:  
Total:  
Term/Student:

O & M:  
Capital:

18. Signatures:

  
\_\_\_\_\_  
Investigator

\_\_\_\_\_  
Investigator

  
\_\_\_\_\_  
Program Director, Resources

  
\_\_\_\_\_  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 6, 1988

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 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)



## 11. Accomplishments in 1987-88:

1. Acted as chairman of the CFS working group on forest site classification (SCALE). Printed proceedings of SCALE meeting in Grande Prairie and reported to CORE. Chairmanship terminated. August 7, 1987 (10-76)  
  
A paper on SCALE was prepared and presented at the Landscape Ecology and Management symposium in Guelph in May, 1987.
2. Assisted to development of a site classification system on Weyerhaeuser (PAPCO) limits in cooperation with Sask. Soil Survey and Sask. District Office under Sask. Agreement via examination of background literature and air photo interpretation pertaining to the pilot areas selected by Weyerhaeuser; and preparation and presentation of extended legend models for possible use in the site classification of the pilot areas. (10-3SA)
3. Provided technology transfer in forest soils and site classification to the Forest Research Branch, Timber Management Branch, Reforestation and Reclamation Branch, and the Resource Evaluation Branch of the Alberta Forest Service; the Timber Management Section of the Forestry Division of Saskatchewan Parks and Renewable Resources; Foresters of the Saskatchewan Division of Weyerhaeuser Canada; the SCALE site classification Working Group of the CFS; and to consultants.
4. Drafted Information Report on subsoil amelioration techniques in forestry. "Boreal forest site improvement by downward expansion of the usable volume of soil - A Review" W.H. Holland and D.J. Pluth. (10-59)
5. Prepared outline entitled "Mountain ecology and land classification" for contribution to Slaymaker and French's book "Canada's Northern and Mountain Environment". (10-84)

## 12. Current Status of Objectives:

1. SCALE chairmanship is terminated, but a commitment to the SCALE Working Group is continuing via a plan to apply GIS techniques to site classification, with emphasis on the relationship of Mapping Units to GIS. A literature review of soil amelioration techniques is in progress. An examination of suitability of the soil mapping for site classification will be made in 1988 on two pilot areas chosen by Weyerhaeuser in Saskatchewan.
2. Technology transfer activities are publications and meetings (see goals 11-1, 2, 4, and 5). Unplanned technology transfer activities occur as a result of questions from clients (see goal 11-3). Both kinds of activities are active and ongoing.



13. Goals for 1988-89:

1. Prepare a work plan for review by NoFC staff re verification of the adequacy of Saskatchewan soil survey mapping (1:125:000) for use in site classification of the Saskatchewan forest inventory maps (1:12,500) and the relationship of mapping units to landform.
2. Publish an Information Report on the review of subsoil amelioration techniques in forestry.
3. Prepare for SCALE members a plan to apply GIS techniques to site classification, with emphasis on the relationship of Mapping Units to site classification and GIS techniques.
4. Provide technology transfer in forest soils and site classification to regional forest resource managers and SCALE members.
5. Write a chapter entitled "Mountain ecology and land classification" for inclusion Slaymaker and French's book "Canada's Northern and Mountain Environment".

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.

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.

15. Duration:

Start: 1986

Completion: 1989

16. Publications 1987-88:

Holland, W.D. 1988. SCALE, Forest Site Classification, interpretation, and land evaluation. In: Landscape Ecology and Management Symposium, May 19-22, 1987. Dept. of Geog., University of Geulph, Guelph, Ontario. In press.

17. Resources 1988-89:

A-base

Saskatchewan Forestry Agreement

PYs: Prof.: Holland 1.0

Tech.: 0.0

Total: 1.0

Term/Student: 0.0

O &amp; M: \$2,000

\$12,000

Capital: Nil

18. Signatures:

W. D. Holland  
Investigator

[Signature]  
Program Director, Resources

G. D. Furl  
Regional Director General

NOR-11

FOREST INSECT AND DISEASE SURVEY  
AND MANAGEMENT SYSTEMS

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1988

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Forest Insect and Disease Surveys
3. New:                      Cont.: X                      4. No.: NOR-11-01
5. Study Leader: H.F. Cerezke and W.J. Volney
6. Key Words: Detection, appraisal, distribution, parasites, hosts, damage, predators, biological control, hazard, susceptibility, management, parks, symptoms, damage, pest extension, effluents
7. Location of Work: Region wide
8. Problem:

Forest Insect and Disease Survey (FIDS) and detection in Canada date back some 50 years. During this period of continuous operation, a wealth of information has accumulated that provides an historical record and knowledge base of native and introduced insect and disease species inhabiting forests and trees, their distributions, damage effects on trees, natural control agents, life cycle development and behavior within the Western/Northern Region. The data are gathered by a wide variety of established sampling, collecting and processing procedures that have been developed over a long period of time. Application of these procedures provides an efficient means of continually updating the knowledge of forest insect and disease infestations and other forest disturbances within the region, and to satisfy nationally-directed surveys such as acid rain monitoring, pest outbreak prediction and plant quarantine concerns. The procedures also provide the basis for generating forest pest-caused loss estimates, in assessing pest controls, and in implementing integrated pest management strategies. During the period, 1976 to 1980, FIDS data helped identify annual tree mortality loss estimates in Canada from insects and diseases to be of the order of 77 mil. m<sup>3</sup> per year, and additional losses in growth reduction to be of a similar magnitude.

The survey, identification, reporting and prediction of losses due to insects, diseases and other damage agents forms an integral part of intensive forest management and other land use interests, and must be maintained on an annual basis because of the dynamic nature of pest

populations, forest growth and development. Hence, the combined objectives of the FIDS program are to assist in the overall protection, wise use and management of forests within the region.

The incorporation of sound pest management strategies within the region rely heavily upon an efficient and comprehensive FIDS operation. Its various functions therefore require a continual updating to incorporate new technologies such as insect pheromones and GIS systems for improvement in sampling methods and in data recording and processing.

9. Objectives:

1. To gain an improved and updated knowledge of forest insects and diseases in the region to help minimize their damage impact effects on trees and forests, provide an advisory service to regional and national 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. To provide management agencies with pest identification, control and impact assessment services relating to effects of insects, diseases, climatic influences and pollutants on trees and other forest vegetation.

10. 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 Manitoba, Saskatchewan and Alberta.
  - e. Forest tent caterpillar in Manitoba, Saskatchewan and Alberta.
  - f. Other insect and disease organisms as identified by client agencies (Cerezke, 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 required. (Cerezke, FIDS Technical 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 within the region. (Cerezke, FIDS Tech. 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 and seed collecting areas. (Cerezke, FIDS Tech. staff)
10. Re-examine ARNEWS 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 FRD Agreements in the prairie provinces. (Cerezke)

Added Goals:

12. Contribute forest pest information and discussions for consultant contract for study on "Risk Management in Forest Planning" (Cerezke).
13. Provide contributions to FIDS 50th. Anniversary Publication as requested (Cerezke).

11. Accomplishments in 1987-88:

1. Aerial and ground surveys were completed region-wide for spruce budworm, jack pine budworm, aspen defoliators and bark beetles. A new infestation of spruce budworm occurred in northwestern Alberta and considerable expansion of the forest tent caterpillar occurred in Saskatchewan and Alberta. An extensive fall egg-band survey to predict 1988 forest tent caterpillar infestation levels was completed in the two provinces.
2. a) Assistance was provided to Alberta Agriculture to monitor for incidence of DED and its vectors. No DED was found in Alberta, nor its bark beetle vectors.



- b) A survey for general insect and disease abundance was conducted in all of the Rocky Mt. Nat'l Parks. An outbreak of the lodgepole needle miner was found in Banff Nat'l Park.
  - c) Pheromone traps to monitor spruce budworm moth populations were placed at about 30 locations in the three prairie provinces. The data are being correlated with defoliation, egg masses and L2 larval counts, based on foliage samples collected. The jack pine budworm pheromone was not available for testing.
  - d) No new pinewood nematode sample materials were collected in 1987, for either tree hosts or insect vectors. No new distribution records of the pinewood nematode were identified.
  - e) Provincial forest tree nurseries in Saskatchewan and Alberta were surveyed for incidence of insects and diseases. A sample of lodgepole pine cones from the PRFN at Smoky Lake, Alberta, showed high incidence of a cone worm. Report prepared "Survey Report of Insect and Disease Conditions at the Pine Ridge Forest Nursery in 1986", Status Report, April, 1987 (Cerezke).
  - f) Other site-specific surveys included pre-spray population assessment of spruce budworm in provincial park areas in Alberta.
3. Data for the 1986 regional Inf. Report was completed and is under review, and a draft copy of the 1987 report is in preparation. Information for the national FIDS report for 1986 was submitted to H.Q.
4. Training and technological development are being put into place to fulfill the pest depletion loss exercise, in cooperation with PNFI. An ARC/INFO software package was acquired at NoFC to digitize FIDS survey maps; training was provided by expertise at PNFI; FIDS survey maps have been collected and coded, and in-house training and initial map digitizing are in progress.
5. Pest extension information was provided for about 2000 client inquiries, dealing with insects, diseases and other damage agents of nurseries, shelterbelts, forests, and ornamental trees and shrubs. Other technology transfer items included the following:
- a) Presented workshop on nursery insects at Pine Ridge Forest Nursery, Smoky Lake (Cerezke).
  - b) Presented slide and field demonstration of insects/diseases in young stands to staff at Weyerhaeuser Co., Prince Albert (Volney, Cerezke).
  - c) Contributed to the preparation of a pest leaflet on bronze birch borer for handout in Manitoba (Cerezke, Daoust-Savoie).
  - d) Presented two training sessions on forest tent caterpillar: at Rochester and at Athabasca, Alberta (Cerezke).
  - e) Presented information on forest tent caterpillar at Alberta Forest Service staff meeting in Edmonton (Cerezke).
  - f) Presented two lectures on insect and disease management in nurseries to forestry students at Univ. Alta. (Cerezke).
  - g) Provided instruction on forest insects and diseases to Junior Forest Warden Leaders at weekend camp in Alberta (Cerezke).
  - h) Presented lecture at Hinton Forestry School to Alberta Forest Service field staff on the topic: "Harvest Layout Design: Influence of Insects and Diseases" (Cerezke).

6. Representation was provided at the following meetings, committees and advisory groups:
  - Alberta Pest Control Advisory Council
  - Dutch elm disease workshop, Manitoba
  - Saskatchewan Advisory Council on Insect/Disease Control
  - National Forest Pest Control Forum
  - Annual FIDS Heads meeting
  - Meeting with Agriculture Canada, Plant Health Division to discuss and review national issues on Scleroderris disease
  - Regional meeting on Acid Rain and monitoring
  - Participated in Swedish Pinewood Nematode Mission meetings held in Ottawa (gave presentation on "Bark beetles and sawyer beetles as potential vectors of PWN") and on field tour in New Brunswick (Cerezke).
  - Participated as an external reviewer at Peer Review of FIDS Project at Great Lakes Forestry Centre (Cerezke).
7. Two meetings of the Regional Insect and Disease Technical Advisory Committee were held, one in Edmonton, the other in Prince Albert. Follow-up summary report and recommendations were presented to the Senior Regional Advisory Committee.
8. First draft report on Survey Methodology was completed and now is in review stages (Moody).
9. A sampling scheme was designed for conducting surveys of insect and disease organisms and damage in plantations and other high-value conifer stands; several plantations were surveyed.
10. ARNEWS plots within the region were re-surveyed for insect/disease damage; increment cores were measured and all basic data were sent to PNFI for computer input and summary.
11. Served as Project Leader, Head of FIDS, and provided functional guidance and supervision on studies initiated under the Federal/Provincial Forest Resources Development Agreements in the Western/Northern Region.
12. Contributed forest pest information and discussions for consultant contract and report on "Risk Management in Forest Planning" (Cerezke).
13. Provided contributions to FIDS 50th. Anniversary Publication:
  - a. Western/Northern FIDS
  - b. Aspen Defoliation : Monitoring and Prediction
12. Present Status of Study:
  1. Regional FIDS activities were focused on detecting, monitoring and mapping current infestations of the major pest species (spruce and jack pine budworms, forest tent caterpillar, mountain pine beetle, etc.). This information is updated annually, summarized in regional and national FIDS publications, and reported at the annual Forest Pest Control Forum meeting in Ottawa. The annual summary of data adds to

the knowledge base of regional outbreak patterns, provides a basis for developing predictive models, and provides immediate useful information for major client agencies in developing pest management strategies.

2. Special surveys were undertaken in support of national, regional and provincial requests and included a survey of introduced pest distributions in southeastern Manitoba, Dutch elm disease and its vectors in southern Alberta, insect and disease pests in forest nurseries and assessment of insect and disease species and damage in plantations.
3. A full complement of 12 permanent ARNEWS plots are now established in the three prairie provinces and will be maintained for long-term monitoring of effects of acid rain, as part of a nationally-directed monitoring program. FIDS similarly completed a nationally-directed survey for the pinewood nematode in 1986 and identifications are still on-going.
4. On an on-going basis, FIDS regularly provides a vast array of information to regional client agencies in the form of extension calls, pest leaflets, lectures, field demonstrations, published information on life history, impact and control, pest identifications and recommendations on pest management.

### 13. Goals for 1988-89:

1. Survey, map and report on major forest pests of the region:
  - a. Mountain pine beetle in Alberta, Saskatchewan and Rocky Mt. national parks;
  - b. Spruce beetle in Alberta;
  - c. Spruce budworm region-wide;
  - d. Jack pine budworm in Alberta, Saskatchewan and Manitoba;
  - e. Forest tent caterpillar in Alberta, Saskatchewan and Manitoba;
  - f. Other insect and disease organisms as identified by client agencies. (FIDS Staff)
2. Conduct special surveys:
  - a. Dutch elm disease and its vectors as required;
  - b. Parks Canada - general insect and disease surveys;
  - c. Selected provincial parks - surveys, collections, identifications and technology transfer as requested;
  - d. Spruce budworm pheromone field trials;
  - e. Insect and disease surveys in provincial forest tree nurseries;
  - f. Other site-specific or pest-specific surveys as requested. (FIDS Staff)
3. Publish 1986 and 1987 regional FIDS Information Reports, and provide regional pest information for 1987 to H.Q. for the national FIDS report. Compile 1988 FIDS data and summarize for the 1988 regional Information Report. (Cerezke, Emond)
4. Continue training of FIDS staff on procedures for data entry and digitizing of FIDS aerial survey maps, (in-house and with PNFI staff);

- digitize all necessary grid base maps of the three prairie provinces and Northwest Territories; initiate summary of data on regional pest depletion losses for period 1981-1986. (Volney)
5. Develop and implement protocols for digitizing FIDS map-based information to be compiled for use by the geographic information system. (Volney)
  6. Provide pest extension information and technology transfer to clientele as requested. (FIDS Staff)
  7. Conduct pest surveys in designated plantations and high-value conifer stands within the three prairie provinces, in close cooperation with provincial forestry staff and FRD staff. (FIDS Staff)
  8. Arrange for pest identification and technology transfer workshops as required. (NOR-11 Project Staff)
  9. Provide diagnostic and advisory services on tree and shrub pests in cooperation with other staff of NOR-11 and with FRDA staff. (FIDS Staff)
  10. Represent CFS and NoFC on various national, regional and provincial forest pest and related insect and disease committees and advisory groups. (FIDS Staff)
  11. Organize and conduct a Regional Insect and Disease Technical Advisory Committee meeting, and prepare a report of recommendations for presentation to the Senior Regional Advisory Committee. (Cerezke, other FIDS Staff)
  12. Re-survey all ARNEWS plots in the region for presence of forest pests and tree damage. (FIDS Staff)
  13. Serve as Project Leader of NOR-11 Project, as FIDS Head of NOR-11-01, and provide functional guidance and supervision on studies initiated under the Federal/Provincial Forest Resources Development Agreements in the Western/Northern Region. (Cerezke, Volney)
  14. Prepare chapter contributions for the proposed sequel to M.L. Prebble's book, "Aerial Control of Forest Insects in Canada" as requested by J.A. Armstrong as follows:
    - a. "Status of Forest Pest Insects in the Northern Region", intended for Volume I, Aerial Spray Research and Control;
    - b. Chapter 2. Insects Affecting Immature Forests; section on "Root collar weevils", intended for Volume II, Ground Control and Protection of Regeneration Forests. (Cerezke)
  15. Review and prepare final draft of Information Report: "The forest insect and disease survey sampling methods and survey techniques, prairie provinces and the Northwest Territories". (Moody)



14. Publications 1987-88:

- Cerezke, H.F. 1987. Bark beetles and sawyer beetles: a review of potential insect vectors of the pinewood nematode in Canada. Presentation made to the Swedish Pinewood Nematode Mission. External Affairs, Ottawa, July 1987.
- Cerezke, H.F.; Moody, B.H. 1988. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba and the Northwest Territories in 1986 and predictions for 1987. Can. For. Serv., North. For. Cent., Edmonton. Inf. Rep. NOR-X-? (in final preparation with Editor).
- Moody, B.H.; Cerezke, H.F. 1988. Contribution In: Forest Insect and Disease Conditions in Canada. 1986. Compiled by E.S. Kondo and B.H. Moody. Agr. Can., Can. For. Serv., Ottawa.

List of File Reports:

- Amirault, P.A.; Gates, H.S.; Niederleitner, S. 1988. Spruce budworm in the Footner Lake Forest - 1987. Joint report of C.F.S./A.F.S., for survey work under the Canada/Alberta Resource Development Agreement. 15 p.
- Cerezke, H.F. 1987. Mountain pine beetle aerial/ground surveys in the Rocky Mountain National Parks in 1987. 2 p.
- Cerezke, H.F. 1987. Report to the Fifteenth Annual Forest Pest Control Forum: Report on the status of forest pests in the Western/Northern region in 1987. 12 p.
- Cerezke, H.F. 1987. Survey report of insect and disease conditions at the Pine Ridge Forest Nursery in 1986. 13 p plus photos.
- Cerezke, H.F. 1987. Harvest layout design: influence of insects and diseases. 11 p. (Prepared as lecture to AFS field staff at Hinton Forestry School).
- Cerezke, H.F.; Daoust-Savoie, M. 1987. Pest leaflet on bronze birch borer. 3 p. (Prepared for handout in Manitoba.).
- Emond, F.J. 1987. Insect and disease conditions in Jasper National Park. 3 p.
- Emond, F.J. 1987. Insect and disease conditions in Banff National Park. 3 p.
- Emond, F.J. 1987. Insect and disease conditions in Kootenay National Park. 3 p.
- Emond, F.J. 1987. Insect and disease conditions in Yoho National Park. 3 p.
- Emond, F.J. 1987. Insect and disease conditions in Waterton Lakes National Park. 3 p.

- Emond, F.J. 1987 Tree pest extension report. 7 p.
- Gates, H.S. 1987. Aerial survey for the detection of spruce beetle, forest tent caterpillar and red belt in the Grande Prairie Forest District, 1987. 5 p.
- Gates, H. 1987. Forest insect and disease survey in the Northwest territories, 1987. 14 p.
- Gates, H. 1987. Logging slash survey for insects in Moonshine Lake Provincial Park. 3 p.
- Gates, H. 1987. 1987 spruce budworm pheromone trapping, egg mass counts and L2 wash for 1988 forecasts in Alberta. 10 p.
- Gates, H. 1988. Pheromone trapping for Choristoneura fumiferana and C. orae using Multi-pher and sticky traps in 1987. (in preparation)
- Gates, H. 1988. Forest insect and disease conditions in Elk Island National Park, 1987. (in preparation)
- Grandmaison, M. 1987. Manitoba forest insect and disease conditions, 1987. 28 p.
- Maruyama, P.J. 1988. Diagnostics for private, commercial, municipal, consultants, and government agencies, 1987. 2 p.
- Tidsbury, C. 1987. Trembling aspen defoliation in Saskatchewan in 1987 and defoliation forecasts for 1988. 6 p.
- Tidsbury, C. 1987. Spruce budworm in Saskatchewan, 1987 and forecasts for 1988. 4 p.
- Tidsbury, C. 1987. Jack pine budworm in Saskatchewan, 1987 and forecasts for 198. 3 p.
- Tidsbury C. 1987. Forest insect and disease conditions in Prince Albert National Park, 1987 and annual tree assessment in the Acid Rain National Early Warning system (ARNEWS) plot - Namchus Lake. 3 p.
- Volney, W.J.A.; Cerezke, H.F. 1987. Pest conditions in the MacDowall Block of the Nisbet Forest. Can. For. Serv., North. For. Cent., Edmonton, Alberta.

#### 15. Environmental Implications:

The NoFC Environmental 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. Duration:

Started: 1936

Completion: Continuing

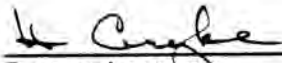
17. Resources:

PYs:	Prof.:	Cerezke	0.6
		Volney	0.2
	Tech.:	Emond	1.0
		Gates	1.0
		Still	1.0
		Grandmaison	1.0 (Manitoba District Office)
		Tidsbury	1.0 (Summer season Saskatchewan Dist. Off.)
	Total:		5.8
	Term/Student		0.3

O &amp; M: \$35,000 + 6,000 for Manitoba District Office

Capital: \$2,500 (extensive roof leak repair work on two trailer campers)

18. Signatures:

  
Investigator

  
Program Director, Protection

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Investigator

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1988

1. Project: Insects and Disease Management Systems and Surveys
2. Title: Bionomics of important forest insects
3. New:                      Cont.: X                      4. No.: NOR-11-03
5. Study Leader: H.F. Cerezke, New Entomologist
6. Key Words: Larvae, adults, taxonomy, parasites, predators, identification, reference collection, forest habitats, plantations, seed and cones, shelterbelts, nurseries, damage impact, control, populations, behavior, bark beetles, woodborers, regeneration pests, budworms, pheromones
7. Location of Work: Northern Forestry Centre and region-wide
8. Problem:

The initial intent of this study was to address forest entomological problems within the region that arise annually or seasonally, often on short notice, and that often require investigative inquiry of 1 to 3 years duration. Typical examples have included woodborer hazard and impact in fire-killed timber, spruce bud midge impact in spruce regeneration, growth loss effects from partial girdling by a root collar weevil and control and damage assessment of insects in spruce seeds and cones.

In 1980, following the development of a mountain pine beetle (MPB) outbreak in Alberta and Saskatchewan, a major shift in research and survey effort was directed toward this beetle. Surveys were necessary to estimate tree losses and to map the annual spread and intensification of the beetle. Because large volumes of merchantable lodgepole pine were being killed, studies were undertaken to explore uses of aerial photography to map infestations, to estimate trees killed, and to assess potential spread.

Provincial forestry and parks agencies in Alberta and Saskatchewan commenced extensive programs to control the beetle and incorporated newly developed pheromone technology into the detection and control strategies. Cooperative research studies were therefore established with these provincial agencies, Simon Fraser Univ. and Univ. of Calgary to help 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., northwestern U.S., as well as in southern Alberta and Saskatchewan 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.

The spruce beetle, an endemic species throughout the region, caused severe losses to mature white spruce in northern Alberta between 1980 and 1984. This outbreak prompted interest in development of pheromone technology, similarly as for MPB. Collaborative studies were subsequently initiated with the University of Calgary, Alberta Forest Service and B.C. Ministry of Forests.

Other regional problems considered important include insects of forest nurseries, plantations and other high-value stands, seeds and cones, and aspen defoliators in stands managed for timber production.

With the anticipated retirement of Dr. H.R. Wong, Study Leader of NOR-11-04, a loss in taxonomic and biosystematic expertise will be realized. To help alleviate this situation a new Entomologist will be hired to fill the position in 1988 and will receive training under Dr. Wong in the taxonomy of forest insects and mites within the region. For this fiscal year, therefore, the goals for this new position will be covered under NOR-11-03. Training will be necessary for diagnostic work in support of the FIDS program (NOR-11-01) and for continuation and upkeep of the permanent insect reference collection of about 60,000 specimens. In addition, there is a need to undertake biosystematic studies of identified important forest insect taxa such as Pissodes.

#### 9. Objectives (Revised, 1988-89):

1. Undertake bionomic studies of selected important forest insect taxonomic groups.
2. Provide technology transfer of pest information to regional clientele, specifically on bark beetles, woodborers, root collar weevil, nursery and regeneration pests, and seed and cone insects.
3. Develop and field test new pheromone techniques and applications for the management of important forest insects.

#### 10. 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 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 Action Plan if required. (Cerezke)
  5. Continue analyses of MPB and spruce beetle data collected in 1985-86 field season. (Cerezke)
  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 to rear live MPB adults at NoFC for electroantennagram studies to be undertaken by Dixon. (Cerezke, Wieser, 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. (Cerezke, Wieser, Dixon, Amirault)
  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. (Cerezke)
  10. Serve as Scientific Authority and external advisor for former 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". (Cerezke)
  11. Present scientific paper at 70th. Can. Chem. Conference, Quebec, June 1987, titled: "The comparative attractancy of the enantiomers of  $\beta$ -exo- $\beta$ -brevicomin and the  $\beta$ -exo- $\beta$ -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 "Diseases of nursery seedlings and plantations". (Cerezke and vice Zalasky)
11. Accomplishments in 1987-88:
1. Temperature data requested to incorporate into report.
  2. Additional field data acquired on attack density measurements to incorporate into manuscript.
  3. Tables for paper were prepared and preparation of text is in progress.

4. Representation on MPB Tech. Com. provided at one meeting and field trip at Invermere, B.C. No input was required for Can/US MPB Action Plan.
  5. Analyses completed on 1985-86 spruce beetle data.
  6. Participation was minor, involving examination of MPB collected materials and preparing reared beetle materials.
  7. Participated in seven field experiments in cooperation with Drs. Wieser and Dixon (Univ. Calgary); P. Amirault (Alta. FRDA); Alta. Forest Service; E. Begin (B.C. Min. Forests) and A. MacKenzie (Crestbrook Forest Ind., Parsons, B.C.). The project was largely funded by the Alberta Forest Service, FRD Agreement, Crestbrook Forest Ind. and CFS. The experiments involved the testing of various pheromone bait formulations in traps and as tree baits at four locations; two in the Peace River Forest, and two near Parsons, B.C. Spruce beetle collections have been processed and analysed. An interim report was prepared to satisfy Crestbrook Forest Ind. requirements.
  8. Report discussed with Alberta Forest Service and topics identified for inclusion in the final report.
  9. Provided technology transfer to several clientele. Provided editorial service for 8 scientific papers to the Canadian Entomologist.
  10. Advised on outcome of PRUF contract to Langor/Spence, University of Alberta and participated in PhD Candidacy Exam for D. Langor.
  11. Contributed co-authorship to scientific paper presented by Dr. Wieser at Canadian Chemical Conf., Quebec; titled "The comparative attractancy of the enantiomers of exo-brevicomine and the exo-5-7dimethyl analog for MPB as determined by trapping and tree baiting in southwestern Alberta and southeastern B.C." (Authored by Dixon, Ibrahim, Wieser and Cerezke).
  12. This item transferred and included under NOR-11-09 (new Study Work Plan -- Dr. I.K. Mallett).
12. Present Status of Study:

Over the past several years a number of entomological problems have arisen region-wide, either through FIDS monitoring or as requests from regional clientele. The main function of this study has been to provide short-term investigations on these problems. More recently (since 1980), the main focus of this study centered on the MPB to help develop and modify methodologies to improve detection, monitoring and control strategies. Much of this work involved close cooperation with client agencies and funding for aerial photography and mapping applications, for initial pheromone testing, and for field bioassay testing of potential new pheromone bait formulations. These studies were concentrated in southwestern Alberta, the Cypress Hills, in Kootenay National Park and in adjacent areas of B.C. The studies have helped develop practical



applications for MPB pheromone use, identified new attractants and inhibitors, resolved some field behavioral questions in beetle attraction, attack pattern and distribution, and identified predator response to synthetic and natural attractants. These studies are now winding down.

Similar studies on the development of spruce beetle pheromones were initiated in 1985, and were expanded in 1986 and 1987.

Transfer of information to regional clientele has been an on-going function, often involving field visitation, literature searches and preparation of reports.

The MPB outbreak extended over large areas in Alberta, British Columbia and northwestern U.S. This prompted the signing of an MOU Action Plan on MPB between Canada and the U.S., and also the formation of an Interagency Technical Committee on MPB for western Canada to deal with jurisdictional boundary issues. This Committee continues to function in recommending monitoring, control and salvage actions.

### 13. Goals for 1988-89:

1. Develop skills in diagnostic procedures for identification of the immature and mature stages of forest insects of the region. (New Entomologist)
2. Initiate biosystematic and ecological studies of the genus, Pissodes within the region. (New Entomologist)
3. Become familiar with the curatorial and maintenance procedures of the permanent insect collection at NoFC. (New Entomologist)
4. Become knowledgeable of procedures to enter, access, retrieve and process data stored in FIDS/INFOBASE. (New Entomologist)
5. Provide maintenance and improvement of nursery stock for foliage and food materials for insect rearing and diagnostics. (New Entomologist)
6. Prepare and submit for review paper on: "Attack pattern and brood productivity of the MPB on three pine hosts". (Cerezke)
7. Prepare revisions and submit to journal : "Mountain pine beetle attack density pattern on semiochemical-baited and unbaited lodgepole pine in southwestern Alberta". (Cerezke)
8. Prepare 1987 field-trapped scolytid material for submission to BRC, Ottawa, for species identification. (Cerezke)
9. Provide representation on MPB Technical Committee and CAN/US MPB Action Plan as required. (Cerezke)
10. Complete analyses of 1987 field-collected data on spruce beetle, in cooperation with Drs. Wieser and Dixon and A. MacKenzie at University of Calgary. (Cerezke)

11. Participate in field experiments, cooperatively with AFS, BCMF, Crestbrook Forest Industries, University of Calgary and P. Amirault (NOR-36-02-4) to test and refine spruce beetle pheromone technology and application in Alberta and eastern B.C. (Cerezke)

14. Publications 1987-88:

Dixon, E.A.; Ibrahim, N.; Wieser, H.; Cerezke, H.F.; Begin, E. 1987. The comparative attractancy of the enantiomers of exo-brevicommin and the exo-5-7-dimethyl analog for MPB as determined by trapping and tree baiting in southwestern Alberta and southeastern British Columbia. Presented as scientific paper at 70th. Can. Chem. Conf., Quebec, and published as an Abstract in a Proc. of this conference.

MacKenzie, A.; Wieser, H.; Dixon, E.; Cerezke, H.F. 1987. A study in pheromone technology for forest pest management, spruce beetle (Dendroctonus rufipennis Kirby). 16 p. Report submitted to Crestbrook Forest Industries, Cranbrook, B.C.

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. Duration:

Started: 1960

Completion: 1992

17. Resources:

PYs:	Prof.:	Cerezke	0.4
		vice New Entomologist	1.0
		Total	1.4
		Term/Student	0.3

O & M: \$7,000  
Capital:

18. Signatures:

H. Cereke  
Investigator

Investigator

Shallan  
Program Director, Protection

Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1988

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Forest insect diagnostic and biosystematic services
3. New:                      Cont.: X
4. No.: NOR-11-04  
(Now incorporates NOR-11-02)
5. Study Leader: H.R. Wong
6. Key Words: Insects, larvae, damage, hosts, parasites, Tenthredinoidea, Symphyta, galls, seasonal occurrence, distribution, taxonomy, identification, reference collection, Nearctic Region, life history
7. Location of Work: Edmonton, Alberta and region
8. Problem:

Insects play a very important role in the forest ecosystem. They attack every part and stage of living and harvested trees. Prompt and accurate identification of the adult and larval stages is necessary to determine the economic status of the different species, kind and type of chemical or biological control necessary to combat them and the best time of application. A reference collection of mature and immature insects, which is an essential prerequisite to diagnostic and biosystematic work, must be maintained and upgraded each year.

Since most of the damage is caused by the immature stages and insect identification is based mainly on the adult stage, a rearing program is a necessity. The rearing program not only provides adults for the identification of the larvae, but also information on seasonal occurrence, hosts, parasites and diseases. It also supplies material for the adult and larval reference collections.

Difficulties are often encountered in diagnosing sibling species or those closely resembling one another either in the adult or larval stages. Life history studies are initiated when the opportunity arises to gain biological information, which will assist in separating these and other

species in central Canada. The success of the diagnostic and biosystematic services are excellent provided experienced personnel, good insect reference collections (adults, larvae and damage) and major taxonomic literature are available. Considerable time must be devoted to 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. 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 for the FIDS/INFOBASE.
3. Initiate biological and ecological studies of forest insects that cause economic damage in the Canadian prairies.
4. To maintain taxonomic expertise on sawflies of Canada at the national and international level.

10. 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.
2. Maintain and improve reference collection of insects and mites.
3. Provide information and specimens to scientists engaged in taxonomic and biological studies.
4. Continue to monitor the spread of introduced insects in the Canadian prairies.
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)

(Goals transferred from NOR-11-02)

6. Identify larval and adult sawflies for research personal, institutions and laboratories.
7. Identify 203 specimens of Pristiphora collected in the James Bay area for the Canadian National Collection, Ottawa, and the U.S. National Museum, Washington.
8. 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.

11. Accomplishments in 1987-88:

1. The number of determinations of mature and immature insects was reduced this year due to the reduction in FIDS personnel and less emphasis placed on general collection of forest insects. Only a few hundred specimens were handled, but the number of enquiries (over 1000) from in-service personnel, clients, outside agencies and scientists remained the same.
2.
  - a. About 200 specimens determined by specialists in Ottawa and by myself have been incorporated into the reference collection.
  - b. Over 300 specimens collected by W.G.H. Ives for the pictorial guide to forest insects of the Prairies and personnel of FIDS were reared, and nearly 100 were overwintered to obtain biological information and specimens for the reference collection.
  - c. Over one hundred specimens were pinned, spread, labelled or preserved for the reference collection.
3. Biological information and/or specimens were provided to:
 

Mr. J. Belick, Environment Canada, Edmonton, Alberta  
 Dr. J.D. Solomon, Southern Hardwoods Lab., Stoneville, Mississippi.  
 Dr. A.T. Drooz, Cary, North Carolina.
4.
  - a. A survey was made in 1987 for the following introduced insects, which have entered the region in the last twenty or more years.
    - The introduced pine sawfly which was first collected in Manitoba in 1983 was not collected again in 1987.
    - The European spruce sawfly, present since 1969 has slightly increased its range from Silver Falls to Powerview in Manitoba.
    - The larch casebearer, which was observed since 1965 in Manitoba was observed between Vassar and South Junction only along Highway 12. This insect was not collected north of this location in 1987.
    - The mountain ash sawfly first recorded on Elder Street at Falcon Lake, Manitoba in 1984 was evident on both sites of this street



and does not appear to have spread much further west than the previous year.

- A single specimen of the Gypsy moth was collected at Sherwood Park, Alberta in 1985. Numerous pheromone traps set out by the Food Production and Inspection Branch throughout Alberta failed to capture any males in 1987.

- b. The European pine shoot moth present in Ontario and British Columbia was not collected in the Canadian prairies this year.

5. a. See 2(b) (Ives and Wong)

- b. The pictorial guide to the forest and shade tree insects of the Prairie Provinces has been completed and will be available to clients and interested personnel this fiscal year (Ives and Wong).

- 6. Identified over 500 larval and adult sawflies for clients and reviewed one manuscript for the Canadian Entomologist and another for the Trans. Am. Entomol. Soc.
- 7. Identified nearly 50 of the 203 specimens of Pristiphora collected in the James Bay area for the Canadian National collection, Ottawa, and the U.S. National Museum, Washington, D.C.
- 8. The paper "Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae) in Hinton, Alberta" has been published.

12. Present Status of Study:

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 over 100 reports and publications dealing with the biology, habits, behavior, distribution, and control of insects. 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 Proteoterus attacking shoots of Manitoba maple, and species of Petrova attacking the shoots of lodgepole pine.

Two new genera of sawflies 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.

13. Goals for 1988-89:

1. Train the new Taxonomist/Entomologist on the identification of forest insects especially immature forms, and the duties and functions of the taxonomist in the Forest Insect and Disease Survey.
2. Identify the remainder of Pristiphora from the James Bay area for the Canadian National Collection, Ottawa and the U.S. National Museum, Washington, D.C.
3. Retire.

14. Publications 1987-88:

- Wu, J.; Wong, H.R. 1987. Colonization of lodgepole pine stumps by ants (Hymenoptera: Formicidae). *Can. Ent.* 119:397-398.
- Ives, W.G.H.; Wong, H.R. 1988. Tree and shrub insects of the Prairie Provinces. *Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rpt. NOR-X-292.*

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. Start and Completion Dates:    Start: 1947                      Completed: 1988

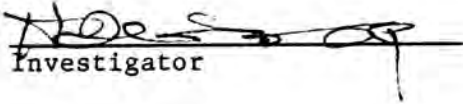
17. Resources 1988-89:

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

O & M: \$800

Capital:

18. Signatures:

  
Investigator

  
Program Director, Protection

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1988

1. Project: Forest Insect and Disease Surveys and Management Systems
2. Title: Damage Appraisal of Major Forest Pests
3. New:                      Cont.: X                      4. No.: NOR-11-05
5. Study Leaders: W.J.A. Volney
6. Key Words: Damage, appraisal, impact, hosts, forest pests, management, mortality, risk, growth loss, stand dynamics, population dynamics, benefit/cost, pest management, jack pine budworm, dwarf mistletoe.
7. Location of Work: Prairie Provinces, Northwest Territories.
8. Background:

Sound pest management systems require information on the resource values threatened by pests. This information can only be obtained from an understanding of pest epidemiology and their effects on host stands. Two different time horizons are considered in developing these pest management systems. These are the short-term and the long-term horizons. They are related to the need for treatments under current pest conditions, and forecasting pest impacts on the timber supply in the integrated resource management system respectively. The basic scientific information required to design pest management systems is therefore embodied in a description of the interactions among pest population dynamics, stand dynamics and control strategies. This description permits an evaluation of the socio-economic impact of pests on resource values and the benefit/cost integration required to embed pest management systems in the integrated resource management system.

This study aims to provide the descriptions of the physical pest impacts and the information on pest population dynamics to make long-term and short-term predictions of their effects on stand yield. An attempt is also to be made to identify critical sources of pest generation mortality and natality so as to be able to manipulate populations effectively.

9. Study Objectives:

1. To develop methods to evaluate 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.
3. Design forest pest management systems which optimize the return from stand management activities.

10. Goals for 1987-88:

1. Assess damage caused by 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 Research Productivity Council (New Brunswick) 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 on 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 feeding of jack pine budworm. (Volney)
7. Prepare paper, for review, on the jack pine budworm outbreaks and the historical record.
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 and Moody)
9. Summarize data on mountain pine beetle damage impact plots located in three rocky mountain National 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. Monitor stands infested with jack pine budworm and write report. (Moody)



Added Goals:

12. Summarize data on tree condition and damage caused by the jack pine budworm in impact plots in Manitoba, and prepare report in co-operation with Manitoba Forestry Branch. (Moody)
13. Monitor stands infected jointly by dwarf mistletoe and jack pine budworm and compile maps and data sets to document status of study. (Moody)
14. Present a paper at meetings of the Entomological Society of Canada. (Volney)
15. Present workshops on pest identification and pest management as required. (Volney)
16. Present seminar to students and faculty of University Departments as required. (Volney)
17. Assist in the publication and distribution of the first issue of the "Forest Insect & Disease Notes". (Volney)

11. Accomplishments in 1987-88:

1. Damage caused by the jack pine budworm in 1987-88 has been evaluated on the impact plots and a report on this study is in progress. (Volney)
2. The population/defoliation assessment plots in Saskatchewan were sampled for early instars, late instars, pupae and egg masses of the jack pine budworm. Defoliation assessments were also made. (Volney)
3. Although the jack pine budworm populations collapsed, pheromone trapping was conducted in the intensive study plots with a commercially available bait. It appears that this tool has merit in assessing low density populations. An experiment to determine the comparative efficacy of 8 baits was conducted in the Nisbet Provincial Forest in co-operation with collaborators at Research Productivity Council (RPC), New Brunswick. The results of the study have been summarized and transmitted to the investigators at RPC. (Volney)
4. Life table estimates of the jack pine budworm populations in the Manitoba study plots will be made as soon as the data can be successfully transmitted from Manitoba. (Volney)
5. Attempts at rearing jack pine budworm larvae on artificial diets were made. Although field collected larvae could be reared on the diets to the adult stage, there was considerable difficulty in establishing young larvae on the diet. (Volney)
6. Studies of the nutritional element concentrations, the phenology of shoots and palatability (to the jack pine budworm) of jack pine foliage for normal and dwarf mistletoe infected branches were initiated. The nutritional element concentrations have been

determined, the phenological measures made and the data made machine readable. The foliage palatability experiments are to be conducted on jack pine budworm stock currently in rearing. (Volney)

7. A paper entitled " Analysis of historic outbreaks of the jack pine budworm in the prairie provinces of Canada" has been submitted to the Can. J. For. Res. (Volney)
8. Functional guidance was provided to the I & D specialist in Manitoba through numerous telephone calls, electronic mail, one 10 day on-site visit, and at several meetings at NoFC and at 2 meetings in Saskatchewan. (Volney)
9. A report on the impact of mountain pine beetle in the three Rocky Mountain parks is in progress. (Moody)
10. A literature review of the effects of the major forest pests of the region on stand productivity is in review. (Moody)
11. A report on the effects of spruce budworm defoliation on forests of Manitoba is in progress. (Moody)
12. The jack pine budworm infestation collapsed in Manitoba. A report on these studies is in progress. (Moody)
13. A compilation of maps and data on plots established to determine the combined effects of dwarf mistletoe and jack pine budworm is in progress. (Moody)
14. A paper entitled "Can jack pine budworm outbreaks be forecast?" was presented at the Entomological Society of Canada meeting in Penticton, B.C. (Volney)
15. Work shops on pest identification and pest management were conducted for Weyerhaeuser Canada Ltd. field personnel and students of the National Indian Forestry Institute. (Volney)
16. A seminar entitled "The biology, dynamics, and management of jack pine budworm populations in the prairie provinces" was presented to the Department of Forest Science, University of Alberta. (Volney)
17. The first issue of "Forest Insect & Disease Notes" were published and distributed to 300 clients. (Volney)
12. Present Status of Study:

A network of permanent impact plots in stands of different ages, growing under different densities 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.

1. The jack pine budworm has been selected as the pest on which to develop impact evaluation procedures. Techniques for assessing growth loss on individual trees, the incidence and amount of top kill in defoliated stands, and the incidence of mortality in affected stands are being developed and applied. Many of these techniques can be modified for defoliators attacking other hosts.
2. Appraisal methods are being developed for the losses caused by the jack pine budworm.
3. Observations on populations density and concomitant growth losses are being made on the jack pine budworm/host tree system. These studies will provide information for monitoring, treatment evaluation, and prediction technologies for managing jack pine budworm populations.

13. Goals for 1988-89:

A-BASE:

1. Prepare life table estimates for jack pine budworm data collected in Manitoba and Saskatchewan. (Volney)
2. Continue studies on jack pine budworm feeding and prepare paper on feeding performance. (Volney)
3. Continue studies on the interaction among the jack pine budworm, dwarf mistletoe and their host. (Volney)
4. Determine feasibility of using weather data and hydrological data in forecasting budworm outbreaks. (Volney)
5. Complete report on the impact of the mountain pine beetle in the three Rocky Mountain Parks. (Moody)
6. Complete literature review of the effects of the major forest pests of the region on stand productivity. (Moody)
7. Complete report on the effects of spruce budworm defoliation on forests of Manitoba. (Moody)
8. Compile maps and data on plots established to determine the combined effects of dwarf mistletoe and jack pine budworm on stand productivity and document status of these studies. (Moody)
9. Provide plot locations and reports on status of impact studies not yet completed. (Moody)

10. Revise as necessary paper entitled: "Analysis of historic outbreaks of the jack pine budworm in the prairie provinces of Canada".

#### SASKATCHEWAN AGREEMENT STUDIES

11. Complete report of Torch River Forest Impact Study. (Volney)
12. Complete report on stem analysis of trees from the Torch River Forest. (Volney)
13. Monitor 600 impact plots in the Torch River Forest for tree mortality. (Volney)
14. Sample the nine intensive study plots in the Nisbet, Torch River and Fort A La Corne Provincial Forests for jack pine budworm populations and defoliation. (Volney)
15. Continue development of pheromone trapping systems to assess their utility in predicting jack pine budworm population trends. (Volney)
16. Continue studies on the interaction of jack pine budworm and mistletoe infection on their host trees. (Volney)
17. Conduct studies into the causes of mortality in pine stands that have been defoliated by the jack pine budworm, through excavation and dissection of root systems, and stem analysis. (Mallett & Volney)
18. Develop proposal to use remote sensing procedures to assess the extent of defoliation and attempt to relate this to damage. (Hall & Volney)

#### MANITOBA AGREEMENT STUDIES

19. Determine volume loss in selected stands of severely defoliated jack pine stands in the Thompson area. Attempt to determine cause of elevated mortality rates in these stands and write a report in conjunction with NOR-11-09. (Volney, Mallett)
14. Publications 1987-88:

Volney, W.J.A.; Cerezke, H.F. 1987. Pest Conditions in the MacDowall Block of the Nisbet Forest. Can. For. Serv., North. For. Cent. Edmonton, Alberta. File Report No. NOR-11-05-1.

Mallett, K.I.; Volney, W.J.A. (Compilers) 1987. Forest Insect and Disease Notes. Can. For. Serv., North. For. Cent. Edmonton, Alberta. Tech. Transfer Note A-001.
  15. Environmental Implications:

The NoFC Environmental Screening Committee has evaluated 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. Duration:

Started: 1986

Completion: 1996

17. Resources 1988-89:

PYs. Prof.: Volney 0.8

Tech.: Szlabey 1.0

Total: 1.8

Term/Student: 0.3

O&M: A-Base  
\$5,000Sask. F.R.D.A.  
\$43,000Man. Prov. Direct  
\$14,200

Contract: ---

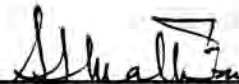
\$48,000

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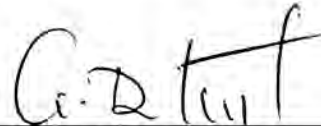
Capital:

18. Signatures:

Investigator



Program Director, Protection



Regional Director General



## 1988-89

Date: February 10, 1988

- Accurate and prompt diagnosis of tree diseases and identification of causal agents are essential to the disease surveys, pest extension services, damage appraisal studies, environmental assessment services, and consideration of possible control measures for tree diseases. Many non-pathogenic fungi in forest ecosystems also play important roles. Proper identification of mycorrhizal fungi, decomposing fungi, and hyperparasitic fungi of forest tree pathogens is important to many research studies and provides better understanding of forest ecosystems. Taxonomy and nomenclature of fungi are constantly being revised. Proper applications of up-to-date information on taxonomy and nomenclature are important whenever names of fungi are used in reports or journal publications. 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.

## B. Western gall rust

Western gall rust has been identified as the most important disease in artificial regeneration and intensive management situations of lodgepole and jack pines in the region. It is essential that it be included in genetic improvement programs of hard pines.

## C. Taxonomy, biology, and pathology of forest tree rusts

An estimate of the losses attributable to forest tree rusts in this region has not been obtained, but rust have caused significant growth loss and mortality of major forest tree species of the region including lodgepole and jack pines, white and black spruces, aspen, balsam poplar, and alpine and balsam firs. In addition, several rust species endemic to the region have been recognized as serious pathogens or potentially dangerous pathogens in other areas where forestry practices are more intensive. It is important to clarify identity, life history, host range, cytology, damage potential, conditions of infection, and taxonomy of forest tree rusts of the region to cope with the present and future problems with this group of tree diseases.

## D. Short-term investigation of selected forest tree diseases

Short-term research activities on selected tree diseases becomes necessary from time to time when diseases are identified as important in certain forest management practices in the region, recognized as important by the public or news media, or identified as suitable topics for joint research activities with outside agencies.

# 9. Study Objectives:

- A. To conduct forest tree disease identification and taxonomic service, and to maintain and upgrade a disease reference collection (Mycological Herbarium) and a fungus culture collection.
- B. 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.
- C. To study taxonomy, morphology, pathology, and life-cycle of forest tree rusts, especially those of pine stem rusts of Canada and related species elsewhere in the world, with the aim of compiling a definitive manual of forest tree rusts of Canada (or North America), and a monograph of pine stem rusts, and to contribute to the taxonomy, nomenclature, and terminology of rust fungi.
- D. To conduct short-term investigations of selected forest tree diseases of the region such as Dutch elm disease, Armillaria root rot, and mortality caused by mountain pine beetle.

10. Goals for 1987-88: (including those from NOR-1107)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 information report entitled "Annotated checklist of tree and shrub diseases in the prairie provinces."
4. Assist H. Zalasky to prepare an information report entitled "Diagnosis and recognition of winter- and other climate-related damage of trees."

B. Armillaria root rot investigation

5. Publish two journal papers on pathogenicity and cultural characteristics with K.I. Mallett.
6. Continue inoculation experiments with M. Mugala (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 P. Blenis, Dept. Plant Science, 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 R. Swanson, and Y. Yamaoka).
10. Start compiling compendium of microorganisms associated with mountain pine beetle and beetle-attacked trees with Y. Yamaoka (visiting scientist).
11. Conduct more inoculation experiments with selected blue stain fungi using heat-pulse velocity instruments (with R. Swanson and 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 W.A. Ayer, Department of Chemistry, University of Alberta.

D. Western gall rust study

14. Complete a comprehensive information report on western gall rust with Dr. P. Blenis, University of Alberta.
15. Continue cytological examinations of spores and germ tubes to clarify the nature of nuclear events in the rust.
16. 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.
17. Host-parasite interactions will be studied with a visiting fellow A. Hopkin, (NSERC), and a graduate student, E. Allen (U of Alberta).

E. Taxonomy, biology, and pathology of forest tree rusts

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

11. Accomplishments for 1987-88:

A. Disease identification and taxonomic service

1. Provided diagnostic and identification service of tree and shrub diseases. About 300 samples and inquiries were received.
2. Maintained and upgraded the disease reference collection (Mycological Herbarium) and a fungus culture collection. About 70 herbarium specimens have been accessioned and about 60 new cultures have been added.
3. Started the revision of an information report entitled "Annotated checklist of tree and shrub diseases in the Prairie Provinces."
4. Significant progress was made in preparation of an information report entitled "Diagnosis and recognition of winter- and other climate-related damage of trees" and is expected to be published in the 1988-89 fiscal year.

B. Armillaria root rot investigation

5. One journal paper (on pathogenicity) is in press (Can J. For. Res.) and another paper (on culture characteristics) is in preparation with K. I. Mallett.
6. Two inoculation experiments were completed and the results will be analysed and a journal paper will be prepared.
7. Collaborated with P. Blenis, University of Alberta on epidemiological investigation of Armillaria root rot.
8. Continued morphological, cytological and cultural examinations of Armillaria root rot pathogens.

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

9. One journal paper entitled "Inoculation of blue stain fungi associated with mountain pine beetle monitored with heat-pulse velocity equipment" has been written and is under internal review; another paper is being written.
10. Significant progress has been made to catalog fungi associated with MPB attacked trees and beetles.
11. Inoculation experiments with heat-pulse velocity instruments were not conducted because of the unavailability of the instruments.
12. Histological examination of tissues invaded by selected blue stain fungi has been initiated to investigate their pathogenicity.
13. Continued investigation of bioactive fungal metabolites of blue stain fungi with W.A. Ayer, University of Alberta (Department of Chemistry).

D. Western gall rust study

14. Significant progress has been made to compile a comprehensive information report on western gall rust with Dr. P. Blenis, University of Alberta (Department of Plant Science).
15. Cytological examination of spores and germ tubes has been postponed until new epifluorescent equipment is made available.
16. Field planting of graftlings of field resistant and susceptible lodgepole pine trees from four different locations in Alberta has been completed ( total of 320 trees).
17. Significant progress has been made on host-parasite interaction investigation with A. Hopkin (NSERC Visiting Fellow), and E. Allen (Ph. D. student, U of Alberta).



E. Taxonomy, biology, and pathology of forest tree rusts

18. Specimens of pine stem rusts collected in China have been examined and recorded.
19. Tentative arrangements to have the 3rd International Conference of IUFRO "Rusts of Pines" Working Party in Banff Centre, Alberta, in September 1989 were made, and the first circular for the meeting has been prepared and is ready to be mailed to the potential participants.
20. An information report entitled "Impact of pine stem rusts of hard pines" with J. Powell (NoFC) and G. A. Van Sickle (PFC) is under editorial review.

12. Present Status of Study:

A. Disease identification and taxonomic service.

1. Tree disease diagnosis and identification service has been provided for FIDS activities since the 1950s.
2. Disease reference collection (Mycological Herbarium) has been maintained and upgraded for many years, and now contains more than 20,000 catalogued specimens.
3. Fungus culture collection was established in the 1950s, and has been maintained and upgraded. The collection now contains more than 1000 cultures, including important isolates of wood decay fungi, Scleroderris canker, Armillaria root rot, Dutch elm disease, mycoparasites of pine stem rusts, and fungi associated with mountain pine beetle.
4. "Annotated checklist of tree and shrub diseases in the Prairie Provinces" was published in 1977, and an information publication entitled "Forest tree diseases of the Prairie Provinces" was published in 1987.
5. Several new forest fungi have been described and published.
6. Because disease detection survey activities are less intensive, the number of samples for identification has decreased to less than 100 per year for the last several years but more collections of fungi from specific studies such as Armillaria root rot study, fungi associated with mountain pine beetle, mycoparasites of pine stem rusts have been identified and filed in the disease reference collection and fungus culture collection.
7. An information report entitled "Diagnosis and recognition of winter- and other climate-related damage to trees" with H. Zalasky is in preparation.

#### B. Western gall rust investigation

1. Morphology, life cycle, nuclear cycle, and taxonomy of the pathogen have been investigated and reported. Comparative studies of cytology and morphology resulted in a new explanation and interpretation of the western gall rust life cycle and the establishment of a new genus, Endocronartium.
2. Three aggressive hyperparasites (Monocillium nordinii, Cladosporium gallicola, and Scytalidium uredinicola) were discovered and investigated with A. Tsuneda (NSERC Visiting Fellow, 1982-84). Mode of parasitism and production of bioactive metabolites produced by these fungi were investigated and documented in journal publications.
3. Active investigations of host-parasite interaction, resistance testing techniques, axenic culture of the pathogen, and epidemiology of the disease are underway with the cooperation of P. Blenis (U of A), A. Hopkin (NSERC Visiting Fellow), E. Allen (Ph.D. student, U of A).
4. A new cooperative investigation with the province of Manitoba to test jack pine genetic improvement material has been proposed.

#### C. Taxonomy, biology, and pathology of forest tree rusts

1. Distribution, taxonomy, life cycle, morphology, cytology, damage, epidemiology, and control of pine stem rusts were compiled and published in a major, fully illustrated, publication entitled "Pine stem rusts of Canada" with J. M. Powell in 1977.
2. Incidence and identity of hyperparasitic fungi, rust-feeding insects, and animal damage to pine stem rusts have been recorded and published by J. M. Powell.
3. Organizing of a IUFRO Working Party meeting in 1989 in Alberta is a major task.
4. Information for the monograph on pine stem rusts is being compiled.
5. A new approach to biocontrol of pine stem rusts has been proposed for future consideration.
6. An information report entitled "Impact of pine stem rusts of hard pines" with J.M. Powell (NoFC), G. A. Van Sickle (PFC) is under review.

#### D. Short-term investigation of selected forest tree diseases

1. Together with S. Takai of GLFC, host-parasite interaction of Dutch elm disease was investigated and a specific toxin of the disease (cerato-ulmin) was discovered.

2. Bioactive metabolites of forest fungi such as Gremmeniella abietina, Ceratocystis spp. associated with mountain pine beetle, and Stereum purpureum were investigated with W. Ayer (U of A).
3. Pathological and chemical investigations of fungi associated with mountain pine beetle have been jointly conducted by W. Ayer (U of A), R. Swanson (NoFC), and Y. Yamaoka (NoFC), and a significant discovery was made. A fungus that is both an effective colonizer and an agent that stops water flow in MPB-attacked trees was identified. Further experiments are in progress.
4. Aspects of distribution, biological species identification, detection method, and pathogenicity tests of Armillaria root rot have been conducted by K. Mallett (NoFC), M. Mugala (U of A), and P. Blenis (U of A). The Armillaria root rot investigations will be transferred to the new study with K. Mallett (NOR-1109), except for some aspects of taxonomy and morphology of the organism complex.

13. Goals for 1988-89:

A. Disease identification service 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. Complete an information report entitled "Diagnosis and recognition of winter- and other climate-related damage of trees" with H. Zalasky and publish during 1988-89 fiscal year.
4. Start preparing an information report entitled "Compendium of aspen and poplar diseases of the prairie provinces".
5. Continue to work on the revision of an information report "Annotated checklist of tree and shrub diseases in the prairie provinces".

B. Western Gall Rust study

6. Initiate western gall rust investigation, in conjunction with the ongoing jack pine genetics and tree improvement program, with J. Klein, K. I. Mallett (NoFC), and Manitoba provincial government personnel (MDNR--Forest Protection and Tree Improvement sections).
  - a. A draft copy of the proposal will be initiated by CFS and will be sent to the director of forest protection (MDNR) for evaluation and formal agreement of cooperation.

- b. Several field-oriented activities (spore collecting, scion collecting, survey of heavily infested jack pine stands, and field evaluation of family plantings etc.) will be conducted during 1988-89 field season.
7. Complete a comprehensive information report on western gall rust with P. Blenis University of Alberta to be published in 1989-90 fiscal year.
  8. Cytological re-examinations of spores and germ tubes will be conducted to clarify the nature of nuclear events of the western gall rust, and the results will be prepared for publication.
  9. Host-parasite interactions will be studied with a visiting fellow (NSERC), A.A. Hopkin, and a Ph.D. student, E. Allen (University of Alberta).
  10. Publish a journal paper entitled "Mechanism and pattern of spore release by Endocronartium harknessii" with K.F. Chang and P. Blenis (Can. J. Bot.).
  11. An attempt will be made to collect and study a gall rust in central Ontario on red pine. A non-sporulating specimen was collected in 1987. Red pine is generally known to be immune to western gall rust and may give interesting information on our ongoing resistance work of western gall rust. The rust may turn out to be a host-alternating Cronartium quercuum.
- C. Taxonomy, biology, and pathology of forest tree rusts
12. Publish an information report entitled "Impact of pine stem rusts of hard pines" with J. M. Powell and A. Van Sickle (PFC).
  13. Continue organizing The 3rd International Conference of IUFRO "Rusts of Pine" Working Party in Alberta in 1989 as the chairman of the organizing committee.
  14. Prepare two invited symposium papers for presentation at the VIth International Congress of Plant Pathology to be held in Kyoto, Japan, in August 1988.
  15. Publish two journal papers entitled "Ontogeny and morphology of teliospores (probasidia) in Uredinales and their significance in taxonomy and phylogeny" (Mycotaxon), and "Auriculariaceae 'rusts'" (Mycologia).
  16. Compile a planning document for biological control of pine stem rusts with the new strategy of using free-moving organisms such as insects and mites as carriers of selected microbial hyperparasites.

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

17. Publish a journal paper entitled "Inoculation of blue stain fungi associated with mountain pine beetle monitored with heat-pulse velocity equipment" with Y. Yamaoka (visiting scientist) and R. Swanson (NoFC).
18. Publish a journal paper entitled "Inoculation experiments with Ceratocystis clavigera on Pinus contorta" with Y. Yamaoka.
19. Plan and conduct inoculation experiments with blue stain fungi with heat-pulse velocity instruments.
20. Collect MPB samples during adult flight in early summer and investigate fungi associated with insects.

E. Armillaria root rot investigation

21. Assist K. Mallett in taxonomical, cytological, and morphological examinations of prairie forms of Armillaria mellea complex to clarify the identity of this group of pathogens in the region. All other ongoing investigations of Armillaria root rot are transferred to a new study (NOR-1109--K. Mallett).

14. Publications 1987-88:

Allen, E.; Blenis, P.V.; Hiratsuka, Y. 1988. Axenic culture of Endocronartium harknessii. Mycologia 80:120-123.

Blenis, P.V.; Hiratsuka, Y.; Mallett, K.I. 1987. Armillaria root rot in Alberta. Agric. For. Bull., Univ. Alberta 10(1):4-5.

Hiratsuka, Y. 1987. Forest tree diseases of the Prairie Provinces of Canada. Can. For. Serv., North. For. Cent. Info. Rep. NOR-X-286.

Hiratsuka, Y.; Blenis, P.V.; Chang, Kan-Fa. 1987. The role of biotic and climatic factors in the epidemiology of western gall rust. Agric. For. Bull., Univ. Alberta 10(1):11-13.

Mallett, K.I.; Hiratsuka, Y. 1988. Inoculation studies of lodgepole pine with Alberta isolates of the Armillaria mellea complex. Can. J. For. Res. (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. Duration:

Started: 1970

Completion: Continuing

17. Resources 1988-89:

PYs: Prof.: Hiratsuka 1.0

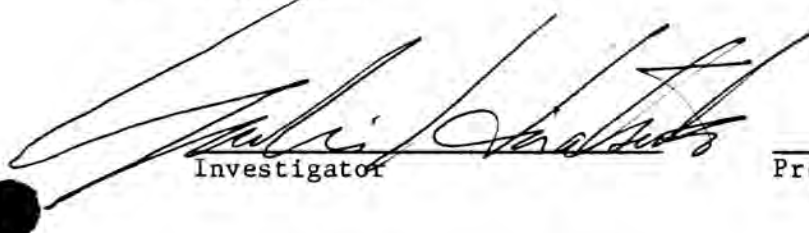
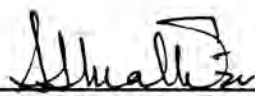

Tech.: Maruyama 1.0

Total: 2.0

Term/Student 0.3

O &amp; M: \$12,000

Capital:

18. Signatures:  
Investigator  
Program Director Protection  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 10, 1988

1. Project: Forest Insect and Disease Survey and Management Systems
2. Title: Operational research studies into economically important tree diseases.
3. New: X      Cont:
4. No.: NOR-11-09
5. Study Leader: K.I. Mallett
6. Key Words: Armillaria root rot, pine stem rusts, dwarf mistletoe, poplar diseases and decay, nursery diseases, seed and cone diseases, taxonomy, pathogenicity, control.
7. Location of Work: Edmonton and region.
8. Background Statement:

For effective forest management, accurate and reliable methods of disease identification, damage, and loss assessment are necessary. As well, information on the biology of forest pathogens, and control measures must be available to the forest resource manager.

In the Western and Northern Region, the economically important tree diseases are Armillaria root rot, hard pine stem rusts, dwarf mistletoe, nursery diseases, poplar decay and deterioration, and seed and cone diseases.

Armillaria root rot, caused by the North American Biological Species (NABS) of the Armillaria mellea complex, has been identified as one of the most important disease problems in the region. Most recent work has centred on the identification of the NABS in the region, their distribution, and pathogenicity. Little is known about the impact of the disease on plantations or intensively managed conifer stands. Information regarding early detection and survey techniques are limited, and also information regarding the biology of the NABS in the region and control measures.

Pine stem rusts are thought to impact young conifer stands through mortality, growth and yield loss. Research to date has focussed on biology of the hard pine rusts. Information on breeding for resistance, epidemiology, impact, and control measures needs to be developed.

Dwarf Mistletoe of jack and lodgepole pines is a highly destructive disease in region. Much information has been collected concerning the biology of dwarf mistletoe, but more information is required on impact and control, measures.

With the increase in Poplar utilization there is a greater demand for investigations into poplar diseases, and deterioration. Methodology is required to determine the amount of decay in poplar stands for inventory purposes. As old growth forests are used, and poplar regeneration and stand management become important, other poplar disease problems will arise. It is important that these problems be identified and the appropriate control measures be developed.

The use of planted stock is becoming increasingly important in intensive forest management. There is a need to study the diseases of conifer seedlings in forest nurseries in the region. Diseases, such as storage moulds of seedlings and damping-off, can cause large losses to nurseries. Little information is available to nursery personnel on the impact of these disease or their control.

Little is known about the seed and cone diseases of the region. More study is required to provide for nursery and breeding program personnel with accurate and reliable information on these diseases.

This study attempts to address the need to: develop impact information and survey techniques for the major disease causing agents for nurseries, plantations and natural stands; study the biology of the major disease causing agents and develop appropriate control strategies; advise forest managers and forest resource users on the major disease causing agents.

#### 9. Study Objectives:

1. To study the taxonomy, distribution, ecology, and pathogenicity of important disease causing agents in Western and Northern Region.
2. To study the impact of disease causing agents in nurseries, plantations, and in natural stands.
3. To develop early detection, survey techniques, and control strategies for disease causing agents in nurseries, plantations, and natural stands.

#### 10. Goals for 1987-88:

1. Initiate studies on the distribution and taxonomy of the NABS of the Armillaria mellea complex in the region.
2. Initiate collaborative studies into storage mould of conifer seedlings; causes and control measures. (Pine Ridge Tree Nursery)
3. Initiate studies into finding alternative fungicides for the control of damping-off in nurseries.

4. Continue investigation of cultural characteristics for the identification of the NABS of the Armillaria mellea complex in the region.
5. Review the literature on Poplar decay and visit Poplar utilization areas to assess needs.
6. Provide advice and technology transfer of information regarding forest diseases and their control to clients.
7. Publish a paper on Pathogenicity of the Alberta Armillaria mellea complex to lodgepole pine.
8. Prepare a paper on the cultural characteristics of the Armillaria mellea complex.

Additional goals

9. Initiate and produce a Forest Insect and Disease Technical Transfer Note.
  10. Attend a workshop on the use of DNA probes for the identification of Pinewood nematode.
11. Accomplishments for 1987-88:
1. Initiated studies on the distribution and taxonomy of the NABS of the Armillaria mellea complex in the region.
  2. Initiated collaborative studies into storage mould of conifers seedlings with Pine Ridge Tree Nursery personnel.
  3. Initiated studies into finding alternative fungicides for the control of damping off in nurseries.
  4. Continued investigations of cultural characteristics for the identification of the NABS of the Armillaria mellea complex of the region.
  5. Reviewed the literature on poplar decay and met with industry personnel to assess research needs.
  6. Provided advice and diagnostic support to NOR-11-01 personnel. Technology transfer of information was provided through 2 workshop presentations, site visits, Advisory committees, and diagnostic service.
  7. Published a paper "Inoculation studies of lodgepole pine with Alberta isolates of the Armillaria mellea complex".
  8. Prepared a paper entitled "The cultural characteristics of the Armillaria mellea complex".

9. Initiated and produced first issue of Forest Insect and Disease Notes in conjunction with NOR-11-01. An article on western gall rust was written.
10. Attended a workshop in the use of DNA probes for the identification of pinewood nematode.

12. Present status of Study

Research studies were initiated into the taxonomy and distribution of the Armillaria mellea complex in the region. Specimen collections were made and are being identified with the aim at developing a distribution map for these species according to geographical region and host species. Identification methods for identifying the various NABS are being developed.

A study to find alternative fungicides for the control of damping off of conifer seedlings was initiated as was a study into the control of storage moulds of conifer seedlings.

13. Goals for 1988-89:

A-base

1. Initiate studies to develop early detection and survey techniques for Armillaria root rot.
2. Continue studies on the distribution and taxonomy of the NABS of the Armillaria mellea complex in the region. Prepare an information report on the A. mellea complex in the region. Prepare two journal papers on vegetative incompatibility in the A. mellea complex.
3. Continue studies on finding alternative fungicides for the control of damping-off in nurseries and establish experimental control trials in the greenhouse.
4. Continue collaborative studies with nurseries on storage moulds of conifer seedlings.
5. Continue studies on the cultural characteristics of the Armillaria mellea complex in the region and prepare a journal publication entitled "The cultural characteristics of the A. mellea complex" for review.
6. Inoculation studies with Armillaria mellea complex species were transferred from NOR-11-06 and will be analyzed.
7. Provide advice and technology transfer of information regarding forest diseases to NOR-11-01 personnel and client groups.
8. Continue as editor of "The Forest Insect and Disease Notes" (in cooperation with personnel from NOR-11).



Saskatchewan Agreement Studies

9. Conduct studies into the causes of mortality in pine stands that have been defoliated by the jack pine budworm, through excavation and dissection of the root systems, and stem analysis, in conjunction with NOR-11-05 (Mallett, Volney)

Manitoba Agreement

10. Determine volume loss in selected stands of severely defoliated jack pine stands in Thompson area. Attempt to determine cause of elevated mortality rates in these stands and write a report, in conjunction with NOR-11-05 (Volney, Mallett).

14. Publications 1987-88:

Blenis, P.V.; Hiratsuka, Y.; Mallett, K.I. 1987. Armillaria root rot in Alberta. Agric. For. Bull., Univ. Alberta. 10:(1):4-5.

Mallett, K.I.; Volney, W.J.A. (Compilers) 1987. Forest Insect and Disease Notes. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Tech. Transfer Note A-001.

Mallett, K.I.; Hiratsuka, Y. 1988. Inoculation studies of lodgepole pine with Alberta isolates of the Armillaria mellea complex. Can. J. For. Res. (in press).

15. Environmental Implications:

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

16. Duration:

Started: 1987                      Completion: 1997

17. Resources 1988-89:

PY'S:    Prof.:            1.0  
          Tech.:            0.0

Total:                  1.0

Term/student: 0.0

O & M: \$ 5,000.00

Funding for goals 8 and 9 is included under NOR-11-05

Capital Equipment: \$68.2 K 1) Zeiss Photomicroscope Axiophot \$52,000; 2) Ependorf Microcentrifuge \$2,200; 3) Percival Plant Growth Chambers (x2) \$14,000

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

NOR-12

NURSERY MANAGEMENT AND TREE IMPROVEMENT

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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
8. 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.

#### 9. 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 industrial 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.

10. 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 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 1P. 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 1P. Outplant 1P 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. Compile 1987 bS data with these results, and prepare and present a technical report at the 1987 Federal-Provincial Nurserymen's Meeting at the PFRA Nursery, Indian Head, Sask. in September 1987.
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).
11. Accomplishments in 1987-88:
1. Seedling physiological research (12-49, 12-51, 12-60)
    - a. Completed 1986 cold hardiness/dormancy testing of lP, bS, wS, jP and rP during the week of 25 May 1987. Presently compiling and analysing data as time permits. (12-49)
    - b. Published a technical report: MONITORING VIABILITY OF OVERWINTERING CONTAINER STOCK, co-authored by Ian J. Dymock and Frank M. Dendwick, as part of the NOR-X-287 Information Report. (12-48)
    - c. A scientific journal manuscript on: OVERWINTERING PHYSIOLOGY OF LODGEPOLE PINE SEEDLINGS is in preparation. Tables and figures have been prepared for the Materials and Methods, and Results sections. The literature review is complete and the writing of the body of text has been initiated. The completed manuscript is expected to be ready for internal review prior to 31 March 1988. Following this review it will then be submitted to Can. J. For. Research. This manuscript was set as the priority scientific journal publication for NOR-12-01, after a meeting with Management Committee 26 May 1987. (12-49)
    - d. Prepared and presented an oral scientific report: PHOTOPERIOD AND NUTRIENT INTERACTIONS IN THE INDUCTION OF COLD HARDINESS IN CONTAINER-GROWN BLACK SPRUCE SEEDLINGS, co-authored by Ian J. Dymock and Frank M. Dendwick, at the 1987 Annual Meeting of the Canadian Society of Plant Physiologists, June 9-12, 1987, at Queen's University, Kingston, Ontario. (12-49)
    - e. Prepared and presented a technical report: EFFECTIVE USE OF WEATHER RECORDS IN CONJUNCTION WITH MONITORING STOCK VIABILITY, co-authored by Ian J. Dymock and Frank M. Dendwick, at the 1987 Federal/Provincial Nurserymen's meeting, September 8-10, 1987, at

PFRA, Indian Head, Saskatchewan. The manuscript is with the compiler and/or editor in preparation for publication as part of a NOR-X Information Report of the meeting's proceedings. (12-49)

- f. Initiated final year of cold hardiness/dormancy testing of 1987 jP container stock 17 August 1987. Testing is half way through the schedule as of program review. (12-49)

2. Cone and seed physiological research (12-62).

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

- Study on lP: Monitored third year of survival, growth, flowering and cone and seed production of outplanted lP in NoFC nursery. Some very serious freezing damage occurred as a result of early flushing during April and early May, prior to the very late snow storm of 19 May 1987, and the record low freezing temperatures of 20 May 1987. A decision was made to repeat the outplanting phase only for 1988. The work was initiated on a new lP crop 24 September 1987 for 1988 outplanting. A manuscript on initial lP results is on hold, in accordance with a publications priority list for NOR-12-01 that was established as of 26 May 1987. (12-62)
- Study on wS: Monitored second year of survival, growth, flowering and cone and seed production of outplanted wS in NoFC nursery. Extreme freezing damage to 75 percent of outplanted stock as a result of early flushing prior to the late winter storm of 19 May 1987. Necessary to repeat outplanting phase of work for 1988, as with lP above. Work was initiated on new wS crop on 24 September 1987 for 1988 outplanting. (12-62)
- Study on jP: Monitored first year of survival, growth, and flowering of outplanted jP in NoFC nursery. Very little damage from late winter storm of 19 May 1987. Data compilation and entry into computer files near completion. Preliminary statistical tests completed. (12-62)
- Study on bS: Completed all light, photoperiod and growth regulator treatments as of 22 May 1987. Outplanting completed in NoFC nursery by 17 July 1987. Dry weight analyses, data entry, and analyses of initial results continue. (12-62)
- Study on rP: This aspect of the study was to have been initiated in September 1987. Due to the severity of the previously mentioned freezing damage on the outplanted wS and lP, it was decided to defer initiation of the rP study until 1988 and to repeat the initial work on wS and lP for outplanting purposes in 1988. (12-62)
- Prepared and presented an oral scientific report: COMPARATIVE INTERACTION OF PHOTOPERIOD AND LIGHT ON EARLY GROWTH OF LODGEPOLE PINE, JACK PINE AND WHITE SPRUCE, co-authored by Ian J. Dymock and Frank M. Dendwick, at the Western Regional Meeting

of the Canadian Society of Plant Physiologists, held February 18-20, 1987 at the University of British Columbia. Compiled initial bS data with that for lP, wS and jP and prepared the text of a technical report: USE OF SUPPLEMENTAL LIGHTS IN CONIFER PRODUCTION - COMPARING BENEFITS VS. COSTS, co-authored by Frank M. Dendwick and Ian J. Dymock. This was then presented by Frank Dendwick, at the 1987 Federal/Provincial Nurserymen's Meeting, held September 8-10, 1987 at the PFKA Nursery, Indian Head, Saskatchewan. The manuscript is with the compiler and/or editor in preparation for publication as part of a NOR-X Information Report on the meeting's proceedings.

3. Provision of consultative services to NoFC staff and CFS regional clients (12-57)
  - a. Provided consultative services as requested for NoFC staff, other CFS personnel, AFS-Research Branch, Saskatchewan and Manitoba provincial forestry personnel, University of Alberta and University of Calgary researchers, private sector greenhouse/nursery personnel, visiting public school, technical college and university groups, visiting researchers, forestry officials, a federal politician, and members of the general public.
  - b. Prepared and presented a one and one-half hour lecture to the Forest Science 517 - Advance Silviculture class on the subject of: REARING SITE-SPECIFIC STOCK USING ACCELERATED GROWTH TECHNIQUES, January 25, 1987 at the University of Alberta. I also prepared and graded one essay question on this topic for the final examination in the course. There were 10 senior undergraduates and graduate level students enrolled in the course.
  - c. Prepared and presented a forty-minute seminar on: PHOTOPERIOD AND NUTRIENT INTERACTIONS IN THE INDUCTION OF COLD HARDINESS IN CONTAINER-GROWN BLACK SPRUCE SEEDLINGS, on the afternoon of 8 June 1987, while on a two day visit to PNFI, June 8-9, 1987. The seminar was attended by approximately 30 persons from PNFI and CFS headquarters.
  - d. Attended a joint CFS/MFB workshop on Greenhouse and Nursery Management Practices in Winnipeg, Manitoba, February 25-26, 1987.

4. Seed analyst duties.

No requests for seed analysis were received in 1987.

5. Provided technical advice to MFB for a contract to grow large, high quality stock at Pineland Provincial Nursery, Hadashville, Manitoba. Maintained telephone contact with Richard Cameron, Nursery Superintendent, at Pineland Provincial Nursery (MFB), to advise on stock treatments and to review progress/success of the 1987 crop.



## 12. Present Status of Study:

The study was initiated in February 1981, with the hiring of the incumbent tree physiologist/study leader. During 1981-82, the incumbent successfully completed all requirements for his doctoral thesis. At the same time, he developed a study proposal to investigate the physiology of overwintering containerized conifer seedlings that were stored outdoors under ambient (natural) weather conditions. Successful overwintering of greenhouse-grown container stock had been identified by nursery managers as a problem area for physiological research. It was felt that there was a lack of basic information on the development of dormancy and cold hardiness and their effect on the survival potential of overwintered, containerized conifer seedlings. The study was to involve monitoring the phenology of cold hardiness, dormancy and survival of overwintering stock using methods proposed for use in nursery production.

Preliminary testing began on lP and wS during 1982-83. Additional tests were added as a full scale (weekly) testing program was initiated on lP and bS during 1983-84. Full scale (weekly) testing was initiated on wS and rP, and replicate (biweekly) testing was continued on lP and bS during 1984-85. Biweekly conductivity tests on roots and shoots was incorporated into the testing program for all four species. Full scale (weekly) testing was initiated on jP, and replicate testing continued on lP, bS, wS and rP during 1985-86. Replicate testing of lP, bS, wS and rP were completed and the second year of replicate work on jP was carried out during 1986-87. The final year of replicate testing on jP was initiated during 1987-88.

Interim results have been reported on at 7 scientific and 3 technical meetings. A file report on the initial results was prepared and presented to regional nursery personnel in 1983. One technical report was published in NOR-X-273, in 1987. An additional technical report has been completed and will be published as part of a NOR-X Information Report early in 1988. A journal article on the lP results is in preparation, to be followed by journal reports on bS, wS, rP and jP. Microscopic and biochemical aspects of this study will continue.

Cone and seed research was initiated in 1983. A study to investigate the effects of accelerated growth on flowering, and cone and seed production began that year. The interactions of light quality and quantity, photoperiod, and the use of applied plant growth regulators (hormones) are under investigation as means of accelerating early growth to promote early and enhanced flowering and cone and seed production.

Interim results have been reported on at 4 scientific and 3 technical meetings. Technical benefits for greenhouse production were reported in NOR-X-274, in 1986, and an additional technical report has been completed and will be published as part of a NOR-X Information Report early in 1988. Journal articles on the early results for lP, wS, jP and bS are to follow. The study continues.

A collaborative study of altitude and latitude effects on lodgepole pine cone and seed maturation in the Alberta Foothills, was initiated in 1984 with Dr. A.K. Hellum, Forest Science Dept., University of Alberta. The



study was completed in 1985, and a symposium report was presented in 1985 and subsequently published in 1986. This study has been terminated.

### 13. Goals for 1988-89:

#### 1. Seedling physiological research (1201)

- a. Complete preparation and review process of a scientific journal manuscript on: OVERWINTERING PHYSIOLOGY OF LODGEPOLE PINE SEEDLINGS. Submit to the Can. J. For. Res.
- b. Initiate and complete preparation and review process of a scientific journal manuscript on: COMPARATIVE OVERWINTERING PHYSIOLOGY OF BLACK AND WHITE SPRUCE SEEDLINGS. Submit to the Can. J. For. Res. Prepare and present an oral scientific report on: A COMPARISON OF COLD HARDINESS IN BLACK AND WHITE SPRUCE SEEDLINGS, at the joint 1988 Annual Meeting of the Canadian Society of Plant Physiologists with the Canadian Botanical Association, to be held from June 5-9, 1988, at the University of Victoria, in Victoria, B.C.
- c. Complete final year of cold hardiness and dormancy tests on 1987 jP. Compile data with 1985 and 1986 jP data and analyse. Complete all analyses of 1984, 1985 and 1986 rP data. (Dendwick)
- d. Initiate microscopic analyses of preserved samples collected during overwintering studies from 1983-88. Conduct needle primordia counts. Conduct mitotic activity/index determinations on buds and root tips. (Dendwick)
- e. Investigate feasibility of initiating biochemical analysis work on freeze-dried samples collected during overwintering studies through collaborative and/or contract work with university researchers. Seek funding/manpower sources.

#### 2. Cone and seed physiological research (1201-00-06)

- a. Accelerated growth/promotion of early flowering in conifers.
  - Continue study on 1P. Monitor fourth year of growth, flowering and cone and seed production of surviving, outplanted 1P. Complete light, photoperiod and growth regulator treatments on replacement 1P stock. Outplant in the NoFC nursery. (Dendwick)
  - Continue study on wS. Monitor third year of growth, flowering and cone and seed production of surviving, outplanted wS. Complete light, photoperiod and growth regulator treatments on replacement wS stock. Outplant in the NoFC nursery. Compile and analyse all data with the initial results. (Dendwick)
  - Continue study on jP. Monitor second year of growth, flowering and cone and seed production of surviving, outplanted jP. Compile and analyse all data with the initial results. (Dendwick)

- Continue study on bS. Monitor first year of growth, flowering and cone and seed production of surviving, outplanted bS. Compile and analyse all data with the initial results. (Dendwick)
- Initiate study on rP. Seed and transplant 1988 rP seedlings, and initiate light, photoperiod and growth regulator treatments. Monitor seedling growth and development. (Dendwick)
- Prepare and present a technical report on: OPTIMIZING LIGHT SOURCES AND PHOTOPERIODS TO GAIN THE MAXIMUM USE OF YOUR GREENHOUSE SYSTEMS, to be presented at the Manitoba Natural Resources/Canadian Forestry Service Tree Improvement Workshop on "Rearing Conifer Plants in Containers for Tree Improvement Programs" to be held January 26-28, 1988 in Winnipeg, Manitoba.

3. Provide consultative services to NoFC staff and CFS regional clients concerning tree physiology and cone and seed production.

4. Perform duties as seed analyst as may be required.

#### 14. Publications 1987-88:

Dendwick, R.M.; Dymock, I.J. 1988. Use of supplemental lights in conifer production - comparing benefits vs costs. In I.K. Edwards, compiler. Proceedings of the 1987 Prairie Nurserymen's Meeting held at Indian Head, Saskatchewan. (In preparation)

Dymock, I.J.; Dendwick, F.M. 1987. Monitoring Viability of Overwintering Container Stock. Pages 22-35 In E.M. Harvey, (compiler). Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Report NOR-X-287.

Dymock, I.J.; Dendwick, F.M. 1988. Effective use of weather records in conjunction with monitoring stock viability. In I.K. Edwards, compiler. Proceedings of the 1987 Prairie Nurserymen's Meeting held at Indian Head, Saskatchewan. (In preparation)

#### 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. Duration:

Started: 1981

Completion:

Overwintering physiology of container seedlings	= 1990
Revised	= 1993

Accelerated growth/flowering/cone & seed production	= 1993
Revised	= 1994

17. Resources 1988-89:

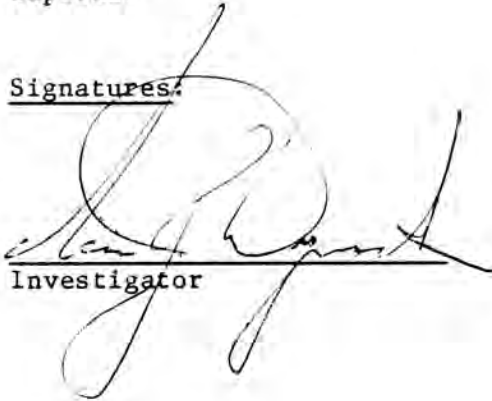
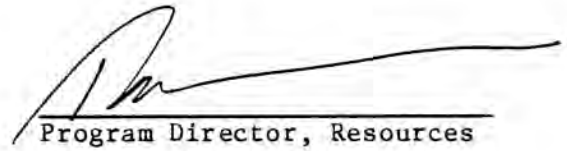
PYs: Prof.: Dymock 1.0  
Tech.: Dendwick 1.0

Total: 2.0

Term/  
Student: 0.3

O & M: \$ 8,000

Capital:

18. Signatures:  
Investigator  
Program Director, Resources  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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 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)

11. Accomplishments in 1987-88:

1. Determination of the disposition of provenance experiment documents, and disposition of the documents, have not been done. This goal and the next one are scheduled to follow a reporting goal for NOR-12-03 which is still pending.

Jack Pine:

1. Drafting of a journal paper on results to 15 years in the jack pine provenance experiment has not been initiated.



## Black Spruce:

1. Tending was done in the test plantations, but the Manitoba plantation requires about 1 person-day of additional work. Verification of location, layout, and stocking were not completed.

12. Present Status of Study:

All objectives have been achieved as far as is feasible for the red pine, Scots pine, and Norway spruce experiments. Completion of objectives will not be feasible for the white spruce experiment. Objectives remain to be completed in future years for the jack pine and black spruce experiments.

13. Goals for 1988-89:

1. Determine the appropriate disposition of documents pertaining to the terminated experiments, and dispose of these documents accordingly.

## Jack Pine:

1. Draft a journal paper on results to 15 years in the plantation at Lonesand, Manitoba.

## Black Spruce:

1. Complete tending of the Manitoba plantation and verify location, layout, and stocking in all plantations.

14. Publications 1987-88:

Nil

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. Duration:

Start: 1955

Completion: 2000

17. Resources 1988-89:

PYs: Prof: Klein 0.3  
Tech: Chapman 0.1

Total: 0.4

O & M: Nil

Capital: Nil

18. Signatures:

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Investigator  

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Program Director, Resources  

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Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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 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)

Added Goals:

11. Complete a course in linear algebra at the University of Alberta.
12. Serve as chairman of the Canadian Tree Improvement Association.

11. Accomplishments in 1987-88:

1. A planned schedule of data analysis was completed on data from all three breeding districts. After discussion with a prospective co-author, it was decided to report results in a series of papers. A draft of a paper entitled "Genetic variation of 10-year growth in eastern Manitoba Jack pine" is nearly ready for review.
2. An invited paper entitled "Selection and mating strategies in second generation breeding populations of conifer tree improvement programs" was presented at the symposium of the 21st meeting of the Canadian Tree Improvement Association in August 1987. The manuscript was accepted as submitted for publication in the proceedings.
3. The blocks for which data were lost were remeasured by staff of the Manitoba District Office.
4. It has been decided that no further planting will be done in the clone bank, and that minimal time or funds will be expended on maintenance. That is what has occurred.
5. Planning of the experimental design and field layout have been completed for a test of genetic gain in the eastern breeding district, but assembly of seedlots and selection of planting sites have not yet been done.
6. Removal of tops of designated trees in the eastern breeding district family test has been done. Removal of stumps was not done because of late arrival of the correct implement adapter. There has been very little tending of the clone bank. Potted grafts of superior genotypes have been repotted into larger containers.
7. A three-day planning meeting for the jack pine seed orchards project was arranged, carried out, and reported in April 1987. The meeting was attended by staff of NoFC, Manitoba District Office, and Manitoba Forestry Branch. Input was provided to a meeting of the Jack Pine Seed Orchards Monitoring Committee. Further guidance was provided as required by telephone.
8. Detailed advice on strategies for breeding of black and white spruce was provided to Manitoba Forestry Branch, and discussed in a subsequent meeting. A demonstration plantation of superior and average jack pine was planned for Pine Ridge Forest Nursery. Alberta Forest Service agreed to do the planting and maintenance. Rearing of stock by NoFC is in progress.
9. Data analysis has been done, and writing is in progress, for a Forest Management Note on selection of western district families at ten years.



10. Preparation of the required report on tree improvement in Alberta under the FRDA is in progress.
11. A course in linear algebra (Math 221) was completed.
12. Minutes are on file of three meetings of the planning committee for the 22nd meeting of the Canadian Tree Improvement Association. The University of Alberta Conference Centre has been reserved for August 14-18, 1989, and mailing of invitations to prospective symposium speakers is in progress.

12. Present Status of Study:

There has been preliminary identification of superior genotypes based on 10-year performance in family tests, for all three breeding districts. Scions or control-pollinated seeds have been produced for seed orchards in every district. Superior source areas have been identified in eastern Manitoba.

It is likely that selection decisions based on 15-year performance will call for only minor modification in light of subsequent performance. Maintenance and measurement of existing family tests to 25 years is proposed in order to determine inter-age correlations. Superior source areas can be identified for Saskatchewan and western Manitoba using data on hand.

Publication of the scientific findings obtained in the course of the breeding work is considered to be an implicit objective which has not yet been achieved.

13. Goals for 1988-89:

1. Publish the manuscript entitled "Genetic variation of 10-year growth in eastern Manitoba jack pine" in a journal. (1203-00-06)
2. Provide functional guidance for development of jack pine seed orchards under the Manitoba FRDA, including designing the layout of the pedigreed eastern breeding district seed orchard at Oakbank. (1203-84-07)
3. Publish a Forest Management Note on selection of western district families at ten years. (1203-00-04)
4. Determine wood density of 200 disks cut from thinned trees of the district family test, and determine a rule for converting 12-joule pilodynne readings into wood density values for jack pine at 15 years from planting. (1203-00-05)
5. Analyze 15-year eastern district data to determine whether any seed orchard progenies should be discarded, to assess the amount of additional gain available by selection on 15-year results, and to begin selection of parents for second generation breeding. (1203-00-13)

6. Complete stock production and assist as required to establish a demonstration plantation with superior and average jack pine families at Pine Ridge Forest Nursery. (1203-00-02)
  7. Continue to serve as chairman of the Canadian Tree Improvement Association. (1203-00-02)
  8. Measure the western district family test at 15 years from planting. (1203-00-04)
  9. Tend family test plantations as required. (1203-00-04, 1203-00-05, 1203-88-09)
  10. Produce a video on the jP tree improvement program in the prairies. (1203-87-10)
  11. Promote, coordinate, and enhance greater use of tree improvement technology in this region, and act as regional contact for the national tree improvement program. (1203-00-02)
  12. Act as Scientific Authority for contract involving tree improvement in Alberta under the FRDA. (1203-00-11)
  13. Act as Scientific Authority for a contract to select parents for second generation breeding by analysis of 15-year data from the eastern breeding district family test.
14. Publications 1987-88:
- Klein, J.I. 1987. Selection and mating strategies in second generation breeding populations of conifer tree improvement programs. Proc. 21st Meetg. Can. Tree Improve. Assoc. Part 2. 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. Duration:
- Start: 1967                      Completion: 2001
17. Resources 1988-89:
- |      |                |     |
|------|----------------|-----|
| PYs: | Prof.: Klein   | 0.7 |
|      | Tech.: Chapman | 0.9 |
|      | Total:         | 1.6 |
|      | Term/Student:  | 0.0 |
- O & M: \$3,500  
Capital:

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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: vacant
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, Recreation and Culture Nurseries, Big River, 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 bareroot 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 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 Regional Reforestation Technical 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).

11. Accomplishments in 1987-88:

1. Investigated greenhouse and nursery problems and provided routine advisory service and technology transfer to regional nurseries.
2. Provided appropriate recommendations to nursery managers on soil fertility management, based on soil test results. Proposal for purchase of soil and plant analytical equipment under federal-provincial agreements was prepared.
3. Continued the study on establishment of size class standards and methods of monitoring stock quality in Saskatchewan. All morphological data have been collected and data entry was partially completed.
4. Participated on the National Tree Nursery Weed Control Committee. Contributed to drafting of the constitution and selection of a formal name for the group (Canadian Tree Nursery Weed Control Association).
5. Acted as lead NoFC contact in cooperating with organizers of regional nurserymen's meetings.
6. No seed inspections under the OECD program were required.
7. Acted as Scientific Authority for R&D contract under the Canada-Saskatchewan FRDA to evaluate cultural practices at the Prince Albert and Big River nurseries.
8. Published the proceedings of the 1986 Prairie Nurserymen's meeting as an Information Report (NOR-X-287).

12. Present Status of Study:

Jack pine and white spruce seedlings from Saskatchewan nurseries have been sampled during lifting and graded into various size classes. The purpose is to develop size class standards objectively. Morphological and physiological data have been collected for the stock while monitoring quality. The results indicated that a 21-day test for measurement of root growth potential was superior to a 7-day test.

All nurseries in the region were visited and prescriptions for herbicides, pesticides were developed to solve clients' problems.

Liaison was maintained with client nurseries and technology transfer was achieved through reports, meetings and workshops. Annually, there is a meeting of prairie nurserymen and the presentations are compiled into proceedings for their benefit.

Participated as a member of the Canadian Tree Nursery Weed Control Association and developed an experimental plan for a national trial of oxyfluorfen (goal) in forest nurseries.

13. Goals for 1988-89:

1. Continue advisory service and investigate nursery problems.
2. Undertake OECD seed inspection work as required. Liaise with National Seed Centre, PNFI.
3. Cooperate with organizers of the 1988 Prairie Nurserymen's meeting to be held at Smoky Lake.
4. Participate in the Canadian Tree Nursery Weed Control Association and contribute to the workshop to be held at Pineland nursery, Hadashville, Manitoba.
5. Publish proceedings of the 1987 Prairie Nurserymen's Meeting held at Indian Head, Saskatchewan.
6. Complete data entry and analysis, and contract with E. Harvey to write a report on monitoring stock quality of wS and jP in Saskatchewan.
7. Continue to act as Co-Scientific Authority with A. Gardner for a contract to review forest nursery management under the Canada-Saskatchewan FRDA.
8. Initiate an experiment on seedbed density and incorporate root pruning and root wrenching as operational factors.
9. Develop calibration curves for nursery soil at Smoky Lake, Prince Albert, and Big River.
10. Monitor soil fertility and seedling nutrition in bareroot nurseries in Alberta and Saskatchewan. Develop a video on analysis of soil and plant tissue.

14. Publications in 1987-88:

- Day, R.; Fraser, N. 1987. Recommendations and guidelines for practices at the Prince Albert and Big River nurseries. Contract report prepared under Canada-Saskatchewan Forest Resource Development Agreement. File Report NOR-1204.
- Harvey, E.M. 1987. Report on the National Tree Nursery Weed Control Association Workshop. Page 42 in E.M. Harvey, compiler. Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Cent. Info. Rep. NOR-X-287
- Harvey, E.M. 1987. Methods of stock quality monitoring for the prairie provinces. Pages 1-7 in E.M. Harvey, compiler. Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-287.
- Harvey, E.M. (compiler) 1987. Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-287.

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. Duration:

Started: 1984

Completion: 1994

17. Resources 1988-89:

PYs: Prof.: 0.9

Tech.: 0.0

Total: 0.9

Term/Student: 0.0

O &amp; M: \$5,000


Capital:

18. Signatures:

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Investigator  

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Program Director, Resources  

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Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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: vacant
  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 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.
- Added Goals:
3. Provide advice on seedling culture and application of herbicides and pesticides to all users of the greenhouse and nursery facility.



11. Accomplishments in 1987-88:

1. Routine administration and maintenance of the greenhouse and nursery facilities was done. Improvements in the nursery included leveling and installation of an irrigation system. The structure of the greenhouses were assessed by Public Works engineering staff and a report, with options, was submitted to NoFC administration. The greenhouse - nursery complex was maintained in a clean and tidy manner by Wendy Mills.
2. Tropicals were grown and maintained for the reception area. Production of bedding plants was terminated.
3. Provided advice in seedling culture and application of herbicides and pesticides to other studies and users of the greenhouse and nursery facility.

12. Present Status of Study:

Three greenhouses, a headerhouse and a nursery have been administered for the benefit of users at NoFC and other agencies.

Assistance is provided to all users of the facility re cultural practices, fumigation and application of herbicides and pesticides.

The greenhouses are kept tidy for the benefit of other users and the nursery facility is weeded and cultivated each growing season.

Advice on safety procedures and on proper clothing has been provided to greenhouse users.

Chemicals, equipment, and supplies for general use have been ordered for users and an inventory of material is maintained.

Bedding plants and tropicals have been grown and maintained for the building and grounds at NoFC.

13. Goals for 1988-89:

1. Administer and maintain the NoFC greenhouse and nursery facility.
2. Provide technical assistance and advice on rearing bareroot and containerized stock to other greenhouse users.
3. Cultivate, fertilize, and release the Colorado spruce component of the nursery shelterbelt.
4. Grow tropicals for NoFC reception area.
5. Assess technical content of new greenhouses at Pineland nursery, and at the Pacific, Great Lakes, and Maritimes Forest Centres with regard to replacement of the NoFC greenhouses.

6. Provide, periodically status report on greenhouses to Program Directors to indicate greenhouse utilization by NoFC staff.

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. Publications 1987-88:

Nil

16. Duration:

Start: 1984

Completion: 1995  
Revised:

17. Resources 1988-89:


PYs: Prof.:	0.1
Tech.:	0.0
Total:	0.1
Student:	0.0
Term: Mills	0.5

O & M: \$2,000

Capital: \$11,000 tractor replacement (See 51-05)

18. Signatures:

Investigator

  
Program Director, Resources

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 14, 1988

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, 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 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)

Added Goals:

6. Prepare two reports, "Frequency of fertilization and growth of containerized seedlings", and "Calibration of nutrient prescriptions for bareroot nurseries", for presentation at the 1987 Prairie Nurserymen's meeting in Indian Head, Saskatchewan.
7. Conduct a workshop on forest tree nursery management in Winnipeg, under sponsorship of the Canada-Manitoba Forest Resource Agreements (FRA).
8. Act as lead NoFC contact concerning the 1987 Prairie Nurserymen's Meeting to be held at Indian Head, Saskatchewan. (see 1204)
9. Prepare a proposal for biotechnology research on commercial conifer species in the region.
10. Prepare a design for an experiment to test the phosphorus solubilizing properties of a fungal preparation in nursery soil.
11. Prepare a proposal requesting funding for Alberta to establish their own soil testing and advisory capability at Pine Ridge nursery. (see 1204)



12. Act as Scientific Authority for a contract let under the Canada-Alberta FRDA to develop a heat transfer model for overwintering containerized seedlings using electrical heating cables.
  13. Act as Co-Scientific Authority (with A. Gardner) for a contract let under the Canada-Saskatchewan FRDA to review and assess cultural practices at the Prince Albert and Big River nurseries. (See 1204)
11. Accomplishments in 1987-88:
1. Data analysis on effect of fertilizer inputs on residual fertility has been completed but preparation of a Forest Management Note is incomplete.
  2. Provided advisory service and investigated seedling growth problems at Champion Forest Products, Hinton, Blue Ridge Lumber, Whitecourt and Pine Ridge Forest Nursery, Smoky Lake. Developed size specifications for seedlings grown by Dakota Ventures for Abitibi-Price Inc., Pine Falls, Manitoba, under the Canada-Manitoba FRA.
  3. Completed a study on the effects of fertilization on hardening off of rP and sP and analysed data. Draft of Forest Management Note on hardening off of wS, lP, bS, and jP is incomplete.
  4. Acted as project leader and coordinator of NOR-12. Prepared summary of Program Reviews 1987-88.
  5. Reviewed forest nursery management research, development and technology transfer in the region and prepared a report, "Research, development and technology transfer in prairie nurseries".
  6. Prepared and presented two papers, "Frequency of fertilization and growth of containerized seedlings" and "Calibration of nutrient prescriptions for bareroot nurseries", at the Prairie Nurserymen's meeting in Indian Head, Saskatchewan.
  7. Conducted a workshop on forest nursery management in Winnipeg under the Canada-Manitoba FRA. Nursery soil fertility, stock quality monitoring cultural practices and outplanting performance were discussed. There were 18 attendees from the Manitoba Forestry Branch.
  8. Acted as lead NoFC contact for the 1987 Prairie Nurserymen's Meeting at Indian Head, Saskatchewan, September 9-10. there were 16 presentations. Four other papers on nursery production were not presented but submitted for the proceedings. Also acted as compiler of the proceedings. (See 1204)
  9. Prepared two proposals (jointly with J. Klein) for biotechnology research on micropropagation and on enzymatic discrimination between genotypes of jP, wS, and bS. The proposals were discussed with the CFS Biotechnology Strategy Task Force on their visit to NoFC.

10. Prepared an experimental design and plan to test phosphorus-solubilizing properties of a fungal preparation (biofertilizer) in nursery soil. The preparation, supplied by Philom Bios Company (a biotechnology research and development organization), Saskatoon is reported to enhance phosphorus uptake by plants. Discussed plan with D. Maynard (collaborator) and with company officials. NoFC is the first forest-research establishment that the company has asked to test the product on forest tree species.
11. Prepared a proposal requesting funding under the Canada-Alberta FRDA for the Alberta Forest Service to set up soil testing facilities at Pine Ridge nursery and to gain expertise in nursery soil management through training courses. The proposal was submitted for consideration by the B-3 Committee for 1988-89. (see 1204)
12. Acted as Scientific Authority for a contract let to Nova Corporation, Calgary under the Canada-Alberta FRDA to develop a heat transfer model for overwintering containerized LP and WS seedlings, using heat from buried electrical cables. Literature has been reviewed and a program to enable processing of weather data has been acquired. The seedlings are being overwintered in an outdoor compound at the company's Joffre facility.
13. Acted as Co-Scientific Authority (with A. Gardner) for a contract let to Lakehead University (R. Day) to review and assess cultural practices at the Prince Albert and Big River nurseries. Recommendations included upgrading of nursery staff, increased phosphorus levels, greater water use efficiency, and monitoring of stock quality. The contract report is entitled, "Recommendations and guidelines for practices at the Prince Albert and Big River nurseries". (see 1204)

12. Present Status of Study:

Objective 1 is partially completed. In bareroot nurseries, the main thrust, presently, is soil calibration by relating soil nutrient inputs to stock quality produced. Work on hardening-off of containerized seedlings will continue and wrap up with a further revision of the present "guidelines" publication. Milestones are described below.

- i) Nutrient status of the seedbed and transplant areas at the Prince Albert and Big River nurseries has been determined through soil sampling and chemical analysis (NOR-X-46, 1973; NOR-X-189, 1977)
- ii) Experiments involving fertilizers (amount, type, form, and frequency), peat, sulphur and leaching have been conducted on jP and WS at Prince Albert (Forestry Report No. 24, 1981). These results have formed the basis for fertilizer prescriptions at nurseries not only in Saskatchewan but also in Alberta and Manitoba.
- iii) Fertilizer experiments were conducted at the Provincial Tree Nursery, Oliver, Alberta. The soil was unsuitable for a conifer nursery owing to its heavy texture and a laboratory study to ameliorate it chemically, indicated that this was impractical. Use of tolerant hardwood species was recommended (NOR-X-187, 1977).

- iv) Annually (since 1981), soil and plant samples have been collected at nurseries in Alberta, Saskatchewan, and Manitoba and submitted to NoFC for chemical analysis. On the basis of the analytical results, fertilizer prescriptions have been prepared for the nurseries prior to the next cropping season. (As of 1988, samples from Manitoba will be analysed, under contract, by the University of Toronto.)
- v) Experiments to determine nutrient requirements of containerized seedlings in the rapid growth phase have been completed. On the basis of the results, a manual with guidelines was prepared in 1979 and later revised (NOR-X-214E, 1983). This publication is in use throughout the Prairies and enjoys wide circulation, generally.
- vi) Nutrient requirements during hardening-off of lP, jP, wS, and bS have been determined and similar work on rP, and sP is in progress. A Forest Management Note (FMN) is in preparation.
- vii) Technology transfer has been achieved throughout the duration of the study. Research presentations are made at nurserymen's meetings, annually, in the region and beyond and there is interaction with client agencies and organizations in investigating seedling growth problems and providing technical advice. Workshops on nursery soil fertility, water use, and stock quality monitoring were given in 1980 (Edmonton and Prince Albert) and 1987 (Winnipeg).

#### Objective 2:

An experiment to determine the effect of fertilizer inputs on residual soil fertility and growth of jP and wS at Prince Albert was completed in 1987. A FMN is in preparation. The results indicate nutrient loss from the soil, probably through leaching.

#### Objective 3:

This objective was postponed because of a Canada-Saskatchewan FRDA contract that was let in 1987 to review and assess cultural practices at Prince Albert and Big River nurseries. Recommendations included monitoring of soil moisture and increased water use efficiency.

#### 13. Goals for 1988-89:

1. Publish FMN on residual effects of fertilization on bareroot seedlings at Prince Albert nursery.
2. Publish FMN on hardening-off of wS, lP, bS, and jP. Analyze data for rP and sP and draft a FMN.
3. Prepare a paper "Effects of fertilization on hardening-off of red pine and Scots pine" for presentation at the 1988 Prairie Nurserymen's Meeting to be held in Smoky Lake, Alberta.
4. Provide advisory services in nursery soil fertility and tree nutrition.

5. Conduct a growth chamber trial to determine the effect of a phosphorus- solubilizing fungus in nursery soil. The trial will be done in collaboration with D. Maynard and the fungal preparation is being supplied by Philom Bios., Saskatoon, a company that is engaged in biotechnology research and development.
6. Act as project leader and coordinator of NOR-12.
7. Act as Scientific authority for a contract let to Nova Corp. under the Canada-Alberta FRDA to develop a heat transfer model for overwintered containerized seedlings.

14. Publications 1987-88:

Edwards, I.K. 1987. Research, development, and technology transfer in prairie nurseries. Can. For. Serv., North. For. Cent., Edmonton, Alberta. File Rep. NOR-1206.

Edwards, I.K. 1987. Nutrient regimes and cold hardiness in conifer seedlings. Pages 14-17 in E.M. Harvey, compiler. Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-287.

Edwards, I.K. 1988. Frequency of fertilization and growth of containerized seedlings. In Proceedings of the Prairie Nurserymen's Meeting held at Indian Head, Saskatchewan, September 9-10, 1987. (In preparation).

Edwards, I.K. 1988. Calibration of nutrient prescriptions for bareroot nurseries. In Proceedings of the Prairie Nurserymen's Meeting held at Indian Head, Saskatchewan, September 9-10, 1987. (In preparation)

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. Duration:

Start: 1972

Completion: 1993

17. Resources 1988-89:

PYs:	Prof.:	Edwards	0.7
	Tech.:	Van Dyk	1.0
	Total:		1.7

Term/Student:	0.0
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O & M: \$9,000

Capital: Nil

18. Signatures:

  
Investigator

  
Program Director, Resources

  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 14, 1988

1. Project: Nursery Management and Tree Improvement
2. Title: Ecosystem and nutrient cycling modelling
3. New:                      Cont.: X
4. No.: NOR-12-07
5. Study Leader: M.J. Apps
6. Key Words: Ecosystem modelling, nutrient cycling, nutrient dynamics, aspen
7. Location of Work: Alberta and region
8. Statement of problem:

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.

There has been an increasing interest in an ecosystem modelling approach to forest resource management and the recent FORCYTE series of models were developed under CFS contract to meet these needs. In particular the most recent version, FORCYTE-11, was specifically designed to include the simulation of coppice regeneration making it potentially applicable to simulation management of aspen. The current interest in the commercial utilization of aspen in Alberta, makes the model worthy of consideration as a potential ecosystem management tool for this species. The model, and its earlier versions, have application to other species as well and spruce and lodgepole pine may be of particular interest in Alberta and the prairie provinces in the future.

There have been three major impediments which have hindered the application of the model: (1) delays in construction of a complete FORCYTE-11 model, (2) apparently large calibration data requirements, and (3) user intimidation caused by its apparent complexity. When FORCYTE-10 was completed and released in 1983, it met many of the original ENFOR environmental objectives but had recognized deficiencies in certain areas (in particular, it could not accommodate suckering species such as aspen, and was heavily dependent on inadequate mathematical relationships such as the Chapman-Richards growth equations). FORCYTE-11 was proposed to overcome these inadequacies and many of the CFS regional activities (NoFC included) "marked time" awaiting the completion of FORCYTE-11.

With hindsight, it is clear that the development of FORCYTE-11 has not followed as clear a path as was needed. A lack of understanding of the difficulties and complexities led to inadequate and uncoordinated funding and FORCYTE-11 development had largely "stalled" by late 1986. The development of in-house CFS expertise on the model serves three functions: the injection of fresh CFS interest to stimulate the model development; a sense of direction to CFS FORCYTE activities provided by a central CFS focus; and a mechanism to directly address CFS interests and concerns within the modelling activities. These factors should help to steer FORCYTE-11 towards a meaningful product.

Since 1980, large data sets have been collected for aspen in Alberta under the ENFOR program. This data may provide the calibration for FORCYTE-11 for aspen ecosystems; this activity is being conducted under a different study (NOR 28-06 goals 6 & 7, Edwards). Much of the data requirements of the FORCYTE-11 model are not required for specific ecosystems, and one facet of this study is to investigate the potential simplification of the model data sets for such applications by developing tools for sensitivity analysis.

The development of user-friendly utilities for access to the model - including setting up (calibration), evaluation of its performance (testing), and gaming (application) - are essential if the model is to overcome the current user intimidation and move from a personal research tool of its authors to the public domain.

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.

## 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 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 (ENFOR P-314).
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/mixedwood 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).

Added goals:

7. Organize and chair CFS FORCYTE Strategy/Planning Meeting to establish a sense of direction for the CFS with respect to the FORCYTE model.
8. Participate in, and assist in the program of, the FORCYTE-11 workshop in Newfoundland.
9. Collaborate with Dr. T. Trofymow, PFC, in the design and supervision of a feasibility study for a FORCYTE validation project at the Shawnigan Lake sites.
  - a) As an added subgoal, arrange a mini FORCYTE workshop at PFC.
10. Prepare new project proposals resulting from the CFS FORCYTE Planning/Strategy Meeting and present these to the ENFOR Technical Advisory Committee along with a report on the meeting.

11. Prepare a User's Manual for the PROBE software package (release 2).
12. Increase familiarity with other soils and ecosystem projects at NoFC by participating in the Whitecourt Site Classification field trip and visiting the vegetation management project study sites.

11. Accomplishments in 1987-88:

1. This goal has been fully met with the completion of PROBE release 2.00 (including a draft user's manual) as a multiple run manager. Interestingly, other FORCYTE users have used PROBE for single run preparation and execution and further refinements will be made to enhance this capability and to accommodate anticipated changes in the FORCYTE model.
2. This goal has been fully met and culminated in a critical FORCYTE planning/strategy workshop in Edmonton attended by all the currently active CFS FORCYTE users. Collaborative effort has continued with UBC coworkers, and assistance has been provided to other CFS FORCYTE workers at PFC, NeFC and MFC.
3. This goal has been met and a sensitivity analysis of portions of the aspen calibrated model will be summarized in the contractor's final report (Western Ecological Services, ENFOR P-314).
4. This goal was fully met with the well received presentation on PROBE at the poster session of the IUFRO International conference at Minneapolis, 24-28 August, 1987. A manuscript, subjected to peer review subsequent to the conference, was accepted for publication in the conference proceedings (expected publication in 1988). In addition, PROBE was one of 15 programs highlighted in an article on the conference in the "NATURAL RESOURCES COMPUTER NEWSLETTER".
5. This goal was fully met with an oral presentation on FORCYTE-11 at the IUFRO International conference at Minneapolis, 24-28 August, 1987, by the senior author (J.P. Kimmins). A manuscript, subjected to peer review subsequent to the conference, was accepted for publication in the conference proceedings (expected publication in 1988). As with PROBE, FORCYTE was one of the 15 programs highlighted in an article on the conference in the "NATURAL RESOURCES COMPUTER NEWSLETTER".
6. The various aspects of this goal were met as follows:
  - a) Evaluation of the potential application of the FORCYTE modelling framework to the management of boreal mixedwood has begun as part of ENFOR P-353. Evaluation of the aspen model continues in conjunction with NOR 28-06 and ENFOR P-353 for which a final contractor's report is expected in February, 1988.
  - b) The basic components for the customized model have been assembled (PROBE) and further refinement deferred pending the aspen data set completion (NOR 28-06), mixedwood data set (ENFOR P-353) assembly (March 1988), and the completion of the FORCYTE-11 benchmark model (Summer, 1988).



c) ENFOR funding for these FORCYTE-11 refinements, initially approved, was withdrawn when PERD funding was reduced. At the Edmonton FORCYTE planning meeting (Nov 1987), these refinements were deferred pending completion and evaluation of the benchmark FORCYTE-11 model.

7. This added goal was fully met with a meeting of all CFS scientists actively involved with FORCYTE held at NoFC 12-14 Nov, 1987. The past and current status of FORCYTE activities were fully reviewed and priorities established for continuing development.
8. This added goal was fully met through active participation in the NeFC workshop 14-17 Dec, 1987. PROBE was presented to, and used by, the participants. En route, a visit was paid to CFS-Maritimes where assistance was rendered to Dr. T. Mahendrappa and his assistant who were having difficulties with execution of FORCYTE and PROBE on their microcomputer.
9. This added goal was fully met with the identification of a contractor and preparation of an ENFOR proposal. Funding was approved for the 1987-88 year and a contract established with Synergetic Digital of Victoria (PFC administered), with Drs. Trofymow and Apps as project supervisors. The feasibility report is expected to be completed by 31 March 1988.
  - a) This added subgoal was fully met. A miniworkshop was held late January at PFC and there were 12 attendees from Victoria, Vancouver and NoFC (Apps and Grewal).
10. This added goal was fully met with the preparation of 5 separate FORCYTE related project proposals all of which were favourably received (i.e. recommended for funding support) by the ENFOR Technical Advisory Committee.
11. This added goal was accomplished with the preparation of "PROBE User's Guide-release 2.00B" which has been printed at UBC and distributed to other CFS FORCYTE users with the PROBE software for use, evaluation and comment.
12. This added goal was fully met by participating in the Whitecourt Site Classification field trip (Sept 15-16, 1987) and visiting the vegetation management project study sites near Grande Prairie (Sept 28-29, 1987).

## 12. Present Status of Study:

Activity to date has been principally devoted to developing expertise with the FORCYTE models, working with the authors towards the completion of FORCYTE-11, and the development of user friendly utilities (PROBE) to enhance its use of FORCYTE-11 and has resulted in several conference presentations on FORCYTE and PROBE. An increasingly important task has been the development of a "critical path" for the FORCYTE program within CFS, culminating in the Nov. 1987 FORCYTE strategy/planning workshop.



The next year should see the completion of benchmark model development, permitting the application of the model to regional ENFOR related tasks. Evaluation of the model as a more general forest management tool has also begun and preliminary indications are encouraging although it is clear that further development will be needed before it will be used on an operational basis. One promising potential application may be in plantation management.

13. Goals for 1988-89:

1. Participate in the Northern Mixedwood Symposium, Edmonton, April 11-14, 1988.
2. Attend IUFRO Conference on "Forest Growth: Process Modeling of Responses to Environmental Stress", Alabama, April, 1988.
3. Participate in International Symposium: "Response Technology 88: Advanced Technology in Natural Resources Management", Colorado, June, 1988.
4. Collaborate with CFS users of FORCYTE and UBC researchers in constructing a benchmark FORCYTE-11 model. Establish and closely coordinate contracts for the required development of the software components.
5. Upgrade the FORCYTE-10 Douglas Fir/Red Alder calibration data set to provide a coniferous development/demonstration data set for FORCYTE-11.
6. Arrange the documentation of processes and assumptions underlying the FORCYTE-11 benchmark model by establishing and monitoring a suitable contract(s) with Prof. J.P. Kimmins.
7. Continue the development of user friendly utilities for use with FORCYTE for both single and multiple run simulations.
8. Develop increased field and practical knowledge of current forestry management and research activities by assisting other NoFC scientists in their field work as circumstances allow.
9. Continue to maintain communication and collaboration where appropriate with other Canadian FORCYTE users.
10. Participate in IUFRO Symposium: "Forest Simulation Systems", California, Nov., 1988.
11. Continue to evaluate potential applications of ecosystem modelling (including FORCYTE) to regional forestry issues and to participate in such opportunities as they arise.

14. Publications 1987-88:

Apps, M.J.; Kurz, W.A.; Kimmins, J.P.; Scoullar, K.A. 1987. User Friendly Applications of the FORCYTE Ecosystem Model on a Micro-computer. In IUFRO Int'l "Forest Growth Modelling and Prediction Conference", Minneapolis, Minnesota, 23-27 August, 1987. Abstract K, p. 72.

Apps, M.J.; Richardson, J. 1987. Summary of proceedings of CFS FORCYTE Strategy/Planning Meeting, Edmonton Nov 12-14, 1987. File report, NoFC.

Kimmins, J.P.; Scoullar, K.A.; Comeau, P.G.; Kurz, W.A.; Apps, M.J.; Chatarpaul, L. 1987. FORCYTE-11: An Example of the Hybrid Simulation Approach to Predicting the Consequences for Production, Yield, Economics, Soil Fertility, Nutrient and Organic Matter Reserves, and Energy Efficiency of Alternative Forestry and Agroforestry Crop Production Systems. In IUFRO Int'l "Forest Growth Modelling and Prediction Conference", Minneapolis, Minnesota, 23-27 August, 1987. Abstract p. 57.

Kurz, W.A.; Apps, M.J.; Chan, Y.H. 1987. PROBE: A program to facilitate user-friendly gaming with FORCYTE. Pages 160-164 in Stiasny, Z.-Z. (Ed.), 6th Can. Bioenergy R&D Seminar, Richmond, B.C. Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.

Kurz, W.A.; Apps, M.J. 1987. PROBE User's Guide version 2.00-B. (Currently printed at UBC - publication by NoFC under review).

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. Duration:

Start: 1986

Completion: 1993

17. Resources 1988-89:

PYs: Prof.: Apps 0.8

Tech.: 0.0

Total: 0.8

Term/Student: 0.0

O & M: (Funds available from ENFOR - see NOR-28-06).

Capital: (ENFOR funding \$10,000 - see NOR-28-06)

18. Signatures:  
\_\_\_\_\_  
Investigator  
\_\_\_\_\_  
Program Director, Resources  
\_\_\_\_\_  
Regional Director, General

NOR-13

FOREST HYDROLOGY AND MICROCLIMATE RESEARCH

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: December 17, 1987

Amended: 14 March 1988

1. Project: Forest Hydrology and Microclimate Research
2. Title: Transfer of technology derived from the Alberta Watershed Research Program, 1963-1986.
3. New:                    Cont: X
4. No.: NOR-13-01
5. Study Leader: R. H. Swanson
6. Key Words: Hydrologic model, forest climate, gauged basin, soil water.
7. Location of work: Alberta, Saskatchewan, Manitoba, Northwest Territories
8. Study Objectives:
  1. To design and propose specific land management practices to increase annual water yield, retard flood peaks or improve on-site watershed condition.
  2. To assist in the evaluation of land management practices with respect to their influence on the hydrologic regime of specified test areas.
  3. To act as consultant and adviser in proposing and evaluating the influence of various land management practices on the local and regional surface and groundwater hydrology.
9. 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, LWD, AES) (87-02)
    - b. Prepare proceedings paper "Applying hydrologic principles to the management of subalpine 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) (87-03)



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) (87-01)
- b. Continue to provide CFS input into the watershed management pilot project. (Swanson) (85-01)

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) (86-01)
- b. Prepare indexed database for Marmot and Streeter photographs. (Fisera) (87-05)

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) (76-01)
- 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) (85-02)
- c. Continue as organizer and general chairman of Canadian Hydrology Symposium-88 on results from small basin research. Complete selection of papers, finalize technical program and field trips. Start preparation of final program and registration materials. (Swanson) (85- 03)
- 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) (87-04)
- e. Conduct lecture tour across Canada on Small Basin Hydrology under sponsorship of Canadian Water Resources Association and NRC Associate Committee on Hydrology. (Swanson) (87-06)
- f. Initiate task force to review hydrologic-forestry problems in the Prairies/Northern region. Report to SRAC in november 87. (Swanson, Powell) (87-07)

Added goal:

- g. As Chairman, North Continental Section, Western Snow Conference (WSC), assume responsibility for program and conduct of 1988 WSC annual meeting in Kalispell, Montana, 18-20 April 1988. (Swanson) (87-08)

10. Accomplishments in 1987-88:

## 1. Publications:

- a. The preparation of the article is well underway. The AES has been contacted regarding their contribution. The completion deadline is May 1988; it will be completed by that date.
- b. The proceedings paper was completed and presented as scheduled. It has been reviewed, revised, edited and returned to the Rocky Mountain Forest and Range Experiment Station for publication in the proceedings.

## 2. Interaction with provincial clients:

- a. Field involvement in research in Marmot Creek Basin has been terminated.
- b. The Pilot project was officially killed by the Alberta Forest Service.

## 3. Provision of data:

- a. We continue to fill requests for Marmot data. The Alberta Department of Environment has been operating the climatic stations, but have not maintained the instruments or recorders. We have received data tapes with little useful information on them since we stopped servicing them ourselves. The Twin 1 and 3, Cabin 5 climatic stations were closed in September 87. Only the Con 5 station remains. We will continue to extract and archive data tapes as supplied by Alberta Environment. Some cleanup of sites was done in 1987 but there is considerably more to do in 1988. We are cooperating with Alberta Environment, the AFS and the AES in this effort.
- b. The database was started on REFLEX and transferred to RapidFile. About 75% of the photographs in Fisera's collection of 1500+ have been entered and annotated. Fisera should complete his collection early in 1988 and will start entering those in Swanson's collection.

## 4. Interaction with outside agencies and NoFC staff:

- a. Attended annual meeting of the Associate Committee on Hydrology and sub committee on Research Priorities in PEI in June. Had Hetherington (PFC) attend too so that he could start alternating for me on my expectation that he will eventually replace me on the

committee. Also attended ACH executive committee meeting in PEI in June and in Ottawa in November.

- b. Convened LAHS symposium on Forest Hydrology and Watershed Management in Vancouver in August. Reviewed 30 papers, edited and prepared camera-ready copy (CRC) for 60 papers. Posted CRC to Oxford in June; proceedings were printed and available for distribution at Vancouver in August. Over 150 individuals registered for the Forest Hydrology Symposium. This task has been completed.
- c. Continued preparations for Canadian Hydrology Symposium 88 at Banff in May 1988. The program and local arrangements committees met in PEI in June in conjunction with the ACH meetings. A call for papers and preliminary registration form was sent to 1500+ hydrologists in Canada. Reports on 30 basins and more than 20 poster papers on specific research results have been submitted. A tentative program and final registration form was mailed to those who have expressed interest in CHS-88 on 16 February 1988.
- d. Served a trial period of one week as acting editor in May. The task will take approximately 6-8 hours per week.
- e. Prepared three 45 minute lectures on a) the Alberta Watershed Research Program: a program to emulate or to avoid; b) WRENSS -- Water Resources Evaluation of Non-point Silvicultural Sources [of pollution]; c) Measurement of Transpiration -- a hydrological and physiological process. I started in St. John's, Newfoundland, 19 October and completed the 1987 portion in Victoria 13 November. The entire tour was completed in January with lectures in Edmonton on the 13th (45 present) and in Calgary on the 20th (40 present). I have lectured to over 400 and have received numerous requests for publications and the WRENSS procedure.
- f. Assembled a task force consisting of myself and J. M. Powell to review hydrologic-forestry problems in the Prairies/Northern region. Visited Winnipeg on 16 September, Regina on 17 September and Edmonton on 18 November 1987. A report was prepared and presented at the Senior Research Advisory Committee meeting on 25 November. Favorable responses to most of the recommendations have been received from Manitoba and Alberta.
- g. Started preparation of program for 1988 Western Snow Conference (WSC) Kalispell, Montana, 18-20 April 1988. Appointed a local arrangements committee in Kalispell, and a program committee from among the WSC executive. Have received 25 abstracts to be considered for presentation. These have been reviewed by myself and the other members of the program committee. Sixteen were selected for oral presentation; 8 for presentation as posters. The authors have been notified, and a technical program prepared. I will meet with the local arrangements committee and the general secretary for the Western Snow Conference on 24-25 February 1988, in Kalispell, to finalize arrangements for this year's annual meeting.

# 11. Present Status of Study:

1. The experimental phase of this study has been completed. The Marmot and Streeter experimental basin programs have been terminated and the results published. Data from these and other research facilities have been incorporated into a procedure (WRENSS) for evaluating the effect of existing or proposed forest practices on annual water yield.
2. The current role of this study is primarily one of technology transfer. The WRENSS procedure needs to be brought to the attention of forest managers throughout the region, and to some extent, throughout Canada. At present this is being accomplished through the organization of symposia and through lectures. However, the most effective technology transfer method appears to be through hands-on demonstration of the procedure's use on the users data and problems.
3. The future role beyond gaining acceptance and application of WRENSS has not been decided. There is a need to complete the WRENSS procedure to allow its use in the more rain-dominated forested areas on the East and West coast.
4. There is also a need for a more comprehensive hydrologic procedure to assist in the solution of soil moisture and shallow groundwater management problems as affected by forest density and arrangement. Similarly, a need has been expressed for a technique to provide reasonable estimates of the water levels in streams at critical periods, e.g. flood peaks from storms or snowmelt, low flows to maintain fish populations in late summer. The implementation of the proposed cross-Canada modeling project would be a major step in this direction.

# 12. Goals for 1988-89:

## 1. Publications:

- a. Prepare critique and review of Marmot and Streeter Basin projects for presentation at Canadian Hydrology Symposium-88, 9-11 May 1988. (Swanson with contributions from Alberta Environment, IWD, AES) (87-02)
- b. Prepare and present paper on "Patterns of nutrient depletion in spruce-fir and aspen-grassland research basins in Alberta", at Canadian Hydrology Symposium-88, 9-11 May 1988, Banff. (Singh, Kalra) (88-01)

## 2. Interaction with provincial clients:

- a. Terminate all NoFC involvement in Marmot Creek Basin. Assist Alberta Environment in final removal of instrumentation and clean-up of basin during the summer. Continue to assist in the use of Mount Allan (Marmot) data. Continue to compile and archive data from microloggers serviced by Alberta Environment. Supply data in machine readable or printed form upon request. (Fisera, Hurdle, Swanson) (86-01)



- b. Assist Saskatchewan Water Corporation and Parks officials in the application of the WRENSS procedure to the design of a harvesting pattern for the watershed that will increase the water level in Kenosee Lake in Moose Mountain Provincial Park, Saskatchewan. (Swanson) (88-02)
  - c. Assist in use of WRENSS and other hydrologic tech transfer procedures on ad hoc basis. (Swanson) (88-03)
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) (76-01)
  - b. Continue as organizer and general chairman of Canadian Hydrology Symposium-88 on results from small basin research. Complete selection of papers, finalize technical program and field trips. Prepare final program, assist in registration and conduct of symposium. Assist in preparation of camera ready copy of papers for publication. (Swanson, help from Fisera and Hurdle at symposium) (85-03)
  - c. Serve as acting editor, Canadian Journal of Forest Research, from January 17 through 25 April 1988 while the editor is away from Edmonton on sabbatical. (Swanson) (87-04)
  - d. Prepare indexed database for Marmot and Streeter transparencies and photographs in Swanson's collection. (Fisera) (87-05)
  - e. Continue as general chairman for 1988 Western Snow Conference meeting in Kalispell in April. Complete selection of papers, notify authors and have WSC general secretary forward typing and format instructions to accepted authors. Assemble program materials for transmittal to WSC secretary for printing of program. Assemble camera ready copy supplied by authors for transmittal to publications committee. (Swanson) (87-08)
  - f. Initiate Canada-wide hydrologic modeling program to provide a common research framework and technology transfer tool. (Swanson) (88-04)

13. Publications 1987-88:

Swanson, Robert H. 1987 Applying hydrologic principles to the management of subalpine forests for water supply. Pages 79-85 In Management of Subalpine Forests: Building on 50 years of Research, Troendle, Charles A., Kaufmann, M. R., Hamre, R. H., and Winokur, Robert P., Technical Coordinators. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM- 149. 253pp.



Swanson, R. H.; Bernier, P. Y.; Woodard, P. D. (Eds.) 1987. Forest Hydrology and Watershed Management. Proceedings of the International Symposium, XIXth General Assembly IUGG, 9-22 August 1987, Vancouver, British Columbia. IAHS Press, Wallingford, UK. IAHS Publication No. 167. 625pp.

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

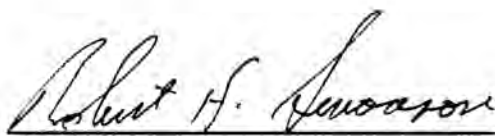
P/Ys:	Prof:	Swanson	0.8
		Vice Bernier	0.2
	Tech:	Fisera	0.5
		Hurdle	0.1
	Total		1.6
	Term/Student		0.3

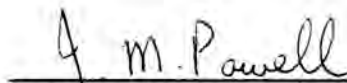
O&M: \$8,000  
Capital: Nil

16. Duration:

Started: 1963                      Completion: 1993

17. Signatures:

  
Investigator

  
Program Director, Environment

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: 17 December 1987

Amended: 14 March 1988

1. Project: Forest Hydrology and Microclimate Research
2. Title: Vegetation manipulation-disposition of snow in forest clearings.
3. New:                      Cont.: X
4. No.: NOR-13-02
5. Study Leader: R. H. Swanson, Vice Bernier
6. Key Words: Hydrologic modelling, snowmelt, evapotranspiration, soil water movement, transpiration.
7. Location of work: Phase I - James River microclimate site near Sundre, Alberta and Northern Forestry Centre, Edmonton, Alberta.  
  
                                 Phase II - Southern portion of Bow and/or Oldman River Basin  
  
                                 Bark beetle outbreak areas in Alberta and/or British Columbia  
  
                                 Other areas in Prairies/Northern Region as needed.

8. Study Objectives:

1. To develop vegetation manipulation-hydrologic models applicable to the prescription and evaluation of forest management activities in the Prairies/Northern Region.
2. To conduct studies as needed to meet the above objective in order to define mathematical relationships describing energy exchange and energy partitioning in the processes of snow accumulation, snowmelt, evaporation and transpiration in the various microclimates created by partial and/or complete forest harvest.

8a. Current problem analyses

1. Snow disposition in clear-cuts

The manipulation of vegetative cover affects the disposition of water on a basin. In rainfall dominated areas, the effect of forest

removal is a relatively predictable increase in annual water yield, plus an increase in stormflow response which is especially marked when storms occur during low flow periods. In snow dominated regions, the effect is not so easily explained. Snow lies on the ground for weeks or months and in some clear-cutting situations, the modification of 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  $0^{\circ}\text{C}$ . 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 clear-cut 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 1 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 clear-cut edges, clear-cuts with debris, or regenerating clear-cuts. 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, vapor 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. This same study will also give us insight to the value of the HPV technique as a diagnostic tool in pathological and physiological investigations.

## 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. Effect of groundwater management practices (primarily drainage) on plant water stress and photosynthesis.

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 from the snowpack by evaporation in 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. Hiratsuka and others in using the Heat Pulse Velocity technique in determining the transpiration regime of healthy lodgepole pine trees, and those infected by blue stain fungi.
- 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. Effect of groundwater management practices (primarily drainage) on plant water stress and photosynthesis.

- 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 1987-88:

## 1. Publications:

## a. Submit for review:

- 1. A paper on using the heat pulse velocity technique in pathological investigations. (Swanson, Hiratsuka) (87-01).
- 2. A paper on invasion of xylem sapwood by fungi. (Hiratsuka, Swanson) (87-02).

b. Complete for publication:

1. Paper on the regeneration and growth of lodgepole pine in small forest openings (Bernier) (86-01).
2. Paper on a multiplexer for the CR21 and 21X microloggers. Probably a short Information Report. (Hurdle) (84-01).
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) (87-06).

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) (86-02)
- 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) (87-03)
- 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) (87-04)
- 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) (87-05)
- e. Evaluate results of regeneration survey conducted by the Alberta Forest Service to determine the necessity for plant water relations research. (Bernier) (87-07)

Added goal:

3. Continue to maintain and upgrade the programmed version of the WRENSS procedure. (Bernier) (87-08)

10. Accomplishments 1987-88:

1. Publications

a. Submit for review:

1. The paper on using the heat pulse velocity technique in pathological investigations has not been completed due to other commitments by Swanson.

2. A paper on invasion of xylem sapwood by fungi was written by Yamaoka, Swanson and Hiratsuka, and presented at the 58th annual meeting of the Canadian Pathological Society in June. A revised version intended for Journal publication is currently under review.

b. Submit for publication:

1. The paper on the regeneration and growth of lodgepole pine in small forest openings has been published in the Can. J. For. Res. 17(7):758-759.
2. The paper on a multiplexer for the CR21 and the 21X microloggers has been canceled. The information is specific to particular applications and if published at all, should be a part of a paper on its use, i.e., such as a paper on HPV instrumentation.
3. The paper on the influence of forest cover on snow evaporation has been presented at a symposium on Forest and Agricultural Meteorology, and published in the Proceedings Preprint Volume.

2. Research activities:

- a. A VAX version of Hydrocomp's HSPF model was received in October. Work is currently under way to get the program up and running on our own machine. Once we get familiar with the structure of the program, we will proceed to simulate the changes in snowmelt and streamflow regimes caused by forest logging.
- b. A study on the effect of juvenile lodgepole pine on snow evaporation was conducted last winter. Although the weather was un-cooperative, a few days of excellent data were obtained. Some of the results have already been published as a conference publication (goal 1-b-3). In addition, a short paper on the use of naphthalene evaporation to measure wind speeds has been accepted for publication in the J. Oceanic and Atmospheric Technology.
- c. Because of the work load associated with the snow evaporation study, and the organization of the IASH meeting in Vancouver (NOR-1301), the evaluation of S. Running's evapotranspiration model was not undertaken this year.
- d. No further work was conducted on blue stain fungi due to other commitments.
- e. The regeneration survey was not carried out by the Alberta Forest Service. Accordingly, no evaluation could be made of its results.

3. The programmed version of the WRENSS procedure was updated and translated to Turbo Basic language. It now offers better physical representation of the snow evaporation phenomenon, as well as an improved user interface.

#### 11. Present Status of Study:

1. This study has been used as the scientific source for the coordination and technology transfer work being conducted under study NOR1301. The results from numerous experiments and studies have been published and incorporated into the WRENSS procedure that is currently our primary technology transfer vehicle.
2. This study is also being used as a vehicle for intra project cooperative research within the NoFC. Current examples are the regeneration survey at the James River Microclimate Study site by Blenis and Bernier, and the heat pulse velocity work in cooperation with Hiratsuka.
3. The future of this study depends very much on whether or not the NoFC intends to maintain in-house hydrologic expertise. The incorporation of the rain-dominated routines into WRENSS is necessary if we feel it desirable to extend this procedure to the East and West Coast forests. The implementation of the HSPF hydrologic and chemical transport model on computer facilities at all CFS Centers is part and parcel of the cross-Canada hydrologic modeling project. There is a need to refine the HSPF model and to simplify it in order to operate it on a microcomputer. The snow transport and evaporation studies planned are needed to complete implementation of the WRENSS procedure in this region.

#### 12. Goals for 1988-89:

##### 1. Publications:

##### a. Submit for review:

1. A paper on using the heat pulse velocity technique in pathological investigations. (Swanson, Hiratsuka) (87-01)
2. A paper on invasion of xylem sapwood by fungi entitled "Inoculation of lodgepole pine with four blue-stain fungi associated with mountain pine beetle, monitored by a heat-pulse velocity (HPV) instrument." (Yamaoka, Swanson, Hiratsuka) (87-02)

- b. Prepare and publish "The effect of evaporation on snow distribution in partially clear-cut forests", at the 1988 Western Snow Conference. (Swanson) (88-02)

## 2. Research activities:

- a. Continue using 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. Couple with transpiration/photosynthesis model for use determining effects of groundwater levels on soil moisture and subsequently on growth processes. (Swanson, Vice Bernier) (86-02)
- b. Coordinate and participate in study of snow loss in large clear-cuts with Alberta Forest Service, Bow-Crow Forest. Assist by helping design sampling program, provision of wind instrumentation to monitor speeds associated with snow accumulation patterns, and conduct trial runs of site-specific evaluations of snow loss under various wind, air temperature and atmospheric moisture conditions, using eddy-correlation techniques (Need at least part of the eddy flux equipment ideally need 3 sets to have a measure of variability for this; see capital equipment request below). (Swanson, Vice Bernier) (87-03)
- 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 model. Explore possible ways to integrate this model into HSPF to replace the non-physiologically based ET routine. (Swanson, cooperative with Bernier, LFC) (87-04)
- d. Evaluate results of regeneration survey conducted by the Alberta Forest Service to determine the necessity for plant water relations research. (Swanson, Vice Bernier) (87-07)
- e. Prepare microcomputer program for the rain-dominated regions of the WRENSS procedure. (Swanson) (88-02)

## 13. Publications 1987-88:

- Bernier, P.Y. 1987. A review of the potential of millimeter microwaves for the remote sensing of snowpack properties. *Nordic Hydrology*, 18:1-20.
- Blenis, P.V.; Bernier, P.Y. 1987. Incidence of Western gall rust infection of lodgepole pine in different sized forest openings. *Can. J. For. Res.* 16:1327-1329.
- Bernier, P.Y. 1987. Regeneration and growth of lodgepole pine in small openings in the Alberta Foothills. *Can. J. For. Res.* 17(7):758-759.
- Bernier, P.Y. 1987. Snow evaporation and the aerodynamic properties of an artificial juvenile lodgepole pine stand. Pages 213-215 in Preprint Vol. 18th Conf. Agricult. For. Meteorol. and 8th Conf. Biometeorol. Aerobiol., Sept.14-18, 1987. West Lafayette, Ind. Am. Meteorol. Soc., Boston, Mass.



Yamaoka, Y.; Swanson, R. H.; Hiratsuka, Y. (In press 1988). Inoculation of lodgepole pine with four blue-stain fungi associated with mountain pine beetle, monitored by a heat-pulse velocity (HPV) instrument. Presented at the joint meeting of the 52nd Annual Meeting of the Mycological Society of America and the 58th Annual Meeting of the Canadian Phytopathological Society, June 22-25, 1987, Ottawa, Ontario, 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. Duration:

Start: 1968                      Completion: 1993

16. Resources 1988-89:

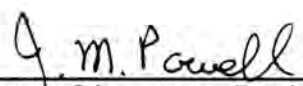
P/Ys:	Prof:	Vice Bernier	0.8
		Swanson	0.2
	Tech:	Hurdle	0.9
		Fisera	0.5
	Total		2.4

O&M            \$ 6,500

Capital       \$29,000 (Eddy flux sensors and recorders)

17. Signatures:

  
Investigator

  
Program Director, Environment

\_\_\_\_\_  
Investigator

  
\_\_\_\_\_  
Regional Director General

NOR-28

WETLANDS AND FOREST PRODUCTIVITY MODELLING

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 12, 1988

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

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

The Prairie Provinces have enormous areas of peat, all north of the prairie zone. The most recent estimates show that about 28% of Alberta, 12% of Saskatchewan and 42% of Manitoba is covered with peat. This translates into approximately 180,000 km<sup>2</sup> in Alberta, 68,000 km<sup>2</sup> in Saskatchewan and 230,000 km<sup>2</sup> in Manitoba.

The amount of peat involved is equally impressive. Conservatively calculating on a basis of 1.5 m average thickness in Alberta and Saskatchewan, and 2 m in Manitoba, the peat resources are 270 x 10<sup>9</sup> m<sup>3</sup> in Alberta, 102 x 10<sup>9</sup> m<sup>3</sup> in Saskatchewan, and 460 x 10<sup>9</sup> m<sup>3</sup> in Manitoba. Estimating the total dry peat content on the basis of 100 kg/m<sup>3</sup>, this would amount to 27.0 x 10<sup>9</sup> tonnes in Alberta, 10.2 x 10<sup>9</sup> tonnes in Saskatchewan, and 46.0 x 10<sup>9</sup> tonnes in Manitoba; a total of 83,200,000,000 tonnes of dry peat.

Peat is a significant reservoir of carbon. Peat formation ties up atmospheric carbon by fossilizing it. On the other hand, oxidation of peat, whether by burning as fuel or by decomposition, liberates carbon,

adding it to the atmosphere as CO<sub>2</sub>. 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  $83.2 \times 10^9$  tonnes of peat, some  $75 \times 10^9$  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.

Based on this background knowledge, guidelines can be established to recognize the value of wetlands for various uses. The suitability of wetlands for forestry can be predicted with reasonable certainty, and management techniques can be recommended for the improvement of drainage and tending of the forest.

#### 9. Study Objectives:

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

10. 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).

Added Goals:

10. Prepare and submit for publication a journal paper on the comparison of wet and dry ashing of peat (Ali, Zoltai and Radford).
11. Publish paper on peatlands and marshes of Canada as aquatic insect habitats (Zoltai).
12. Publish chapter in book on periglacial phenomena on earth hummocks (Zoltai).
13. Finalize and publish report on the natural resources of Wager Bay, NWT (Zoltai).

11. Accomplishments in 1987-88:

1. Paper "Relationships between nutrients and vegetation in peatlands of the Prairie Provinces" was presented at the Wetland Symposium (Zoltai and Johnson). This is being published in the proceedings of the symposium.
2. Work on manuscript on management of peatlands and peat resources is proceeding slower than expected, due to lack of time (Zoltai). Gave a presentation at CIF annual chapter meeting: "Forest drainage: an international perspective and an Alberta opportunity".



3. Work on manuscript on wetland classification from remotely sensed imagery began by defining the wetland forms recognizable from air photos (Zoltai).
4. Manuscript "Distribution of base metals in peat near a smelter at Flin Flon, Manitoba" submitted and accepted by journal (Zoltai).
5. Paper entitled "Additions to the bryophyte flora of Alberta, Saskatchewan and Manitoba, Canada" has been submitted to journal (Johnson).
6. Paper entitled "Lichens new to Alberta, Saskatchewan and Manitoba" has been submitted to journal (Johnson).
7. Paper entitled "Vascular plants new to Manitoba" has been submitted to journal (Johnson).
8. Paper entitled "Late-Quaternary volcanic ash in the peatlands of central Alberta" has been prepared and submitted to journal (Zoltai).
9. Acted as National Organizing Committee Member, Co-Chairman of Local Organizing Committee (Zoltai) and member of the Local Organizing Committee (Johnson) for Symposium 87, Wetlands-Peatlands.
10. Prepared and submitted for publication a journal paper entitled "A comparison of dry and wet ashing for the chemical analysis of peat" (Ali, Zoltai, Radford).
11. Published lead paper on the peatlands and marshes of Canada as aquatic insect habitat (Zoltai).
12. Published chapter in periglacial phenomena book on earth hummocks in Canada and Iceland (Zoltai).
13. Published report on the natural resources of Wager Bay, NWT.

12. Present Status:

The project is now in a "reporting" stage. In this phase the raw data collected during the field program is examined and various aspects are presented in journal papers. Aspects of wetland management become clarified during this phase, and the adequacy information for management recommendations is decided. This is phase in which stress is put on communicating our knowledge gained during the data collection phase to the scientific community and land managers.

13. Goals for 1988-89:

1. Continue work on manuscript on management of peatlands and peat resources (Zoltai).
2. Prepare first draft of manuscript on wetland classification from remotely sensed imagery (Zoltai).

3. Present paper on wetland conservation in Canada at the field conference of International Mire Conservation Group in Sweden (Zoltai) if attendance approved.
4. Publish paper "Late-Quaternary volcanic ash in the peatlands of central Alberta" (Zoltai)
5. Initiate compilation of vegetation and peatland dynamics in Alberta as an information report (Zoltai, Johnson).
6. Aid publisher in finalizing "Ecoregions of Canada" (Zoltai).
7. Continue contributing to the National Wetlands Working Group in providing classification standards, and providing technical advice on conservation strategy.

14. Publications 1987-88:

- Ali, M.W.; Zoltai, S.C.; Radford, F.G. A comparison of dry and wet ashing for the chemical analysis of peat. Can. J. Soil Sci. (in press)
- Schunke, E.; Zoltai, S.C. 1988. Earth hummocks (Thufur). In: Advances in periglacial geomorphology. M.J. Clark (ed.). John Wiley & Sons, Chichester, p. 231-245.
- Zoltai, S.C. 1987. Peatlands and marshes in the wetland regions of Canada. In: Aquatic insects of peatlands and marshes in Canada. D.M. Rosenberg and H.V. Danks (eds.). Mem. Entomol. Soc. Can. No. 140, p. 5-13.
- Zoltai, S.C. Distribution of base metals in peat near a smelter at Flin Flon, Manitoba. Water, Air, and Soil Pollution. (In press)
- Zoltai, S.C.; Holroyd, G.L.; Scotter, G.W. 1987. A natural resource survey of Wager Bay, Northwest Territories. Environ. Can., Can. Wildl. Serv., West. & North. Reg., Edmonton Tech. Rep. Ser. No. 25, 129 p.
- Zoltai, S.C.; Johnson, J.D. 1988. Relationships between nutrients and vegetation in peatlands of the Prairie Provinces. Proc. Symposium 87, Wetlands-Peatlands.

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. Duration:

Started: 1981

Estimated Completion: 1994

17. Resources for 1988-89:

PYs: Prof.: Zoltai 0.9  
Johnson 0.5

Tech.: Ali 0.5

Total: 1.9

Term/Student: 0.0

O & M: \$4,000

Capital:

18. Signatures:

SC. Zoltai  
Investigator

Shallin  
Program Director, Protection

J. D. Johnson  
Investigator

C. D. Hunt  
Regional Director General

## STUDY WORK PLAN

1988-89

Date: February 12, 1988

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  
(Canada-Alberta 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. About 4 million ha in Alberta are considered suitable for drainage and conversion to productive forest. There is, however, very little information available on the long-term effects of forest drainage on tree growth and the environment.

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, 259 ha), a treed fen (Wolf Creek, 132 ha), and a treed swamp (Goose River, 320 ha). 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 were installed, survey lines 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.

Drainage ditch network designs were prepared using Toth'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. Ditching was completed on the Goose River area (135 ha ditched) in September, 1986; on McLennan (90 ha) in July, 1987; and on Wolf Creek (60 ha) in October, 1987.

In 1986, transects were established and instrumentation installed on a control site and on three different ditch spacings for each experimental drainage area. Peat, water, and foliage samples were collected on each transect to determine its nutrient status. Ground temperatures and groundwater table levels were monitored during 1986 and 1987. To evaluate the effects of drainage on ground vegetation composition and tree growth, permanent sample plots were established and measured. Stream water samples were collected periodically to determine the effects of ditching on stream water chemistry and suspended sediment loads.

The Canadian Forestry Service (CFS) and Alberta Forest Service (AFS) cooperate closely on all aspects of the study. The AFS is responsible for most of the operational activities, and the CFS carries out the scientific research. Responsibility for installing tree growth PSPs is shared. On the Goose River site, the AFS established fertilizer-thinning studies and also implemented ditch mounding trials.

#### 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 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)
11. Accomplishments in 1987-88:
  1. The manuscript was published as Information Report NOR-X-288.
  2. The instrumentation networks were completed and monitored.
  3. 90 stream water quality samples were collected during the field season and analysed in the laboratory for 16 inorganic chemical elements and suspended sediment.
  4. 150 ground vegetation permanent sample plots on the three experimental areas were remeasured.
  5. a. On Goose River, McLennan and Wolf Creek experimental drainage areas, established 17 permanent sample plots (PSPs) perpendicular to ditches to evaluate tree growth as a function of distance from ditches.  
b. Assisted AFS in establishing and measuring 64 PSPs to evaluate the effects of drainage and fertilizer and thinning on tree growth.
  6. The paper was presented at the Wetlands '87 Symposium, and will be published in the Symposium proceedings.
  7. Seventeen foresters and researchers participated in the post-symposium forest drainage tour of Goose River and McLennan. The participants came from China, Finland, B.C., New Brunswick, Newfoundland, Ontario, and Alberta.
  8. The annual report required by the agreement will be ready before the end of March, 1988.

9. The paper was published in Water Resources Research.
10. a. As Scientific Advisor, worked closely with AFS to maintain progress of wetlands drainage and improvement program.
- b. Prepared report concerning drainage problems on Abitibi-Price Forest Management Licence, near Pine Falls, Manitoba.
- c. Advised graduate students (University of Alberta, University of Manitoba) on field projects related to forest drainage.

12. Present Status of Study:

As of November 1987, all three sites had been ditched, bringing to an end the pre-treatment data collecting period. A minimum of one summer's data and a maximum of two summers' data were collected from the sites. Preliminary analyses on the effects of drainage on groundwater table levels and on stream water quality are in progress (objective 2).

Tree growth and ground vegetation permanent sample plots were established on the three drainage sites. The work is about 60% complete. A few years of post-treatment data are required to meet objectives 1 and 3.

13. Goals for 1988-89:

1. To present a paper entitled Preliminary effects of forest drainage in Alberta, Canada on ground water table levels and stream water quality at the International Symposium on the Hydrology of Wetlands in Temperate and Cold Regions, Joensuu, Finland, 6-8 June, 1988. (Hillman pending approval).
2. Continue to monitor groundwater table levels, ground temperature, and stream water quality on each experimental area. (Hillman, Robson)
3. Observe ground vegetation permanent sample plots at Wolf Creek and remeasure if necessary. (Johnson)
4. Measure peat subsidence on the three experimental drainage areas. (Robson)
5. Complete installation and measurement of tree growth permanent sample plots on the three experimental areas. Some plots to be established perpendicular to ditches. (Johnson, Robson)
6. Establish criteria for sampling trees for stem analyses, and collect tree disks from the Fort McMurray (Athabasca Forest), Goose River, McLennan, and Wolf Creek experimental drainage areas, and carry out tree ring and stem analyses on them to obtain pre- and post-drainage growth rates. (Hillman, Johnson, Robson)
7. Prepare annual report on progress to date, as required by the Wetlands Drainage and Improvement Program, Canada-Alberta Forest Resource Development Agreement. (Hillman)

8. Provide scientific and technical advice on forest drainage projects and problems. (Hillman)

14. Publications 1987-88:

- Hillman, G.R. 1987. Improving wetlands for forestry in Canada. Can. For. Serv., Northern For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-288. 29 pp.
- Hillman, G.R. 1987. Improving wetlands for forestry in Alberta. In Wetlands - Peatlands Symposium '87 Proceedings, Edmonton, Alberta. August 23-27. (in press)
- Hillman, G.R.; Verschuren, J.P. 1988. Simulation of the effects of forest cover, and its removal, on subsurface water. Water Resources Research. 24(2):305-314.
- Hillman, G.R. 1987. Drainage problems and reforestation on Abitibi-Price Inc. Forest Management Licence, Pine Falls, Manitoba. Unpublished file report NOR-28-03-01. 21 pp.
- Johnson, J.D. 1987. A botanically interesting peatland in north-central Alberta. Alberta Naturalist 17(1):1-3.

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. Duration:

Start: 1985

Completion: 1993

17. Resources 1988-89:

PYs: Prof.: Hillman 1.0  
Johnson 0.5

Tech.: Robson 1.0  
Ali 0.5

Total: 3.0

Term/Student: 0.3 [+1.3 Job Development Program]

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

Capital: \$35,000

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

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 9, 1988

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 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).

Added Goals:

14. Organize a FORCYTE Strategy/planning meeting to plan the future activities of CFS with respect to the FORCYTE modeling project and to translate the findings into recommendations to the ENFOR Technical Committee. (M.J. Apps).
15. Establish and oversee a contract(s) to evaluate the performance of the aspen calibrated model in preparation for application to mixed wood stands. (P-353) (Scientific Authority: M.J. Apps).
16. Collaborate with T. Trofymow, PFC, in preparation of an ENFOR proposal to evaluate the use of Shawnigan Lake data to test (validate) portions of the FORCYTE-11 model, and to co-supervise any subsequent work. (M.J. Apps).
17. Establish a contract with UBC to provide modeling support for CFS users of FORCYTE, begin the construction of the benchmark FORCYTE-11 model, and upgrade the user friendly utilities. (ENFOR funds allocated Dec. 1987) (P-369) (Scientific Authority: M.J. Apps).
18. Publish notes on "use of tree biomass equations over broad regions" and "heat of combustion and energy potential of trees" in National Woodlands, and finalize proceedings paper. (T. Singh)

# 11. Accomplishments in 1987-88:

1. The information report "Economics of alternatives for industrial utilization of aspen" is with the editors for review. (P-207) (Scientific Authority: W. Ondro).
2. The information report on "Downed dead fuels in central Alberta forest cover types" was published. (P-23) (Scientific Authority: T. Singh).
3. The regression equations for biomass of component of small diameter ( 10 cm) trees were submitted to the contractor, Western Ecological Services, Ltd. The project was worked on sporadically during the year and recalculation of biomass and nutrient data is incomplete. The report is expected by March 31, 1988. (P-205) (Scientific Authority: I. Edwards).
4.
  - i) Nutrient cycling data collected on aspen plots in Alberta were summarized and data on litter decay were submitted to Western Ecological Services Ltd., as requested. Much of the contractor's time was spent on data assembly to fulfil the requirements of the FORCYTE model, which uses three site productivity classes (low, medium, and high) instead of one (medium) that characterizes the sites in Project P-205. Calibration data were derived from sites near the study area and, when necessary aspen data from a broader geographic area were assembled.
  - ii) In preparation for sensitivity tests of the model, input files for the sub-programs, TREDATA and SOILSDATA have been described and a list of input and output variables has been drawn up for initial sensitivity analysis.
  - iii) Sensitivity analysis of the model is in progress and, after a six month extension because of late delivery of subcontracted material, the report is expected 15 February 1988. A "Progress report on adaptation of nutrient cycling data to the FORCYTE growth simulation model for aspen stands in Alberta" is available. (P-314) (Scientific Authority: I. Edwards).
5. A contract "Evaluation of potential use of the FORCYTE Modeling Framework in Mixedwood Stands" was established with Western Ecological Services Ltd. Interviews with federal, provincial and industrial forest managers and scientists commenced in the fall of 1987 and a Preliminary Report was prepared on 28 December. Although originally set up as two year study, it was decided to defer phase 2 until 1989/90 and after completion of the benchmark FORCYTE-11 model (P-369). (P-353) (Scientific Authority: M.J. Apps).
6. Funding recommended by the ENFOR Technical committee was withdrawn when anticipated PERD awards were not realized. At the CFS FORCYTE strategy meeting (see added goal 14) the decision was reached to defer any model refinements until the benchmark FORCYTE-11 model was completed. (P-357 withdrawn) (Scientific Authority: M.J. Apps).

7. The \$30 K ENFOR funding was used to enhance a contract of Weyerhaeuser Canada with the Saskatchewan Research Council (SRC) to survey forest resources south of their forest lease limits. The SRC undertook multispectral image analysis of the area and the data has been digitized on maps. A final report is expected in late 1988 (P-334) (Scientific Authority: Saskatchewan District Office).
8. Progress reports on the contract on "Wood density of Canadian tree species" were received from FORINTEK. The final report has been deferred as the contract has been approved for a further year so as to include wood density data sources from Canadian species grown outside of Canada. (P-335) (Scientific Authority: J.M. Powell).
9. The paper "Some climatic aspects of biomass productivity of white spruce stemwood" was published. (P-149 and extensions) (Scientific Authority: J.M. Powell).
10. The information report "Utilization and market potential of poplars in Alberta" is with the editor. (P-207 and extension) (Scientific Authority: W. Ondro).
11. The paper on "Variation and prediction of conifer crown fuels in the Northwest Territories" is under review. (P-169) (Scientific Authority: T. Singh).
12. The journal note on "Predicting fuel weights for small trees and components" is under review. (P-314 extension) (T. Singh).
13. The ENFOR Production Technical Committee meeting in December was attended by Powell and Apps, the latter to report on the FORCYTE Strategy/planning (see goal 14). Coordination was continued and further proposals were submitted for 1988-89. (J. Powell et al.).
14. A FORCYTE Strategy/planning meeting was held at NoFC (Nov. 11-13, 1987) and was attended by all CFS researchers active with FORCYTE. A series of recommendations were prepared and presented to the ENFOR Technical Committee meeting in December, 1987. (Apps).
15. A contract was established with UBC entitled "Evaluation of the performance of the Aspen calibrated FORCYTE-11 model and preparation of a journal manuscript." A second contract to provide technical support, entitled "Prepare and Conduct a Series of Gaming Runs of the Aspen Calibrated FORCYTE-11 Model" was established with Life Sciences Programming Ltd. The completion of these contracts have been delayed by delays in completion of the aspen data set (goals 3 and 4) and DSS delays in awarding the UBC contract. Nevertheless, a draft manuscript on the TREEGROW and FORSOILS module's performance in the aspen calibrated model is expected prior to 31 March 1988. (P-353) (Scientific Authority: M.J. Apps).
16. A successful ENFOR proposal was prepared and a subsequent PFC contract established with Synergetic Digital Ltd. entitled "A Feasibility Study for the calibration, testing and evaluation of FORCYTE-11 using



Data from CFS Shawnigan Lake Project." Three meetings have taken place with the contractor and CFS-PFC co-workers. (PFC: P-367) (M.J. Apps)

17. A contract with UBC entitled "Modeling support for CFS users, refinements to PROBE multiple run manager, and phase 1 of benchmark FORCYTE-11 construction" will be in place by Feb. 15, 1988. Work has already commenced and prototype software and draft documentation is expected by March 31. (P-370) (Scientific Authority: M.J. Apps)
18. Two notes on "use of tree biomass equations over broad regions" and "heat of combustion and energy potential of trees" were published in the National Woodlands. A proceedings paper on prediction of errors in tree biomass regression functions was also published (T. Singh).

12. Present Status of Study:

Since the inception of the program NoFC has undertaken 25 ENFOR contracts of which 19 have been completed except for some final publications. Of the remainder, three final reports are awaited, while three others are on-going through 1988-89.

Contracts to establish biomass prediction equations for regional tree species have been completed, and publications published, although two additional publications refining prediction equations for small diameter components are currently under review.

A major contract to investigate the impact of aspen biomass removal on site quality and nutrient status has been completed although we await the final report. Much of this data and data collected under another study has been used as input to an adaptation of the FORCYTE model for Alberta aspen stands. Major effort is now being expended to document the FORCYTE-11 model and sensitivity test the model.

Two contracts provided production and delivery costs of poplar biomass under two operational regimes. Industrial options for use of poplar for products were also assessed including as an energy source; reports on one of these studies are in final editing stages.

Studies were completed and published on the effects of climate and tree growth/biomass including a literature survey and through tree ring analysis. A study to compile a comprehensive source book of wood density data for Canadian tree species is nearing completion. Major input was also provided for the Canadian Biomass inventory including studies of non-inventoried forested areas in the region, and development of a pilot computer mapping system.

13. Goals for 1988-89:

1. Publish Information Report entitled "Utilization and market potential of poplars in Alberta". (P-207 and extension) (Scientific Authority: W. Ondro). (see also NOR-4-08)



2. Publish Information Report entitled "Economics of alternatives for industrial utilization of aspen". (P-207) (Scientific Authority: W. Ondro).
3. Review the final report "Data analysis of biomass and nutrient content in Alberta aspen ecosystems" and prepare Information Report for publication. (P-205) (Scientific Authority: I. Edwards)
4. Review the final report "Adaptation of nutrient cycling data to the FORCYTE growth simulation model for aspen stands in Alberta". Liaise with Apps and prepare information report for publication. (#P-314 and extension) (Scientific Authority: I. Edwards)
5. Complete review and publish paper on "Variation and prediction of conifer crown fuels in the Northwest Territories". (P-169) (Scientific Authority: T. Singh).
6. Complete review and publish journal note on "Predicting fuel wieghts for small trees and components". (#P-314 extension) (T. Singh).
7. Continue to oversee the three-year contract on "Wood density of Canadian tree species" being undertaken by FORINTEK. (P-335) (Scientific Authority: J.M. Powell)
8. Cooperate in overseeing completion of a contract on "Non-core area wood supply in central Saskatchewan" with Weyerhaeuser Canada and Saskatchewan Research Council. (P-334) (Scientific Authority: Saskatchewan District Office).
9. Carry on such maintenance activities as are required to reactivate the application of FORCYTE-11 to the management of aspen and aspen/mixed stands. (P-353 phase 2 deferred to 1990) (Scientific Authority: M.J. Apps).
10. Establish, monitor and guide a contract with UBC (J.P. Kimmins) for the completion of a benchmark FORCYTE-11 model, and provision of modeling support to CFS FORCYTE users. (P-369) (Scientific Authority: M.J. Apps).
11. Establish and oversee a contract(s) to upgrade the existing FORCYTE-10 Douglas Fir/red alder data set for use as calibration, demonstration and developmental data set for the FORCYTE-11 benchmark model. (P-368) (Scientific Authority: M.J. Apps).
12. Establish, monitor and oversee a contract with J.P. Kimmins UBC to produce documentation of ecosystem components, processes, assumptions, and conceptual representations of the algorithms used in the benchmark FORCYTE-11 model. (P-370) (Scientific Authority: M.J. Apps).
13. Assist in the organization of, and participate in, a user's workshop on the benchmark FORCYTE-11 model, tentatively to be held at PNFI Sept./Oct., 1988. (M.J. Apps, and others).

14. Continue coordination of NoFC ENFOR projects ensuring their completion and publication. Act as establishment representative on national committee and submit reports on the program as required. (J.M. Powell).

14. Publications 1987-88:

- Gonzalez, J.S. 1987. Wood density of tree species in British Columbia. Pages 106-109 In Stiasny, Z.-Z. (Ed.). 6th Can. Bioenergy R & D Seminar, Richmond, B.C. Feb. 16-18, 1987., Elsevier Appl. Sci. Publishers Ltd., London.
- Grewal, H.S. 1987. Biomass productivity in two-year-old aspen cutovers near Calling Lake and Slave Lake, Alberta. Pages 124-128 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C. Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.
- Jozsa, L.A.; Powell, J.M. 1987. Some climatic aspects of biomass productivity of white spruce stem-wood. Can. J. For. Res. 17:1075-1079.
- Kurz, W.A.; Apps, M.J.; Chan, Y.-H. 1987. A program to facilitate user-friendly gaming with FORCYTE. Pages 160-164 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C. Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.
- Peterson, E.B. 1987. Progress report on adaptation of nutrient cycling data to the FORCYTE growth simulation model for aspen stands in Alberta. P-314 File Report. Nov. 10. 27 pp.
- Peterson, E.B. 1987. Preliminary report on evaluation of FORCYTE modelling framework in relation to boreal mixedwood forest management and utilization. P-353 File Report. Dec. 28. 24 pp.
- Peterson, E.B.; Chan, Y.-H.; Peterson, N.M. 1987. Biomass and nutrient content of aspen ecosystems in Alberta, Canada. Pages 119-123 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C., Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.
- Peterson, E.B.; Chan, Y.-H.; Peterson, N.M.; Kabzems, R.D.; Kimmins, J.P. 1987. Calibration of FORCYTE-11 growth simulation model for aspen ecosystems in Alberta, Canada. Pages 151-154 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C. Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.
- Singh, T. 1987. Prediction error in tree biomass regression functions for western Canada. Pages 199-208 in Proc. Workshop on Tree Biomass Regression Functions and their contribution to the Error of Forest Inventory Estimates. May 26-30, 1986. Syracuse, N.Y. USDA, For. Serv., Northeastern For. Exp. Stn. NE-GTR-117.
- Singh, T. 1987. Estimating downed-dead roundwood fuel volumes in central Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alberta NOR-X-289.

- Singh, T. 1987. Wood density variations in thirteen Canadian tree species. *Wood and Fiber Science*. 19:362-369.
- Singh, T. 1987. Heat of combustion of energy potential of tree species in Western Canada. *Nat. Woodlands*. 10(4):8-9.
- Singh, T. 1987. Extending tree biomass equations over broad forest regions. *Nat. Woodlands*. 10(6): 8-9.
- Singh, T.; Kostecky, M.M. 1987. Energy potential from Manitoba forest biomass. Pages 101-105 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C., Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.
- Woodland Resource Services Ltd. 1987. Development of an integrated operation for aspen wood products and energy from aspen biomass. Pages 172-174 in Stiasny, Z.-Z. (Ed.) 6th Can. Bioenergy R & D Seminar, Richmond, B.C., Feb. 16-18, 1987. Elsevier Appl. Sci. Publ. Ltd., London.

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. Starting Date: 1978

Completion Date: 1993

17. Resources 1988-89:

PYs: Prof.:	Edwards	0.3
	Apps	0.2
Tech.:		0.0
Total:		0.5
Term/Student:		0.0

O&M: Nil

Contracts & In-house R&D: \$116,000 ENFOR funding  
 Management: \$10,000 ENFOR funding  
 Capital: \$10,000 ENFOR funding

Total: \$136,000 (From CFS ENFOR allocation from PERD funding)

18. Signatures:

A. K. Edwards  
Investigator

[Signature]  
Investigator

J. M. Powell  
Program Director, Environment  
ENFOR Representative

[Signature]  
Program Director, Protection

C. D. Tut  
Regional Director General

## Canadian Forestry Service

## STUDY WORK PLAN

1988-89

Responsibility Centre : Northern Forestry Centre

Date: February 12, 1988

1. Project: Wetlands and Forest Productivity Modelling
2. Title: Boreal forest risk factor modelling
3. New:                      Cont.: X
4. No.: NOR-28-07
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: Edmonton laboratory, prairie provinces, N.W.T., British Columbia.
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. Improved techniques to enable realistic projections of future timber supplies are needed in Alberta and other prairie provinces and Northwest Territories.

Prevailing climatic conditions of long, cold winters and short growing season are responsible for slow growth rates typical of the boreal tree species. Fires which frequently result in destruction of large areas comprising the future growing stock are a common occurrence. During the past two decades the forest area lost in Alberta due to fires averaged 0.5 % annually, which is considerable because of the long rotations under which the boreal forests are managed. During a rotation of 100 years, for example, about a half of Alberta's forest area can be

expected to suffer fire losses if all stands were equally prone to fire hazards. 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. These problems have not so far been objectively handled in resource allocation and management, mainly because of a general lack of available tools for such predictions.



Long-term planning of forest management should be mainly based on expectation of return on investment and management efforts. 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. 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.

A total of five years is estimated to cover all stages of the study. These stages are:

1. 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.
2. Preliminary development stage: Preliminary attempts at development of a conceptual model dealing with risk factors relating to growth and yield.
3. Intermediary stage: Implementation of model concepts and strategies to achieve parameter estimation and calibration.
4. 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.
5. 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.

The three modelling methodologies to be used are: a) stochastic, b) deterministic, and c) dynamic modelling. This will enable a comparative assessment of the three approaches in the study.

Because of the availability of most data bases for modelling, McLeod working circle in the leasehold of Champion Forest Products Ltd. was selected as a logical unit for the formulation and development of the model. Preliminary version of Forestry Risk Model (FORIM-1) based on fire risk and growth and yield data from this working circle is ready for including other risk factors. Adjoining boreal ecoregions will be accessed 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 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 regions in western Canada.

#### 10. 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 on insect and disease infestations, and 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 reports as required by 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, representing 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 the 11th Annual Meeting of the Alberta Climatological Association, Feb 24, 1987.

Added Goal:

14. Present a paper at the Symposium on the Impacts of Climate Change and Variability on the Canadian Prairies.

11. Accomplishments in 1987-88:

1. Sources of risk factor data were located and identified for each category separately. The following steps were taken for creating the required data bases:
  - a) Fire risk data for Alberta were obtained on tape and tested for stochastic determination of fire rates in Hinton leasehold.
  - b) Insect and disease risk data were extracted from Forest Insect and Disease Survey Reports for Alberta under a contract with Jack Petty. The data will be formatted to meet direct input requirements of the insect and disease factor module.
  - c) Site and growth data base is being obtained through the Regional Growth and Yield Cooperative and MPC (Microcomputer Permanent Sampling Plot Catalogue). Data from Hinton leasehold and from CFS and provincial data sources are expected to be part of MPC and available for modelling purposes.
  - d) Other data such as climatic data are available from Canadian Climate Centre data bases on as needed basis.
2. The data and available information from NoFC scientists and technicians are being obtained and summarized for insect and disease infestations in Alberta. A similar approach needs to be adopted for the fire risk data.
3. Preliminary work was done for computing the probabilities of fire occurrence and its effect on short- and long-term timber losses. Lognormal, Pareto, Weibull, and Laplace were the distributions tested. Chi-square goodness-of-fit tests were made to determine which distribution best described the observed fire frequencies. The selected distribution will be used to represent probabilities of fire hazard and to simulate the effects on timber supplies for different risk levels.
4. Preliminary work on modifying FORIM-1 modules was done. Some improvements were made in the Forest Yield prediction module, but was limited because of the non-availability of Champion data. Annual Allowable Cut module is being improved by obtaining better estimates of risk factors and the related hazard probabilities. Computer program modifications will be continued to keep up with the various stages in the development of the model.
5. Cumulative probabilities of obtaining expected timber volumes were determined for McLeod Working Circle under different rotations and fire risk levels. The simulation results from FORIM-1 showed that rotation length and fire risk severity have significant effects on annual allowable cut. The expected yields increased 8.3, 9.7, and 11.7 % when rotation age was lowered by 10 years, for mild, medium and severe fire risks, respectively; the annual allowable cut estimates need to be adjusted accordingly.



6. Preliminary work on testing plotter and peripherals was done, and the need for additional software identified. The work will be continued with the acquisition of software.
  7. Attended IUFRO Conference on "Forest Growth Modelling and Prediction", Minneapolis, U.S.A., August 24-28, 1987. It provided an overview of the current status of forestry growth modelling research and usage, and indicated need for updating training on simulation modelling, differential equations, time series, and linear programming methodologies.
  8. A paper "Risk factor modelling for forest yield predictions in Alberta" was prepared and presented at the IUFRO Forest Growth Modelling and Prediction Conference. The paper was accepted for printing in the Proceedings.
  9. Requirement of Canada-Alberta Agreement was met by preparing "Boreal forest risk factor modelling" as the needed Annual Report.
  10. A summary note entitled "Soil temperature variations in clearcuts" was prepared.
  11. Statistical and other advice was provided to colleagues and clients in the ongoing programs of NoFC. Attended the following: Alberta Climatological Committee, Steering Committee for Symposium/Workshop on the Impacts of Climate Variability and Change on the Canadian Prairies, and Canada Committee on Ecological Land Classification.
  12. The input and needed expertise were provided to SRC. The Phase I contract Report entitled "An exploration and assessment of the implications of climatic change for the boreal forest and forestry economics of the prairie provinces and Northwest Territories" has been prepared and submitted, and the research needed for Phase II identified.
  13. Proceedings of the workshop and the 11th Annual Meeting of the Alberta Climatological Association were compiled and are being published as an Information Report by NoFC.
  14. A paper entitled "An overview of the effects of climate change and climate variability on forest vegetation in western Canada" was presented.
12. Present Status of Study:

The study has progressed through the initial stage in the first year. The preliminary version of the forestry risk model (FORIM-1) based on fire as a risk factor and using a stochastic approach has been prepared. A deterministic forest level approach is being applied on the insect and disease data using FORMAN model. At present a search is being made to identify and select a dynamic modelling methodology for including risk and uncertainty in forest management decisions.



13. Goals for 1988-89:

1. Obtain data from MPC and Canadian Climate Centre data bases, and from NoFC scientists and technicians, for implementing stages 2 and 3 in the development of risk factor model.
2. Initiate work for incorporating the insect and disease risk module in the model to obtain updated version (FORIM-2).
3. Write/modify computer programs for determining annual allowable cut under different risk and growth scenarios simulated on IBM-PC and NoFC VAX system.
4. Prepare risk factor maps for boreal forest ecoregions in the Hinton leasehold.
5. Update training on simulation modelling, differential equations, computer graphics, time series, and linear programming optimization methodologies; attend IUFRO Seminar on Forest Growth Process Modelling of Responses to Environmental Stress, April 19-22, 1988.
6. Prepare journal paper on "Fire risk modelling in the boreal forest of Alberta".
7. Initiate work on a manuscript "Forest insect and disease risk factors in the boreal forest of Alberta" (Singh, Cerezke).
8. Contribute expertise and provide input on the forestry impacts of climatic change to Phase II of proposed SRC contract, and to CCELC.
9. Prepare annual progress report for the Canada-Alberta Forest Resource Development Agreement on risk factor modelling.
10. Prepare for review paper on soil temperature variations in clearcuts.
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 development of their activities.

14. Publications 1987-88:

- Dempster, W.R.; Stevens, N.A. 1987. Risk management in forest planning. Joint publication, Canada-Alberta Forest Resource Development Agreement. (Scientific Authority: T. Singh)
- Singh, T. 1987. Risk factor modelling for forest yield predictions in Alberta, Canada. Pages - in U.S. Forest Service, Proceedings of the Forest Growth Modelling and Prediction Conference, Department of Forest Resources, University of Minnesota, St. Paul, Mn. (In Press)

Singh, T. (Compiler) 1988. Current Applied Climatological Research in Alberta. Proceedings of the Workshop and the 11th Annual Meeting of the Alberta Climatological Association, Feb. 24, 1987, Edmonton, Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Info. Rep. NOR-X-294.

Singh, T. 1988. Northern Forestry Centre, Canadian Forestry Service, Pages 57-58 in Proceedings of the Workshop and the 11th Annual Meeting of Alberta Climatological Association, Feb. 24, 1987 in Edmonton, Alberta. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-294.

Singh, T.,; Higginbotham, K.O. 1987. An overview of the effects of climate change and climate variability on forest vegetation in western Canada. Pages - in Proceedings of the Symposium/workshop on the Impacts of Climate Change and Variability on the Canadian Prairies (In Press).

Singh, T. 1988. Modelling forest yield risk factors in Canada. National Woodlands 11(1):21-22.

Wheaton, E.E.; Singh, T.; Dempster, R.; Higginbotham, K.O.; Thorpe, J.; Van Kooten, G.C.; Taylor, J.S. 1987. An exploration and assessment of the implications of climatic change for the boreal forest and forestry economics of the prairie provinces and Northwest Territories: Phase I. Environment Canada, Canadian Climate Centre. SRC Publication No. E-906-36-B-87.

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. Duration:

Started: 1987                      Completion: 1992

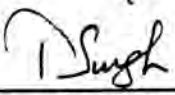
17. Resources 1988-89:

PYs:	Prof.: Singh	1.0
	Tech.: vice Schultz	1.0 (vacant)
	Total	2.0

O & M: \$3,000 - A-Base  
Canada-Alberta Agreement - \$25 K  
SRC contract - \$10 K

Capital:

18. Signatures:

  
Investigator

  
Program Director, Protection

  
Regional Director General

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NOR-33  
INFORMATION

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 12, 1988

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

There is a need for the Northern Forestry Centre to ensure that regional clients (forest resource and industrial managers, scientific community, and educational community) are adequately informed of the results of research and development programs in a relevant and timely manner and at a reasonable cost.

9. Study Objectives:
  1. Edit, publish, and distribute scientific, technical, and other publications of the Northern Forestry Centre and its two district offices.
10. 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)

Added Goal:

9. Present a seminar on the NoFC manuscript review procedure to staff in Edmonton and both district offices. (J.S., B.B.) (33- )

11. Accomplishments in 1987-88:

1. Assisted the research staff, through the provision of editing and publishing services, in the preparation and publication of:
  - a. 8 Information Reports
  - b. 2 Forest Management Notes
  - c. 2 Forestry Reports
  - d. 45 journal articles and miscellaneous publications.
2. Tree and shrub insects of the prairie provinces, by W.G.H. Ives and H.R. Wong, was edited, typeset, and given to the printer for printing and delivery by the end of March 1988. The report on diagnosis and recognition of winter frost damage is being revised by Y. Hiratsuka.
3. Oversaw production and printing or reprinting of locally published scientific and technical information.
4. In 1987 distributed 16,000 publications automatically, 50,000 publications in response to over 4,000 written and telephoned requests, and 50,000 Ecotours in a final distribution. There were 400 mailing list address changes, additions, or deletions.

5. Provided editorial, typographical, and printing assistance for public information activities.
6. The bibliography of 1980-85 publications of the Northern Forestry Centre was revised to incorporate 1986 publications and is being finalized for typesetting.
7. New models of typesetting equipment were investigated to provide the basis for more-intensive study in 1988-89.
8. A draft Canadian Forestry Service publications policy for general as well as scientific and technical publications was reviewed by J. Samoil.
9. Three seminars were presented on the manuscript review procedure: two for Edmonton staff and one for district office staff who were in Edmonton for project reviews.

12. Present Status of Study:

Since 1970, 294 Information Reports, 44 Forest Management Notes, 33 Forestry Reports, and nearly 800 journal and symposium articles and miscellaneous publications have been edited and produced.

13. Goals for 1988-89:

1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately:
  - a. 15 Information Reports
  - b. 7-10 Forest Management Notes
  - c. 8 Pest Leaflets (revisions and reprinting)
  - d. 40 journal articles and miscellaneous publications. (J.S., B.B.)
2. Assist in the preparation of a special technical report on diagnosis and recognition of winter frost damage, by H. Zalasky and Y. Hiratsuka (J.S., B.B.)
3. Prepare and publish the Program Review 1987-88 of the Northern Forestry Centre. (J.S., B.B.)
4. Oversee production and printing or reprinting of locally published scientific and technical information. (J.S., B.B.)
5. Continue responsibility for the distribution of scientific and technical publications, maintaining a mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence. Conduct a major update of the mailing list to delete inactive subscribers and obtain information on subject interests. (J.S., B.B.)

6. Provide editorial, typographical, and printing assistance for public information activities. (J.S., B.B., E.S.)
  7. Print as an Information Report a bibliography of 1980-86 publications of the Northern Forestry Centre. (J.S.)
  8. Investigate upgrading and replacement of typesetting equipment, making recommendations regarding timing and type of equipment required. (J.S., B.B.)
  9. Serve on in-house, regional, and national working/advisory committees, as required. (J.S.)
  10. Present seminars to staff on the revised CFS style manual and new CFS publications policy when these are available. (J.S., B.B.)
  11. Investigate staff demand for a seminar on techniques of scientific and technical writing and present it if there is sufficient interest. (J.S., B.B.)
  12. Establish guidelines for authors on the preparation of computer graphics for use in publications. (J.S., B.B.)
  13. In cooperation with development agreement personnel, assess personnel and financial requirements and prepare guidelines for publishing reports arising from agreement activities following expiration of the agreements. (J.S., R.N.)
  14. Participate in a training program for communications personnel, as required by Treasury Board. (J.S., B.B.)
14. Publications 1987-88:

#### INFORMATION REPORTS

- Chrosciewicz, Z. 1988. Forest regeneration on burned, planted, and seeded clear-cuts in central Saskatchewan. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-293.
- Grewal, H., editor. 1987. Bibliography of lodgepole pine literature. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-291.
- Harvey, E.M., compiler. 1987. Proceedings of the 1986 Prairie Federal-Provincial Nurserymen's Meeting. Can. For. Serv., North. For. Cent., Edmonton, Alberta. NOR-X-287.
- Hillman, G.R. 1987. Improving wetlands for forestry in Canada. Can. For. Serv., North. For. Cent., Edmonton, Alberta. NOR-X-288.
- Ives, W.G.H.; Wong, H.R. 1988. Tree and shrub insects of the prairie provinces. Can. For. Serv., North. For. Cent., Edmonton, Alberta. NOR-X-292.

- Radvanyi, A. 1987. Snowshoe hares and forest plantations: a literature review and problem analysis. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-290.
- Singh, T. 1988. Current applied climatological research in Alberta. Proceedings of the Workshop and 11th Annual Meeting of the Alberta Climatological Association, February 24, 1987. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-294.
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- McAlpine, R.S. 1987. Two BASIC programs for fire danger and fire behavior computations. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 43.
- Walker, N.R.; Ball, W.J. 1987. Container seedling field performance after 10 years. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note. 44.

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- Samoil, J.K., editor. 1987. Manitoba's forests. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Rep. 32.
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- Alexander, M.E.; Lanoville, R.A. 1987. Wildfires as a source of fire behavior data: a case study from Northwest Territories, Canada. Pages 86-93 in Preprint vol. Ninth Conf. Fire For. Meteorol., April 21-24, 1987, San Diego, California. Am. Meteorol. Soc., Boston, Mass.
- Allen, E.A.; Blenis, P.V.; Hiratsuka, Y. 1988. Axenic culture of Endocronartium harknessii. Mycologia 80(1):120-123.
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- Baker, J. 1987. Distribution of N in a simulated profile of a Podsolc Gray Luvisol following urea fertilization. Can. J. Soil Sci. 67:271-280.
- Bella, I.E.; Navratil, S. 1987. Growth losses from winter drying (red belt damage) in lodgepole pine stands on the east slopes of the Rockies in Alberta. Can. J. For. Res. 17(10):1289-1292.



- Bernier, P.Y. 1987. Microwave sensing of snowpack properties: potential and limitations. *Nord. Hydrol.* 18:1-20.
- Bernier, P.Y. 1987. Regeneration and growth of lodgepole pine in small openings in the Alberta foothills. *Can. J. For. Res.* 17:758-759.
- Bernier, P.Y. 1987. Snow evaporation and the aerodynamic properties of an artificial juvenile lodgepole pine stand. Pages 213-215 in Preprint vol. 18th Conf. Agric. For. Meteorol. and 8th Conf. Biometeorol. Aerobiol., September 14-18, 1987. Am. Meteorol. Soc., Boston, Mass.
- Blenis, P.V.; Hiratsuka, Y.; Mallett, K.I. 1987. Armillaria root rot in Alberta. *Univ. Alberta Agric. For. Bull.* 10(1):4-5.
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- Chakravarty, P.; Sidhu, S.S. 1987. Effect of glyphosate, hexazinone, and triclopyr on in vitro growth of five species of ectomycorrhizal fungi. *Eur. J. For. Pathol.* 17:204-210.
- Chakravarty, P.; Sidhu, S.S. 1987. Effect of hexazinone (Pronone<sup>TM</sup> 5G) on the seedling growth and mycorrhizal incidence of Pinus contorta var. latifolia and Picea glauca. *Eur. J. For. Pathol.* 17:282-291.
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- Edwards, I.E. 1987. Nutrient regimes and cold hardiness in conifer seedlings. Pages 14-17 in E.M. Harvey, compiler. *Proc. 1986 Prairie Fed.-Prov. Nurserymen's Meet., September 9-11, 1986, The Pas, Manitoba.* Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-287.
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- Hillman, G.R.; Verschuren, J.P. 1988. Simulation of the effects of forest cover, and its removal, on subsurface water. Water Resour. Res. 24(2):305-314.
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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. Duration:

Start: 1970

Completion: Continuing

17. Resources 1988-89:

PYs: Prof.: Samoil 1.0  
Boughton 1.0

Tech.: Schiewe 1.0

Total: 3.0

Term/Student: Graphic Artist 0.75  
Distribution Clerk 0.75

O & M: \$59,900

Capital:

18. Signatures:

Samoil  
Investigator

Brenda S. S. S. S.  
Investigator

A. D. L. L.  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 12, 1988

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, 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 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 TI 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)

11. Accomplishments in 1987-88:

1. Coordinated activities of technology transfer and information project staff within NoFC, including public information, public relations, scientific and technical editing and publishing, extension services, library, and photographic services.

Additional activities during the study year included:

- arrangements for two Ministerial visits (spring and fall 1987)
- coordination of CFS input into operation and funding of "Alberta's Managed Forests" exhibit trailer schedule.
- visitation and interpretive contributions to Jumpingpound demonstration forest sponsored by the Canada-Alberta FRDA
- secretarial services to Senior Regional Advisory Council
- participation in Clearwater and Pineland nurseries official opening ceremonies in Manitoba
- hosting of forestry delegation from People's Republic of China and preliminary arrangements for twinning with the Chinese Academy of Forestry in Heilongjiang Province
- participation in media subcommittee of Canadian Council of Forest Ministers Research and Development Forum in Edmonton. (R.N.) (33-2)

2. Served on in-house, regional, and NGO Committees as follows: (R.N.) (33-4)

- Canada-Alberta FRDA Public Information Subcommittee
- NoFC library committee
- NoFC Computer users committee
- EG-ESS conversion committee
- AFA School Education Committee and NFW organizing committee
- CIF Rocky Mountain Section Council member

3. Continued to participate in implementation of communication 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. (R.N.) (33-1)

4. Incomplete. Unanticipated delays in undertaking initial stages of the accomplishments evaluation, and alternate assignments contributed to failure to complete goal. Participation of an assistant evaluator should expedite completion of evaluation project during the forthcoming study year. (33-6)

5. Incomplete. Implementation of this goal has been delayed pending the outcome of NoFC Management assessment of recent technology transfer initiatives and potential opportunities for development of same. In the interim, effort was directed at developing, promoting the use of, and reviewing for publication, several issues of a new NoFC publication medium - Technology Transfer Notes. Reviewed for publication several sections of Canada-Manitoba FRA Demonstration Notes and information brochures produced under the Canada-Saskatchewan FRDA. (33-6)

6. Attended the fall meeting of the Federal Laboratory Consortium for Technology Transfer in Sacramento Calif. (33-40)

7. Participated in the initial regional planning stage of phase II of the CCFM forestry awareness campaign - Green Gold/L'or Vert. (33-26)

8. There was limited opportunity to further develop the NoFC photographic records and library. Slide duplication equipment will be requisitioned early in the forthcoming study year to facilitate this endeavor. (33-5)
9. 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 Sportsmen's Show, the Sherwood Park Trade Fair, Alberta Science Teachers Federation exhibition at Red Deer, and National Forest Week, Westmount Mall exhibit, Forestry Centre of Alberta mall exhibit at Edson, Northern Alberta Forestry Show at Grande Prairie, AFPA annual meeting at Jasper Park Lodge. Region-wide, NoFC and District Office personnel contacted 125,600 members of the general and other targetted publics and distributed 142,600 pieces of literature in the process. In addition, 32,900 visitors toured the "Alberta's Managed Forests" exhibit trailer sponsored by the Canada- Alberta FRDA. (33-7)
10. 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. Several NoFC and District staff participated as judges at local and regional Science Fairs in 1987. (33-8)
11. Maintained stocking and control of NoFC inventory of public information and extension literature, exhibition materials and supplies and ordered replenishment or new supplies as required. Packaged and shipped or mailed information/education materials as required in response to public, institutional, or CFS District Office requests. (33-42)
12. Participated in proposal and planning stages of a major technology transfer symposium on mixedwood management in northern forests. This symposium will take place in Edmonton April 11-14, 1988. (R.N.)

12 Present Status:

Initiated in 1984 as an aggregate study (technology transfer, extension services, public information, library services and photographic services) at the time of Project establishment. In 1987-88 disaggregation of study activities ensued such that technology transfer and extension services became a distinct study.

13. Goals for 1988-89:

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 FRDAs. (see NOR-36) (R.N.) (33-6)
6. Attend semi-annual meeting of Federal Laboratory Consortium for Technology Transfer. (R.N.) (33-40)
7. Pursue an opportunity to conclude a twinning arrangement between NoFC and the Chinese Academy of Forestry in Harbin, Heilongjiang Province, People's Republic of China.
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)

14. Publications 1987-88:

Nil

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 study activities are not potentially detrimental to the environment.

16. Duration:

Started: 1984

Completion: continuing

17. Resources 1988-89:

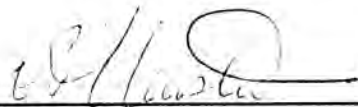
PYs: Prof.:	Newstead	1.0
Tech.:	Stewart, H.	1.0

Total:	2.0
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O & M: \$12,000

Capital:

16. Signatures:

  
Investigator

  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 12, 1988

1. Project: Information
2. Title: Library Services
3. New:                      Cont.: X
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 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)

11. Accomplishments in 1987-88:

1. The Library staff continued to provide library services as required to staff to support the research conducted at NoFC and its District Offices. The Librarian paid a visit to the Manitoba District Office to assist and advise the staff about planning and organizing their library.
2. The librarian took an introductory training course to do on-line searching on DIALOG. An account has been set up with the Canadian Library Association to receive discounts for DIALOG searching costs.

The library is now sharing an ENVOY 100 mail box with Financial Services.

3. A contract was signed with Sydney on 31 Dec. 1987, to purchase their automated library system for all of the C.F.S. libraries. This has been scheduled to arrive during the 1988-89 fiscal year for the NoFC library.
4. Cooperation is taking place among the C.F.S. libraries with the routing of journal titles, and sharing of duplicates or gift publications. The library is also notifying the University of Alberta library of any proposed cancellations or additions to journal titles.
5. The bulk of the collection of the USDA Forest Service publications has been shifted from the storage area to the main library. Only the older USDA publications still remain in the storage area.
6. This has been expanded to cover general library policy. It has been drafted and is presently being revised, following feedback from library committee members.
7. The terms of reference and mandate of the library committee have been drafted with the help of a library subcommittee. These have been reviewed, revised and ratified by the library committee and referred to the Management Committee for their approval.
8. The Periodicals Holdings list has been revised and needs to be checked before it is sent to the Canada Institute for Scientific and Technical Information for inclusion in the data base for the Union List of Scientific Serials in Canadian Libraries. A printout of the NoFC library holdings from the CAN/OLE data base can serve as the updated list.
9. The gift materials and duplicates have been reduced in number by discarding those of no value and donating a number of the rest to the University of Alberta library, the Manitoba District Office, Grant McEwan College for the Library Technician's Programme. The remainder are packed in boxes for further action.

12. Present Status of Study:

Management and development of NoFC Library and auxiliary Services has progressed satisfactorily towards servicing research and regional development needs of NoFC and District Offices since its inception in 1970.

13. Goals for 1988-89:

1. To continue to provide library services as required to support the research conducted at NoFC and its district offices.
2. To complete and implement library policy.
3. To continue to provide on-line data base literature searches on site.
4. To develop with advice and input from the Library Committee or a Library Subcommittee and in cooperation with the other CFS Libraries an acquisition and implementation plan to acquire, install, inaugurate and monitor the Sydney automated Library System including O&M, delivery, capital, training and human resource requirement.
5. To continue to cooperate with CFS and other associated libraries.
6. To provide assistance and guidance with the organization and setting up of the Manitoba District Office library.
7. To work towards completion of updating of the Periodicals Holdings List.
8. To work towards disposal of duplicate and gift materials.
9. To investigate the use of Serial Management's System's Site program for on-line book ordering with a view to implementation to reduce staff time involved and to fill book order requests more promptly.

14. Publications 1987-88:

Nil

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 study activities are not potentially detrimental to the environment.

16. Duration:

Start: 1970

Completion: Ongoing

17. Resources 1988-89:

PYs:	Prof.:	Robinson	1.0
	Tech.:	Hopp	1.0
	Total:		2.0

O &amp; M: \$30,000

Capital: \$33,000 Sydney Automated Library System

18. Signatures:

David J. Robinson  
Investigator

C. D. Tut  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 12, 1988

1. Project: Information2. Title: Public Information and Media Relations3. New:                      Cont.: X                      4. No.: NOR-33-045. Study Leader: A. Ascher (Cooperator: P.S. Debnam)6. Key Words: Communications, public relations, media relations, public information, photography.7. Location of Work: Throughout region8. Problem:

Canadian Forestry Service activities throughout Western and Northern region are not well known, and lack of appreciation exists regarding the federal and provincial roles in forest research and management. Target audiences for our messages can include but are not restricted to the educated urban public, media, political representatives, business/financial groups and outdoors/environmental associations. Informed target audiences can prove to be valuable allies as we compete for a greater share of tax dollars to implement intensive forest management practices and corollary research endeavors.

9. Study Objectives:

1. Create increased public awareness and understanding of CFS and NoFC initiatives in the forestry sector, and inform target audiences of the benefits of the forest resource both to people in our region, and to Canadians as a whole.
2. Enhance internal CFS and NoFC communications opportunities to exchange information, solicit feedback, and to identify and act upon concerns or issues warrenting attention.
3. Provide a range of public and media relations services.
4. Provide a full range of photographic support services to NoFC personnel.

10. 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)

Added Goal:

19. Produce information video on Big Fish Lake Experimental Burning Project. (A.A.)

11. Accomplishments in 1987-88:

1. Coordinated information services and activities within NoFC, including translation, public information, public relations, media relations and photographic services. (A.A., P.D.)
2. Served on the following committees:
  - a. Canada-Alberta Forest Resource Development Agreement Public Information Subcommittee (A.A.)
  - b. Canada-Manitoba Forest Renewal Agreement Public Information Subcommittee (A.A.)
  - c. NoFC Awards Committee (A.A.)
3. Participated in the continued implementation of public information plans under the Canada-Manitoba FRA, and Saskatchewan and Alberta FRDA's. A tabloid detailing activities under the Canada-Manitoba FRA was written and printed. Official openings of facilities at the Pineland and Clearwater Provincial Nurseries were held. Advisory and translation assistance were given to the Saskatchewan District Office when required. Planning was begun on the content, printing and distribution of a tabloid detailing activities under the Canada-Alberta FRDA. (A.A.)

4. Developed public information and media materials and presentations including Canada-Manitoba FRA tabloid, media releases and backgrounders. (A.A.)
5. Acted as NoFC focal point for communication with the public by responding to inquiries for information, tours, presentations and the like. (A.A.)
6. Provided photographic and advisory services to NoFC research and research development projects including processing, printing, photo enlargement/reduction, specialized photography and layouts, and/or monitored the performance of contract services for same. Undertook field trip to gather photographic resource material on Alberta's aspen industry.
7. Incomplete owing to lack of opportunity to coordinate inventory transfer and develop access to computer inventory records of central stores re: photographic equipment. (P.D.)
8. Active working relationships with various media were maintained through delivery of media releases, follow-up phone calls, notification of various events and booking interviews with staff members. Selected media throughout the region continued to receive TIMBERLINES, and other information when requested. (A.A.)
9. Little opportunity arose to assist staff members prepare for media interviews for two reasons: few staff were contacted by the media this year, and the information officer was often informed of the interview after it had taken place. Media contact forms were generally completed by the staff members interviewed or by the Information Officer. Assistance given to some staff in identifying and/or promoting newsworthy activities, workshops, symposiums, etc. (A.A.)
10. Dialogue was maintained with regional director general, program directors and project leaders to assist in identifying events or programs suitable for promotion to our target audiences. (A.A.)
11. A new audio-visual presentation describing research and development activities of the Northern Forestry Centre was produced. In addition, two loop tapes of the audio are being produced so the presentation can be set up for continuous play at exhibition booths. (A.A.)
12. An audio tape for the Connie Fir mascot was produced. (A.A.)
13. Attempts were made to work with NoFC clients for joint promotional endeavors. (A.A.)
14. TIMBERLINES was published quarterly; minor refinements in content and layout were incorporated. (A.A.)
15. Information was gathered for an inventory of in-house photographic, video and computer-generated graphics systems. (A.A.)



16. Assistance was given to 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.)
17. The annual Program Review was published in cooperation with the Scientific and Technical Publishing Unit. (A.A.)
18. The first draft of an External Communications Framework was produced, as the basis for this study's contribution to an annual Information Project Workplan. (A.A.)
19. An informational video on the Big Fish Lake Experimental Burning Project was produced. (A.A.)

12. Present Status of Study:

Through development of a detailed external communications plan, efforts are being made to ensure target audiences are informed of NoFC and CFS initiatives. Efforts to date in the area of internal communications have been limited. Public and media relations services are provided when required. Provision of a full range of photographic services is ongoing.

13. Goals for 1988-89:

1. Coordinate information services and activities within NoFC, including translation, public information, public relations, media relations and internal communications. (A.A.)
2. Obtain management approval of an annual communications plan, based on the External Communications framework already drafted. Such a plan could include promotion and distribution of the Big Fish Lake Experimental Burning Project video; distribution of the Canada-Manitoba FRA tabloid; writing, printing and distribution of a Canada-Alberta FRDA tabloid, promotion of seed shipment to China, and start-up of planning for a 20th Anniversary Open House in 1990. (A.A.)
3. Develop public information and media materials, including media releases, feature articles, backgrounders, exhibits, brochures, videos and others as required. (A.A.)
4. Investigate means of improving internal communication in the region, including the feasibility of initiating a monthly newsletter. (A.A.)
5. Participate in the continued implementation of public information plans under the Manitoba FRA, and Saskatchewan and Alberta FRDA's (see NOR-36). (A.A.)
6. To publish or otherwise make available to staff members the results of the inventory of in-house video, graphics, etc. capabilities, including instructions to access these facilities. (A.A.)
7. Assist in the development of a sequence of steps to be followed when assembling audio-visual presentations. (A.A.)



8. To continue to publish TIMBERLINES four times a year, taking into account management objectives and public interest, and work to time its distribution with publications offerings. (A.A.)
9. To coordinate the publication of proceedings from the Mixedwood Symposium. (A.A.)
10. To coordinate the publication of a "Who's Who" of NoFC, in cooperation with the Scientific and Technical Publishing Unit. (A.A.)
11. To continue serving on NoFC Awards Committee, and any other in-house, regional, national and NGO working/advisory committees as required. (A.A.)
12. To participate as required in Government of Canada communications training workshop. (A.A.)
13. Provide photographic and advisory services to NoFC research and regional development projects including processing, printing, photo enlargement/reduction, specialized photography and layouts, and/or monitor the performance of contract services for same. Investigate the acquisition of slide duplication equipment. (P.D.)
14. Undertake field trips to gather photographic resource material as time allows. (P.D.)
15. Complete transfer of photography inventory, developing a system workable for both photo section and stores. (P.D.)

14. Publications 1987-88:

TIMBERLINES, Nos. 1, 2, 3, and 4. Author and editor, A. Ascher.

The Forestry Leader, published by the Canada-Manitoba Forest Renewal Agreement. Authors and editors, A. Ascher and C. Gauthier

Northern Forestry Centre. 1987. Program Review 1986-87. (Eds.). A. Ascher and B. Boughton. Can. For. Serv., North. For. Cent., Edmonton, Alberta.

### 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 study activities are not potentially detrimental to the environment.

16. Duration:

Start: 1987

Completion: ongoing

17. Resources 1988-89:


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

Total:	2.0
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O & M: \$15,000

Capital:

18. Signatures:

  
Investigator

  
Regional Director General

NOR-36

DEVELOPMENT AGREEMENTS

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Canada-Manitoba Renewal Forest Agreement and District Office
3. New:                      Cont.:    X                      4. No.:    NOR 36-01
5. Study Leader: J. McQueen (a summary of Manitoba District activities)

N.B. See details in separate study statements for:

Name

- |  |                            |
|--|----------------------------|
| i) Forest Pest management surveys & damage appraisal | 36-01-1                    |
| ii) Stand-tending/regeneration demonstrations        | (36-01-2) See NOR-36-01-12 |
| iii) Fire management                                 | 36-01-3                    |
| iv) Silvicultural guidelines for spruce              | (36-01-4) See NOR-36-01-11 |
| v) Jack pine seed orchards                           | 36-01-5                    |
| vi) Site classification                              | (36-01-6) See NOR-10-06    |
| vii) Nursery development                             | (36-01-7) See NOR-12-01    |
| viii) Forest economics                               | (36-01-8) See NOR-3-01     |
| ix) Forest inventory                                 | (36-01-9) See NOR-4-01     |
| x) Tree improvement                                  | (36-01-10) See NOR-12-03   |
| 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 Canadian Forestry Service in matters related to federal and provincial governments, industry and the general public.

#### 9. Goals for 1987-88:

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 1985/86 by the Agreement Directorate, including liaison with DSS, appropriate NFC/FEDC Office staff, contractors and provincial representatives.
5. Evaluation - Ensure development funding and implementation of projects pursuant to direction from the Canada Manitoba Directorate. 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 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 1987-88:

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. The Moose Lake Indian Band declined an opportunity to become involved in a thinning program on the Reserve. 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. By late 1987 it became apparent that growing techniques at both Dakota Plains and Dakota Teepee were less than adequate. Final resolution of the various problems has yet to be made.
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 200 townships in the southeastern corner of the Province have been completed and another 84 are in progress. The next area to be addressed will be the northwest corner of the Province including Manfor's FML.
4. The CFS was involved in thirteen community fairs during the year and made an estimated 50,000 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, produced in the spring of 1987, covered the work done during the

first two years of the agreement and makes recommendations for the remaining three years as well as providing recommendations for future agreements.

6. The Dutch elm disease work initiated with CEIC during the 1986-87 fiscal year was completed. No new CEIC programs were initiated.
  7. A variety of fire management training courses were presented to provincial staff. Analysis of fire weather and behaviour associated with the Wallace Lake wildfire was started and is expected to be completed next year. Through agreement funding we have started to compile a fire incidence data base for the years 1968 to 1986.
  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 1988-89.
  9. Forest Mensuration: 355 damage plots were measured in May and 110 were remeasured in the fall. A series of population study plots were 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 \$2,300,000.
  11. Developed and established the Interlake seed orchard with 22,000 Jack Pine seedlings. Maintained existing northern breeding district orchards. Developed a pedigreed seed orchard site at Oak Bank on Federal land. Prepared pedigreed seed and sowed seed at Hadashville. Carried out a major thinning and selection program in the Eastern District.
  12. Assessed container seedling performance in various regions of the Province. An experimental design and layout on the Abitibi FML was done. Stock site trials will commence next spring. Report preparation on a variety of silvicultural reports continued during the winter months.
11. Goals for 1988-89:
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 completing provincial forest inventory data.

4. Public Information - Ensure continued implementation and revision, as required, of the Public Information Strategy approved in 1985/86 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 become involved with the Western Diversification Office on forestry related matters.
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 Manitoba forestry work opportunities. Efforts will be made in the technology transfer area to provide information on increasing mill efficiency. A study on the Manitoba Christmas tree markets will be done. An opportunity id conference will be planned with the idea of holding the conference in early winter 1988 being given strong consideration.
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 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 1987-88:  
  
See individual study statements especially those relating to economic, fire management and forest research.
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 1988-89:

PYs: Agreement: 9.0  
A-base: 4.0

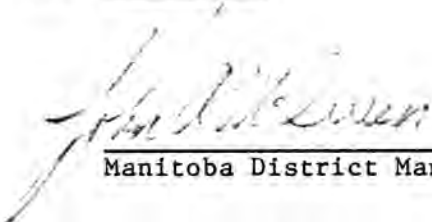


Total: 13.0

O & M: 648.8 K + 2.0 K A-Base

Capital: 200.0 K

Salaries: 400.0 K

Grants & Contributions: 1598.5 K

15. Signatures:  
\_\_\_\_\_  
Manitoba District Manager  
\_\_\_\_\_  
Program Director, Development  
\_\_\_\_\_  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

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: Marilyn 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 impact 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 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)

10. Accomplishments in 1987-88:

1. Continued assessment of defoliation of the buds from the jack pine tree to examine possible relationship between jack pine budworm counts and defoliation intensities. (Daoust-Savoie)
2. Assessed cumulative and current defoliation from the jack pine budworm in the remaining 330 "Damage Appraisal Permanent Plots". 355 permanent plots were initially established for this study; 25 plots have been cut out. The increment cores collected from the 1986 established plots have been processed on the Digi-Mic. (Daoust-Savoie)

3. The jack pine budworm phenology study was continued for its second field season. Eight trees were selected from each of the same two locations Sandilands and Belair used in the first field season, 1986. The 16 trees were visited weekly for 12 weeks from the end of May to the middle of August. A total of 576 samples were taken. The results from the buds measured, male flowers, female cones and jack pine budworms counted have been entered into computer data sets. The results from 1986 and 1987 field seasons have been compared. (Daoust-Savoie)
4. The population study of the jack pine budworm in Sandilands, Kettle Hills, and Manigotogan went into its second field season for the collection of budworm larvae and pupae and the third field season for the egg mass collection. A total of 3888 branch samples were examined; budworm larvae, pupae and eggmasses extracted and preserved. The buds from the egg mass sample collections were also examined and the rate of defoliation recorded. The results have been placed into data sets and the statistical analysis begun. (Daoust-Savoie)
5. The head capsules of the jack pine budworms extracted from the jack pine "Population" and "Phenology" study were measured. The budworms were then placed into the appropriate instar according to the head capsule measurements (taken from Dr. Vince Nealis report "The Number of Instars In Jack Pine Budworm, Choristoneura pinus pinus Free ) and a flow chart has been designed showing the growth of the instars over the field season. (Daoust-Savoie)
6. Jack pine pheromone traps were placed in the three population study plots: Sandilands, Kettle Hills, and Manigotogan, and the two phenology plots: Belair and Sandilands. The results have been entered into computer data sets. (Daoust-Savoie)
7. The last eight out of the nine permanent sample plots have been measured. The distance between each tree within the cells have been measured and recorded. (Daoust-Savoie)
8. Aerial and ground surveys were conducted. The areas of moderate to severe infestations were mapped for major forest pests (jack pine budworm, spruce budworm, and aspen defoliators ) of Manitoba. (Grandmaison)
9. The special surveys conducted for particular pests or designated area, were as follows:  
  
Conducted a pest survey in Riding Mountain National Park. Conducted pest surveys in young plantations and high value stands. (Grandmaison)
10. Compiled and reported on the forest pest situation in Manitoba. (Manitoba Forest Insect and Disease Conditions 1987, File Report.) (Grandmaison)
11. Performed an annual assessment (two visits) on the four ARNEWS plots. (Grandmaison)

12. Provided pest extension service and technology transfer to various client agencies and the general public. (Grandmaison, Daoust-Savoie)
13. Provided assistance in:
  - The design, editing and supervision of plates for the "Heritage Trees of Manitoba" for the Manitoba Forestry Association.
  - The collection of insect and wood samples for W. Ives and R. Wong's book "Tree and Shrub Insects of the Prairie Provinces".
  - A survey of known introduced pests with R. Wong.
  - Sampling of diseased red pine with K. Mallett. (Grandmaison)
14. Initiate a slide-tape presentation on major insect and disease problems in Manitoba. (Cooperation with MOU.) (Grandmaison)
15. NoFC and CFS were represented at the following workshops, committees, and advisory groups:
  - Regional Insect and Disease Technical Advisory Committee (March, Oct.) (Grandmaison, Daoust-Savoie), North Central Pest Workshop (Oct.) (Daoust-Savoie), Annual Forest Pest Review - Northern Ontario (Oct.) (Grandmaison, Daoust-Savoie).
  - Committee on Plantation Pests Survey (5 meetings) (Daoust-Savoie, chairman) (Oct.) (Grandmaison)
  - Eastern Spruce Budworm Research Work Conference (Daoust-Savoie)
  - Dutch Elm Disease Research Committee. (Grandmaison, Daoust-Savoie)
  - Dutch Elm Disease Advisory Committee. (Grandmaison)

11. Goals for 1988-89:

1. Continue assessment of possible relationship between microsporangiate bud counts and defoliation intensity in the prediction of future defoliation of the jack pine budworm. (Daoust-Savoie)
2. Assess cumulative and current defoliation from the jack pine budworm in the "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 Belair, Sandilands, Kettle Hills, Sandilands (Haddashville) and Manigotogan plots. (Daoust-Savoie)
6. Complete analysis of the data from the Jack Pine Budworm Phenology Study. (Daoust-Savoie)
7. Complete analysis of the data of the Jack Pine Budworm Population Study. (Daoust-Savoie)

8. Survey, map and report on major forest pest of Manitoba (jack pine budworm, spruce budworm, forest tent caterpillar, etc.) (Grandmaison)
  9. Conduct special surveys for particular pests or of designated areas. (Grandmaison)
  10. Conduct pest surveys of young plantations and high value stands. (Grandmaison)
  11. Compile and report on the forest pest situation in Manitoba for 1988 and pest predictions for 1989. (Grandmaison)
  12. Perform annual assessments on the four ARNEWS plots. (Grandmaison).
  13. Participate in the completion of a slide/tape presentation of major pest problems in Manitoba. (Grandmaison, Daoust-Savoie)
  14. Participate in the annual Regional Insect and Disease Technical Advisory Committee meeting. (Grandmaison, Daoust-Savoie)
  15. Provide pest extension service and technology transfer to various client agencies and the general public. (Grandmaison, Daoust-Savoie)
  16. Represent NOFC and CFS on various provincial forest insect and disease committee and advisory groups. (Grandmaison, Daoust-Savoie)
12. Publications 1987-88:
- File Report: Pest Conditions in Manitoba 1987.(Grandmaison)
- File Report: Status Report: Jack Pine Budworm Phenology Study in Manitoba.
- Status Report: Jack Pine Budworm Population Study in Manitoba. (Daoust-Savoie)
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 1988-89:
- |      |               |               |     |             |
|------|---------------|---------------|-----|-------------|
| PYs: | Prof.:        | Daoust-Savoie | 1.0 | (Agreement) |
|      | Tech.:        | Grandmaison   | 1.0 | (A-base)    |
|      | Total:        |               | 2.0 |             |
|      | Term/Student: |               | 0.0 |             |

O & M : \$9,080 (Daoust-Savoie)

O & M : \$6,000.00 (A-base no. 1101.)(Grandmaison)

Capital:

Grants & Contributions: CFS \$33,000/\$33,000 MFB

CFS \$39,000/\$39,000 MFB (Environment  
Project)

15. Signatures:

Martin Louis  
Investigator

                      
Supervisor

G. J. A. Voz  
Technical Advisor

John H. Lewis  
District Manager

Mark E.  
Program Director, Protection

Steve Price  
Program Director, Development

G. D. Hunt  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Fire Management (Manitoba)
3. New:                      Cont.: X                      4. No.: NOR-36-01-3
5. Study Leader: K.G. 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 1987-88:
  1. Continue to enhance the relationship between fire research and operations in Manitoba 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.
  - c) participating and/or instructing at regional and provincial training courses.
- 2. In cooperation with the Province, develop and conduct training courses on fire behavior.
- 3. Establish a formal research working group within the province which could provide input the regional technical subcommittee.
- 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. Continue the compilation and analysis of the relationship of fire weather and fire danger to fire activity in Manitoba.
- 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,
  - b) completing a case study on extreme fire behavior in Manitoba,
  - c) if possible, obtain field observations of extreme wildfire behavior.
- 7. Produce and distribute (within Manitoba) three bulletins on various fire management topics.
- 8. Continue to provide advice and services on various fire management topics, especially to the provincial fire management organization.
- 10. Accomplishments in 1987-88:
  - 1. - Represented the CFS fire research project at the province's Annual Fire Program Meeting, November 24-25, in Winnipeg.
    - Made presentations on the FBP System at three regional fire meetings held this spring.
    - Held one or two day meetings with each of the six regional Fire Control Officers to discuss fire management and fire research in Manitoba.
  - 2. Organized and conducted two Fire Behavior Prediction Workshops held January 11-14 and February 1-4, 1988 at Hecla Island. Attendees included 31 provincial Natural Resource Officers and representatives from MANFOR and Abitibi-Price Inc.

3. A formal fire research working group comprized of four Regional Services staff (both management and field staff) and one CFS person was established. The direction for this group is now provided by the provincial organization and two meetings were held this year.
4. C. Ogilvie (NoFC) completed the seen area maps for all of the province's fire towers and the information was used by a consultant to complete a report on the effectiveness of the entire detection system.
  - Work by R. Dixon (Manitoba Remote Sensing Centre) on forest fuel type mapping continued but this project is no longer being funded by the agreement.
  - Funding was provided to B. Lee (NoFC) to support his work on expert systems for prescribed burning and initial attack dispatching.
  - Assisted in the arrangements and logistics which will send five Manitoba Natural Resources staff to the course entitled Fire and Resource Management for Line Officers and Resource Managers. It will be held February 29 to March 11, 1988 at the National Advanced Resource Technology Centre in Marana, Arizona. Funding was provided through the Agreement.
5. A fire occurrence database for the period of 1968-86 has been compiled, checked for accuracy and errors have been corrected. This work was done by Dave Hahn who was hired under the Agreement.
6. A poster comprized of 23 representative photos of the FPB System fuel types in Manitoba was published (see section 13).
  - Observations of extreme fire behavior and on-site fire behavior predictions were made at the 1987 Wallace Lake Fire were made and used by the provincial overhead team. Pertinent weather data and fire behavior information has been analyzed. This information was used at a number of workshops and presentations and will be formally published in 1988-89. An article entitled "An Overview of the 1987 Wallace Lake Fire, Manitoba" was submitted to Fire Management Notes for publication.
  - Fire behavior information for the 1987 Woodridge Fire was also collected but no analysis has taken place at this time.
7. Two Technology Transfer Notes were produced and distributed (see section 13 for titles).
8. Provided information to provincial staff regarding the potential for and requirements needed to conduct prescribed burns in both the Duck Mountains and Lake St. George areas.

Publications on a variety of fire management topics were distributed to fire management personnel upon request.

- In cooperation with AES a second set of data was collected with regard to evaluating the accuracy of the thermo-hygrometer.
- A Fire Weather and Fire Behavior Workshop is to be held at Riding Mountain National Park, March 15-17, 1988. Eighteen Parks Canada staff will be in attendance.
- Served as a member of the Central Region Fire Weather Committee and coordinated the Fourth Scientific and Technical Seminar held April 2, 1987 in Winnipeg. A file report outlining the four presentations has been completed.
- Assisted in the coordination of an equipment demonstration during which Chuck Ogilvie (NoFC) showed the effectiveness of a "blower" in fighting grass fires. Approximately 40 provincial staff attended.
- Participated in the public information programs during Forest Week and at the Thompson Nickel Days (July 9-13, 1987).

#### 11. Present Status of Study:

1. Various technology transfer activities have been undertaken to improve and advance fire management in Manitoba. This includes:
  - planning and conducting workshops and training courses on recent developments in fire weather, fire behavior, and fire management planning,
  - demonstrations of new fire fighting equipment and computer programs,
  - publication of newsletters (2/year) and posters on topics of current interest to fire management staff, and
  - distribution of publications on various fire management topics plus personal consultation.
2. To assist the identification of research needs, meetings are held annually with regional and provincial fire management staff. A formal committee composed of field and management staff has also been established to deal with fire research matters in the province.
3. A number of applied research projects have been conducted in order to assist fire managers in their decision-making process. This includes:
  - an analysis of the provincial fire weather stations and instrumentation used,
  - the development of a fire occurrence database for the period of 1968-86,
  - the compilation of all available fire weather data,

- an analysis of the efficiency of the present fire weather station network,
- a report on the use of Bird-dog aircraft in Manitoba, and
- an analysis of some examples of extreme fire behavior in Manitoba.

The objectives of this study are on-going and will be continued under the present Canada/Manitoba Forest Renewal Agreement.

12. Goals for 1988-89:

1. Maintain liaison between fire research and operations in Manitoba 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,
  - c) continue to participate as a member of the Manitoba Fire Research Committee,
  - d) continue to provide advisory services on fire weather and serve as a member of the Central Region Fire Weather Committee.
2. Continue to monitor and provide input and direction to research projects and other fire management activities conducted under the Agreement.
3. Complete a file report on the accuracy of the thermo-hygrometer.
4. Finish the analysis of the fire occurrence database (1968-86) and complete a file report showing any significant trends in Manitoba. A formal presentation of this report will be made to the province.
5. Publish an article and an Information Report on the fire weather and fire behavior associated with the 1987 Wallace Lake Fire.
6. Collect fuel loading, fire weather and fire behavior data on a prescribed fire conducted by the province at Lake St. George.
7. Assist in the field work associated with the Lowland Black Spruce Experimental Burning Project at Big Fish Lake (NOR-05-05).
8. Continue to provide technology transfer services by:
  - a) participating in and conducting workshops on various topics (e.g., fire weather, fire behavior) upon request from the province,
  - b) producing and distributing two Technology Transfer Notes on topics related to fire management in Manitoba.



- c) continuing to provide advice and services on fire management topics, especially to the provincial fire management organization.

13. Publications 1987-88:

- Hirsch, K.G. 1987a. A Brief overview of the Canadian Forest Fire Weather Index (FWI) System. Govt. Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man. Tech. Trans. Note M-001. 2 p.
- Hirsch, K.G. 1987b. An example of the sensitivity of the Canadian Forest Fire Weather Index (FWI) System to small fire weather observation changes. Govt. Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man. Tech. Trans. Note M-002. 2 p.
- Hirsch, K.G. (compiler) 1987c. Fire Behavior Prediction Workshop (manual), Hecla Island, Manitoba, February 16-19, 1987. Govt. Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man. Study NOR-36-01-3 (NOR-36-06) File Report No. 2. [Three-ring binder; limited distribution].
- Hirsch, K.G. 1988a. Examples of the Canadian Forest Fire Behavior (FBP) System fuel types in Manitoba. Govt. Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man. (poster with text).
- Hirsch, K.G. (editor) 1988b. Proceeding of the Fourth Central Region Fire Weather Committee Scientific and Technical Seminar, April 2, 1986. Gov't Can., Can. For. Serv., Man. Dist. Office, Winnipeg, Man. Study NOR-36-01-3 (NOR-36-06) File Report No. 3.

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. Duration:

Started: 1984                      Completion: 1989

16. Resources 1988-89:

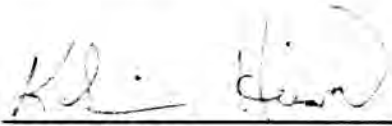
PY's: Prof.: Hirsch 1.0

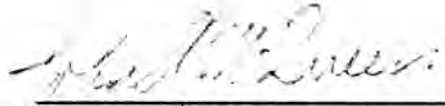
Student:                      0.4

Tech:                          0.0

O & M: \$11,080

17. Signatures:

  
Investigator

  
District Manager

  
Technical Advisor

  
Program Director, Development

  
Program Director, Environment

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

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 1987-88:
  1. In cooperation with Manitoba Forestry Branch (MFB) operate and share the use of Tree Improvement Facility (TIF) 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 Southeast 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 seedlings, initiate and complete site development, plan 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.

Added Goals:

7. Measure benchmark trees in the IMSSO and carry out maintenance.
8. Rear seedlings for Public Awareness Program.

10. Accomplishments in 1987-88:

1. Major accomplishments were achieved by operating the new Tree Improvement Facility the first full year, meeting all expectations. A maiden crop of 40,000 excellent quality jack pine seedlings were reared.
2. An establishment report for the Northern Mass Selection Seed Orchard is in progress and scheduled for completion in March 1988. Survival and growth is excellent one year after planting. First annual post planting maintenance was carried out.
3. Pedigreed seed for the Eastern Breeding District was extracted and processed. Crop rearing of 12,500 jack pine seedlings was completed by November 1, 1987. Major site development (debris disposal, land breaking and landfilling) was completed. Minor land levelling and irrigation remains to be done at the Oakbank orchard site.
4. Seed Production Areas in the Southeast Region are established on 15 year assessment data. Final minor culling was carried out on the Mass Selection Orchard (1972) at Oakbank to facilitate seed collection. Entire cone crop was collected by Manitoba Forestry Branch (MFB).
5. Interlake Mass Selection Seed Orchard was developed (site cleared and soil worked over) and established (20,000 plottrees, plus 2,000 border trees were planted) including fencing and fireguarding.
6. Alternate needs and orchard options for the Western Region are being considered by MFB. All clonal orchard stock on-hand for this region was root and canopy pruned and inventoried in May 1987.

7. Completed measurement of 8,000 benchmark trees in the IMSSO and carried out post planting maintenance scheduled for 1988.
8. Reared 5,000 colorado spruce seedlings for the Public Awareness Program.

11. Goals for 1988-89:

1. In cooperation with MFB continue to operate and share the use of the Tree Improvement Facility at Pineland Forest Nursery.
2. Prepare a comprehensive establishment report for the IMSSO and work towards developing a joint maintenance schedule with MFB Regional staff.
3. Complete Oakbank orchard site development (land levelling and irrigation installation). Complete crop rearing of pedigreed stock. Complete orchard establishment (plot layout and planting) including fencing and fireguarding.
4. Follow through with second phase of the EBD thinning process (uproot and remove 6,000 stumps and relocate all plot pins).
5. Select the base option for the Western Region orchard or procure clonal stock only.
6. Develop a joint maintenance program for the NMSSO with MFB staff in the Northern Region.

12. Publications 1987-88:

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 1988-89:

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

O & M: \$30,000 (+ 43,000 contracts)

Capital:

Grants & Contributions:

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

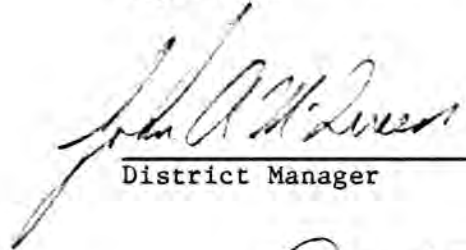


15. Signatures:

  
Investigator

  
Supervisor

  
Technical Advisor

  
District Manager

  
Program Director, 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 developement 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				Prepare a complete and comprehensive establishment report for each of the jack pine seed orchards for MFB

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



SCHEDULE

GREENHOUSE CALENDAR FOR GROWING JACK PINE ORCHARD STOCK

YEAR	1986					1987					1988					1989																
MONTH	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Breeding District (Orchard)	NMSSO		TEST PERIOD		IMSSO		EBD		PEDIGREED		ORCHARD		CBD		ORCHARD																	
Growing time frame shown for each respective orchard crop	in out		Monitor climate control system		Seed Grow 40,000 Seedlings to a height of 30 cm		Seed Grow 8,800 Seedlings to a height of approx. 40 cm				Cull crop to 4,400 seedlings and grow to 90 cm tall				Start growing Orchard stock																	

IMSSO - Interlake Mass Selection Seed Orchard

EBD - Eastern Breeding District

CBD - Central Breeding District

NMSSO - Northern Mass Selection Seed Orchard

## STUDY WORK PLAN

1988-89

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Silvicultural research and technology transfer, Manitoba.
3. New:               Cont.: X
4. No.: NOR-36-01-11
5. Study Leader: W.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 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 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 in RMNP". (Kolabinski)
10. To compile and analyze MS-211, MS-216, MS-228 data. (Kolabinski)

10. Accomplishments in 1987-1988:

1. To determine seedling performance differences that may result from trenching and non-trenching on open areas and strip areas (for black and white spruce container and container-transplant stock) four split-plot experiments were planned and established for 1988 spring planting near Pine Falls. Winter-bladed strips and open areas were examined in March immediately after blading; areas were selected in early summer for trenching and herbiciding in August followed by actual block layout in September. The proposed work was discussed on-site in September with P. Hall, R. Smith and J. McQueen and a copy of the layout provided to each.
2. First-year field performance of various operational and experimental container stock types was evaluated by pinning and measuring 17 plots (Pine Falls, Pigeon River, Lac du Bonnet, Jackhead Lake, Sandilands and the Pas) in early summer followed by destructive assessment in October. Dry weights and analysis were completed in November and a file report is in preparation.
3. Supervised study NOR-36-01-3.
4. Numerous contacts were made with Manitoba government nurserymen, field and industrial foresters in preparation for goals 1 and 2. Toured on-going regional site classification work in the Duck Mountain with I. Corns and regional foresters. Visited Abitibi wetlands with G. Hillman. Attended the 1987 Regional Reforestation Technical Committee Meeting in Alberta etc.

5. Worked on MFA Forestry Week and Heritage Tree Committees and CFS booth at Red River Exhibition and Forestry Week. Served on the executive of the Manitoba Section of the CIF/LFC. Collected diameters of 100 suspected triploid aspen in Riding Mountain National Park and provided the data with a tree-map to the Section and to Parks Canada.
6.
  - a. A Forest Management Note manuscript, Site Preparation Affects Seedling Performance after 20 years, was submitted to NoFC in December.
  - b. A Forest Management Note manuscript, Seeding and Planting on Shallow Rocky soils, Manitoba will be submitted in March.
  - c. A Forest Management Note, Container Seedling Field Performance After 10 Years by Walker and Ball was published in August.
7. A preliminary examination of the four Porcupine Mountain MS-228 shelterwood areas indicated that although logged since establishment remeasurements are possible.
8. Field measurements were completed for MS 216 Area 1, MS-228 Area 1 and MS-211 Area 5. This completes field measurements for MS-211 and MS-216.
9. Following consultation with R. Waldron detailed remeasurements were dropped due to lack of existing time in the Agreement. Certain aspects of this work are being examined by N. Walker.
10. A File Report, Effects of Strip Cutting, Shelterwood Cutting and Seedbed Treatment on Growth and Regeneration of White Spruce, RMNP, Manitoba, was sent to Parks Canada in December.
11. Present Status: Continuing.
12. Goals for 1988-89:
  1.
    - a. To establish a spruce stock-site trial in cooperation with Abitibi-Price Inc. near Pine Falls by supervising planting and taking outplanting measurements. Soil moisture data will be collected bi-weekly from all areas during the growing season.
    - b. To prepare an establishment report for (a).
    - c. To select areas and carry out block layout for a second planting replication in spring 1989 in anticipation of a new 1989 Agreement.
  2. To assess Soviet Scots Pine provenance trials in the Sandilands Forest Reserve and at Cowan and conduct a short tour for major Christmas tree growers in Manitoba.
  3. To supervise study NOR-36-01-3.

4. To perform liaison and technology transfer with Manitoba and CFS personnel.
5. To participate in a number of public awareness activities.
6. To complete all publications on MS-226, MS-238 and MS-229.
7. To complete field measurements on MS-228 shelterwood cutting (4 areas in the Porcupine Mountain). (Kolabinski)
8. To complete revisions required for MS-182 manuscript. (Kolabinski)
9. To compile and analyse MS-228 shelterwood data and prepare a report. (Kolabinski)
10. To compile and analyse MS-211-216 and prepare a report.
11. To organize a number of CFS public information displays in Winnipeg and rural Manitoba. (Dyck)

13. Publications 1987-88:

Walker, N.R.; Ball, W.J. 1987. Container Seedling Field Performance after 10 years. Can. For. Serv., North. For. Cent., Edmonton, Alberta. For. Manage. Note 44.

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. Duration:

Started: 1984                      Completion: 1989

16. Resources 1988-89:

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

Total:                      3.0

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

Total:                      \$17,473

Capital:

Grants & Contributions:



17. Signatures:

W.B. Bell  
Investigator

\_\_\_\_\_  
Technical Advisor

John A. McQuinn  
District Manager

Steve Drier  
Program Director, Development

C. D. Hunt  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Forest Renewal and Intensive Forest Management (Manitoba)
3. New:                      Cont.: X                      4. No.: NOR-36-01-12
5. Study Leader: N. M. 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
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 1987-88:

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. Monitor industry quarterly advance payment requests, progress claims, and program budgets.
4. Identify Native Bands for silvicultural project involvement and where applicable administer and implement suitable renewal and/or stand tending operations.
5. 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, plus any other suitable study plots, select additional field plots for use as Demonstration Areas in Manitoba.
6. Remeasure, as appropriate, selected Demonstration Areas and prepare appropriate short reports outlining treatments and updated results.
7. 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.
8. In co-operation with the Manitoba Forestry Branch and the Forestry Relations officer (NoFC) prepare and erect appropriate demonstration plot signage.
9. Distribute the Forest Management Demonstration Manual and Notes to provincial foresters and update as required.
10. Transfer the Forest Management Demonstration Notes, and change as required, to the general public.

Added Goals:

11. Prepare and present a Juvenile Spacing Training Workshop.
12. Coordinate the Wadell Scarification trials in Manitoba.

10. Accomplishments in 1987-88:

1. The two major forest industry companies in the Province (Abitibi-Price and Manfor) were involved in a variety of reforestation and stand tending activities during the year. These included surveys (8382 ha), site preparation (851 ha), cone collections (18 hl), tree planting (171095lt), herbicide treatments (501 ha), juvenile spacing & conifer release (506 ha), and direct seeding (40 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 (668000 seedlings).
3. Abitibi-Price and Manfor quarterly advance payment requests, progress claims, and budgets were monitored with total expenditures under Programs A-2 and B-4 amounting to \$1 053 740.00.
4. A stand tending project for the Moose Lake Indian Band through the Moose Lake Loggers was indefinitely suspended due to severe winter drying on the contract site.
5. 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:

D - MS - 093 Scarification, wS, Riding Mountain

D - MS - 093 Aerial Spraying, tA, Riding Mountain

Other suitable plots chosen were:

Prescribed Burning, bS, Sandilands Provincial Forest  
Planting, sP, Skinners Nursery, Dropmore

6. In 1987-88 field measurements were taken from the scarification and aerial spraying operations in Riding Mountain and from the sP plantations at Dropmore. A report on the scarification operation has been drafted and is ready for review. A second report based on MS-90 Seeding in Duck Mountain remeasured in 1986-87 has been reviewed and approved, and is ready for final editing.
7. Location maps have been prepared for all published reports and proposals. All demonstration areas located on Crown Land have been registered with the Manitoba Crown Land Registry.
8. Demonstration plot signs (58) have been erected in four Demonstration Areas on Crown Land.

9. Two hundred and fifty Manitoba Forestry Demonstration Areas Manuals with seven Forest Management Demonstration Notes have been printed and distributed by the Province.
  10. Transfer of the Forest Management Demonstration Notes to the general public has been reconsidered as more areas are required before they may be of interest to the public.
  11. Coordinated and instructed a Juvenile Spacing Training Workshop in The Pas on September 29 and 30 for silvicultural contractor/worker development.
  12. Coordinated the Manitoba portion of the Silva Wadell Scarification Trials.
11. Goals for 1988-89:
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. Monitor industry quarterly advance payment requests, progress claims, and program budgets.
  4. Identify Native Bands for silvicultural project involvement and where applicable administer and implement suitable renewal and/or stand tending operations.
  5. 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.
  6. Remeasure, as appropriate, selected Demonstration Areas and prepare appropriate short reports outlining treatments and updated results.
  7. 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.
  8. In co-operation with the Manitoba Forestry Branch and the Forestry Relations officer (NoFC) prepare and erect appropriate demonstration plot signage.
  9. Assist in distributing the Forest Management Demonstration Manual and Notes to provincial foresters and update as required.



## 12. Publications 1987-88:

- Walker, N.R. 1987. Elk and Moose Browsing Prevents the Growth of A New Trembling Aspen/Balsam Poplar Forest. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 2:7-10.
- Walker, N.R. 1987. Post-Burn Interval Does Not Enhance Direct Seeding or Planting Survival of Jack Pine. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 4:17-22.
- Walker, N.R. 1987. Naturally Regenerated Jack Pine Has Improved Stem Form. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No 5:23-29.
- Walker, N.R. 1987. Barrel and Chain Scarification Promotes Successful Jack Pine Regeneration in Southeastern Manitoba. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 6:31-34.
- Walker, N.R. 1987. Regular Spacing Increases Merchantable Volume in White Spruce. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 7:35-37.
- Walker, N.R.; Witt, D.R. 1987. White Spruce Transplant Stock Grading Increases Yields, 59 Years After Planting. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 1:3-6.
- Walker, N.R.; Witt, D.R. 1987. White Spruce Sawlogs Produced 68 Years After Planting. Can.-Man. Econ. Reg. Dev. Agreement. For. Mgmt. Dem. Note No. 3:11-15.

## 13. Environmental Implications:

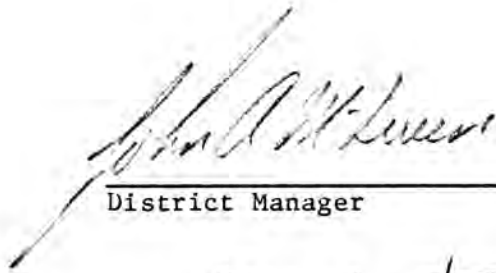
The agreement manager has been directed by management committee to include all pertinent environmental information on the PAF associated with this project. The PAF will serve as the official document which the environmental screening committee will review.

## 14. Resources 1988-89:

PYs: Prof.: Cataldo	1.0
Tech.: Walker	1.0
Total:	2.0
Term/Student:	0.0
O & M	\$22,000
Capital:	Nil
Grants & Contributions:	\$

15. Signatures:

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Investigator

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District Manager

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Program Director, Development

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Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY STATEMENT

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 20, 1988

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)  | See NOR-10-03 |
|   | (NOR-36-02-1A) | See NOR-10-03 |
|   | (NOR-36-02-1B) | See NOR-7-04  |
|   | (NOR-36-02-1C) | See NOR-3-01  |
| ii) Tree Improvement (Alberta)                          | (NOR-36-02-2)  | See NOR-12-03 |
| iii) Wetland Drainage (Alberta)                         | (NOR-36-02-3)  | See NOR-28-03 |
| iv) Forest Pest Management & Damage Appraisal (Alberta) | NOR-36-02-4    |               |
| v) Managed Stand Yield Tables (Alberta)                 | (NOR-36-02-5)  | See NOR-4-10  |
| vi) Demonstration Project (Alberta)                     | (NOR-36-02-6)  | See NOR-10-04 |
| vii) Forest Economics & Statistics (Alberta)            | (NOR-36-02-7)  | See NOR-3-01  |
| viii) Public Information (Alberta)                      | (NOR-36-02-8)  | See NOR-33-04 |
| ix) Boreal risk factor modelling                        | (NOR-36-02-9)  | See NOR-28-07 |

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: Alberta wide and NoFC, Edmonton.
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 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 Devmis and CFS's Financial Information Systems);
  - to ensure collection of data required for Agreement evaluation; and
  - provide coordination for Agreement implementation and maintain liaison with the provincial members of the Program Management Committee.
- B. Development general:
1. Provide staff functions as required to District Managers in Winnipeg and Prince Albert in the implementation of the Canada-Manitoba and Canada-Saskatchewan Agreements, and job creation projects. 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.



# 11. Accomplishments in 1987-88:

## A. Alberta Agreement:

### 1. Reforestation:

- implemented 12 projects ranging in value from \$7,300 to \$30,000 and involving activities including release cutting tree planting & management plan development.
- projects handled by two forestry officers.
- reviewed provincial direct delivery proposals.

### 2. Forestry Research Development Demonstrations

- served as secretary to B.3 committee.
- maintained records & monitored 20 B.3 projects ranging in value from \$16,000 to \$201,000 - for details see NOR-3, 4, 7, 10, 12, 28, 33.
- implemented 8 cost shared and 18 federal direct delivery projects ranging in value from \$5,000 to \$573,000.

### 3. Public Information, Evaluation & Administration

- implemented 12 project ranging in value from \$1,500 to \$153,000.
- for details re: Public Information see NOR-33.

## B. Development General:

1. Assisted district Managers as required and where possible.
2. Reviewed Saskatchewan project authorization forms only & coordinated approval process for Saskatchewan only.
3. Implemented DEVMIS as much as possible and with the assistance of personnel under NOR-51.
4. No major program for job development in 1987-88.

# 12. Goals for 1988-89:

1. Manage Alberta Agreement as required by NoFC management committee & program director.
2. Assist with Manitoba and Saskatchewan agreements if required.

13. Publications 1987-88:

Nil

a) Reports prepared: See attached list.

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 1988-89:

PYs:	Prof:	Price	1.0	(A-Base)
		Côté	1.0	
		Stephen	1.0	
	Support:	Abma	1.0	
	Total:		4.0	
	Term:	Mrklas	1.0	


Contracts/O &amp; M: \$1,542,500 + \$2,000 A-base

Capital: \$20,000

Grants &amp; Contributions: \$500,000

16. Signatures:

  
 Alberta Agreement Manager

  
 Program, Director, Development

  
 Regional Director General

## REPORTS PRINTED UNDER CANADA-ALBERTA F.R.D.A. 1987-88

Name	Author(s)
Review of Pulping and Papermaking Properties of Aspen	Arbokem Inc. Al Wong
Directory of Primary Wood-Using Industries in Alberta-1986	C.R. Bamsey
1986 Site Preparation-Donaren 180 D Powered Disk Trencher and Sinkkila HMF Scarifer	D.A. Gibbard B.J. Sutherland
Risk Management in Forest Planning	W.R. Dempster N.A. Stevens
Microcomputer PSP Catalogue System (MPC) Guide to Operation - User's Manual	Silvacom Ltd. CFS-NFC
Aspen Quality Workshop	Proceedings
Preparation of Pulp From Sound Alberta Aspen and Balsam Poplar by Various Processes	Econtech Services Ltd. Paul. R. Thomas
Aspen Shingles and Shakes in Alberta	Foal Enterprises Inc.
Spruce Budworm in the Footner Lake Forest - 1987	P.A. Amirault H. Gates S. Neiderleitner
Workshop on Aspen Pulp	Proceedings
Dimential Stabilization - FP 2.4.1.	ARC
Isocyanates (M.D.I.) - FP 2.2.1.	ARC
Oriented Strandboard (O.S.B.) Optimization FP 2.1.1.	ARC
Alberta Aspen vs Black Poplar Wood Quality Differences	ARC
Coating and Embossed Panel - FP 2.5.1.	ARC
Aspen vs Black Poplar - Phase I-FP 2.6.1.	ARC
Stressed Skin Panels - FP 2.3.1.	ARC
Machine Stress Rating Panel Products	ARC

Report on Cement-bonded particleboard, its applications and a preliminary assessment of a plant to be located in Alberta

Ligna Technologies Ltd.

An assessment of applications and markets for lignin from steam pre-treated aspen wood, with emphasis on enhanced oil recovery

R. Sutcliffe  
Forintek Canada Corp.

Application of scanning and imaging techniques to assess decay and wood quality in logs and standing trees

J.R.T. Hailey  
P.I. Morris  
Forintek Canada Corp.

Potential for lignin-based adhesives  
state-of-the-art review

P. Steiner  
Forintek Canada Corp.

Light - Coloured, fast-curing, phenolformaldehyde adhesives for waferboard and oriented-strand board

P. Steiner  
Forintek Canada Corp.

Canada-Alberta Forest Resource  
Development Agreement

1988-89

	PYs	O&M	Contracts/ Supplies	G & C	Capital
NOR-36-02					
A.2 Reforestation	1.0	7,400	32,600	150,000	-
B.3 Forestry R&D	2.0	-	930,500	20,000	-
B.4 Hardwood R&D	-	-	441,830	330,000	-
C.5 Public Information	-	-	113,150	-	-
C.6 Evaluation	-	-	25,000	-	-
C.7 Administration	2.0	-	12,000	18,000	20,000
TOTALS:	5.0	7,400	1,555,080	518,000	20,000



## CANADIAN FORESTRY SERVICE

## STUDY STATEMENT

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Forest pest management and damage appraisal (Alberta)
3. New:                    Cont.: X
4. No.: NOR-36-02-4
5. Study Leader: P. Amirault
6. Key words: Damage appraisal, diagnostic and advisory services, forest management, forest pests, forest pest surveys, hazard rating, pest impact, technology transfer.
7. Location of Work: Northern Forestry Centre; Alberta-wide
8. Background:

The Province of Alberta, like other jurisdictions in Canada, is adopting "intensive" forest management techniques. This has implications for all fields of forest research and planning, and implies that damage caused by forest insects and diseases will be minimized. This was recognized in the Canada-Alberta Forest Development Agreement as funds were allotted for forest insect and disease studies. The proposal which governs the agreement is a comprehensive document which outlines a wide variety of potential areas of study. While varied, these areas of study are designed to compliment existing Forest Insect and Disease Survey (FIDS) programs. The studies initiated as a result of the Canada-Alberta Forest Resource Development Agreement are intended to provide information that will enhance and improve the survey and management of forest pests in Alberta.

9. 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 existing methods to assess population and infestation levels of forest pests.

10. Goals for 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 (at least a two year endeavour).
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 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)).

Added Goals:

13. To assist in establishing a Geographic Information System to access and store regional historical FIDS data.

11. Accomplishments in 1987-88:

1. A status report evaluating mountain pine beetle hazard-rating systems is being prepared by B. Moody (A-base goal).
2. Selected forest inventory permanent sample plots were used to conduct a province-wide spruce beetle survey. The development of software to enable data to be collected from said plots using an electronic data recorder was contracted to Silvacom Ltd. (Edmonton).
3. Surveys of insect and disease pests in young stands were completed in Alberta and a report prepared. The survey results complement a region-wide survey identified in NOR-11-01.
4. Spruce budworm surveys were conducted in the Footner Lake Forest to assess the current infestation at the request of the AFS and a status report was prepared. General surveys of the spruce and jack pine budworm were conducted elsewhere in the province (reference NOR-11-01).
5. Spruce beetle pheromone lures were tested (A-base goal, NOR-11-03), and \$10,000 contributed to the University of Calgary for pheromone development.
6. Collections of pine budworm were made at several locations to rear for subsequent taxonomic examination.
7. Several co-operative pest surveys were conducted with provincial personnel including; provenance trial plantations at the request of the Genetics Section of the Reforestation and Reclamation Branch of AFS, and surveys of specific plantations where regional AFS staff had asked for consultation on problems.
8. Sampling of jack pine stands for dwarf mistletoe distribution and damage was completed; data are being analysed.
9. Collections and observations of Dendroctonus punctatus were made at various times during the year.
10. Minor components of the jack pine budworm pheromone lure were identified by the Research and Productivity Council, Fredericton, N.B. (work sponsored by an agreement contract).
11. The forest tent caterpillar was successfully introduced onto aspen which had overgrown a spruce plantation. It has yet to be determined if the population can subsequently expand, improving growing conditions for the spruce.

12. This proposal withdrawn due to the retirement of a major participant (at the AFS).
13. Assisted in setting up a Geographic Information System to access and store regional historical FIDS data.

12. Present Status:

1. Field work associated with the development of a hazard-rating system for mountain pine beetle in lodgepole pine stands has been completed. A report is being prepared by B. Moody.
2. Surveys of dwarf mistletoe damage to jack pine stands have been completed and data analysis has begun.

The provincial portion of region-wide surveys of insects and diseases in young stands (including plantations) was implemented.

Agreement personnel are involved in developing procedures for incorporating historical FIDS data into a Geographical Information System.

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

Diagnostic and advisory services have been provided on request since the beginning of the project.

4. The use of forest inventory plots to conduct pest surveys was investigated. The project culminated with a province-wide spruce beetle survey on said plots. Software has been developed which can facilitate the collection of plot data using portable data recorders.

Development of pheromone lures for jack pine budworm and spruce beetle were assisted by financial contributions from the FRDA. Field assistance in testing these products was also provided. Spruce and jack pine budworm surveys have been expanded.

The ability of the FIDS unit to react to and report on current problems at the request of clients has been improved by the addition of agreement resources. The expansion of survey efforts and the preparation of a status report on spruce budworm activity in the Footner Lake Forest is an example.

13. Goals for 1988-89:

1. Report on the use of forest inventory permanent sample plots for insect and disease surveys.
2. Expand and improve surveys for insect and disease incidence in young stands in Alberta (see also NOR-11-01). Report on results to date.

3. Continue with spruce and jack pine budworm surveys in Alberta. Continue to work with the AFS in closely monitoring spruce budworm conditions in northern Alberta (cross reference NOR-11-01).
4. Continue with field testing and financial support for developing a pheromone lure for the spruce beetle (cross reference NOR-11-03).
5. To continue to investigate the distribution of pine budworm species in Alberta.
6. To continue to offer diagnosis and advice on insect and disease problems to provincial personnel and to promote their involvement in forest insect and disease surveys.
7. To report on the distribution and impact of dwarf mistletoe on jack pine in Alberta.
8. To continue to incorporate historical FIDS data into a Geographic Information System.

14. Publications 1987-88:

Amirault, P.A.; Gates, H.; Niederleitner, S. 1988. Spruce budworm in the Footner Lake Forest - 1987. A status report. Can-Alta. For. Res. Develop. Agree. Rep., 15p.

Amirault, P.A.; Niederleitner, S. 1987. Pest surveys in young stands, Alberta - 1987. File Report.

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. Duration:

Started: 1985

Completion: 1990

17. Resources 1988-89:

PYs:	Prof.:	Amirault	1.0
	Tech.:		0.0

Total:	1.0
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Term/Student	0.0
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O & M: 6.0

O & M: Contract 52.8

Capital:

Grants & Contributions: 20.0

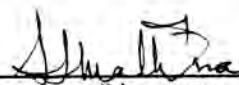


18. Signatures:

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Investigator  
Alberta Agreement Manager

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Technical Advisor  
Program Director, Development  
Program Director, Protection  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988/89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Canada-Saskatchewan Forest Resource Development Agreement
3. New:                      Cont.: X                      4. No.: NOR-36-03
4. 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) See NOR-11-05 |
| ix) Forest Economics (Sask.)                    | (NOR-39-03-9) See NOR-3-01  |

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, woodlots

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 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, 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 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: FO2, 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 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 for 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, material 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 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 1987-88.

#### 10. Accomplishment for 1987-88:

##### 1. Forest Renewal/Growth Enhancement and Stand Tending:

- solicited, developed and discussed over 20 forestry projects and proposals from forest industry and Indian Bands. Have initiated over 75 private woodlot management proposals. Other information contacts have included 20 organizations, equipment seminars (58 people) and woodlot tours--50 people;
- 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., as well as Indian Bands and private woodlot owners;
- reviewed, amended and processed for approval 24 Project Authorization Forms (PAF's) for forestry projects under the FRDA in conformance to the annual work plan;
- planned, implemented, monitored and audited 24 federal direct delivery forestry projects;
- reviewed and monitored five provincially implemented cost-shared projects in Program 1;
- planned, co-ordinated and implemented silvicultural field trial of the Wadell disc trencher involving the client agencies of the Province of Saskatchewan, Weyerhaeuser Canada and Saskatchewan Forest Products. Completed the second treatment phase of the shear blading trial with Martinni plow, Bracke, Barrels and trenchers. Planted, monitored and evaluated planting on areas treated in 1986 in cooperation with GLFC;
- produced file report on the Field Trials on the Donaren 180, TTS Delta Powered Disc Trenchers in the boreal Mixedwoods of Saskatchewan;



- evaluated the performance of the Madge Rotoclear on jack pine cutovers;
- 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, and analyzing equipment trial results.

## 2. Agreement Co-ordination and Management:

- represented the CFS at Program Management Committee meetings to plan, review, and monitor federal direct projects, cost-shared projects and 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, FEDC, Western Diversification, SIAP, Manitoba Remote Sensing, 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;
- developed and distributed quarterly reports and work plans to the agreement directorate;
- arranged meetings, site visits and presentations under agreement program with representatives from industry, Indian Bands, the Province and other governmental and non-governmental agencies;
- co-ordinated the "Alternative Products for Small Saskatchewan Sawmills" seminar in November for small sawmill operators, including a demonstration of proper sawing techniques.
- attendance at the Northern Agricultural Conference in La Ronge; attendance in the Woodlot Extension Specialist Seminar in Charlottetown, PEI; sent two delegates to the First Annual Christmas Tree Growers' Conference in Halifax.

## 3. Nursery Development:

- completed processing of invoices related to the construction of Big River Forest Nursery Irrigation Pumphouse and Cold Storage Packing facility, and the Prince Albert Forest Nursery Irrigation Pumphouse;
- completed the report "The Recommendations and Guidelines for Cultural Practices at the Big River and Prince Albert Nurseries", by Professor R.J. Day and N.J. Fraser, Lakehead University.

## 4. Geographic Information System:

- ensured completion and final acceptance of the federally purchased macro GIS. Added a voltage surge protector to the system.

## 5. Evaluation:

- obtained approval from the Directorate of an evaluation report framework tailored to the Manitoba "green-ribbon" committee;
- 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 Meetings and full staff meetings; 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;
- received, processed and paid PAF's/Progress Claims during 1987-88 in compliance with the regulations contained in the Procedures Manual;
- provided co-ordination and direction on all other administrative matters related to a District office including accommodations, renovation, camps, vehicles, computerization, equipment, inventory and stores.

## 7. Job Creation:

- co-ordinated the CFS technical monitoring of CEIC funded Job Development forestry projects in Saskatchewan.

## 11. Goals for 1988-89:

### 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 Programs 1 and 2;
- plan, co-ordinate and implement a silvicultural equipment field trial for mechanical thinning for the fall of 1988;
- arrange the planting of the second phase/treatment of areas of shear blade completed this fall as well as the monitoring of areas planted in 1987;
- produce report on the silvicultural equipment field trial of secondary treatments conducted in 1987, ensure publication of "Field Trials of Donaren 180, TTS Delta Powered Disc Trenchers in the Boreal Mixedwoods of Saskatchewan". Produce a technical note on the mechanical thinning trial completed in summer of 1988;
- liaise and coordinate with the other administrative and research activities in the District and Regional office Supervisor: F02, Renewal and Intensive Management Coordinator (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 coordination), PFRA/PWC (construction services);
- direct, coordinate and consult with sub-committee of the PMC including Nursery Development, Public Information, GIS and Evaluation;
- coordinate with and advise the FRDA Directorate and the MOU sub-committee;
- provide overall day-to-day direction to programs under the FRDA with industry, Indian Bands, the Province, within the CFS and other federal departments;
- 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;
- complete the formation of the Christmas Tree Growers' Association;
- establish and implement an operational woodlot program;
- to organize and deliver a woodlot seminar to demonstrate proper forest management and silvicultural techniques.

12. Publications:

- Draft Report of TTS Delta Disc Trencher and Donaren Disc Trencher Trial, Saskatchewan 1987;
- Amisk Lake Reserve 1984, Inventory and 5-year Forest Management Plan (Silviba Services Ltd.).

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. Duration:

Start: June 21, 1984

Completion: December 31, 1989

15. Resources:

PY's Prof.:	Fautley (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&amp;M: \$ 401.7 K + \$2.0 K (A-base)


Capital: \$8.0 K


G&amp;C: \$1,610.8 K


Salaries: \$ 312.9 K

Total: \$2,333.4 K

15. Signatures:
  
 District Manager

  
 Program Director, Development

  
 Senior Implementation Officer

  
 Regional Director General

## Canada-Saskatchewan Forest Resource

## Development Agreement

1988-89

	PY's	Contract/O&M	G&C	Capital
NOR-36-03: (includes \$6,000. A-base)	5.0	Development Agreement \$86,227.00	\$1,578,800.00	\$6,000.00
NOR-36-03-1	1.1	Forest Mensuration \$10,000.00	-	-
NOR-36-03-2	1.6	Silviculture Investigations \$22,000.00	10,000.00	2,000.00
NOR-36-03-3	0.1	Nursery Investigations \$42,000.00	-	-
NOR-36-03-4	1.1	Fire Management \$67,500.00	-	-
NOR-36-03-5	0.2	Stem Injection \$100.00	-	-
NOR-36-03-6	0.2	Vegetation Management \$2,000.00	-	-
NOR-36-03-7	0.8	Public Information \$86,873.00	22,000.00	-
NOR-11-05	0.0	Insects and Disease \$91,000.00	-	-
Total:	10.0	\$407,700.00	\$1,610,800.00	\$8,000.00



NOR-36-03

	Devel. Agr. Gen. 36-03	Mensuration 36-03-1	Silviculture 36-03-2	Nursery 36-03-3	Fire 36-03-4	Stem Injection 36-03-5	Vegetation Management 36-03-6	Public Information 36-03-7	Insect & Disease 11-05	Total
Fautley	1.0									1.0
Bacon	1.0									1.0
Gardner			0.6	0.1		0.1	0.2			1.0
Newman	1.0									1.0
Loseth		1.0								1.0
De Groot					1.0					1.0
Lee								1.0		1.0
Sidders	1.0									1.0
Barth		0.1	0.7		0.1	0.1				1.0
Johnston	1.0									1.0
Urquhart	1.0									1.0
Taylor	1.0									1.0
Student			0.3							0.3
Total	7.0	1.1	1.6	0.1	1.1	0.2	0.2	1.0	0.0	12.3

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Forest Mensuration Research (Saskatchewan)
3. New:                      Cont.: X
4. No.: NOR-36-03-1
5. Study Leader: P. Loseth
6. Key Words: Growth and yield, analytical procedures, computer modelling, data manipulation, technology transfer
7. Location of Work: Saskatchewan
8. Study Objectives:
  1. To interface closely with DPRC personnel in Timber Management Inventory and Silviculture Branches with the objectives of undertaking specific projects relating to growth and yield data manipulation and analysis.
  2. To contribute through technology transfer to the development and advancement of growth and yield data analysis procedures and growth projection systems.
  3. To provide an advisory role on growth and yield-related projects funded under FRDA and provide liaison with other regions and agencies participating in growth and yield research projects.
9. 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 DPRC 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.

Added Goal:

10. Initiate the establishment of a growth and yield field trial of a newly available variety of Siberian Scots pine to test for growth variation by stocking density and site condition.

10. Accomplishments in 1987-88:

1. Close contact was maintained with the Project Leader, Stand Productivity and Forest Inventory, and with other members of the North American modelling fraternity. Attendance at the CFS Modelling Working Group meeting at Petawawa National Forestry Institute in October allowed numerous contacts with CFS personnel from the NoFC, CFS-M, PNFI, LFC and PFC establishments. Attendance at the IUFRO Forest Growth Modelling and Prediction Conference in Minneapolis, MN, in August, allowed for working relationships to be established with a large number of international members of the modelling community.
2. Initial discussions were undertaken with Weyerhaeuser Canada Ltd., and Saskatchewan DPRC Forestry Branch personnel, regarding available managed stand data. An attempt was made to define a preliminary outline of data required to further delineate a comprehensive data set for managed stand development work.

3. In conjunction with Weyerhaeuser Canada Ltd., and the Saskatchewan DPRC Forestry Branch, undertook a co-operative project to develop a site index system compatible with Weyerhaeuser requirements and provincial inventory data and procedures. This work was carried out by a consultant under contract to Weyerhaeuser using provincial and CFS data. The site index project should be reported on as a joint technical note by the consultant, CFS, SPRC and Weyerhaeuser. It is expected that this co-operation will continue to the calibration of an appropriate growth model as the next logical step. Other agencies, both within Saskatchewan and in other provinces, will be invited to participate in this undertaking.
4. The IUFRO meeting allowed for close examination of several available growth simulators. A new version of TWIGS (3.0 in FORTRAN) was obtained from the U.S.F.S. in preparation for validation against PSP data. Initial discussions were held with the author of the Stand Projection System (SPS) model regarding its suitability to Saskatchewan conditions and a New Zealand developed differential equation model was reviewed for possible use in boreal conditions.
5. The determinations of product type and maximum yield from specific stands based on stand density and site is intimately related to the development of a suitable modelling framework and will be addressed as part of the model calibration/validation process.
6. Discussions were undertaken with Weyerhaeuser employees from their Tacoma research base regarding the work that they have done on volume equation validation for Saskatchewan species and data. Although discrepancies were found, they were not of the magnitude expected and have lead to the realization that other factors, such as localization of volume equations and differing utilization levels are at play. Initial discussions have been held with both Weyerhaeuser and SPRC regarding examining this problem further to rectify areas of disagreement.
7. The problem of determining the yield of repeatedly selectively-logged stands is again a further requirement of the model calibration/validation process and will be addressed in that work.
8. Several areas of GIS work were undertaken as follows:
  - advise Weyerhaeuser regarding their acquisition of a micro-GIS system;
  - project officer for the province's acquisition and implementation of a mainframe GIS system;
  - provided advice and expertise on silvicultural data input to a GIS to SPRC;
  - advised the Sask. CFS fire research group regarding a GIS-based project they undertook;
  - involved with the acquisition of non-core, private land inventory data from remotely-sensed, GIS processed information for the Saskatchewan woodlot program;
  - provided background information on micro-GIS systems to a wide range of clients, from industry, other government agencies and other CFS offices.

The prairie region (Alberta) growth and yield co-op was actively supported as well. The micro-computer PSP catalog program (MPC) was reviewed for NoFC staff prior to its final release. The previously mentioned Saskatchewan co-operative undertakings were a direct result of the activities of the regional body. The Saskatchewan group is planning to maintain an active role in the regional group while trying to expand their client base in Saskatchewan.

9. Work has started on the development of a micro-computer based data bank to summarize FRDA field projects in Saskatchewan. This work will tie to project maps entered into a micro-GIS and provide a summary package of field work undertaken under the current FRDA.
10. Seed has been secured from PNFI for the Siberian Scots pine trial and a thorough field review was done of existing Scots pine plantations in Saskatchewan. Trial design has been outlined and site selection guidelines are in place although no specific sites have been chosen at this time.

11. Present Status of Study:

Excellent progress has been made in establishing sound working relationships with client base in Saskatchewan. Objectives are all being met and activity will continue in all areas.

12. Goals for 1988-89:

1. Maintain liaison with and contribute to Regional Growth and Yield co-operative and Saskatchewan Growth and Yield Co-operative by attending meetings and ensuring communications are maintained among co-operators.
2. In co-operation with Weyerhaeuser Canada, ensure completion of contract with Applied Biometrics Ltd., Nanaimo, B.C., related to development of site index curves for major commercial species in Saskatchewan.
3. Attend GIS meeting in Edmonton, March 1988.
4. Continue provision of advice and services and technology transfer in the area of growth and yield research and development to client base in Saskatchewan.
5. Other goals may be added following assumption of new duties by new position incumbent.

13. Publications 1987-88:

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. Duration:

Started: 1986.

Completion: 1989.

16. Resources:

PY's: Prof.:	P. Loseth	1.0
Tech.:	Barth	0.1
Total:		1.1
Term/Student		0.0


O&amp;M: \$ 10,000.00

Contract: Nil


Capital: Nil

17. Signatures:

  
Investigator

  
District Manager

  
Supervisor

  
Program Director, Development

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Silviculture Investigations (Saskatchewan)
3. New:                      Cont.: X                      4. No.: NOR-36-03-2
5. Study Leaders: A. Gardner, G. Barth
6. Key Words: Technology transfer, forest renewal surveys, LSP, site preparation, tree improvement, seeding, fertilization, demonstration, seed collection
7. Location of Work: Saskatchewan
8. Study Objectives:
  1. To contribute to the development and advancement of forest renewal operations in Saskatchewan through provision of advice and services and technology transfer relevant to several aspects of regeneration, silviculture, including surveys, site preparation, planting stock handling and assessments of seeding, as well as in the broader areas of tree improvement and forest fertilization.
  2. To initiate, conduct and report on field trials relevant to planting stock types, site preparation equipment and seeding of coniferous species.
  3. To promote technology transfer by organizing and conducting technical workshops and seminars from time to time on topics of importance and relevance to silvicultural advancement in Saskatchewan.
9. 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.

Added Goal:

8. Participate with Weyerhaeuser Canada to initiate a contract to develop an effective methodology for hare control on high risk plantations.

10. Accomplishments 1987-88:

1. Two meetings have been held to initiate discussion within Saskatchewan Parks, Recreation and Culture, relating to content and format of a third level plantation assessment to be conducted subsequent to fifth year assessment.
2. Advice and consultations continue to be provided to silviculture staff of provincial Forestry Branch on methods of analysis of data-sets pertaining to provincial trials. The analysis of these data sets has been assumed by the province.
3. LSP contract with Dendron Resource Surveys Inc. has been completed. The final report is on file.
4. A large field trial testing six scarification implements, two stock types and herbicide control vs. no control of vegetation has been partially established near the Red Earth Reserve. Planting and initial measurements will be completed in 1988.
5. Promotion of participation in the "Management and Utilization of Mixedwood Forests" symposium to be held April 1988 has been undertaken. Indications are that all major agencies will be sending at least one representative.
6. Preliminary brushing of a 3.5 km trail north of Candle Lake was completed. The project will not be continued.
7. Saskatchewan Parks, Recreation and Culture has implemented appropriate recommendations from the IFS stock handling report.

8. Participated with Weyerhaeuser Canada in the initiation of a contract with TAEM Inc. to investigate busulphan as a chemo-sterilant for use in hare population control.

11. Present Status of Study:

Study is meeting objective in technology transfer. New field trials relating to planting methods and stock-types will be initiated in Cypress Hills. It is recommended that Objective 4 on the original Study Work Plan be moved to NOR-36-03-7 (Public Information).

12. Goals for 1988-89:

1. Complete installation of stand establishment trial at Red Earth site.
2. Initiate stocking surveys on provincial plantations established 10 or more years ago to determine levels of stocking to intended species and present stocking to all commercial species.
3. Continue to promote and participate in discussions with Saskatchewan Parks, Recreation and Culture on third level plantation surveys. Data from Goal 2 will contribute to discussions.
4. Initiate technology transfer activity in Cypress Hills Provincial Park related to regeneration of native lodgepole pine stands. Activities to include monitoring of spring planting program in 1988, establishment of survival and growth plots on a variety of sites and development of extended program of technology transfer.
5. Continue to participate with Weyerhaeuser Canada on a contract to evaluate busulphan as a chemo-sterilant for use in hare population control.
6. Continue participation on Regional Reforestation Technical Advisory Committee.

13. Publications 1987-88:

- 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.
- Dendron Resource Surveys Inc. 1987. Weyerhaeuser- Saskatchewan Parks, Recreation and Culture cutover survey. Dendron Resource Surveys Inc., Ottawa, Ont. Contract Report-Large Scale Aerial Photography.

Barth, G.R. 1987. White spruce stock performance trial in the Mixedwood Section of Saskatchewan. File Report. 14 p.

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. Duration:

Started: 1985

Completion: 1993

16. Resources:

PY's: Prof. Gardner 0.6  
(Brace A-Base)

Tech. - Barth 0.7

Total: 1.3

Term/Student: 0.3

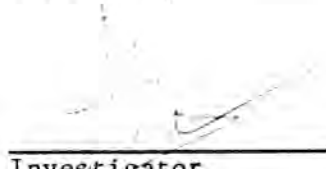
O&M: \$10,000.00


Contract: 12,000.00


Capital: 2,000.00

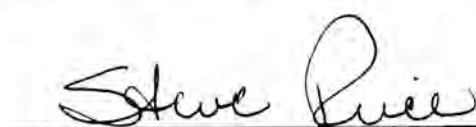
G&C: 10,000.00


15. Signatures:

  
Investigator

  
District Manager

  
Investigator

  
Program Director, Development

  
Regional Director General



## 1988-89

Date: January 19, 1988

1. Project: Development Agreements
2. Title: Forest Nursery Investigations (Saskatchewan)
3. New:                      Cont.: X    4. No.: NOR-36-03-3
5. Study Leaders: A. Gardner
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 1987-88:
  1. To initiate and supervise a contract to evaluate and report on current nursery stock production procedures and related cultural treatments.
10. Accomplishments in 1987-88:
  1. A contract was initiated and completed with Professor R.J. Day of Lakehead University for review of tree seedling cultural regimes at the Prince Albert and Big River nurseries, Saskatchewan. Two reports were produced entitled: "Recommendations and Guidelines for cultural practices at the Prince Albert Nursery, and "Recommendations and Guidelines for cultural practices at the Big River Nursery". Working manuals for each nursery will be developed from the reports for each nursery.

11. Present Status of Study:

Objectives one and two of the work of the work plan have been met.  
Objective two is combined with objective 3 in the cultural manuals.  
Objective 3 will be substantially met following work planned for 1988-89.

12. Goals for 1988-89:

1. To continue technology transfer in the area of forest tree seedling cultural regimes in Saskatchewan nurseries by initiating contracts to:
  - i) provide in-field workshops for Prince Albert and Big River nursery staff on the subjects of irrigation technology (water management) and fertilization technology.
  - ii) develop soil moisture retention curves and soil pH buffer curves for both nurseries and an operational manual for the rhizometer at Prince Albert nursery.
  - iii) review, evaluate and make recommendations for improvement of the irrigation systems at both nurseries.

13. Publications 1987-88:

Woodland Resource Services Inc. 1987. Review of white spruce and jack pine seed collection, processing and utilization procedures used in Saskatchewan. (Contract Report.)

Day, R.J.; Fraser, N.J. 1988. Recommendations and guidelines for cultural practices at the Prince Albert Nursery. Nursery Report 87-1; Lakehead University, School of Forestry, Thunder Bay, Ont.

Day, R.J.; Fraser, N.J. 1988. Recommendations and guidelines for cultural practices at the Big River Nursery. Nursery Report 87-2; Lakehead University, School of Forestry, Thunder Bay, Ont.

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. Duration:

Started: 1986.

Completion: 1988.

16. Resources:



PY's: Prof. Gardner	0.1
Tech.	0.0
Total:	0.1
Term/Student:	0.0

O&M: \$ 2,000.00

Contract: 40,000.00

Capital: Nil

17. Signatures:

  
\_\_\_\_\_  
Investigator  
\_\_\_\_\_  
Program Director, Development  
\_\_\_\_\_  
District Manager  
\_\_\_\_\_  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: 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 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.

10. Accomplishments 1987-88:

1. a) Maintained consultations with the NoFC Fire Research Unit on all Fire Management activities in Saskatchewan being done under the agreement.
- b) Acted as liaison between the Province and Tim Williamson on the Elan Fire Economics Study; and Bryan Lee on his Studies/Contracts with the Province.
- c) Continued use of the 'Saskatchewan Forest Fire Notes' Newsletter as an information transfer medium.
- d) Attended the Central Region Fire Weather Committee (CRFWC) Technical Subcommittee Meeting (Winnipeg) in April, and submitted an Agency Report for the 13th Annual Meeting (Winnipeg) in December.
- e) Attended the AGM of the Saskatchewan Climate Advisory Committee (Regina) in October.
- f) Participated on a committee with the Saskatchewan Climate Advisory Committee and the Saskatchewan Feasibility Study for a Climate Service Centre in Saskatchewan.
- g) Attended the Regional Technical Committee on Fire Research Meeting (Edmonton) in October, and the Technical Seminar in March.
- h) Participated on the Cypress Hills Management Plan Committee in regards to the use of fire in the Cypress Hills Provincial Park.
- i) Participated on the Prescribed Fire Working Group in the review of Terms of Reference and Strategic Plan.
- j) Produced a short, internal report with recommendations on the fire behavior of the Elan Fire, as requested by the Province.



- k) Presented a brief on fire behavior of the Elan Fire at a Board of Review Meeting shortly after the fire.
- l) Presented a Fire Behavior Case Study of the Elan Fire at the 36th Annual Meeting of the Canadian Committee on Forest Fire Management. The Case Study will be published next year.
- m) Presented an overview of CFS-Fire Research Activities as a guest speaker at the Weyerhaeuser Annual Spring Fire Meeting.
- n) Presented a paper entitled 'Interpreting the Canadian Forest Fire Weather Index (FWI) System' at the Fourth CRFWC Scientific and Technical Seminar (Winnipeg) in April.
- o) Presented R.S. McAlpine's Poster Paper entitled 'LAPFWI and LAPFBP: Two BASIC Computer Programs to Assess Potential Fire Behavior' at the 9th Conference on Fire and Forest Meteorology (San Diego, CA) in April.
- p) Participated at the Symposium and Workshop on 'Protecting People and Homes from Wildfire in the Interior West' (Missoula, MO) in October; acted as a co-ordinator for the Working Group on "Helping Homeowners and Developers Understand Residential Development Problems" and gave a presentation addressing the Working Group topic; presented a poster paper entitled 'Application of Fire Danger Rating to the Wildland/Urban Fire Problem: A Case Study of the Nesbit Provincial Forest, Saskatchewan'; participated in a short television interview regarding CFS participation at the symposium.
- q) Presented a one-day course at the Northern Institute of Technology (Prince Albert) on use of the Canadian Forest Fire Danger Rating System (CFFDRS) in October.
- r) Participated as an instructor at the Fire Behavior Prediction Workshop (Hecla Island, Man.) in January.
- s) Testified as an expert witness at a trial in July involving a landowner burning windrows.
- t) Acted as a reviewer on a number of manuscripts.
- u) Provided fire behavior information in the field during the Elan Fire, and the fire bust in La Ronge Region in July.
- v) Submitted an article entitled 'New Fire Danger/Behavior Training Courses in Saskatchewan' to Forest Fire News.
- w) Distributed CFFDRS binders to all districts and regions in Saskatchewan, and to other interested agencies in the province.
- x) Assisted in providing information during public displays at local exhibitions.

- y) Commence secondment with the provincial Fire Management Branch for six months (beginning Feb. 29/88) to perform technology transfer activities.
  - z) Prepared a fire behavior presentation on the Elan fire for the departmental convention held in Saskatoon in January.
2. The local Workshop/Seminar was replaced with course instruction for the Province and the Northern Institute of Technology.
  3. a) Participated in the Big Fish Lake Experimental Burning project again this year.
  - b) Attended an Instructor Training Course (ITC) in March.
  4. A contract to evaluate the efficiency of the Saskatchewan Detection System was initiated with C.J. Ogilvie acting as CFS Technical Expert. The tower seen-area maps were digitized using the facilities at Saskatchewan Research Council; responsibility for establishing the required fire data base was assumed by the Province.
  5. The information package for rural homeowners on protecting property from fire at the wildland/urban interface will not be produced due to the time being taken by secondment, and since this is an issue which was recommended for resolution at a national level (see report on Missoula, MO, conference by De Groot and Alexander, October, 1987).
  6. The pilot study of fuel type mapping in Saskatchewan was merged with the 'Dispatch Assistant' program contract being undertaken by B. Lee and Dr. S. Pickford. This project will allow the Provincial Fire Centre to utilize the Province's Geographic Information System data base.
  7. Collection of the 1978-82 data base for the Saskatchewan Fire Weather Station Network was completed.
  8. Responsibility for the fire report data base was assumed by the Province (see Accomplishment 4). It is intended that the Fire Weather Information and Fire Report Information data bases will be annually stored for future use.
  9. a) Provided partial funding for three provincial staff to attend the Regional Technical Committee on Fire Research Meeting (Edmonton) in October.
  - b) Provided partial funding for a provincial staff member to attend a course on trouble-shooting and maintenance of the Fire Weather Station Network (Victoria) in November.
  - c) Provided partial funding for a provincial staff member to attend a course on producing seen-area maps for lookout towers (Edmonton) in November.

10. Served as project officer for the following:

- a) Acquisition of an IBM 386-based microcomputer for the Province.
- b) Meteorologist contract.
- c) Detection Study contract.
- d) Computer Services contract with Provincial Fire Centre.
- e) Climate Service Centre Feasibility Study contract through Saskatchewan Research Council and Saskatchewan Climate Advisory Committee.

11. Present Status of Study:

- 1. Information transfer has reached the level of activity designated in the original agreement Operational Plan. The technology transfer process and activities under the FRDA are firmly established and are ongoing at a rate comensurate with all predetermined goals.
- 2. The continued long-term fire research effort in Saskatchewan by NoFC is being encouraged and promoted through various studies being done in the province with support from the agreement.

12. Goals for 1988-89:

- 1. While working under secondment for the Saskatchewan Department of Parks, Recreation and Culture (April to early October):
  - i) Provide technology transfer information by working closer with Regional Fire Operations and on-site fire activities.
  - ii) Develop an initial Baseline Presuppression Planning System for Saskatchewan through a review of literature and other similar operational systems, and through participation and consultation with Saskatchewan fire operations.
  - iii) Develop personal fire management expertise through exposure and participation in provincial fire management operations.
- 2. 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.
- 3. Develop fire management expertise through courses and field experience.
- 4. Continue to supervise a contract to evaluate the efficiency of the Saskatchewan detection system.
- 5. Continue to provide support for provincial personnel to attend training courses and seminars on various aspects of fire management.
- 6. Continue to act as project officer on cost-shared projects and capital purchases.
- 7. Complete a paper dealing with fire behavior on the Elan fire.

13. Publications 1987-88:

- Alexander, M.E.; De Groot, W.J. 1988. Fire behavior in jack pine stands as related to the Canadian Forest Fire Weather Index (FWI) System. Govt. Can., Can. For. Serv., North. For. Cent., Edmonton, Alta. Poster (w/text). (in press)
- De Groot, W.J. 1987. Interpreting the Canadian Forest Fire Weather Index (FWI) System. IN Proceedings of the Fourth Central Region Fire Weather Committee scientific and technical seminar (April 2, Winnipeg, Man.), K.G. Hirsch (compiler and editor). Government of Canada, Canadian Forestry Service, Manitoba District Office, Winnipeg, Man. (in press)
- De Groot, W.J. 1987. An overview of the Canadian Forest Fire Danger Rating System. Gov. Can., Can. For. Serv., Sask. Dist. Off., Prince Albert, Sask. Tech. Trans. Note S-001. 4 p.
- De Groot, W.J. 1988. A comparison of fuel types for predicting fire behavior with forest ecosystems in the mixedwood section of Saskatchewan. Gov. Can., Can. For. Serv., Sask. Dist. Off., Prince Albert, Sask. Tech. Trans. Note. (in press)
- De Groot, W.J. 1988. Application of fire danger rating to the wildland/urban fire problem: a case study of the Nisbet Provincial Forest, Saskatchewan. IN Proceedings of the Symposium and Workshop on Protecting People and Homes from Wildfire in the Interior West (October 6-8, 1987, Missoula, Montana). U.S. Forest Service, Missoula, Montana. (in press)
- De Groot, W.J. 1988. New fire danger/behavior training courses in Saskatchewan. Forest Fire News. No. 28. (in press)

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. Duration:

Started: 1985

Completion: 1990

16. Resources:

PY's: Prof. De Groot	1.0 (0.5 assigned to STEP position with province)
Tech. Barten	0.1
Total	1.1

O&M: \$32,500.00

Contract: 35,000.00

Capital: Nil

17. Signatures:

William W. W. W.  
Investigator

Richard R. R.  
Technical Advisor

[Signature]  
Supervisor

J. M. Powell  
Program Director, Environment

[Signature]  
District Manager

Steve R. R.  
Program Director, Development

A. D. D.  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: 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 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.

10. Accomplishments for 1987-88:

1. Additional literature was acquired relating to aspen management, ecology and phenology. Reference material has been utilized by silviculture staff of Weyerhaeuser Canada on several occasions.
2. Completed first-year, post-treatment assessment relating to the aspen injection trial underway.
3. Submission of report to ECW on treatment efficacy deferred until treatment effects stabilize.

11. Present Status of Study:

Density levels of post-treatment aspen stems will require several more seasons to stabilize. Chemical injection and girdling are equally effective in controlling residual, mature aspen stems. Treatment efficacy results will be reported to ECW (Western) and to Project Leader NOR-10 when treatment effects stabilize. Further efforts will be continued under a goal of NOR-36-03-2.

12. Goals for 1988-89:

1. Conduct second annual assessment of the aspen-injection trial.
2. Prepare file report on status of treatment efficacy related to aspen sucker control and composition of vegetation community.
3. Transfer goals to NOR-36-03-2 Terminate Study.

13. Publications 1987-88:

Nil

14. 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.

15. Duration:

Started: 1986

Completion: 1990 Fall

16. Resources:

PY's:	Prof. Gardner	0.1
	Tech. Barth	0.1
	Total	0.2
	Term/Student	0.0


O&M: \$100.00


Contract: Nil

Capital: Nil

17. Signatures:

  
Investigator

  
Program Director, Development

  
District Manager

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: 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, SPRC, vegetation response, crop tree response, efficacy, crop tolerance, chemical and non-chemical vegetation, application guideline development, project evaluation.
7. Location of Work: Saskatchewan
8. Study Objectives:
  1. To provide liaison and technology transfer advice and services to government and industrial clients in Saskatchewan on forest vegetation management options as required.
  2. To assist government and industrial agencies in the development of project guidelines for forest chemical applications.
  3. To maintain liaison with Regional Vegetation Control Project (NOR-10-09) and to the Expert Committee on Weeds (Western), Silviculture Group.
9. 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.

10. Accomplishments 1987-88:

1. Information on vegetation management tools and applicable chemicals was conveyed to personnel of Weyerhaeuser Canada and Saskatchewan Parks, Recreation and Culture and to the membership of the Saskatchewan Christmas Tree Growers' Association.

Liaison with Hoechst Canada relating to chemical application approval process, site selection and ECW experimental protocol use, was undertaken with respect to a preliminary trial of "Ignite" herbicide in Saskatchewan.

2. No vegetation management projects were undertaken by Weyerhaeuser Canada, Saskatchewan Branch in 1987-88. Use of herbicides in forest management continues to be under internal review. Technical information exchange on vegetation management methodologies is on-going.
3. Reporting on vegetation management activities in Saskatchewan was reported to the Regional Vegetation Management Project at the Regional Reforestation Technical Committee annual meeting in Slave Lake, Alberta.

Information relating to vegetation management activity in western Canada is communicated through the minutes of the annual meeting of the Silviculture Group, Expert Committee on Weeds (Western) to over 70 clients.

11. Present Status of Study:

Project is well established with respect to information exchange with client base on vegetation management technology. Development of project guidelines for forest chemical applications will be initiated in 1988-89.

12. Goals for 1988-89:

1. Continue to provide advice and services and information exchange on forest vegetation management technology to client base in Saskatchewan.
2. To assist in the development of project guidelines for forest chemical applications in Saskatchewan by contributing to the drafting of preliminary guidelines and project evaluation forms for review by Saskatchewan Parks, Recreation and Culture and Saskatchewan Environment.
3. Maintain liaison with Regional Vegetation Management Project at NoFC on forest vegetation management activities in Saskatchewan.



4. Serve as recording secretary to the Expert Committee on Weeds (Western) Silviculture Group at the annual meeting Nov. 28-Dec. 1, 1988, Winnipeg, Manitoba.

13. Publications 1987-88:

Nil

14. 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.

15. Duration:

Started: 1986

Completion: 1990

16. Resources:


PY's: Prof. Gardner	0.2
(A-base - Brace)	
Tech.	0.0
Total	0.2
Term/Student	0.0

O&M: \$2,000

Contract: Nil

Capital: Nil

15. Signatures:

  
Investigator

  
Program Director, Development

  
District Manager

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: January 19, 1988

1. Project: Development Agreement
2. Title: Forestry Public Information
3. New:                    Cont.: X                    4. No.: NOR-36-03-7
5. Study Leaders: vice 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.
  4. Promote public awareness of forest management activities in Saskatchewan by developing self-guiding demonstration area for use by forestry practioners, students and the general public.
9. Goals for 1987-88:
  1. Co-ordinate CFS and FRDA public information programming and activities within Saskatchewan (ongoing).
  2. Co-chairman of the Canada-Saskatchewan Forest Resource Development Agreement public information subcommittee (ongoing).
  3. Develop with provincial consultation, program of public information for the FRDA for 1987-88 (ongoing).

4. Serve as Scientific Authority on the standing offer (with Saskatchewan public relations firm) for production of FRDA-related public information publications (ongoing).
  5. Develop and co-ordinate approval of press releases related to FRDA activities (ongoing).
  6. Arrange for a maximum of media focus on FRDA-related activities including press tours, interviews, feature articles and presentations (ongoing).
  7. Provide for press clipping service of small, local daily and weekly Saskatchewan newspapers. Discontinued due to associated costs.
  8. Provide input into the development of the CFS National Advertising Campaign, Phase II, through liaison with NoFC (Technology Transfer and Information) and CFS HQ. District office will provide follow-up support to CFS National Awareness Campaign as necessary.
  9. Co-ordinate (with NoFC, NOR-33-02/03/04) and conduct the 1987-88 public information exhibit schedule for Saskatchewan including National Forest Week, Pioneer Days (Saskatoon), Prince Albert Exhibition, North Battleford Exhibition and Regina Exhibition. Exhibition circuit was completed August 1987.
  10. Maintain liaison between CFS Saskatchewan and other forestry organizations and associations including the SFA, CFA, CIF (ongoing).
  11. Organize and co-ordinate opening ceremonies for the Prince Albert Pumphouse and the Big River Pumphouse and Cold Storage and Packing Facility (pending decision from Province).
  12. Produce a publication jointly with the Province describing Agreement accomplishments to date (under discussion).
  13. Distribute and promote the use of a slide/tape (and video) to be produced in 1987-88, describing agreement accomplishments to date. Completed March 31, 1988.
  14. Provide input for national and regional newsletters (ongoing).
10. Accomplishments 1987-88:
1. Co-ordinated CFS and FRDA public information programming activities within Saskatchewan.
  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 1987-88.
  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 via interviews and feature articles.
6. Co-ordinated (with NoFC, NOR-33-02/03/04) and conducted the 1987-88 public information exhibit schedule for Sask., including National Forest Week, Saskatoon Exhibition, Prince Albert Exhibition, Regina Exhibition and North Battleford Exhibition.
7. Maintained liaison between CFS Sask. and other forestry organizations and associations including the SFA, CFA, CIF.
8. Distributed and promoted the use of a video and other in-house materials describing CFS and FRDA related initiatives and accomplishments to date.
9. Up-dated displays on general CFS activities in Saskatchewan.

11. Present Status of Study:

Since the inception of the FRDA Agreement we have and continue to provide public and private sector information services aimed at increasing awareness of forestry values, CFS activities and Agreement related initiatives in Saskatchewan. This has entailed the production and distribution of relevant literature (eg. Forever Forests Series of Publication) educational materials (eg. Commercial Trees of Saskatchewan poster) and a FRDA video, press releases, interviews, writing newspaper articles, erecting roadside demonstration signage and manning a comprehensive information and display circuit during National Forestry Week and Provincial Summer Fair functions.

Displays and exhibits have been upgraded and updated as required to reflect new initiatives and concerns in the forestry sector (eg. Woodlot Extension Program and Aspen Utilization).

12. Goals for 1988-89:

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 1988-89.
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 ongoing support of CFS National Awareness Campaign in co-operation with NoFC (Information) and CFS HQ as requested.
  8. Promote Private Woodlot Extension Program through the released literature/publications and the use of appropriate displays.
  9. Co-ordinate (with NoFC, NOR-33-02, 04) and conduct the 1988-89 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. Continue promoting use of in-house slide/tape and video presentations regarding agreement-related initiatives, among school groups and others.
  14. Initiate and complete evaluation and accompanying report on the Can.-Sask. FRDA 1984-89.
  15. Provide input for national and regional newsletters.
  16. Assist local CIF contingency in completing preparations for the hosting of the 1988 CIF annual meeting.
13. Publications 1987-88:
1. Forever Forests pamphlet series: Technology in the Forest - February, 1988.
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. Duration:
- Started: 1984                      Completion: 1989



16. Resources 1988-89:





PY's: Prof. 1.0

Total 1.0

O&amp;M: \$36,873.00

G&amp;C: 22,000.00

Contracts: 50,000.00

17. Signatures:  
Investigators  
District Manager  
Investigator  
Program Director, Development  
Regional Director General

NOR-51

FINANCIAL, ADMINISTRATIVE AND SUPPORT SERVICES

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

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 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.

Added Goals:

17. Implement a voluntary switch to the use of T.B. approved Individual Travel Cards.
18. Prepare an analysis of NoFC O&M expenditures and conduct a study that formally addresses NoFC O&M deficiencies.

11. Accomplishments in 1987-88:

1. Achieved. Late payment charges with major utilities have been eliminated. Average turn around time was 10 days. Total invoices processed was 2760. Stats - Edmonton only (Dec. 86 - Nov. 87).
2. Achieved. No. of travel claims processed was 967. Average turn around was 5.4 days. Stats - Edmonton only.
3. Achieved. Compliments have been received from various employees regarding the achievement of this goal. No. of advances issued was 234. Stats - Edmonton only.
4. Achieved in a timely and accurate manner for NoFC and the two districts.
5. Achieved. No. of J.V.'s processed was 284. Stats - Edmonton only.
6. Commenced Nov. 1, 1987. Accessibility to commitment set up documentation has been improved over last year. No. of commitments input were 2596. Stats - Edmonton only.
7. Commitment descriptions have been incorporated into inquiries. Commitments are reviewed monthly to ensure their integrity.
8. Monthly reconciliations are being conducted, with the working papers being retained on file.
9. Achieved normally on a same day basis.
10. Achieved normally on a same day basis or within requested deadline.
11. Achieved. Monthly financial report has been expanded to include detail on budgets, agreement detail and person year information.
12. Achieved. This goal has given us the capability of including agreement detail in the Monthly Financial Report.
13. Achieved and monitored monthly.
14. Achieved through the use of a dummy study (5050). Financial statements are reconciled using this account.
15. Reconciliations are done on a monthly basis (PAF,/FINCON/DEVMIS). Financial reports are generated following this reconciliation.
16. Achieved. Up to date figures are included in monthly financial reports.
17. Switch over to Individual Travel Cards implemented.
18. Finalized NoFC O&M study which has since been expanded upon to include all of CFS. We have since incorporated all the numbers for CFS (Nationally).



12. Goals for 1988-89:

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. Continue to maintain integrity and usefulness of commitments.
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. Use E-mail to communicate financial report info. to District Managers and receive feed back via E-mail or equivalent. System will be in place by August 1, 1988.
13. Monitor use of Individual Travel Cards.

14. Reconcile agreement reporting and systems to ensure proper control and integrity in numbers used and communicated.
15. 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.
16. Develop and implement a new financial reporting system using the VAX, which is well documented and provides better description of studies/projects. To be completed by July 1, 1987.
17. Develop standards for the processing of travel claims and invoices.
13. Publications 1987-88:
- Nil
14. Environmental Implications:
- N/A
15. Resources 1988-89:
- |      |        |                          |
|------|--------|--------------------------|
| 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: \$17.600
- Capital:
16. Signatures:

  
Investigator

  
Manager, Management Services

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

1. Project: Financial, Administrative and Support Services2. Title: Management Services3. New:                      Cont.: X4. No.: NOR-51-025. Study Leader: P.G. Stewart6. Key Words: Management services7. Location of Work: NoFC, Winnipeg, Prince Albert8. Problem:

N/A

9. Study Objectives:

To provide financial, administrative and support services to NoFC Director General, Program Directors, Project Leaders, Study Leaders, District Offices, and employees.

10. 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.

Added Goals

11. Conduct O&M study to show additional needs at NoFC.
12. Chair committee to conduct study of computer needs at NoFC.
13. Chair committee to write terms of reference for NoFC Computing Services Group.
14. Refill storeperson position.
15. Act as Secretary to the Project Leaders Meeting.

11. Accomplishments in 1987-88:


1. Oversaw financial, administrative, material Management, vehicles and building operations (see other study statements).
2. Refilled PG position on June 26, 1987. G. Fawcett was appointed to this position.
3. Monthly data has been collected in Finance, Administration and Material Management.
4. The User's Handbook was issued in March, 1987. Changes to make it more useful have been suggested and will be incorporated into the next revision.
5. Participated in Management at NoFC by being a member of NoFC Management Committee. Took the minutes and, in general, produced the minutes and circulated them within (3) working days of the meeting.
6. Monitored NoFC resources on a monthly basis, reported to Management Committee and took corrective action as required. Provided monthly statements. Completed the 1986-87 fiscal year in excellent financial and person-year situation. Received some extra funding which eased O&M situation in 1987/88.
7. Visited Winnipeg District Office in June, 1987 and will visit again in February, 1988. D. Benke visited the Saskatchewan District Office in December, 1987.
8. Hosted one meeting of Regional Managers, Management Services at NoFC in June. Attended a second meeting in September 1987. A third meeting dealing specifically with minor construction was held at LFC in Quebec City in January, 1988.

9. The capital budget was allocated and controlled. By March 31, 1988. All funds should be expended on the approved items.
  10. Liaised with the tenants in the building. Sent invoices for accommodations out in November, 1987 and informed tenants of increased rates for 1988/89. Discussed these with them as requested.
  11. The O&M study at NoFC was completed by mid-August 1987. It was expanded to include all of CFS at the September SMC meeting. P. Stewart and D. Benke co-ordinated sending out the instructions and receiving back the information from regional establishments. MFC and GLFC/FPMI were visited to verify their numbers.
  12. A consulting firm, DMR, conducted a study of computing needs at NoFC. The final report was delivered in early September 1987. As a result a new VAX 8350 was ordered along with a PC network, some new PC's and peripherals.
  13. A committee was set up to write the Terms of Reference for the computing group. This document was approved on November 16, 1987 at the Management Committee Meeting.
  14. The storeperson position was refilled on June 26, 1987 by a candidate from the Visible Minorities Program. NoFC received one person-year from PSC for this position.
  15. Acted as secretary to the Project Leaders Committee by sending out notices, putting together the agenda and issuing the minutes after the meeting.
12. Goals for 1988-89:
1. Oversee financial, administrative, materiel management, vehicles and building operations (see other study statements).
  2. Collect monthly data on functions under Management Services
  3. Update users handbook for use by employees in NoFC by March 31, 1989 if sufficient changes to warrant reprinting.
  4. Participate in Management of NoFC; take minutes at Management Committee and circulate the typed minutes within three (3) working days of the meeting.
  5. Monitor NoFC resources on a monthly basis and draw attention to problem areas. Provide monthly financial statements.
  6. Visit each District Office at least once during the year.
  7. Attend two (2) meetings of Managers, Management Services.
  8. Monitor capital budgets.



9. Liaise with tenants in the building.
10. Conduct study on the size of the vehicle fleet.
11. Act as Secretary to the Project Leaders Meeting. Issue notice one week before meeting, issue agenda one day prior to meeting and circulate minutes within one week of the meeting.
12. Attend Manager, Management Services meeting to discuss capital construction budget for 1989-90.
13. Publications 1987-88:  
Users Handbook
14. Environmental Implications:  
N/A
15. Resources 1988-89:  

PYs:	P. Stewart	1.0
	Total:	1.0
O & M:	\$5,400	
Capital:	\$5,000	
16. Signatures:



Manager, Management Services



Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

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 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 skills upgrading 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 and private courier.
6. Ensure photocopier in mail room is working and properly supplied; call maintenance within one hour of machine being reported as mal-functioning.
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.

Added goal:

12. Purchase and install electronic mail meter, trip kit and precision scale. This acquisition will save on postage costs.

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.

Added Goals:

3. Implement chargeback system for long-distance calls. A computerized system was installed to facilitate cost-recovery. System operational in July 1987.
4. Arrange for telecommunication needs of Veterinary Inspection Division, Agriculture Canada as new tenant of NoFC.
5. Arrange for implementation of all trunk and line turn-ups to meet Canada Place requirement.

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.

Added Goals:

4. Continue to input data to VAX with less emphasis on typewriter use.
5. Arrange for airvelope pickup and sending.

Administration:

1. Prepare the 1988-89 Conference Plan for the deadline set by Ottawa.
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 report to HQ.
  - d. updated file on VAX with conference information on irregular basis.
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.
  - e. Prepare 1988-89 Training Plan documentation.
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. Provide updated charts for April 1 and October 30 and above this as requested.
8. Submit to Finance within five working days of June 30, September 30, December 31, March 31 the details of amounts to bill non-NoFC users in the building. Charges are for telex, telephone long distance, postage, copier, etc.
9. Arrange for monthly visit and set up schedule for Public Health Nurse to attend at NoFC.
10. Arrange with Agriculture Canada Word Processing Technology Centre, Ottawa for on-site DECMATE III advanced and beginner training of NoFC and district office staff for 4 employees.

Added Goals:

11. Purchase and arrange for installation of new directory board for building showing NoFC down to the project level and tenants.
  12. Arrange for the provision of a Canada flag symbol so employees may use the laser printer to type letters leaving the building.
11. Accomplishments for 1987-88:

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 1/87 - Dec 31/87 = 2564	
- Res. - 502, Pro. - 161, Per. - 131, F&A - 886, Ext. - 555,	
Dev. - 297	
2. Provided training to AES operators to ensure they understood and could use the capabilities of the 7300 software program. Provided on-site training courses for all operators relative to skills upgrading, through AES Data Ltd. for 3 operators.
3. Ensured an even distribution of workload among all operators.

Records and Photocopying:

1. Opened and recorded all incoming mail and affixed date stamp, with the exception of advertisements, newspapers, magazines.
 

# pieces mail received = 45,654
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 pages received: 17,727/sent: 1,687  
 # Telex messages received: 21/sent: 13
4. Prepared and forwarded 3 times a week mail to the District Offices and Ottawa by Priority Post.  
 # Priority Post envelopes sent = 442
5. Prepared mail for pick-up each day by Canada Post and private courier.
6. Ensured photocopier in mail room is working and properly supplied; called maintenance within one hour of machine being reported as malfunctioning.  
 # service calls = 44  
 # copies made Jan - Dec/87 = 544,969 (mail room only)  
 Monthly average = 45,414 copies
7. Maintained counts of item as presently being done.
8. Maintained and operated a BF system.
9. Reviewed opening of all incoming mail for coding and statistical purposes.
10. Forest Resource Data for Kananaskis and Alberta was cataloged, boxed, labelled and returned to shelving units, maps organized and cataloged in map cases in Room B069 and files stored in filing cabinets. FIDS rearing sheet data (125 boxes) stored on new shelving in B069. Climate data removed from floor in B071 and stored on new shelving in B069. Due to staff shortages, completion of shortage of scientific Records has not been done on a continuing basis. 25 cu. ft. of records were destroyed and 17 cu. ft. of records were sent to Archives.
11. Catalogued and stored maps.
12. Purchased and installed electronic mail meter, trip kit and precision scale. This acquisition will save on postage costs. Estimated saving in 1987-88 was approximately \$1250.00 plus many man-hours in processing.

Telecommunications:

1. Reviewed rental charges each month to ensure they were accurate and correct.



2. Placed orders for repair or change within two days of receiving the order.

# orders placed Jan - Dec/87 = 56

3. Implemented chargeback system for long-distance calls. A computerized system was installed to facilitate cost-recovery. System operational in July 1987.
4. Arranged for telecommunication needs of Veterinary Inspection Division, Agriculture Canada as new tenant of NoFC.
5. Arranged for implementation of all trunk and line turn-ups to meet Canada Place requirement.

#### Reception:

1. Greeted visitors, referred to the appropriate employee in NoFC.
2. Answered the telephone switchboard, took messages, forwarded calls. Number of calls answered 26,207 during period June 1 - December 31/87.
3. Prepared requisitions, correspondence, contracts within 24 hours of receiving them. Maintained a log of all typing.

Jobs completed Jan - Dec/87 = 1,522.

4. Continued to input data to VAX with less emphasis on typewriter use.
5. Arranged for airvelope pickup and sending. Sent 49 airvelopes/ couriers

#### Administration:

1. Prepared the 1988-89 Conference Plan for the deadline set by Ottawa.
2. Monitored the 1987-88 Conference Plan:
  - a. to ensure approved attendee's knew they were on the plan, issued letter of notification on May 11, 1987
  - b. made changes and substitutions as necessary (4).
  - c. submitted quarterly reports to HQ.
  - d. Updated file on VAX with conference information on irregular basis.
3. Actioned classification and staffing requests within 2 day of receiving them, as long as there were no extenuating circumstances. Ensured all packages forwarded to Personnel were complete. Number of packages sent to personnel were 280.

4. 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. Letters of notice were somewhat confusing as to status - this will be rectified in 1988-89.
  - 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.
  - e. Prepared 1988-89 Training Plan documentation.
5. Prepared, monitored, and did not exceed budget for administration without specific approval from Manager, Management Services.
6. Compiled monthly statistics and provide to Manager, Management Services.
7. Prepared, monitored and maintained organization charts for region. Provided updated charts for April 1 and October 30 and above this as requested.
8. Submitted to Finance within five working days of June 30, September 30, December 31, March 31 the details of amounts to bill non-NoFC users in the building. Charges are for telex, telephone long distance, postage, copier, etc.
9. Arranged for monthly visit and set up schedule for Public Health Nurse to attend at NoFC. Health nurse visited 11 times.
10. Arranged with Agriculture Canada Word Processing Technology Centre, Ottawa for on-site DECMATE III advanced and beginner training of NoFC and district office staff for 4 employees.
11. Goal not accomplished. See 1988-89 Goal #9.
12. Arranged for the provision of a Canada flag symbol so employees may use the laser printer to type letters leaving the building.

12. Goals for 1988-89:

Word Processing:

1. Provide the following turn around time to clients:

1 - 5 pages	1 working day
5 - 25 pages	3 working days

2. Ensure an even distribution of workload among all operators.
3. Purchase Magnetic Tape Backup for the system to reduce the downtime when performing back-up to between 30 mins. - 1 hr.
4. Conduct a study and recommend how to change the work processing equipment to PC's that operate on the new VAX 8350. Provide a written report by March 31, 1988 (at least interim) and a final report by June 4, 1988.

#### 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 and private courier.
6. Ensure photocopier in mail room is working and properly supplied; call maintenance within one hour of machine being reported as malfunctioning. Recommend the acquisition of a new machine for NoFC. Provide alternatives so budget constraints are considered.
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.

#### Telecommunications:

1. Review rental charges each month to ensure they are accurate and correct. Maintain monthly detail of rental costs.
2. Place an order for repair or change within two days of receiving the order.
3. On a monthly basis, provide finance with billings on each study for long distance chargeback.

#### Reception:

1. Greet visitors, refer to the appropriate employee in NoFC.

2. Answer the telephone switchboard, take messages, forward calls and maintain monthly statistics.
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 1989-90 Conference Plan for the deadline set by HQ.
2. Monitor the 1988-89 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. to submit quarterly reports to HQ.
  - d. Input data to conference file on VAX by February 28, 1988 and update within 2 days f changes occuring throughout 1988/89.
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. The Program Director will sign the classification form prior to D. Kill approving it.
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 1989/90 training plan by December 1988.
  - e. Prepare 1989-90 Training Plan documentation.
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. Provide updated charts for April 1 and October 30 and above this as requested.
8. Submit to Finance within five working days of June 30, September 30, December 31, March 31 the details of amounts to bill non-NoFC users in the building. Charges are for telex, telephone long distance, postage, copier, etc.
9. Purchase and arrange for installation of new directory board for building showing NoFC down to the project level and tenants.
13. Publications 1987-88:  
N/A
14. Environmental Implications:  
N/A
15. Resources 1988-89:

PYs:	Burke	1.0
	Fulton	1.0
	Simunkovic	1.0
	Ratansi	1.0
	Phillips, T.	1.0
	Total:	5.0

O & M: \$145,600

Capital:
16. Signatures:

Janna-Mae Burke  
Investigator

Paul Allen  
Manager, Management Services

C. D. Tut  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

1. Project: Financial, Administrative and Support Services
2. Title: Materiel Management
3. New:                      Cont.: X
4. No.: NOR-51-04
5. Study Leader: G.R. Fawcett
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 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.

11. Accomplishments in 1987-88:

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 order including petty cash processed from Jan. 1 - Dec. 31 1987 was 2251.
2. Ensured proper signing authority is on each requisition before actioning. Coded all requisitions except for line objects.
3. Followed 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 data. Written documentation will be placed on each file of this follow-up.

Number of follow-ups recorded - 53.

4. Records were maintained of all documents issued and received.
5. Monthly reports have been prepared on the above.
6. Necessary documentation is kept on file for all exceptional purchasing (e.g., emergencies).
7. Although the MMIS system has not been activated preliminary work in the nature of test file transfers from DTR to Ingress and liaison with finance to transfer vendor code data from Fincon were carried out.
8. Training in use of terminal and in maintaining purchasing end of MMIS is not to be implemented until the new computer is installed.
9. Training of M. Sampson in the acting position of Purchasing Clerk took place from July 1987.

Stores

1. An inventory of all stores items was maintained. An inventory of expendables and stationary was performed in February, August and December.
2. Items requested were available. If not available, it was 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 1741 from January 1, 1987 to December 31/87.

3. A minimum/maximum system was maintained and stores supplies were within these.
4. Requested office supplies were available.
5. Monthly costs for receivable items were provided to Finance by the second (2) working day of the following month for Jving back to projects. Total costs recovered in 1987 was approximately \$7500.
6. The individual bar code card system continues to be maintained.
7. It was not feasible to implement MMIS.
8. Finalized the set up of the stores area in the storage shed.
9. Ensured proper warehousing and storage in the areas where assigned shelving is located.
10. Ensured proper warehousing of all parts of the storage shed so space is used most efficiently.
11. Vacated Room B097. Contents removed to shed.
12. Cleared 2 storage trailers from south side of Greenhouse.
13. Restaffed the vacant stores position from the visible minorities program. Thereby saving 1 PY.
14. Training of A. Yohannes in the position of Storesclerk took place from June 1987.

#### Inventory

1. All equipment and attractive items were tagged and furniture, equipment and attractive items entered into the inventory before the item is released from stores. Assigned holders signed for all equipment issued.
  2. Arranged disposal of surplus equipment. Including 4 storage trailers emptied by relocation of equipment to shed. The value of items disposed of to CADC were \$151,394.10.
12. Goals for 1988-89:

#### 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. Follow 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 good/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. New VAX to be installed February/March and MMIS should be operational for 88/89 Fiscal Year as long as computer acquisition meets the anticipated deadline.
8. Train Purchasing Clerk in use of terminal and in maintaining purchasing end of MMIS.
9. Develop a method to produce purchasing documents directly from MMIS. NoFC's aim would be to have the system in place by July 31, 1988.

#### Stores

1. An inventory of all stores items will be maintained. An inventory of expendables and stationary will be performed on April 30, July 30, Oct. 30, and Jan. 30. A report will be written. The aim is to achieve 10% or less error rate.
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.
6. The individual bar code card system will be maintained. Adapt present bar code system to MMIS system by July 31, 1988.

7. MMIS will be fully implemented.
8. Ensure proper warehousing and storage in the areas where assigned shelving is located.
9. 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. Arrange disposal of surplus equipment.
3. Perform inventories in Saskatchewan and Manitoba district office.

#### 13. Publications 1987-88:

Nil

#### 14. Environmental Implications:

N/A

#### 15. Resources 1988-89:

PYs:	Fawcett	0.5
	Sampson	1.0
	Yohannes	1.0
	Total:	2.5

O & M: \$19,100

Capital:

#### 16. Signatures:

Guy Fawcett  
Investigator

Robert H. H. H.  
Manager, Management Services

C. D. H.  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

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 facilities at NoFC.
10. 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.

Added Goals:

21. Install eyewash station in Room 2022.
22. Fabricate four prototype stands for instrument shelters for wetland Drainage Project.
23. Install screen door at balcony entrance.
24. Install panic bars on doors of new chemical storage rooms.
25. Paint rooms B006, B008, B009, B097, M028, 2010, 2011, 2013, 3070, 3072 (10 rooms).
26. Install R.O. system and washers in M109.
27. Repaint yellow lines in parking lot.
28. Install shelving in new chemical storage rooms.
29. Install carpet and new exhaust fan in room 136A.
30. Fabricate signs for parking lot.
31. Build stainless steel cabinet and install dishwasher in the kitchen.

32. Install new coffee brewer in the kitchen.
33. Level grounds in NW corner of nursery.
34. Check fire alarm systems twice.
35. Replace four (4) venetian blinds in 2013 & 3078.
36. Install fire alarm & telephone lines into new chemical shed.
37. Replace bearings on #3 fan unit (2).
38. Install new canopy in 3026.
39. Install emergency power to special cooling tower
40. Construct chemical storage shed using NoFC talents and subcontractors.
41. Install shelving in B097.
42. Install Emergency Response Kits on first, second and third floor in the building.
43. Install overhead door in groundskeeper's shed.

11. Accomplishments in 1987-88:

1. Did not overhaul the Massey Ferguson tractor because funds were not available.
2. An initial tender was sent out. There were problems with the specifications. A roof consultant was hired to assess the situation, recommend courses of action and provide an estimate of costs. This report was received in early November, 1987. Tenders will be re-issued in January, 1988 so repairs may be actioned early in the 1988-89 fiscal year.
3. The project was postponed and will be actioned in 1988-89. After assessing the situation it was decided one more year's service could be received from the sumps.
4. Replaced belt sander in carpenter shop.
5. Replaced special cooling tower.
6. Completed the ultrasounding of all unfired pressure vessels in the boiler room
7. Cleaned the lagging but did not have the manpower resources to paint it.
8. Replaced power units on #1 to #4 A/C units.

9. Purchased a new power mower.
10. After an investigation, it was concluded there was not sufficient funds to complete this project. The type of canopy to be installed has been decided and it has been included in the 1988-89 Minor Construction requests.
11. Provided general maintenance in the building.
12. Cleared snow as required from the parking lots and driveways.
13. Maintained the grounds during the summer including cutting the grass, planting flowers and maintaining flowers and shrubs. Constructed the berm on the west side of the property and planted evergreen trees on the berm. Removed shrubs from south end of main wing and purchased replacement ones for planting in 1988.
14. No funds were provided for this project so it was not actioned.
15. Oversaw cleaning contract, electrical contract and all other maintenance contracts (in building).
16. Lived within budget provided. Replenished stock where required.
17. Continued preventative maintenance program.
18. Overhauled #30 air compressor.
19. Installed two (2) darkroom doors in photoshop.
20. Planted trees on west fence - University Property.
21. Installed eyewash station in Room 2022.
22. Fabricated four prototype stands for instrument shelters for Wetland Drainage Project.
23. Installed screen door at balcony entrance.
24. Installed panic bars on doors of new chemical storage rooms.
25. Painted rooms B006, B008, B009, B097, M028, 2010, 2011, 2013, 3070, 3072 (10 rooms).
26. Installed R.O. system and washers in M109.
27. Repainted yellow lines in parking lot.
28. Installed shelving in new chemical storage rooms.
29. Installed carpet and new exhaust fan in room 136A.
30. Fabricated signs for parking lot.

31. Built stainless steel cabinet and installed dishwasher in the kitchen.
32. Installed new coffee brewer in the kitchen.
33. Levelled grounds in NW corner of nursery.
34. Checked fire alarm systems twice.
35. Replaced four (4) venetian blinds in 2013 & 3078.
36. Installed fire alarm & telephone lines into new chemical shed.
37. Replaced bearings on #3 fan unit (2).
38. Installed new canopy in 3026.
39. Installed emergency power to special cooling tower
40. Constructed chemical storage shed using NoFC talents and sub contractors. Saved approximately \$18 K.
41. Installed shelving in B097.
42. Installed Emergency Response Kits on first, second and third floor in the building.
43. Installed overhead door in groundskeeper's shed.

12. Goals for 1988-89:

1. Overhaul M.F. tractor at a cost of approximately \$9 K.
2. Replace/repair several sections of main roof as detailed on consultants report by July 1, 1988. (Approximate cost \$200,000 K)
3. Replace #1 to #4 sumps including sump pumps.
4. Replace Bolen tractor and equipment at a cost of \$16,700.
5. Provide glass canopy for both northside entrances.
6. Provide glass enclosure for southside courtyard.
7. Provide general maintenance in the building.
8. Clear snow as required from the parking lots and driveways.
9. Maintain the grounds during the summer months including cutting the grass, planting and maintaining flowers, attending to shrubs and trees regarding the proper pruning and fertilizing of the plants.
10. Replace shrubs on south side of the building.

11. Oversee the installation of a new lawn including sprinkler system.
  12. Continue a regular preventative maintenance program.
  13. Live within budget provided.
  14. Plant popular on the berm and finish planting the evergreen trees.
  15. Paint 16 rooms in the building.
  16. Upgrade the concrete slab on the southside of the building to prevent flooding in heavy rain.
  17. Install drainage system in nursery to solve the drainage problem.
  18. Repair 2 venture fume hoods which use perchloric acid in M041 and M084.
  19. Devise a statistical methodology for the Maintenance Operations.
  20. Improve the public address system so it may be heard in all parts of the building.
  21. Replace approximately 20 venetian blinds which cannot be repaired.
  22. Refill Senior Craftsman's position.
  23. Test fire alarm system twice during the year.
13. Publications 1987-88:
- N/A
14. Environmental Implications:
- N/A
15. Resources 1988-89:
- |      |            |   |     |
|------|------------|---|-----|
| PYs: | Schoendube | - | 0.5 |
|      | Colistro   | - | 0.9 |
|      | Schmidt    | - | 1.0 |
|      | Burton     | - | 1.0 |
|      | Total      | - | 3.4 |
- O & M: \$21,600
- Capital: 384,000

16. Signatures:

H. Selamany  
Investigator

Pam Allen  
Manager, Management Services

G. Stunt  
Regional Director General



## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

1. Project: Financial, Administrative and Support Services2. Title: Building Operations3. New:                      Cont.: X4. No.: NOR-51-065. Study Leader: H. Schoendube6. Key Words: Building operations7. Location of Work: NoFC8. Problem:

N/A

9. Study Objectives:

To maintain the heating, ventilation, and air conditioning systems at NoFC.

10. Goals for 1987-88:

1. Monitor energy saving and effect cost saving in relation to laboratory operations with 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.
  11. Operate the back-up boiler to conserve energy during the months of May through September.
  12. Chair the Safety Committee.
  13. Check the building each day on weekends and holidays to ensure all systems were operating properly.
11. Accomplishments in 1987-88:
1. Monitored energy usage and effected cost saving in relation to laboratory operations with respect to air quality and heating. For example completed the installation of cheaper hallway lights near elevators to reduce costs. Incorporated cooling water for operation of growth chambers and cold rooms with operations of the special cooling tower.
  2. Installed new panel for the fire alarm system in room M123.
  3. Daily monitored the operation of the boilers and equipment to ensure safe and efficient operation.
  4. Carried out preventative maintenance on boilers and associated equipment as required.
  5. Replaced refractory of #1 and #2 boiler. Overhauled #1 boiler on the fire- and water side.
  6. Daily checked the greenhouses and adjusted temperatures as required by the greenhouse users.
  7. Carried out complete building checks on a daily basis and made adjustments as required to the buildings heating and ventilation systems.
  8. Controlled work and materials by issuing work orders for all projects under taken. Number of work orders issued were 350.
  9. Supervised the Commissionaire's contract. Supervised waste management and elevator maintenance to ensure a high quality of service.

10. Provided heat, light, natural gas, water, and air conditioning services to the building.
11. Operated the back-up boiler to conserve energy during the months of May through September.
12. Chaired the Safety Committee.
13. Checked the building each day on weekends and holidays to ensure all systems were operating properly.

12. Goals for 1988-89:

1. Monitor energy usage and effect cost savings in relation to laboratory operations with respect to air quality and heat distribution.
2. Daily monitor the operation of the boilers and equipment to ensure safe and efficient operation.
3. Carry out preventative maintenance on boilers and associated equipment as required.
4. Daily check the greenhouses and adjust temperatures, air, etc. to meet specifications set out by the greenhouse users.
5. Carry out complete building checks daily and make adjustments as required to heating, ventilation, air conditioning, safety systems, to ensure safe and efficient operation.
6. Control work and materials by issuing workorders for all projects undertaken.
7. Supervise cleaning, waste management, elevator maintenance, and commissionaire's contracts and ensure a high quality of service.
8. Provide heat, light, natural gas, water, and air conditioning services to the building.
9. Overhaul/replace #1 feedpump and control valve by July 31, 1988.
10. Overhaul/replace #31 & #32 laboratory air compressors by July 31, 1988.
11. Overhaul/replace #1 condensate pump and receiver tank by September 1, 1988.
12. Supply and install additional air supply and exhaust systems for room M109 by May 31, 1988.
13. Forecast expenditures for the safe and efficient operation of the facilities which will be for gas, power, water, Corps. of Commissionaires, janitorial services, waste management, electrical contractor, elevator contractor, maintenance plus service costs

including emergency expenses. The budget will not be exceeded without the prior approval of the Manager, Management Services.

14. Replace present lights in boiler room with fluorescent lights by June 30, 1988.
  15. Move steam generator from basement to penthouse by May 31, 1988.
  16. Complete the stock taking by making up cards for all items and move all items to Room M097, B093, B091. Clean up M129 area and work area B091 and B089 by October 31, 1988.
13. Publications 1987-88:
- Nil
14. Environmental Implications:
- N/A
15. Resources 1988-89:
- |      |            |   |            |
|------|------------|---|------------|
| PYs: | Schoendube | - | 0.4        |
|      | Fisher     | - | 0.75       |
|      | Lybbert    | - | 1.0        |
|      | De Costa   | - | 0.9        |
|      |            |   | <hr/> 3.05 |
- O & M: \$231,300
- Capital:
16. Signatures:

H. Schoendube  
Investigator

Paul J. H. [Signature]  
Manager, Management Services

C. D. [Signature]  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

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), Oakbank  
                                 (Manitoba)
8. Problem:  
                                 N/A
9. Study Objectives:  
                                 To maintain the Physical Facilities of the NoFC camps at Hinton,  
                                 Candle Lake, Chip Lake, Prince Albert and Oakbank.
10. 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 in P.A..
  8. Finalize the closing of Kananaskis.

11. Accomplishments in 1987-88:

1. Opened and closed camps in the Spring and Fall of 1987. This required 4 trips and 19 person-days of work.
2. Repaired trailer roof where it was required. Repaired roofs on 5 trailers.
3. Repaired two (2) shower cabinets in trailers in Hinton.
4. Did not need to do this in 1987-88.
5. Corrected wiring in two trailers in Hinton (447 and 424).
6. Completed the roofing in Candle Lake. Used 13 person days.
7. Arranged for the supply of power, propane and water in Hinton, Candle Lake and Duplex in Prince Albert.
8. Finalized the closing of Kananaskis. This required 4 person days of work.

12. Goals for 1988-89:

1. Open and close camps in Spring and Fall of 1988.
2. Arrange through C. Rentz for the cutting of grass at Hinton Camp in the summer months of 1988.
3. Arrange for the supply of propane and electricity to Hinton Camp.
4. Arrange for the water supply in Candle Lake.
5. Install signs at Hinton, Candle Lake and Oakbank.
6. Visit and assess conditions of the camps prior to the visit of working crews to determine work to be done.
7. Improve conditions of log buildings in Candle Lake by removing old varnish from the outside walls and applying new coats of varnish.
8. Paint or varnish doors on trailers 446 and 448.
9. Varnish the washrooms cabin at Hinton.

13. Publications 1987-88:

N/A

14. Environmental Implications:

N/A



15. Resources 1988-89:

PYs:	Schoendube	-	0.1
	Colistro	-	0.1
	De Costa	-	0.1
	Total:	-	0.3

O &amp; M: \$6,900

Capital:

16. Signatures:

H. Schoendube  
Investigator

Palm Hill  
Manager, Management Services

C. D. [Signature]  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

1. Project: Financial, Administrative and Support Services
2. Title: Vehicles
3. New:                      Cont.:    X
4. No.:    NOR-51-09
5. Study Leader:    G. Fawcett
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 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 ones 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.

11. Accomplishments in 1987-88:

1. Assigned vehicles for the 1987 field season by May 1, 1987.
2. Integrated 1987/88 replacement vehicles into the fleet. Disposed of 12 vehicles replaced by the new ones.
3. Ordered 3 vehicles for 1988/89 in October 1987. Prepared priority list for additional vehicles.
4. Ensured all vehicles in the fleet have the required maintenance performed on them per a written maintenance schedule. Performed scheduled safety maintenance requirements.
5. Provided monthly the required FMIS information by the 10th of the following month. FMIS is fully computerized, computer generated forms are sent to DSS.
6. Developed by June 1, 1987 the kilometer charges for 1987/88. By the tenth (10) working day of the following month provided to Finance the charges by study for the previous month.
7. Usually satisfied all requests for vehicles during the fiscal year.
8. Did not exceed the budget provided.
9. Material Management was not instructed to implement the parking policy. Preparation to do so were made.
10. Dispose in conjunction with stores the surplus equipment related to vehicles.
11. Ensured proper safety and winter emergency kits are available in vehicles stores.

12. Computerized vehicle scheduling became fully operational allowing reservations and day to day use to be kept track of and charge backs to be calculated automatically on return of pool vehicles.

12. Goals for 1988-89:

1. Assign vehicles for the 1988 field season by May 1, 1988.
2. Integrate 1988/89 replacement vehicles into the fleet. Dispose of the vehicles the new ones are replacing.
3. Order in 1989/90 replacement vehicles in October 1988.
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 using the computerized system.
6. Develop by June 1, 1988 the kilometer charges for 1988/89. 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 if applicable co-ordinate the installation of automatic gates if funds approved.
10. Ensure proper safety and winter emergency kits are available in vehicles stores.
11. Conduct a study in conjunction with Manager, Management Services to assess whether the fleet is too large and investigate whether maintenance schedules and practices as presently exist are the best ones. Completed by September 30, 1988.

13. Publications 1987-88:

Nil

14. Environmental Implications:

N/A

15. Resources 1988-89:

PYs: Fawcett 0.5  
Wake 1.0

Total: 1.5

O & M: \$25,000  
Capital: \$16,600

16. Signatures:

  
Investigator

  
Manager, Management Services

  
Regional Director General

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 5, 1988

1. Project: Financial, Administrative and Support Services
2. Title: Safety
3. New:                      Cont.:        X                      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 1987-88:
  1. Conduct four (4) standard First Aid courses 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.
11. Accomplishments 1987-88:
  1. Conducted three (3) first aid courses. Trained 19 employees.
  2. Conducted two (2) C.P.R. courses. Trained 10 employees.



3. Kept record of changes for next revision.
  4. Put on safety films on 4 different days. To make it a regular occurrence we need a VHS player.
  5. Did not put in for a defensive driving course because of lack of interest.
  6. Trained lab. technicians in the use of SCBA equipment. Seven (7) people have been trained.
12. Goals for 1988-89:
1. Conduct three (3) first aid courses.
  2. Conduct four (4) C.P.R. courses.
  3. Provide training and upgrading in use of the SCBAs. There should be at least 6 on each floor.
  4. Put on safety films with respect to safety in the workplace on a monthly basis as a minimum.
  5. Put on a defensive driving course.
13. Publications 1987-88:
- N/A
14. Environmental Implications:
- N/A
15. Resources 1988-89:
- PYs: Fisher 0.25  
Total: 0.25
- O & M: \$3,500
- Capital: Nil
16. Signatures:

  
Investigator

  
Manager, Management Services

  
Regional Director General

NOR-53

COMPUTING AND DATA PROCESSING SERVICES

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988 - 89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 1, 1988

1. Project: Computing and Data Processing Services.
2. Title: Computing and Data Processing Services.
3. New:                    Cont.: X                    4. No.: NOR-53-01
5. Study Leader: W. Chow
6. Key Words: Computing, data processing, programming, system analysis, graphics, data entry, statistical analysis, information retrieval, DEVMIS, MMIS, FMIS, database, SAS, VAX 8350, word processing, telecommunications, personal computers, office automation, networking, local area networking, computer modelling, SYDNEY, MINITAB, BMDP.
7. Location of work: Edmonton
8. Study Objectives:
  - 1) To provide computer and data processing services to solve scientific problems and to provide other consulting services regarding various types of analyses using the in-house computer (VAX 8350) and personal computer systems for mathematical and scientific analyses, financial and material management systems; to provide data output using laser printers, plotters and various terminals; to develop and maintain programs and systems on the mini and micro computers.
  - 2) To provide training, consulting and programming assistance on the usage of the in-house computer and the University of Alberta computer, the various personal computers, Nicolet plotter, as well as other plotters, printers and graphics terminals.
  - 3) To provide data entry and operational assistance, tape backup and restore, address label printing and workplan updates.
  - 4) To initiate studies into the potential of the many personal computers and their features; as well, word processors, phototypesetters and any other new office automation or computer related equipment will be evaluated as to the possibility for communications with in-house

facilities and remote stations; telecommunications facilities will also be evaluated as required.

- 6) To advise on statistical procedures and packages available, any computer related consulting, system analysis and design, where possible, and to provide any other computer related service and advice which may be required by NoFC staff, other agencies or outside users.
- 7) To provide computer modelling assistance on a short term basis - for periods of one to six months.

9. 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 EDP 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.
4. Continue with the Ottawa work 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. Set up the PC network with ETHERNET.
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 district 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).

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.
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. Assist users with the Polaroid Palette.
16. Assist, when needed, with the software packages for the various personal computers. Assist with installation of 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 DATAPAC.

Additional Goals:

17. Participate in a wordprocessing study for all of NoFC and make recommendations as to hardware and software.
18. Participate in the Library Committee and help draft the terms of reference for the Library.
19. Attend Management Committee meetings to keep Management informed as to the status of the computer and network purchases.
20. Computer modelling assistance to be provided on a 1 - 3 month term basis during the last half of the year. Three studies are involved as a test of this service. The study leaders involved will be Drs. T. Singh, R. Swanson and M. Apps.
21. We will participate in the formation of a computer committee which will put out the terms of reference for the Computing Centre.

10. Accomplishments for 1987-88:

1. Prepared yearly report on computer usage by individual researcher. Prepared the annual HQ report and other reports for AgCan. Assisted with PC purchases and justifications. Was in contact with CFS EDP coordinator in Ottawa frequently during the VAX ordering process.
2. Wrote or adapted programs and systems as required and provided documentation. Assisted with the installation of the new IS systems.

3. Prepared the purchase orders for the VAX upgrade. Prepared our site so interruptions to users would be minimal during the installation of the new VAX. Installed the 8350 and peripherals and software.
4. Completed the old year and new year Ottawa work plan entries and revisions.
5. Provided training and assistance as required with in-house courses. The courses covered the VAX and personal computing introduction.
6. Provided keypunch and data entry services and backup and restore services as required by various projects. As of October 1, 1987, no further keypunch services were available, as we are phasing out the card reader as of March 31, 1988. All users have been informed that they must have their card files put on tape; the U of A no longer has a card reader either.
7. Expanded and maintained the local area network using existing wiring as far as possible; added ethernet trunks and 15 PC connections. We also added a larger distribution facility in the admin wing.
8. Installed and assisted as required with the personal computers.
9. Gave in-house courses to potential users of the VAX system. Prepared and presented beginners personal computing course on a one to one basis. Attended courses on VAX internals and SAS.
10. Continued with assistance to the district offices and set up regular visits as proposed in the terms of reference document.
11. 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).
12. The MARS mapping system did not get any support from management and has been shelved. Evaluated GIS proposals and sat in on meetings concerning the use of other facilities' systems. At this moment, the FIDS system is finally coming on line; Hall's system is being discussed at the Management meetings; REAP connection and/or ARC connection are also being discussed.
13. Active assistance with ENFOR is no longer required. Instead, we provide the same type of consulting services as to the rest of NoFC.
14. Assisted users with the plotting system. Tested out various paper types and pens for best results. Printed many graphs for the Fire section and others.
15. 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 they could use the computer aided instruction courses available



on the VAX. Assistance was given to people who wished to use the Polaroid palette slide and overhead display system.

16. Assisted with the software packages for the various personal computers. Assisted with the installation of the finance section's FMIS here and in the district offices; set up the PC's to interact properly with the VAX and DATAPAC.
17. Participated in a word processing study at NoFC and made suggestions as to hardware and software.
18. Participated as a member of the Library Committee and helped draft the terms of reference.
19. Attended Management Committee meetings to keep Management informed as to the status of the computer and network purchases.
20. Computer modelling assistance was provided on a 1 - 3 month term basis during the last half of the year. Three studies were involved as a test of this service. The study leaders involved were Drs. T. Singh, R. Swanson and M. Apps.
21. We participated in the formation of a computer committee which put out the terms of reference for the Computing Centre.

#### 11. Present Status of Study:

1. The Computing Centre is providing the best up-to-date service to NoFC users possible with the present computer configuration and personnel. We cover data processing, programming, system analysis, computer modelling, graphics, information retrieval, evaluations of personal computer requests, word processing and telecommunications and we provide assistance with office automation - mostly word processing at present - until the IS systems are installed. We are also providing computer modelling on an assignment basis. Since this is a service study, our goals tend to be continued from year to year.

#### 12. Goals for 1988-89:

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. Act as the NoFC representative at the ITAC, BISC-ITAC and AgCan computing meetings.
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 information systems- FMIS, MMIS, DEVMIS, SYDNEY and personnel. Assist, when needed, with the software packages for the various personal computers. Assist users with DATATRIEVE, MINITAB, SAS, BMDP and WORDPERFECT as required for data bases, statistics and document editing. Help users with BASIC, C and FORTRAN as required. Assist with the plotting system, Polaroid Palette, slide and overhead presentations. Expand and

maintain the mailing label database and prepare a user manual for the various users.


3. Complete the PC network using ETHERNET. Prepare documentation on the new system to help users with the transformation to the new VAX 8350.
  4. Continue with the Ottawa work plan rollup and enter year end corrections.
  5. 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. Continue with assistance to the district offices regarding personal computers, data processing, word processing and telecommunications. Set up a regular twice a year or more site visits as required and as set out in the terms of reference.
  6. Provide data entry services and backup and restore services as required by various projects. Provide various other operator services.
  7. 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. Attend the U.S. DECUS meeting to obtain the very latest news in DEC and DEC compatible hardware and software and attend meetings dealing with VAX problems.
  8. Continue to supply computer modelling support on a short term basis, one to six months.
12. Publications 1987-88:
- Grewal, H., editor. 1987. Bibliography of lodgepole pine literature. Can. For. Serv., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-291.
13. Environmental Impact:
- N/A.
14. Duration:
- Start: 1970                      Completion: Ongoing.
15. Resources 1988-89:
- |      |              |         |     |
|------|--------------|---------|-----|
| PYs: | Prof.:       | Chow    | 1.0 |
|      |              | Irwin   | 1.0 |
|      |              | Paradis | 1.0 |
|      | Tech.:       | Hai     | 1.0 |
|      | Total:       |         | 4.0 |
|      | Term/Student |         | 1.6 |

O & M: \$59,000 (NOT included are the prepaid costs for the VAX -  
\$55,526)

Capital:

16. Signatures:

  
Investigator

  
Program Director, Environment

  
Regional Director General

NOR-54

MANAGEMENT OF REGIONAL DEVELOPMENT PROGRAM

## CANADIAN FORESTRY SERVICE

## STUDY WORK PLAN

1988-89

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Responsibility Centre: NORTHERN FORESTRY CENTRE

Date: February 8, 1988

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.J. Heit
6. Key Words: Management, common support, economic development, agreements, job creation, prairie region, FORSTATS, Industrial Development
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, economic intelligence on new forestry investment
  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 1987-88:
  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 strategies for the next set of Agreements WDO and other program opportunities.

10. Accomplishments in 1987-88:

1. Managed the NOR-3 Economics studies statements and co-chaired GIS conference.
2. Developed, monitored and cooperated with CEIC, the job creation programs for Manitoba, Saskatchewan, Alberta and NWT which are forestry related.
3. 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.
4. Developed and implemented the programs under Canada-Manitoba, Canada-Saskatchewan, and Canada-Alberta Agreement Programs. The description of same is included in NOR-36.
5. Co-authored papers on the next round of program related efforts including Agreements, Secondary Forestry Directory.
6. Entered into negotiations with Alberta, Manitoba and Saskatchewan.
7. Negotiated fiscal program arrangements related to Weyerhaeuser's purchase of P.A. Pulp Company.
8. Participated in NoFC management team's efforts related to the management of NoFC such as Strategic Planning, Capital acquisition, computer purchase, O&M budget management and personnel management.
9. Served as chairperson of Alberta Forestry Association's Membership drive and director of same, and since July as President.
10. Participated in interdepartment exercises such as DRIE and WDO.

11. Goals for 1988-89:

1. To deliver the large array of programs associated with NOR-36.
2. To manage, through the District Managers the Winnipeg and Prince Albert 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 NOR-3 economics program, through the project leader.
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 1987-88:

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. Started: 1984

Completion: 1990 or continuing

14. Resources 1988-89:

PYs: Prof.: Heit 1.0

Tech.: Nil

Total: 1.0

Term/Student: Nil

O & M: \$14,500

Capital: Nil

15. Signatures:

  
Program Director, Development

  
Regional Director General