

STUDY STATEMENTS

1982-83

NORTHERN FOREST RESEARCH CENTRE

CANADIAN FORESTRY SERVICE

APRIL 1982

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NOR-1

Detection and Appraisal of Forest Insects and Diseases

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 14, 1982

1. Project: Detection and appraisal of forest insects and diseases
2. Title: Forest insect and disease survey
3. New: Cont.: X 4. No.: NOR-1-033
5. Study Leader: Y. Hiratsuka, H. Cerezke and B. Moody
6. Key Words: Detection, appraisal, distribution, parasites, hosts, damage, predators, biological control, hazard, susceptibility, stability, management, parks, recreation, symptoms, damage, effluents, easement atmosphere.
7. Location of Work: Throughout region.
8. Study Objectives:
 1. To gain an improved knowledge of forest insects and diseases in the region for the purpose of minimizing damage to trees and shrubs attributable to these organisms and to provide an advisory service to management agencies and the public, and to contribute to FIDS national overview of important pest conditions.
 2. Provide management agencies with diagnostic impact and appraisal services relating to effects of insects, diseases, climatic influences and pollutants on trees and shrubs and other types of vegetation.
9. Goals for 1981-82:
 1. Aerial and ground surveys to monitor major forest pests will be conducted in the three prairie provinces and the Northwest Territories (Petty, Still, Grandmaison, Tidsbury, Gates).
 2. Provide pest extension service to various client agencies (Emond).
 3. Special surveys for particular pests or of designated areas will be conducted. Some examples of special surveys which will be carried out in 1981 are:

- a. Mountain pine beetle surveys in southern Alberta and southern Saskatchewan including Cypress Hills and Rocky Mountain National Parks (Petty, Still, Grandmaison).
 - b. Repeat true color aerial photography in Cypress Hills Provincial Park (likely joint cost-shared with Alberta Parks) and cover additional areas not covered in 1980-81 (Hall, Petty).
 - c. Schleroderris canker detection surveys will be conducted in Banff and Jasper National Parks and in red pine plantations in eastern Manitoba (Hiratsuka).
 - d. Data on insect and disease incidence and tree mortality in mechanically thinned plots near Edson will be summarized into a report (Cerezke).
 - e. Elm bark beetle surveys will be conducted in Alberta with personnel from Alberta Agriculture (Emond).
4. Compile and publish an information report on the forest pest situations in the region for 1980 and make predictions for 1981. Draft copy of the report will be sent to the FIDS co-ordinator (Ottawa) by the end of January, 1981.
 5. Organize annual Federal-Provincial forest pest review and planning meeting in March of 1981 with representatives from provincial forest services and Parks Canada.
 6. Prepare and present lectures and talks on forest insects and diseases to various client agencies as requested.
 7. Contribute several articles to "Forest Management Notes" as required.
 8. Review and evaluate survey methods used elsewhere for major forest insects and diseases, and work towards the production of a standard survey methodology manual suitable for the region (Moody).
 9. A report on mountain pine beetle incorporating data up to 1980 will be prepared and published possibly as an information report (Cerezke, Petty).
 10. Pest depletion estimates by major forest pests for 1976-81 will be made and will be incorporated in the National Forest Resource Data Program (Moody).

10. Accomplishments for 1981-82:

1. Aerial and ground surveys were conducted, and areas of severe to moderate infestations were mapped of major forest pests (spruce budworm, mountain pine beetle, forest tent caterpillar, and jack pine budworm) in the three prairie provinces and the Northwest Territories.
2. Pest extension program was conducted and more than 2,000 inquiries were processed. Information booths on tree pests were displayed, on several occasions, to the general public, and many pest leaflets and other publications were distributed.
3. Many special surveys for particular pests or of designated areas were conducted. Examples are as follows:
 - a. Special surveys were conducted of mountain pine beetle in southern Alberta and several national parks.
 - b. Scleroderris canker detection survey was conducted in Banff and Jasper National parks with Dr. C. Dorworth (GLFRC) but the disease was not found in new locations.
 - c. Report of results from survey on insect and disease incidence and tree mortality in mechanically thinned plots near Edson has been prepared.
 - d. Elm bark beetle surveys were conducted with Alberta Agriculture but beetles were not detected in southern Alberta.
4. Compiled and published information report on the forest pest situations in the region for 1980 and made predictions for 1981. Draft copy of the report was sent to Ottawa for FIDS national report.
5. Annual interagency FIDS review and planning meeting was conducted at NoFRC with representations from three prairie provinces, the Northwest Territories and Parks Canada.
6. Lectures and talks on forest pests were presented on various occasions, e.g. Parks Canada staff, tree pruning courses sponsored by Alberta Agriculture, staff of tree nurseries, AFS staff on mountain pine beetle, etc.
7. One article entitled "1981 forecast for the forest tent caterpillar in the prairie provinces" was published in the Forest Management Note (No. 7).
8. Significant progress has been made towards the production of a standard survey methodology manual suitable for the region.
9. The first draft report completed in 1980 has not been revised. Since much of the data contained in this report has already been published in 1980 and 1981 FIDS reports, further need for the above as a publication needs to be discussed.

10. Pest depletion estimates by major forest pests for 1976-81 were made and sent to Ottawa coordinator for national compilation and incorporation in the National Forest Resource Data Program.

11. Goals for 1982-83:

1. Survey, map and report on major forest pests of the region, i.e. mountain pine beetle, forest tent caterpillar, spruce budworm, and jack pine budworm.
2. Conduct special surveys for particular pests or of designated areas.
3. Compile and publish an information report on the forest pest situations in the region for 1981 and make predictions for 1982. Draft copy of the report will be sent to FIDS coordinator in Ottawa for national compilations.
4. Provide pest extension service to various client agencies and general public.
5. Represent NoFRC and CFS on various provincial, regional and national forest insect and disease committees and advisory groups.
6. Organize and conduct annual interagency FIDS review and planning meeting with representatives (contact persons) from three prairie provinces, the Northwest Territories and Parks Canada (Prairie and Western regions).
7. Continue working towards the production of a standard survey methodology manual suitable for the region.
8. Make a map of major aspen and balsam poplar distribution in Alberta and explore the possibility of using satellite imagery to delineate area of severe defoliation by forest tent caterpillar and other aspen-poplar defoliators.

12. Publications:

Up to 1981 (from 1970)

Journal articles: 10

Information reports, notes, etc.: 32

File reports: Numerous (about 15/year)

1981-82:

Journal articles:

Nil

Information reports, notes, etc.:

Hiratsuka, Y., H. F. Cerezke, J. Petty and G. N. Still. 1981.
Forest insect and disease conditions in Alberta, Saskatchewan,
1980 and predictions for 1981. Northern Forest Research Centre,
Information Report NOR-1-231, 13 p.

Still, G. N. 1981. Forecast for the forest tent caterpillar in the
prairie provinces. Forest Management Note No. 7, 2 p.

File reports:

Grandmaison, M. 1981. Forest tent caterpillar (*Malacosma disstria*
Hbn.) defoliation forecasts for 1982 in Saskatchewan. File Report.

Still, G. N. 1981. Spruce budworm in Alberta. 1981. (*Choristoneura*
fumiferana Clem.). File Report.

Still, G. N. and M. Grandmaison. 1981. Forest insect and disease
conditions in the Northwest Territories and Wood Buffalo National
Park, 1981. File Report.

Still, G. N. 1981. Forest insect and disease conditions in Prince
Albert National Park, 1981. File Report.

Still, G. N. 1981. Jack pine budworm in Saskatchewan, 1981 and fore-
cast for 1982. File Report.

Petty, J. 1981. Some insects and diseases of Kananaskis Provincial
Park. File Report.

Still, G. N. 1981. Trembling aspen defoliation in Alberta, 1981.
File Report.

Petty, J. 1981. Mountain pine beetle - Cypress Hills Provincial Park.
File Report.

Still, G. N. 1981. Trembling aspen defoliation in Saskatchewan,
1981. File Report.

Still, G. N. and J. Petty. 1981. Forest tent caterpillar defoliation
forecast for 1981 - Central Alberta. File Report.

Cerezke, H. and H. Gates. 1982. Damage and mortality factors in
mechanically thinned young lodgepole pine, Edson Forest,
Alberta. File Report.

Tidsbury, C. 1982. Spruce budworm infestations in Manitoba 1981 and
forecasts in 1982. File Report.

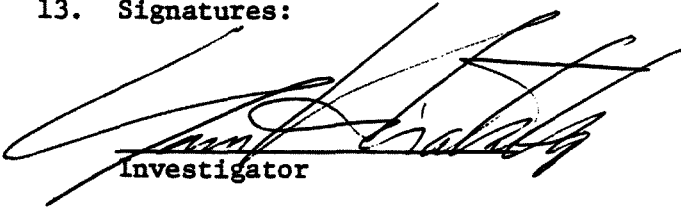
Tidsbury, C. 1982. Forest tent caterpillar infestations in Manitoba, 1981 and defoliation forecasts for 1982. File Report.

Emond, F. J. 1981. Tree pest extension report, 1981. File Report.

Tidsbury, C. 1982. Insect and disease conditions in Riding Mountain National Park, 1981. File Report.

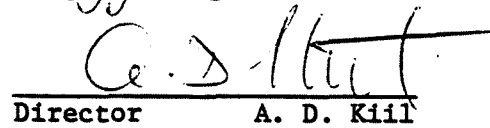
Tidsbury, C. 1982. Insect and infectious disease conditions in the Pineland Forest Nursery, Hadashville, Manitoba, 1981. File Report.

13. Signatures:


Investigator


Program Manager


Investigator


Director A. D. Kill


Investigator

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 14, 1982

1. Project: Detection and appraisal of forest insects and diseases
2. Title: Sawfly systematics
3. New: Cont.:
4. No.: NOR-1-058
5. Study Leader: H.R. Wong
6. Key Words: Tenthredinoidea, Nearctic Region, distribution, hosts, keys, life history, morphology, new genera, new species, biogeography, revision, Symphyta, evolution, phylogeny.
7. Location of Work: Edmonton, Alberta
8. Study Objectives:
 1. To make biosystematic studies of the sawflies of Canada and maintain taxonomic expertise in this group of insects at the national and international level.
 2. To separate the various sawfly species in their mature and immature forms by means of keys, descriptions and illustrations.
 3. To study the evolution and biogeography of the more important sawfly genera leading to their revision in North America, North of Mexico.
 4. To study the external and internal morphology of the more economic sawfly species.
9. Goals for 1981-82:
 1. Identify sawflies for research personnel, institutions and laboratories.
 2. Prepare descriptions of the 27 new species of *Pristiphora* for a monograph on the Evolution, Classification and Biogeography of the genus *Pristiphora* Latreille with a catalogue of the world species (Nymenoptera: Tenthredinidea).
 3. Find morphological characters in larvae of the coniferous feeding sawfly of the family Diprionidae to separate the different genera in North America.

10. Accomplishments in 1981-82:

1. (a) Identified nearly 350 larval and adult sawflies for the Forest Insect and Disease Survey of the Northern Forest Research Centre, Canadian National Collection, regional clients and in-service personnel.
- (b) Reviewer. Two sawfly papers submitted to the Canadian Entomologist.
- (c) Presented a paper on sawfly taxonomy at the invitation of the Chinese Academy of Forestry, Beijing, China on November 10, 1981.
2. Descriptions have been made for the 27 new species of *Pristiphora* from the Northwest Territories, Yukon and Alaska. These species will be incorporated in the study on the evolution and taxonomy of this genus.
3. Morphological characters have been found on the head and body to separate the different genera of Diprionidae in North America.

11. Goals for 1982-83:

1. Identify sawflies for research personnel, institutions and laboratories.
2. Illustrate the morphological characters to separate the different genera of Diprionidae in North America.
3. Collaborate with J.A. Drouin on an information report dealing with seasonal development and chemical control of the birch leaf miners in Alberta.
4. When time permits work on the *Pristiphora* monograph.

12. Publications:

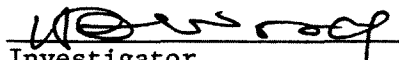
Up to 1981-82


Journal articles	27
Information Reports etc.	8
File Reports	0

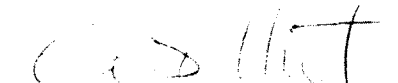
1980-81

Nil

13. Signatures:


Investigator


Program Manager


Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 15, 1982

1. Project: Detection and appraisal of forest insects and diseases
2. Title: Control and damage impact of insects injurious to trees and shrubs.
3. New: Cont.: X 4. No.: NOR-1-143
5. Study Leader: H. F. Cerezke
6. Key Words: Forest habitats, shelterbelts, woodlots, parks and recreational areas, plantations, seed orchards, tree nurseries, pesticides, cultural control, integrated control, growth losses, pupulation sampling.
7. Location of Work: Region wide.
8. Study Objectives:
 1. To maintain up-to-date information and provide technical and advisory services on insect problems of trees and shrubs common to the region, laws related to pesticides and their usage, insect control methods and effects of pesticides on the environment.
 2. To provide information on insect control, abundance, hazard, damage impact and depletion losses in areas of concern to various clients.
9. Goals for 1981-82:
 1. Provide lead role at NoFRC in coordination of mountain pine beetle activity within the region with client agencies (AFS, Parks Canada, Alta. Parks, Private Industry, Sask. Parks, Sask. D.T.R.R.) and with PFRC, BCMF and H.Q. as required.

Some specific goals include:

 - (i) provide advisory and information role on biological and control aspects in the mountain pine beetle infestations of the region as requested.

- (ii) provide documentation, with cooperation of Alta. Parks and FIDS, of the outbreak history and distribution of mountain pine beetle in the Cypress Hills, for the purpose of evaluating control strategy now in place and its success.
 - (iii) gather information on the mountain pine beetle in the Cypress Hills for biological assessment of tree attack pattern, brood survival and productivity, and mortality factors.
 - (iv) Incorporate the biological information into a stand hazard rating classification which can be used in the overall forest - park management plan of Cypress Hills Prov. Parks.
2. Finalize the following reports or publications:
- (a) Impact studies of the jack-pine budworm (*Choristoneura pinus pinus*) in Nisbet Provincial Forest, Sask.
 - (b) Surveys of spruce budworm populations and damage impact in Riding Mt. National Park, 1979-80.
 - (c) Control studies of seed and cone insects in mature white spruce trees with carbofuran near Grande Prairie, Alberta.
3. Provide CFS - NoFRC representation on various provincial, regional and national committees as required.

10. Accomplishments in 1981-82:

- 1. Little progress made toward preparation of first draft because of heavy commitments on mountain pine beetle (MPB). A few photographs were assembled and several references were added to files. Further input will be devoted between now and end of fiscal year.
- 2. Involvement in mountain pine beetle was varied and time consuming as indicated in the following:
 - (a) A typed brochure on the biology, damage and tree protection aspects of mountain pine beetle was prepared and distributed on a request-need basis. Clearance for insecticidal approval was obtained from CDA, Ottawa, Alberta, Environment and Saskatchewan Environment.
 - (b) A special survey was initiated with FIDS to establish the dispersion of the MPB in the southern prairie zone (results reported under NOR-1-033). Data are being gathered to relate to wind and beetle emergence and flight.

- (c) Attended three meetings with AFS staff to review MPB status in the designated control and salvage zones of SW Alta. Participated by aerial and ground surveys to assess the outbreak and controls. Prepared a report for AFS use.
- (d) Conducted an evaluation of overwinter survival and population trend in the Cypress Hills (Alta. side), including 4 locations, and summarized main results for Provincial Park use. Data contribute toward 2 (ii, iii and iv).
- (e) Participated as speaker at joint AFS-CFS-CIF sponsored MPB Symposium, Coleman, Alta., Feb. 1981. Presented a report "An Overview of the Problem".
- (f) Prepared short note for Prairie Landscape Magazine titled "Mountain Pine Beetle in Southern Alberta and Saskatchewan".
- (g) Participated in a 2-day training program on MPB for national park Wardens in Kootenay and Yoho N.P.
- (h) Presented talk as one of three panel speakers to Environment Protection Study Group of Public Advisory Committee, Environment Council of Alberta.
Title: "Mountain Pine Beetle Control and Salvage Operations, with Special Reference to the South Castle Area".
- (i) Served as CFS-NoFRC representative on Technical Subcommittee on MPB to help resolve problems relating to the MPB in the Rocky Mt. zone along the B.C.- Alta. border. Attended four meetings with PFRC - BCMF - AFS and PC participation to review and formulate a control strategy plan. Also attended two meetints of the Interagency Committee on MPB.
- (j) Attended International meeting at Fairmont Hot Springs to review all concerns of MPB in western U.S. and Canada.
- (k) Provided input into several T.V., newspaper media reports on MPB.
- (l) Assisted in an aerial-ground inspection of suspected MPB-killed trees in Rocky-Clearwater Forest; identified that causal agent was likely lightning. Report prepared for AFS: "Report on Group Tree Mortality, Rocky-Clearwater Forest".
- (m) Numerous consultory services and technical advice have been provided to different clientel and agencies including identification of bark beetle specimens.

3. (a) Little progress made toward finalizing this report due to MPB.
 - (b) Foliage collected in 1980 has been examined and analyzed for pattern of recovery following budworm collapse. Data have yet to be incorporated into the 1979-80 report.
 - (c) Final report on seed and cone insect study prepared and circulated for local editorial review. Permission for use of data was obtained from Proctor and Gamble. Final revisions still incomplete.
 4. Served as CFS-NoFRC representative on the following committees:
 - (a) Alberta Pest Control Advisory Committee: attended and reported.
 - (b) Annual Meeting of the Insect Committee of Saskatchewan Advisory Council of Crop Pests: Submitted a report.
 - (c) Western Forum and Western Committee of Crop Pests: attended and provided reports.
 - (d) Forest Pest Control Forum Review Meeting - Ottawa: attended and prepared reports.
 - (e) Environmental Subcommittee of Alberta Horticultural Advisory Committee: attended and provided a report. Also, gave slide presentation on MPB.
 - (f) Attended extra spruce budworm meetings in Ottawa dealing with depletion loss and Survey Implementation Plans.
 - (g) Attended Pheromone Workshop at FPMI for national review of forest insects within CFS, April, 1981.
 5. Provided a variety of consultory services in the form of editorial reviews, insect identifications, control information, tree growth problems and other technical information dispersal.
11. Goals for 1982-83:
1. Provide lead role at NoFRC in coordination of MPB survey, monitoring, infestation spread and population trend evaluation within the region with client agencies, and including the following areas:
 - (a) Help coordinate aerial and ground detection within FIDS and outside agencies in forested, urban, park and agricultural areas for annual mapping of infestations;

- (b) Provide on-site assessment of MPB hazard and potential for spread in key sensitive areas defined by Inter-agency and/or Technical Subcommittee;
 - (c) Maintain active role as NoFRC representative on MPB Technical Subcommittee to review and recommend need for control action;
 - (d) Maintain advisory role on MPB technical information to satisfy client requests;
 - (e) Initiate field evaluation studies with client agencies for assessment of the effectiveness of control strategies;
 - (f) Examine stand hazard rating systems published elsewhere to extract those elements which can be applicable in western Canada.
 - (g) Prepare reports on MPB activity as requested and for annual or seasonal update.
2. Finalize the following reports or publications:
- (a) Impact studies of the jack pine budworm (*Choristoneura pinus pinus*) in Nisbet Provincial Forest, Sask.
 - (b) Surveys of spruce budworm populations and damage impact in Riding Mt. National Park, 1979-80.
 - (c) Control studies of seed and cone insects in mature white spruce trees with carbofuran near Grande Prairie, Alberta.
3. Provide CFS-NoFRC representation on various provincial, regional and national committees as required.
12. Publications:

1981-82

Cerezke, H. F. 1981. Mountain pine beetle in southern Alberta and Saskatchewan - Prairie Landscape Magazine, 1 p.

Cerezke, H. F. 1982. Mountain pine beetle: an overview of the problem. Proc. being assembled and printed by Alberta Forest Service.

Cerezke, H. F., J. A. Drouin and B. Neill. 1981. Revision of recommended insecticides for control of insects on shelterbelts, ornamental trees and shrubs. (Chapter in WCCP report, 1981); 17 pp.

Cerezke, H. F. 1981. Control recommendations for insects of "Seasoned Wood and Timber Structures"; 3 pp. (New chapter for 1981 WCCP report).

Unpublished reports 1981 82

Cerezke, H. F. 1981. Report on group-tree mortality, Rocky-Clearwater Forest, 3 pp.

Cerezke, H. F. 1981. Interim report on mountain pine beetle in the Cypress Hills, Alberta, 4 pp.

Cerezke, H. F. 1981. Mountain pine beetle - its biology, damage and control, 4 pp. Prepared as handout brochure.

Cerezke, H. F. 1981. Assessment of mountain pine beetle control area, Porcupine Hills - East Livingstone Range, Sept. 1981, 4 pp.

Cerezke, H. F. 1981. Mountain pine beetle control and salvage operations, with special reference to the South Castle area; 7 pp. illust. with slides. Panel presentation to Environ. Protection Study Group, Public Advisory Comm., Environment Council of Alta.

Cerezke, H. F. 1981. Western Forest Insect Work Conference: Workshop summary: How can we speed up the return of survey information to the land manager, 2 pp.


Knowles, K., Y. Beaubien, H. Gates, D. Hunt and D. Taylor. 1981. White spotted sawyer beetle survey, Kipahigan Lake fires, Manitoba, April 1981. 10 pp. For. Br., Dept. Nat'l Resources, Manitoba.

Additional Reports prepared by H. Cerezke for the following Committees: Alta. Pest Control Advisory Committee; Insect Committee of Sask. Adv. Council of Crop Pests; Forest Pest Control Forum, Environmental Subcom., Alta. Hort. Adv. Comm.

13. Signatures:


Investigator


Program Manager


Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 14, 1982

1. Project: Detection and appraisal of forest insects and diseases
2. Title: Forest Insects: Diagnostic and taxonomic services
3. New: Cont.: X 4. No.: NOR-1-154
5. Study Leader: H. R. Wong
6. Key Words: Insects, larvae, damage, hosts, parasites, biological control, galls, seasonal occurrence, distribution, nomenclature, taxonomy, identification, reference collection, insectary, life history.
7. Location of Work: Edmonton, Alberta.
8. Study Objectives:
 1. Provide diagnostic and biosystematic services to clients, in-service personnel, outside agencies and scientists engaged in biological and taxonomic research on insects.
 2. Maintain and improve the regional collection of insects and mites.
 3. When the opportunity arises, initiate biological and ethological studies to improve the diagnostic and biosystematic services.
9. Goals for 1981-82:
 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 regional reference collection of insects and mites.
 3. Provide information and specimens to scientists engaged in taxonomic and biological studies.

Goals Added in 1981:

4. Make surveys in eastern Manitoba and western Alberta for the European pine shoot moth, larch casebearer and the European spruce sawfly.
5. Identify the species of pill beetle in outbreak numbers in the nursery beds of spruce and pine in Big River, Sask.
6. Review application for Research Grant.
7. Determine the species of *Proteoteras* attacking shoots of boxelder in the Prairies.

10. Accomplishments in 1981-82:

1. Determined several thousand insect specimens in the mature and/or immature stages submitted to the Northern Forest Research Centre and handled over a thousand enquiries for in-service personnel, clients, outside agencies and scientists.
2. (a) One hundred and thirty specimens determined by specialists in Ottawa and by myself have been incorporated into the Insect Reference collection.
- (b) Over four hundred immature insects were reared and about seventy-five overwintered to obtain biological information and specimens for the reference collection.
- (c) Over three hundred specimens were pinned, spread, labelled or preserved for the reference or store collections.
3. Biological information and/or specimens were provided to the following:

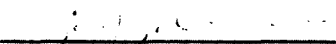
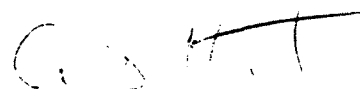
Dr. Xia gang-row, Chinese Academy of Forestry, Baijing, China.
 K. D. Bolte, Biosystematic Research Institute, Ottawa, Ontario.
 Dr. D. N. Duffy, McGill University, Anne de Bellevue, Quebec.
 D. R. Ward, Carleton University, Ottawa, Ontario.
 Dr. D. E. Bright, Biosystematic Research Institute, Ottawa, Ontario.
 Dr. W. C. McGutha, Biosystematic Research Institute, Ottawa, Ontario.
 Dr. P. Dang, Biosystematic Research Institute, Ottawa, Ontario.
 I. Cummings, University of Alberta, Edmonton, Alberta.
4. Field collections in eastern Manitoba and western Alberta disclosed populations of the larch casebearer declined in Manitoba, and still not present in Alberta. The European spruce sawfly appeared to be more abundant in Manitoba and has spread west to Vivian and north to Lac du Bonnet. The European shoot moth has not been detected in the Prairies, although present in Ontario and British Columbia.

5. The species of pill beetle in outbreak numbers in the spruce and pine nursery beds in Big River, Sask. has been identified as *Tylicus subcanus* Lec. This species has been recorded from British Columbia, Washington and Oregon. It appears to be the first observed infestation in Saskatchewan.
 6. Reviewed the merits of an application to the Natural Sciences and Engineering Research Council for a research grant in my field of knowledge.
 7. Field collections and laboratory studies indicate three species and not one attack the shoots of boxelder in the Prairies. These have been identified as *Proteoteras aesculana* Riley, *P. willingana* (Kearfott) and *P. crescentana* Kearfott.
 8. Chairman of the local arrangements committee of the thirty-second meeting of the western forest insect work conference at Banff, Alberta, 1981.
11. Goals for 1982-83:
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 regional reference collection of insects and mites.
 3. Provide information and specimens to scientists engaged in taxonomic and biological studies.
 4. Instruct Yvonne Beaubien of the Manitoba Dept. of Natural Resources on the identification and curating of insects.
 5. Instruct Bert Bailey of the National Research Council, Saskatoon, Sask. on how to identify species of the genus *Proteoteras*.
 6. Prepare insects for display in the New Natural History Museum of the Manitoba Forestry Association near Hadashville, Manitoba.
 7. Identify approximately 2,850 insects for the Forest Technology School, Hinton, Alberta.
 8. Collaborate with Dr. P. Dang, Biosystematic Research Institute on a paper dealing with the identification of *Proteoteras* in the Canadian Prairies.
 9. Collaborate with J. A. Drouin on an information report dealing with Insect pests of saskatoon and chokecherry in Alberta and their control.
 10. Make a survey of the tree nurseries in the Canadian Prairies to determine the major insects attacking seedlings, and prepare a forest management note on them.

12. Publications:

Up to 1980-81

Journal articles	37
Information Reports etc.	30
File Reports	1

13. Signatures:
Investigator
Program Manager
Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 15, 1982

1. Project: Detection and appraisal of forest insects and diseases
2. Title: Damage appraisal of major forest pests.
3. New: Cont.: X 4. No.: NOR-1-184
5. Study Leader: B.H. Moody
6. Key Words: Damage, appraisal, impact, hosts, forest pests, management, mortality, growth loss.
7. Location of Work: Prairie Provinces, Northwest Territories.
8. Study Objectives:
 1. To determine the significance of specific forest pests in terms of measured damage to the tree and forest stands.
 2. To develop or modify appraisal methods for assessment of losses caused by forest pests; and to provide information on forest depletion that can be used in the national forest statistics data program.
9. Goals for 1981-82:
 1. Conduct preliminary surveys of established impact study plots and areas of known pest infestations to determine the current and past pest damage, and the feasibility of quantifying its effect on tree mortality and growth loss. Major pests involved would be:
 - a. Mountain pine beetle in southern Alberta and Saskatchewan.
 - b. Spruce budworm in Manitoba.
 2. Review and evaluate the literature and data on the effects of major forest pests on tree growth and tree mortality in the forests of the region. If possible, apply this information to quantify pest depletion estimates for the National Forest Resource Data Program.

Goals for 1981-82 (cont'd.)

3. Investigate the possibility of establishing permanent plots in forests with known pests infestations (spruce budworm, jack pine budworm and dwarf mistletoes) to measure impact annually.
4. Investigate the possibility of using remote sensing techniques to assess pest damage.
5. Explore avenues of improved liaison with other forestry agencies to maximize data collection.

10. Accomplishments for 1981-82:

- (1) Preliminary surveys were conducted and impact plots (37) established in mountain pine beetle infested pine stands in Waterton Lakes, Yoho and Kootenay National Parks. The spruce budworm impact plots established in 1978 in Riding Mountain National Park were reassessed.
- (2) The literature and available data on the effects of major forest pests on tree mortality and growth in the region were reviewed and evaluated and used for depletion estimates for the National Forestry Statistics Program.
- (3) Permanent plots (17) were established in spruce-fir forests with known pest infestations by the spruce budworm in Manitoba.
- (4) Remote sensing techniques to assess pest damage were investigated, and a seminar and discussion held at NoFRC. An Information Report on the proceedings is in final preparation.
- (5) Contacts with provincial forestry personnel have been established and cooperation has been good.

11. Goals for 1982-83:

- (1) Remeasure 37 impact plots and assess damage by the mountain pine beetle in the National Parks. Establish additional plots if required.
- (2) Prepare first draft of a literature review on the effects of major forest pests on tree mortality and growth in the forests of the region.
- (3) Remeasure 17 spruce budworm impact plots established in 1981 in Manitoba and establish additional plots if required. Establish impact plots in stands of known jack pine budworm infestations and dwarf mistletoe infection.

Goals for 1982-83 (cont'd.)

- (4) Continue to investigate the use of remote sensing techniques as a tool to assess pest damage in cooperation with project NOR-22.
- (5) Continue to develop effective working relationships with officials of provincial and industrial forest resource management agencies.

12. Publications:

1981-82:

Journal articles: Nil
Information reports, notes, etc.

The following Papers In Hudak and A. G. Raske (editors). 1981. Review of the Spruce Budworm Outbreak in Newfoundland -- its Control and Management Implications. Env. Can., Can. For. Serv., Nfld. For. Res. Centre. Inf. Rpt. N-X-205.

- (a) Moody, B. H. 1981. Damage caused by the spruce budworm in immature stands. pp. 47-49.
- (b) Raske, A. G. and B. H. Moody. 1981. V. 3. Damage by the present outbreak to the forests of Newfoundland to 1979, a) Commercial fibre production. b) Mature stands. pp. 37-47.
- (c) Van Nostrand, R. S., B. H. Moody and D. B. Bradshaw. 1981. II. The forests of Newfoundland, their major pests and fire history. pp. 3-10.
- (d) Blais, J. R., E. G. Kettela and B. H. Moody. 1981. III. History of spruce budworm outbreaks in eastern North America with special reference to Newfoundland. pp. 12-17.

Moody, B. H. 1981. The role, informational requirements and pest problems of the forest insect and disease survey. Paper presented at seminar on "The Use of Remote Sensing in Forest Pest Damage Appraisal". Envir. Can., Can. For. Serv., NoFRC, Inf. Rpt. NOR-X- (In Press).

File Reports:

Moody, B. H. 1981. Impact of the mountain pine beetle on various lodgepole pine stands. I. Plot establishment and methods. File Rpt. Study NOR-1-184.

Moody, B. H. 1981. Impact of the spruce budworm on some major forest types of Manitoba. I. Plot establishment and methods. File Rpt. Study NOR-1-184

13. Signatures:

B. H. Moody
Investigator

[Signature]
Program Manager

[Signature]
Director A. D. Kill

NOR-3

Resource Opportunities and Policy Guidelines

1982 - 83

Date: January 28, 1982

1. Project: Resource opportunities and policy guidelines
2. Title: An assessment of the forest-based economy of the Prairie Provinces
3. New: Cont.: X 4. No.: NOR-3-123
5. Study Leader: W. Ondro, T. Williamson
6. Key Words: Sawmills, pulp mills, products, employment, markets, costs, benefits, economic impacts, forest industry
7. Location of Work: Northern Forest Research Centre, Edmonton, Prince Albert, Regina, Winnipeg
8. Study Objectives:
 1. To provide socio-economic information to regional forestry programs for rational policy formulation and program development by identifying and estimating the major economic benefits, product flows and impacts of the forest resource and its utilization in W & N Region.
 2. To provide input of regional forestry programs by participating as a team member in interdisciplinary studies.
 3. To provide economic statistics and guidelines on costs and benefits, concerning the forest resource, impacts of forest management, marketing, and related socio-economic data.
9. Goals for 1981-82:
 1. Publish "Directory of Primary Wood-Using Industries in Saskatchewan, 1980".
 2. Prepare and publish Information Report "Forest Industry in the Economy of Alberta 1979/80".
 3. Prepare Information Report "Forest Industry in the Economy of Manitoba, 1980/81".

9. Goals for 1981-82: (cont'd)

4. Prepare Information Report "Forest Industry in the Economy of Saskatchewan, 1980/81".
5. Prepare Forestry Fact Sheets for Alberta, Saskatchewan and Manitoba 1980/81".
6. Provide economic expertise and conduct feasibility studies to ensure effective implementation of DREE agreements in Prairie Provinces as required.
7. Identify opportunities relating to research in the area of intensive forest management.

Goals added:

8. Complete data collection and initiate analysis for study "Capacity of forest product industry and demand for forest products in Northwest Territories".
 9. Prepare contribution to a position paper on "Economic Impact of Mountain Pine Beetle in Alberta".
 10. Initiate analysis for "Information Report", "Utilization of Mill Residues in Alberta".
 11. Prepare Forest Management Note on "Harvesting Forest Biomass by Dyka Side cutter". (in review)
 12. Initiate analysis for Information Report "Production Functions in Alberta's Sawmill Industries".
 13. Supervise preparation of contract report "Return on Investment in Alberta's forest industry".
 14. Prepare contributions for NoFRC's Forestry Report "Core dibble reduces impact of soil compaction on seedling growth" and "Advances in mechanical reforestation".
 15. Prepare a critique of "Cost-Benefit Analysis in Reforestation in Manitoba.
10. Accomplishments for 1981-82:
1. A "Directory of primary wood using industries in Saskatchewan 1980", was published.
 2. An Information Report "Forest Industry in the Economy of Alberta 1978/79 was prepared (in review)

10. Accomplishments for 1981-82: (cont'd)

3. An Information Report on the "Forest Industry in the Economy of Manitoba" was not prepared; data is now ready for processing.
4. An Information Report on the "Forest Industry in the Economy of Saskatchewan" was not prepared; data is being summarized for analysis.
5. A Fact Sheet for Alberta was initiated (in review). Fact Sheets for Saskatchewan and Manitoba were not prepared.
6. Economic expertise for effective implementation of DREE agreements were provided upon request.
7. Some opportunities relating to research in the area of intensive forest management were tentatively identified.
8. Data collection was completed and analysis were initiated for the study "Capacity of forest product industry and demand for forest products in N.W.T."
9. A contribution to a Position paper "Impact of Mountain Pine Beetle on forest industry in Alberta" was prepared.
10. Analyses were initiated for Information Report "Utilization of Mill Residues in Alberta"
11. Forest Management Note "Harvesting Forest Biomass by Dyka Side Cutter" was prepared and is under review.
12. Analyses were initiated for Information Report "Production Functions in Alberta Sawmill Industries".
13. Preparation of Contract Report "Return on investment in Alberta forest industry" was supervised.
14. Contributions to the Forestry Report "Core dibble reduces impact of soil compaction on seedling growth" and "Advances in mechanical reforestration" were published.
15. A critique of "Cost-Benefit Analysis in Reforestation in Manitoba" was prepared.

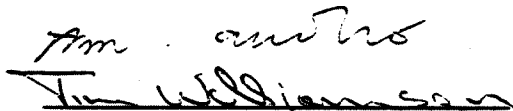
11. Goals for 1982-83:

1. Publish an Information Report on the "Forest Industry in the Economy of Alberta 1978/79".
2. Prepare an Information Report on the "Forest Industry in the Economy of Manitoba, 1980/81".

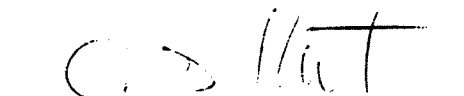
11. Goals for 1982-83: (cont'd)

3. Prepare an Information Report on the "Forest Industry in the Economy of Saskatchewan, 1980/81".
4. Prepare and publish a Fact Sheet for Saskatchewan and Manitoba.
5. Prepare an Information Report on the "Capacity of Forest Industry and Demand for Forest Products in N.W.T.".
6. Prepare a report on the "Utilization of Mill Residues in Alberta".
7. Publish a Forest Management Note "Harvesting of Forest Biomass by Dyka Side Cutter".
8. Prepare a thesis on the "Production Functions in Alberta's Industries".
9. Prepare and publish a contract Information Report on the "Return on Investment in Alberta Forest Industry".
10. Provide economic expertise and conduct feasibility studies to ensure effective implementation of DREE agreements in Prairie Provinces as required.
11. Identify subject areas, needs and scope for economic analysis on the economic effects of intensive forest management.

12. Signatures:


Investigator


Program Manager


Director A.D. Kill

NOR-4

Yields of Managed Stands

1982 - 83

Date: January 27, 1982

1. Project: Yields of managed stands
2. Title: Growth and yield of lodgepole pine in the foothills section
of Alberta
3. New: Cont.: X 4. No.: NOR-4-009
5. Study Leader: I.E. Bella
6. Key Words: *Pinus contorta*, stand development, yield tables,
management planning, B. 19a, c., thinning and spacing.
7. Location of Work: Foothills section of Alberta
8. Study Objectives:
 1. To construct a variable-density yield table for use in natural,
unmanaged lodgepole pine stands.
 2. To determine how thinning and spacing affects diameter, height
and volume growth, and stand development of lodgepole pine.
9. Goals for 1981-82:
 1. Goals and accomplishments are covered under NOR-4-045.
 2. This study is now combined with NOR-4-045.

Phil Larkin

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 27, 1982

1. Project: Yields of managed stands
2. Title: Growth and yield of five commercially important native species in Alberta, Saskatchewan, and Manitoba
3. New: Cont.: X 4. No.: NOR-4-045
5. Study Leader: I. E. Bella
6. Key Words: *Pinus banksiana*, *P. contorta* var. *latifolia*, *P. resinosa*, *Picea glauca*, *Populus tremuloides*, tree and stand growth, yield tables, thinning and spacing.
7. Location of Work: Various locations in Alberta, Saskatchewan, and Manitoba.
8. Problem:

Improved forest management requires reliable methods of forecasting growth and yield of stands of different density and site quality. Such methods are also necessary to make decisions about density control treatments designed to increase merchantable yield or shorten rotation. As planting is being used increasingly for stand renewal, information is needed on the effect of spacing on growth and yield of such new stands.

There are now adequate variable density yield tables for the lodgepole pine type in Alberta, which also show the reduction of productivity at high stand densities. Provisional yield tables have also been published for jack pine in Manitoba and aspen in Manitoba and Saskatchewan.

These two important pine species, lP and jP, often regenerate in very dense stands and require thinning treatment to maintain rapid growth. Aspen, also a pioneer species, produces very dense sucker stands after disturbance. While the general nature of relationships between growth and stand density are well understood, specific information is scanty on actual growth figures at different thinning regimes. The same applies to growth at various spacings. To obtain such needed growth and yield information, several thinning and spacing trials were established in the past and periodically remeasured.

Methods:

Thinning experiments. In the earlier ones, where trees were individually selected and cut, the intensity of thinning was defined in an arbitrary fashion, usually on the basis of crown class designation. In the more recent experiments, intensity was defined by spacing, basal area, or SDI. In strip thinning, intensity is the function of residual strip width, while the width of the cut strip is constant. Stands were thinned once in all but two experiments. Stand ages and site conditions usually differed by studies. Measurements and remeasurement: dbh to 1/10 inch of all trees, height and crown dimensions of selected sample trees only. In most selective thinning experiments, the trees on the plots were mapped. More recently, some short-term studies have been undertaken on testing thinning equipments (brush saws); and analyzing two exploratory thinning-fertilization experiments in lodgepole pine.

Spacing experiments in conifers:

Manitoba:

Four spacings were used: 4 X 4, 6 X 6, 8 X 8, and 10 X 10 feet; 49 trees (7 X 7 matrix) on each plot with a surround of two rows. Each spacing was replicated four times per species per area. Trials established for the three species were:

Picea glauca - at Riding Mountain on fresh till.
- in Sandilands Forest Reserve on fresh sand.

Pinus banksiana - Sandilands Forest Reserve on dry and/or fresh sand.

P. resinosa - in Sandilands on fresh sand.

Alberta:

Lodgepole pine only. Five spacings were established in fire-origin stands: 200, 400, 800, 1600, and 3200 stems/ac with 100 trees per plot. Two replicates were put in for 3 site types.

Gregg Burn - 7-year-old stand spaced in 1964.

Tepee Pole Creek - 27-year-old stand spaced in 1967.

9. Study Objectives:

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

4. Use all available growth and yield information on these species to derive and/or adapt a suitable stand growth model for evaluating stand management options in terms of growth and yield.

10. Resources:

- a. Starting date: as early as 1921
- b. Estimated year of completion: Most of these studies generally extend over the life of the stand.
- c. Estimated total Prof. man-years required: N/A
- d. Essential new major equipment items for 1982-83 with costs: Nil
- e. Essential new major equipment items beyond 1983 with costs: Nil
- f. 1982-83 man-years

Prof.	0.8	(I.E. Bella)
Supp.	0.5	(vacant)
Casual	<u>0.2</u>	
Total	1.5	

11. Progress to Date:

1. Objective 1 of this study has been satisfied. Continued remeasurement of various permanent growth and yield plots will provide valuable base-line data against which many of our cultural treatments can be compared.
 - a) Growth and yield plots, 1P: established: 1951, 1952, 1953
remeasured: 1961, 1974 (next 1984)
other species: every 10 years, or as need arises.
2. Thinning experiments (see also summary table):
 - a) Sample plots have been established and thinning treatment carried out where required. Trees on the plots were measured and remeasured. Interim results of the thinning experiments have been published.
 - b) Undertook the assessment of growth response to operational strip thinning programs in pine--jack pine in Manitoba, lodgepole in Alberta--by the respective provincial government agencies, and published results as became available.
 - c) Conducted performance trials with brush saws for thinning young lodgepole pine stands.
3. Spacing experiments:

Manitoba:

 - a) The spacing trials were established in the spring of 1963 and 1964. First year mortality was filled in the first spring following planting. A cursory examination to determine mortality trends and general health status of trees was done in the autumn of 1971.

- b) Spacing trials with adequate survival were remeasured in the late summer of 1973 and 1978. (One replication of the jack pine trials that were located south of Sandilands on dry sites, were abandoned because of excessive mortality due to a severe drought in 1967.) An Information Report was written based on the remeasurement results.

Alberta:

- c) Gregg Burn (Hinton):

1963 & 1964 - 5 espacements established in 7-year-old pine
on 3 sites
1966 - initial measurements
1970 - plot maintenance
1971 - trees remeasured
1973 - biological agents affecting growth and survival of
each tree identified
1974 - plot maintenance
1976 - trees remeasured and aerial photographs taken
1981 - remeasured

- d) Tepee Pole Creek:

1966 & 1967 - initial treatments applied to 25-year-old pine stand
1972 - plots remeasured
1977 - plots remeasured
(1982 - to be remeasured)

- 4. Over 40 reports and journal articles have been published on growth and yield and biomass productivity, on thinning and spacing response mainly on jP, lP and aspen; but also on rP, sP, and wS by Ackerman, R.F., I.E. Bella, J.P. DeFranceschi, J.H. Cayford, W.D. Johnstone, G.A. Steneker, J.M. Jarvis, R.T. Pike, L.A. Smithers and G.M. Wilson between 1950 and 1980.

12. Goals for 1981-82:

- 1. Publish report on the Gregg Burn spacing.
- 2. Publish report on the McKay thinning study.
- 3. Complete the analysis of the Tepee Pole Creek data.
- 4. Direct the measurement of the Gregg Burn trials.
- 5. Publish the results of growth response to mechanical thinning in lP as an Information Report, or journal article.
- 6. Analyze data, prepare and publish an Information Report on growth response to mechanical thinning in jP if warranted.
- 7. Continue to participate in the development of growth and yield data bank in the region.

8. Review the results of testing the STEMS model and if justified, organize demonstrations and initiate operational runs for up-dating forest inventories with provincial inventory divisions.
 9. Direct field sampling and analysis on the effect of seismic line opening on tree and stand growth in west-central Alberta (a cooperative shared-cost study with the AFS).
 10. Prepare a common framework for growth and yield studies.
13. Accomplishments in 1981-82:
1. Report on the Gregg Burn spacing was published including results from the 1976 remeasurement.
 2. Report on the McKay thinning was published.
 3. The analysis of the Tepee Pole Creek spacing study is in progress.
 4. The Gregg Burn spacing trial has been remeasured.
 5. A manuscript on growth response of 1P to mechanical thinning has been submitted to the For. Chron.
 6. Data on growth response of jP to mechanical thinning has been analyzed but publication deferred until additional data becomes available.
 7. Continued to participate in the development of growth and yield data bank in the region.
 8. Test runs of the STEM model have been reviewed as of March 1981, and it was deemed to need further calibration runs before initiating demonstration and operational runs. H. Grewal is working on this full time (NOR-4-075).
 9. All the field sampling for the seismic line tree and stand growth study has been completed, the stem analysis disc measurements are nearly completed and the data analysis has been initiated.
 10. Growth and yield studies of five native species has been pooled, combining NOR-4-045, NOR-4-009, and thinning studies from NOR-4-075.
14. Goals for 1982-83:
1. Direct the remeasurement of the Tepee Pole Creek spacing study, conduct an analysis of all data and prepare a joint report with W. Johnstone.
 2. Complete the analysis and reporting on the seismic line tree and stand growth study (a cooperative shared-cost study with the AFS).

3. Initiate a study to determine the cause and duration of accelerated early growth of 1P following logging and scarification in the Edson Forest.
4. Direct the remeasurement of a precommercial thinning study of jP in SE Manitoba (Study #2) and aspen thinning studies in Turtle and Riding Mtns. in Manitoba (Study #1 and #3; 17 PSP), and at Pelly, Sask. (Study #2; 14 PSP).
5. Publish report on the "Influence of stand edge on the performance of white spruce and lodgepole pine seedlings".
6. Contribute to the symposium and field tour on "Regeneration in Northern Latitudes" scheduled for Aug. 16-19/82 in Hinton.

15. Publications:

Up to 1981-82

Journal articles: 5

Information Reports, Notes, etc.: 30

File Reports: Several


1981-82

1. Johnstone, W.D. 1981. Effects of spacing 7-year-old lodgepole pine in west-central Alberta. Inf. Rep. NOR-X-236. 18 pp.
2. _____. 1981. Precommercial thinning speeds growth and development of lodgepole pine: 25 year results. Inf. Rep. NOR-X-237. 30 pp.

16. Signatures:


Investigator


Program Manager


Director

A. D. Kil

SUMMARY OF ACTIVE THINNING EXPERIMENTS IN PINE,

1982

Study No.	Location	Soil and Site	Stand age at establishment	Date of establishment	Date of remeas.*	No. of plots	Plot size (acres)	Thinning	
								Method	Intensity
2-jP	Sand-lands, Man.	Stratified sand and gravel outwash; moist	15	1952	1957 1962 1967 1971 1977 (1982)	16	0.1	Low selection thinning to specified Stand Density Index every 5 years, except in 1971 and later	Control, no thinning - 2 plots Thinned: To 40%, 50%, 60%, 70% 80%, 100%, and 120% of control SDI 2 plots each
3-jP	Sand-lands, Man.	Medium sand; fresh	40	1958	1963 1968 1973 1978 (1983)	20	0.1	Merchantable Selection thinning, low and crown. Only trees with dbh over 4" were removed.	Control, no thinning - 4 plots Thinned: Heavy low 4 plots Light low 4 plots Heavy crown 4 plots Light crown 4 plots
4-jP	Sand-lands Forest Res., Man.	a. Sand, fresh	9	1964	1965 1968 1973 1978	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	5	.002 - .007	Mechanical Strip-thinning	Thinned 1-way: 5 plots

SUMMARY OF ACTIVE THINNING EXPERIMENTS IN PINE,
1982 (Continued)

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

SUMMARY OF ACTIVE THINNING AND OTHER GROWTH STUDIES IN ASPEN

Study No.	Location	Soil and site	Stand age at establishment	Date of establishment	Date of remeas.*	No. of plots	Plot size (acres)	Thinning	
								Methods	Intensity
1 (MS133)	Turtle Mtn. For. Res.	Non telluric mesic clay loam till	11	1948	1953 1960 1965 1971 1976 (1981)	5	0.2	Regular spacing and alternate strips	Control, no thinning - 2 plots Thinned: 5' x 5', 7' x 7', and 20' alternate strips - 1 plot each
2 (MS155)	Pelly, Sask.	Non telluric mesic clay loam till	14	1951	1957 1962 1967 1972 1977 (1982)	14	0.2	Thinned to fixed SDI every 5 years, except in 1972 and later	Control, no thinning - 2 plots Thinned: to 120, 100, 80, 70, 60, and 50% of SDI of control in 1951 - 2 plots each intensity
3 (MS146)	Riding Mountain	Non telluric mesic clay loam till	14	1950	1960 1965 1971 1976 (1981)	4	0.1	Regular spacing	Control, no thinning - 1 plot Thinned: 8' x 8', 10' x 10' 12' x 12' - 1 plot each
	National Park	Telluric mesic silty clay loam till	23	1950	1960 1965 1971 1976 (1981)	8	0.2	Regular spacing	Control, no thinning - 2 plots Thinned: 8' x 8', 10' x 10' 12' x 12' - 2 plots each
4 (MS232)	Porcupine Mtn., Swan River, Manitoba	Non telluric mesic clay loam till	15	1964	1969 (1984)	24	0.1	Thinning to regular spacing and pruning	Control, no thinning - 12 plots Thinned and Pruned: 12' x 12' sp. with 5 pruning treatments

* Planned measurement in the coming year are in brackets.

1982 - 83

Date: January 27, 1982

1. Project: Yields of Managed Stands
2. Title: Stand modelling of the growth and development of important forest types in the Prairie Provinces
3. New: Cont.: X
4. No.: NOR-4-075
5. Study Leader: H. Grewal
Co-operator I. Bella
6. Key Words: Tree and stand growth, stand development, density-competition effects, yields, stocking, site, ecological systems, models, simulation, aspen, jack pine, black and white spruce, red pine, lodgepole pine
7. Location of work: Manitoba, Saskatchewan and Alberta, some of the analysis at University of British Columbia
8. Study Objectives:

To forecast growth and yield of forest stands growing under a range of site and density conditions using a stand growth model developed for this purpose.
9. Goals for 1981-82:
 1. Continue to participate in the development of growth and yield data bank in the region.
 2. Review the results of testing the STEMS model for aspen, and if justified, organize demonstrations and initiate operational runs for updating forest inventories in cooperation with provincial inventory divisions - as planned allow for the coniferous types (NOR-4-45)
 3. Direct the remeasurement of thinning studies No. 1 and 3 (17 PSP) in Turtle and Riding mountains, Manitoba.

10. Accomplishments for 1981-82:

1. Continued to participate in the development of growth and yield data bank in the region.
2. Further calibration runs were conducted on the STEMS tree growth model from the USFS, Minnesota. The model tested for jack pine and aspen showed satisfactory results. No demonstration runs have been done to date.
3. Remeasurement of thinning studies No. 1 and 3 (17 PSP) in Turtle and Riding mountains, Manitoba was postponed until spring 1982.

11. Goals for 1982-83:

1. Organize demonstrations of STEMS model to forest industries and provincial forest services and possibly initiate operational runs for updating forest inventories in co-operation with provincial inventory divisions.
2. Revise STEMS program so that it can be run on the PDP 11/60 mini computer at the centre.
3. Test STEMS model for growth and yield predictions for lodgepole pine, white and black spruce and red pine.
4. Initiate tests on STEMS model for management routines (e.g. thinning, clearcutting, regeneration etc.) and to modify them for regional conditions.
5. Complete residence requirement towards a Ph.D. at the University of British Columbia, and initiate thesis preparation on adaptations of STEMS for the Prairie Provinces.

12. Signatures:

Harjit S. Grewal
Investigator

[Signature]
Program Manager

G. D. Hill
Director A.D. Kill

1982 - 83

Date: 27 Jan. 1982

- a) Sampling of soils: All 24 treatments at both 80-year-old stands will be sampled as follows:
- i. surface litter (L-F-H)
 - ii. surface mineral (0-5 cm)
 - iii. upper subsoil (5-25 cm)
 - iv. lower subsoil (25-50 cm)

9. Goals for 1981-82: (cont'd)

This will involve the sampling of 432 soil pits at four levels (1728 soil layers). These samples will be subjected to various analyses with reference to N, P, and S in the major soil fractions in the various soil layers sampled. In addition the basic soil chemistry of the variously treated plots will also be examined to determine fertilizer effects on such soil factors as pH organic matter content exchangeable and titratable acidity, etc.

- b) Sampling of foliage: Each of the trees used for stem analysis will be sampled on the N, S, E & W sides at 3 locations from the upper 1/3 of the tree crown for current growth and foliar nutrient level determinations. On selected trees foliage of 3 years will also be collected for similar analyses. Analyses to be undertaken on the foliage will include: twig-needle ratios for new growth, moisture percentages, non protein N, P & S, protein N, P. & S and total N, P & S.
- 2) Publish Information Report on five-year residual effect of fertilizer applications of N, P and S in four treatments.

10. Accomplishments in 1981-82:

- 1) a) Thirteen of the 24 treatments (39 of 72 plots) for each area were sampled. All 18 plots of the mid treatment were sampled (six treatments at the centre) Other treatments included N, P, & S rates from nil to the highest rate of application.

One pit per plot was dug instead of the 3 originally intended. However pits were sampled by horizon rather than by arbitrary depth. This necessitated the digging of pits twice the depth.

Reasons for this change were:

- a) modifications within an horizon more readily detected
- b) movement of applied fertilizer elements more readily seen
- c) sampling of the "C" horizon (relatively unaltered parent material) would give a measure of movement.

Approximately 6 horizons per pit were sampled.

- b) Current growth foliar samples were taken from 3 dominant or co-dominant trees per plot. All 144 plots (72 in each area) were sampled. In addition from selected treatments 1st 2nd 3rd and 4th year foliar material was also taken.

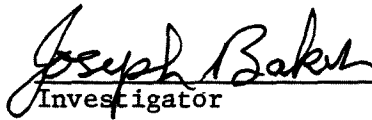
All these samples are presently in preparation for analysis.


- 2) Five-year fertilizer effects on both soil concentrations and distributions as well as on foliar composition were written up as an Information Report, submitted for review, returned and re-written. These are being re-typed presently.

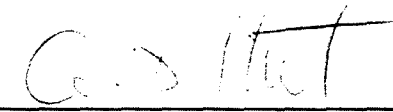
11. Goals for 1982-83:

- 1) Analyze sampled plots for 10-year residual effects of fertilizer amendments on the N, P, & S distribution in both soils and foliar materials
- 2) Complete and publish 5-year fertilizer effects
- 3) Further sampling 70-year old stands for additional control sites at each area

12. Signatures:


Investigator


Program Manager


Director A.D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

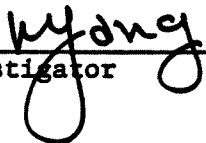
1982 - 83


Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

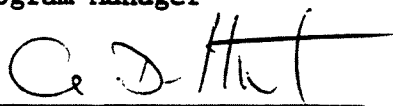
Date: January 27, 1982

1. Project: Yields of managed stands.
2. Title: Fertilization of established lodgepole pine stands.
3. New: Cont.: X 4. No.: NOR-4-122
5. Study Leader: R. C. Yang
6. Key Words: *Pinus contorta*, B. 19a, tree nutrition, nutrient deficiencies, nitrogen, phosphorus, sulphur.
7. Location of Work: Hinton, Alberta
8. Goals for 1981-82:
 1. Complete analysis of greenhouse fertilization trial data by regression with dummy variable technique and prepare manuscripts for publication.
 2. Remeasure all fertilization plots in four areas (total 288 plots).
 3. Collect and measure stem analysis discs from dominant and co-dominant trees in each plot. The intensity of the sampling is pending on the outcome of a preliminary examination of the fertilization effects.
 4. Initiate analysis of data on stand responses to fertilization.
 5. Participate and provide samples for a cooperative study with Prof. M. Micho of the University of Alberta to assess fertilization effects on wood properties of lodgepole pine.
9. Accomplishments in 1981-82:
 1. Completed the analysis of greenhouse fertilization trial data; a manuscript on statistical aspects of forest fertilization experiments has been prepared.
 2. Completed the dbh tally and height measurements on all study plots in both 30- and 70-year-old stands.

3. A total of 442 dominant or codominant trees (three trees per plot) in the 70-year-old stand were felled for stem analysis; some 5,000 discs were obtained for diameter and height growth determinations. Ring measurements on the discs are in progress.
 4. Computer programs to process tree and stand growth response to fertilization have been developed; analysis of data on diameter growth is in progress.
 5. In cooperation with Dr. M. Micho, University of Alberta, a pilot study based on 13 trees to assess fertilization effects on specific gravity and fiber length of lodgepole pine wood has been initiated; sampling techniques to determine these wood parameters were developed.
10. Goals for 1982-83:
1. Prepare the final draft and publish results of the greenhouse fertilization study.
 2. Complete the measurement of stem analysis discs obtained from the 70-year-old fertilized 1P stand and conduct appropriate statistical analyses. Prepare a report on 10-year growth response to fertilization of these stands.
 3. Collect stem analysis sample from the 30-year-old 1P stand and conduct measurements; initiate analysis of fertilization effects on growth and yield of these stands.
 4. Participate and provide samples for the study in cooperation with Dr. M. Micho to determine fertilization effects on wood properties of lodgepole pine if preliminary results warrant further investigations.
11. Signatures:


Investigator


Program Manager


Director A. D. Kil

NOR-5

Fire Management Systems and Guidelines

1982 - 83

Date: January 12, 1982

1. Project: Fire management systems and guidelines
2. Title: Fire retardant and airtanker evaluations and application
3. New: Cont.: X 4. No.: NOR-5-037
5. Study Leader: R.G. Newstead and R.J. Lieskovsky
6. Key Words: Airtankers, helitankers, retardants, aerial suppression, airtanker accuracy, effectiveness, drop patterns, static testing, tank and gating systems, simulation models, wildfires.
7. Location of Work: Throughout region
8. Study Objectives:
 1. To measure and evaluate the drop characteristics of various airtanker/fire retardant combinations, including helitankers.
 2. To evaluate fire retardants and determine the optimum application required to slow and/or stop fires burning in different fuels under varying burning conditions.
 3. To observe and evaluate the effectiveness of airtankers and helitankers and other fireline construction resources during fire suppression operations.
 4. To evaluate new retardant mixing systems and their role on wildfire operations.
 5. To analyze and disseminate information concerning resource use optimization to fire management agencies through technical assistance, consultation, and training.
9. Goals for 1981-82:
 1. Publish guidelines for the development and selection of water thickening compounds as a Forest Management Note. (Newstead)

9. Goals for 1981-82: (cont'd)

2. Contribute articles for publication in a Forestry Report as originally proposed for the 1980-81 study year.
 - 1) Evaluation of airtankers and fire retardants on wildfires (Lieskovsky)
 - 2) Retardant effectiveness studied under field conditions. (Newstead)
3. In co-operation with the Alberta Forest Service conduct on-site investigation of airtanker/retardant effectiveness in wildfire control. This goal is dependent upon the provision of suitable transportation to and from fire locations by the AFS during the initial month of the airtanker contract period; and the extent of wildfire occurrence during that period. If successful this goal could be extended to include additional fire seasons in the interest of developing a sound data base for future analysis. (Newstead and Lieskovsky)
4. Continue modification, instrumentation, and calibration of retardant spray apparatus and burning table. Inaugurate a series of lab tests designed to provide a better understanding of the fire suppression, retardancy, and rheological characteristics of present and proposed fire retardant compounds. (Lieskovsky)
5. Provide technical assistance, training, and technology transfer to regional, national, and international fire control agencies and industrial organizations as requested. (Newstead and Lieskovsky)

Goals added:

6. Conduct retardant and water drop trials with the Bell 205A helicopter and belly-mounted tanking system and conventional bucket. In conjunction, determine rotor downwash effects of this helicopter on surface fire behaviour. Assess preliminary modifications to DC-6B tank and gating systems.
7. Attend "Functions of the Middle Manager" course.

10. Accomplishments in 1981-82:

1. Published a Forest Management Note on short-term retardant development and selection guidelines. (see publications)
2. Revised and contributed two articles for proposed Forestry Report:
 - 1) Evaluation of airtankers and fire retardants on wildfires,
 - 2) Retardant effectiveness studied under field conditions.

10. Accomplishments in 1981-82: (cont'd)

3. With the full cooperation of the Alberta Forest Service conducted on-site investigation of air tanker/retardant effectiveness on 12 fires. Preliminary observations have been submitted for inclusion in a forthcoming Forestry Report and have been presented to the Alberta Forest Service, Forest Protection Officers and Bird-dog Officers meetings.
4. Modification and instrumentation of the retardant spray apparatus and burning table has been carried out, however calibration and testing of these facilities is pending completion of developmental work delayed owing to other equipment development priorities.
5. Technical assistance, training and technology transfer was provided as follows:
 - a) Assisted A.F.S. personnel in complete evaluation of retardant mixing and storage facilities and retardant quality at all retardant bases in Alberta. Additional technical assistance was provided in regard to the 4 new liquid retardant bases. Reports on findings and recommendations were subsequently submitted to the Alberta Forest Service and Chemonics Industries respectively.
 - b) Provided technical advice to A.F.S. personnel involved in the suppression of the high priority Swan Hills fire DS-3-23-81. A summary report on observations and recommendations was subsequently submitted to the Swan Hills Fire Review Board.
 - c) Participated in two meetings of the CCFFC sub-committee on Forest Fire Research.
 - d) Attended annual meeting of AFS Forest Protection Staff.
 - e) Reviewed three manuscripts, one internal and two external, being prepared for publication.
 - f) Conducted technical presentations at the Forest Technology School pertaining to retardant, preparation and quality control, and air tanker and helitanker operations in forest fire control.
 - g) Provided technical data re: helicopters and buckets for inclusion in A.F.S. aircraft specifications manual, 3rd Edition.

10. Accomplishments in 1981-82: (cont'd)

6. Conducted retardant and water drop trials with the Bell 205 helitanker with both belly-mounted tanking system and conventional bucket in cooperation with the N.W.T. Northern Affairs Program, Chemonics Industries Ltd., Frontier Helicopters and B.C. Forest Service at Kamloops, B.C. Results of these tests are compiled and computer plotting of drop patterns completed. In conjunction with these trials, preliminary assessment of DC-6B tank and gating modifications was conducted at Abbotsford, B.C. A file report has been completed and will be forwarded to cooperating agencies.
7. Attended and completed P.S.C. sponsored course, "Functions of the Middle Manager".


11. Goals for 1982-83:

1. Continue on-site evaluation of retardant/airtanker effectiveness in wildfire control.
2. Investigate and promote modifications of fixed-wing tank and gating systems and helicopter tank and bucket systems. Develop new drop grid system to facilitate testing of new/modified airtanker and helitanker delivery systems.
3. Test and calibrate a prototype retardant application system and combustion table for use under controlled laboratory conditions.
4. Provide technical assistance, training and technology transfer to regional, national and international fire control agencies and industrial organizations as requested.

12. Signatures:


Investigator


Program Manager


Director A.D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 12, 1982

1. Project: Fire management systems and guidelines
2. Title: Fire behaviour in boreal forest fuels
3. New: Cont.: X
4. No.: NOR-5-086
5. Study Leader: Z. Chrosciewicz
6. Key Words: Canadian Forest Fire Weather Index, fire behaviour, fire effects, danger rating.
7. Location of Work: Various areas within the western and northern region.
8. Study Objectives:
 1. To develop fire spread and intensity tables for major fuel complexes.
 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 tables and guidelines.
9. Goals for 1981-82:
 1. Submission for publication of four reports, two on postburn jack pine regeneration in southeastern Manitoba and central Saskatchewan (one each), and two on foliar moisture contents, and foliar heat contents in major conifers of central Alberta (one each).
 2. Preparation of text for two chapters in the proposed international monograph on white spruce regeneration.

9. Goals for 1981-82: (cont'd)

3. Continuation of data analysis leading to the determination of basic relationships between fuels, fire behaviour and weather for semimature jack pine stands in central Alberta.
4. Continuation of providing consultative services as required.

Goals Added:

5. Continuation of chemical foliar analyses for major conifers in central Alberta.
6. Submission for publication of a report on rating fire hazard in forest ecosystems of central Saskatchewan.


10. Accomplishments in 1981-82:

1. The write-up of three scheduled papers for publication was completed, and the fourth one is now in preparation. The completed papers on "Failures and successes in jack pine regeneration following postcut burning and seeding treatments in southeastern Manitoba" and on "Jack pine and other forest regeneration following postcut burning and seeding treatments in central Saskatchewan" are proposed Information Reports, whereas that on "Foliar moisture variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" is a proposed article for the Can. J. For. Res. The paper on "Foliar calorific variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" is now being prepared for the Can. J. For. Res.
2. A good progress was made in the preparation of text for two chapters in the proposed international monograph on white spruce regeneration. Literature review and one of the chapters are now completed, and work on the remaining chapter is in its final stages.
3. Dimensional categorizations of total forest biomass (trees, shrubs, herbs, grasses, mosses, downed roundwood, surface litter, and raw humus) in semimature jack pine stands of central Alberta were continuing. More than 150 regression equations were solved, and just as many dry-weight tables were computed, so far.
4. Consultative services were provided to several forestry officials and educators from various parts of Canada and from abroad.
5. Nitrogen concentrations were determined in some 480 foliar samples from major conifers in central Alberta.
6. The write-up of the fifth, unscheduled paper for publication was also completed. This one on "Forest ecosystems and fire hazard in central Saskatchewan" is a proposed article for the For. Rep.

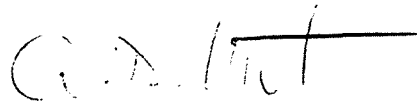
11. Goals for 1982-83:

1. Publish "Forest ecosystems and fire hazard in central Saskatchewan" (Forestry Report). [See Study NOR-5-174, Goal]
2. Publish "Failures and successes in jack pine regeneration following postcut burning and seeding treatments in southeastern Manitoba (Information Report)
3. Publish "Jack pine and other forest regeneration following postcut burning and seeding treatments in central Saskatchewan (Information Report)
4. Publish "Foliar moisture variations in jack pine, black spruce, white spruce, and balsam fir, central Alberta" (Canadian Journal of Forest Research).
5. Publish "Foliar calorific variations in jack pine, black spruce, white spruce, and balsam fir, central Alberta" (Canadian Journal of Forest Research)
6. Complete preparation of text for the second chapter in the proposed international monograph on white spruce regeneration. Submit both chapters for publication.
7. Continue data analysis on dimensionally categorized biomass of six major understorey shrub species in central Alberta.
8. Continue data analysis on relationships between fuels, fire behaviour and weather for semimature jack pine stands in central Alberta.
9. Analyse data on relationships between standard moisture codes (CFWI-System) and sampled moisture contents of dimensionally categorized aerial and ground fuels on jack pine clear-cuts in central Saskatchewan.
10. Continue with technology transfer as required.

12. Signatures:


Investigator


Program Manager


Director A.D. Kill

1982 - 83

Date: January 12, 1982.

1. Project: Fire management systems and guidelines
2. Title: Evaluation and planning of fire detection, surveillance and communications systems and methods.
3. New: Cont.: X 4. No.: NOR-5-131
5. Study Leader: C.J. Ogilvie
6. Key Words: Aerial patrols, lookouts, forestry communications, weather data collection, storm tracking, wildfire smoke emission, wildfire mapping, remote sensing.
7. Location of work: Alberta, National Parks, and Northwest Territories, Saskatchewan, Manitoba
8. Study Objectives:
 1. Develop plans for wildfire surveillance and communications systems for the Northwest Territories, and other clients, on request.
 2. Identify the most advantageous detection medium (alternative) for given conditions.
 3. Define and identify factors influencing the design of wildfire detection and communication systems.
 4. Develop effective wildfire mapping and surveillance techniques.
9. Goals for 1981-82:
 1. Provide an article for the Forestry Report on the use of the scan-extender on large fires.
 2. Write a Management Note on the scan-extender detailing its construction and uses.

9. Goals for 1981-82: (cont'd)

3. Enter a co-operative study with the AFS to establish the capabilities of the Thermovision Scan-extender combination for various flying heights, target sizes and target composition.
4. Provide Forestry Report article on 3 years of detection effort in Saskatchewan.
5. Continue a co-operative study with the Department of Northern Saskatchewan to develop improved methods of detecting incipient lightning fires under different fuel and fire weather conditions.
6. Provide liaison, technical services and training to client agencies as the need arises.
7. Terminate study and move 1981-82 Goal 5 to Study 174.

10. Accomplishments in 1981-82:

1. Provided first draft of article for the Forestry Report on the use of the scan-extender on large fires.
2. Prepared first draft of Forest Management Note on the scan-extender.
3. Conducted a test in conjunction with the Saskatchewan Department of Tourism and Renewable Resources (DTRR) to establish the capability of the thermovision-scan extender at several heights above ground for different target sizes. The system can reliably locate hotspots, equivalent to eight charcoal briquets from 4000 ft. (1219 m)
4. Provided first draft of article for the forestry report on three years of detection effort in Saskatchewan.
5. Continued the cooperative study with DTRR (Saskatchewan) to develop improved methods of detecting lightning fires using the scan-extender, the LLP system and the fire weather codes and indices.

Saskatchewan lightning and lightning fire data suggests that most lightning fires in 1980 and 1981 started when the FFMC was 80 or greater. In 1981, some lightning fires were visually detected before the area was thermally scanned. All of these fires, except one, were smoking heavily, presenting some control difficulties. This resulted in a decision to conduct a combined thermal and visual search as soon as possible after a lightning storm rather than wait for 24 hours before thermally searching a storm path for "holdover" fires.

10. Accomplishments in 1981-82: (cont'd)

In 1982, a 7° lens will be tested on the thermovision (rather than the standard 20° lens) from a fixed-wing aircraft flying fast (290 km/h:180mph) at high altitudes (2500-3000 m: 8-10,000 ft.) This will increase the rate of scanned area (approx. 3X) without increasing costs, compared to a Bell 206 helicopter.

The LLP direction finder in Prince Albert was relocated to improve the accuracy of the system.

6. Provided liaison and technical services to client agencies as follows:

- a) Developed an inexpensive portable fire finder for use in Saskatchewan fire towers.
- b) Trained an employee of DTRR (Saskatchewan) on the use of the scan extender.
- c) Developed a mount to attach the scan extender to a Bell 206A helicopter.
- d) Provided an evaluation of the AGA supervisor to DTRR (Saskatchewan) personnel.
- e) Provided an evaluation of the intertech infrared scanning system to DTRR personnel based on an operational exercise.
- f) Attended LLP Workshop (Tucson) and gave a brief presentation on the lightning fire detection program in Saskatchewan.
- g) Examined the LLP system at Slave Lake, Alberta at the request of that forest's fire control officer.
- h) Presented a slide lecture on NoFRC detection activities to students at the Hinton Forest Technology School.
- i) Provided information on the operation of the scan extender (including video tapes and polaroid pictures) to the B.C. Forest Service (R. Townsend) and the Ontario Ministry of Natural Resources (J.F. Goodman)
- j) Assisted in the relocation of two look-out towers in Saskatchewan based on seen-area maps.
- k) Arranged a demonstration of the English Electric Valve Company's pyroelectric videocon tube for members of the C.F.S. A.F.S.

7. Reactivate and continue study.

11. Goals for 1982-83:

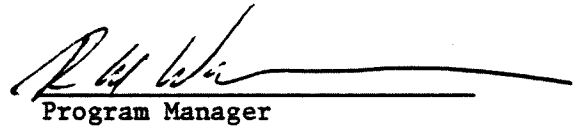
1. Develop lightning fire detection method using AGA thermovision/scan extender from high-flying twin-engine aircraft.
2. Assess currently available infrared systems, including operational procedures, availability, sensitivity, accuracy and costs.

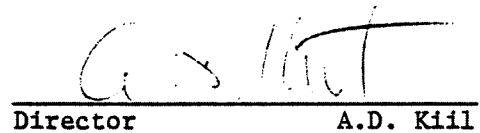
11. Goals for 1982-83: (cont'd)

3. Compile and analyze LLP system data and fire occurrence data using NoFRC computer and data base management systems to develop an effective method for lightning fire prediction.
4. Publish FMN report on "Construction and use of portable fire finder".
5. Provide liaison, technical services and training to client agencies.

12. Signatures:


Investigator


Program Manager


Director

A.D. Kil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 12, 1982

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-5-168
5. Study Leader: D.E. Dubé
6. Key Words: Fire ecology, fire history, fire cycle, fire type, fire climax, fire scar rating
7. Location of Work: Region Wide
8. Study Objectives:
 1. To develop and implement fire management programs in designated National Parks.
 2. To define the needs and priorities of client agencies in the area of fire impact assessments.
9. Goals for 1981-82:
 1. Publish as Information Report "Early plant succession following wildfire, Kootenay National Park".
 2. Publish in Forestry Report "Prescribed burning in Elk Island National Park".
 3. Complete and submit fire management study for Nahanni National Park.
 4. Complete and submit fire management study for Wood Buffalo National Park.
 5. Assist in prescribed burning programs in Elk Island National Park, Banff and Prince Albert National Park.

9. Goals for 1981-82: (cont'd)

6. Assess status of current study; make recommendations giving consideration to proposed CFS/National Parks agreement and modify or terminate study as appropriate.
7. Provide advice and consultation and participate in training sessions of client agencies and meetings relevant to study content.

10. Accomplishments in 1981-82:

1. No progress was made in the study year. The report has been through the initial review process and is currently with the author awaiting revision.
2. Report on prescribed burning in Elk Island National Park is complete. A condensed version is required for the forestry report. All other contributing articles have been submitted for review to the Technical Information section.
3. No progress was made in the study year. Though considered a high priority, day-to-day commitments precluded work on this goal.
4. No progress was made in the study year for the reason indicated in three, above.
5. Attended several meetings (see "1981 activities") with Elk Island National Park personnel to discuss a long-term prescribed burning plan. Some preburn vegetation sampling was conducted by NoFRC but 1981 spring burning did not take place due to rapid green-up and other pending commitments by park personnel. Banff Park did not receive administrative approval for burning in the fall of 1981. However, a very fruitful meeting took place with superintendents and chief wardens of Banff, Jasper, Kootenay and Yoho Parks where a firm and unanimous commitment was made to pursue fire management activities, including prescribed burning in the 4 contiguous mountain parks.
Bruce Wilson, Superintendent, Prince Albert National Park, met with CFS/CWS personnel to reaffirm prescribed burning operations/research within the park.
6. Study should continue until current goals are completed. The CFS/Parks Canada memorandum of understanding is now in place (Sept. 4, 1981) and essentially preserves the basic concepts of CFS/Parks Canada cooperation that have evolved through years of informal cooperation.
7. See attached "1981 activities"

1981 ACTIVITIES - D. DUBE

- January 9: Attended meeting of library committee.
- 12-15: Wood Buffalo National Park - board of review.
- 20: Met with R. Fytche, AFS to discuss fire loss statistics.
- 26: Program review.
- 30: Provided slides and data for AFS personnel participating in fire management course, Marana, Arizona.
- February 2: Met with AFS to discuss on-site retardant effectiveness program.
- 9: Fire section meeting.
- 11: Meeting with Elk Island National Park regarding proposed fire management plan.
- 13: Environment Council of Alberta meeting - review of fire research activities in National Parks.
- 17: Attended program review of Technical information project.
- 18: Presented seminar to Canadian Society of Environmental Biologists.
- 19: Presented four hour review of NoFRC fire research program to forest tech students at Hinton, Alberta.
- 20: Met with personnel from Elk Island National Park to discuss their fire management document.
- 25: Met and provided information to private consultant, (R. Hudson) Manecon Limited, on contract to the Dene Nation, NWT.
- 27: Met with H. Abbott, Elk Island National Park to review fire management document.
- March 9: Computer Applications Committee.
- 10-11: Traveled to Prince George to review BCFS/PFRC fire ecology project in northern B.C.

March 16: Meeting regarding use of new telephone system.

17-18: Hinton meeting of AFS forest protection officers.

24: Met with Elk Island National Park personnel re: prescribed burning plan.

24: Met with Parks Canada-Prairie Region (D. MacMillan) to discuss fire workshop in Riding Mountain National Park.

25: Attended seminar at U of A presented by P. Stickney, USFS on fire effects.

26: Attended meeting on Nat. For. Res. Data program presented by T. Honer.

26: Met with student interested in pursuing forestry career.

27: P. Stickney, USFS visited NoFRC and presented an informal seminar on fire effects research.

31: Attended seminar at U of A by J. Bentz on fire history in Ram Mountain area.

April 6: Board interview for vacant fire technician position.

7: Demonstration of remote weather station at AFS depot.

7: Met with D. Kiil re: fire program.

8: Attended meeting on biomass info in NWT hosted by C. Kirby.

9: Seminar at U of A presented by M. Johnson on prescribed burning thesis.

10: Met with EINP personnel and U of A to discuss burning project.

22-23: Attended PSC sponsored "Management of Time" course.

27-30: Traveled to Montreal for National Fire Danager Rating meeting.

May 4: Met with Personnel (Kolstad) re: PAS review process.

7: Meeting in board room to provide study overview.

12-13: NWT fire management program committee meeting in Yellowknife, NWT (1st).

- May 20: LMCC meeting.
- 21: NWT fire management program committee meeting in Yellowknife, NWT (2nd).
- 22: Environment Council of Alberta meeting, Edmonton.
- 26: Met with Alberta provincial parks to discuss danger rating approaches.
- June 1: NWT fire management program committee meeting (3rd) in Yellowknife, NWT.
- 3-5: Attended "Classification Evaluation Course" in Jasper National Park.
- 16: NWT fire management program committee meeting (4th) in Ft. Simpson, NWT.
- 26: Met with Parks Canada, Hdqt's. (N. Loupchene) in Edmonton, to discuss fire research activities in national parks.
- July 6: Met with Yukon Forest Service (Morgan) to discuss fuel sampling procedures.
- 6: Met with AFS to review data base for fire atlas.
- 8: NWT fire management program committee meeting (5th) in Yellowknife, NWT.
- 6-10: Alberta Ecosystem Consultants visited NoFRC to finalize two reports.
- 23: Met with U of Toronto professor (P. Aird) to discuss fire program.
- 29: Met with EINP to discuss prescribed burning program.
- August 10: Met with NFI (W. Clark - Petawawa) to discuss damage appraisal research.
- 11: NWT fire management program committee meeting (7th) in Ft. MacPherson, NWT.
- 18: Dene Nation representatives (Lockhart and Burke) visited NoFRC to discuss fire management activities in NWT.

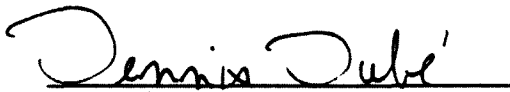
- August 25: Member of Classification committee that met to review 3 PAS's.
- September 1: Met with Director of PILP (P. Fogerty) to discuss opportunities for commercial production of items developed by NoFRC.
- 2: Meeting with Alberta Dept. of Energy and Natural Resources to discuss options to produce maps for fire atlas projects.
- 14: Met with the research subcommittee of the CCFFC to discuss fire research strategies.
- October 1: Provided high school student with information for a science presentation.
- 1: Reviewed on an informal, internal basis two PAS's that had been prepared for submission.
- 9: Discussed "What our Forests Mean to Us" on Capital Cable T.V. as a CFS contribution to Environment Week.
- 19-23: Attended Intermountain Fire Council workshop in Salt Lake City, Utah.
- November 2-5: Attended "Damage appraisal workshop" in Ottawa.
- 6: LMCC meeting.
- 9: Met with the superintendent, Prince Albert National Park (B. Wilson) to discuss prescribed burning program.
- 13: Brief presentation at "West Central Provinces Forest Economist" meeting.
- 18-19: Attended Forest Protection Officers (AFS) meeting in Hinton, Alberta.
- 20: Attended seminar on "Influence of Forest Fires on the Swedish Boreal Forest" by Dr. O. Zackrisson.
- 25: Met with the research subcommittee of the CCFFC.
- 30: Traveled to Banff at the request of Parks Canada to discuss fire management planning in the 4 contiguous mountain parks, with superintendents and chief wardens.

- December 3: Lectured at U of A to fourth year agriculture students
 on fire management planning in national parks.
- 7-11: Attended fire research program review of NFI in Petawawa,
 Ontario.

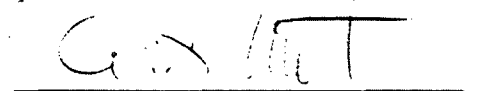
11. Goals for 1982-83:

1. Publish information report "Early plant succession following wild-fire, Kootenay National Park".
2. Complete and submit fire management studies for Nahanni and Wood Buffalo National Parks.
3. Assess status of "Role of fire in forest and intermingled vegetation in the Prairie Provinces Rocky Mountains and Far North"; make recommendations giving consideration to CFS/Parks Canada agreement and modify or terminate study as appropriate.

12. Signatures:


Investigator


Program Manager


Director A.K. Kill

1982 - 83

Date: January 12, 1982

1. Project: Fire management systems and guidelines.
2. Title: Decision-aid models for use in fire management.
3. New: Cont.: X 4. No.: NOR-5-174
5. Study Leader: D. Dubé, R.G. Newstead, Z. Chrosciewicz, M.E. Alexander
6. Key Words: Fire behaviour, fuels, fireline production, fire statistics,
fire effects, decision models, fire management, computer
systems.
7. Location of work: Regional
8. Study Objectives:
 1. To identify the key factors relating to the occurrence, behaviour,
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.
9. Goals for 1981-82:
 1. Publish an Information Report on the development and application
of the fire containment model incorporating fire line productivity
information, fire spread data and other required minor modifica-
tions. (Newstead)
 2. Assemble, synthesize and organize regional fuels, weather and
statistical fire data into a format, using in-house computer
facilities, that enable easy and rapid retrieval. (Dubé, Alexander,
Chrosciewicz and Delisle)
 3. Prepare a regional forest fire atlas based upon historical fire
statistics. (Delisle)

9. Goals for 1981-82: (cont'd)

4. Initiate a cooperative program with the AFS to develop priority zoning guidelines aimed at providing more cost/effective fire management planning. (Alexander, Dubé)
5. Refine and calibrate the performance of a resource location-allocation model based on Masters thesis and apply same to updated fire occurrence data in co-operation with the Alberta Forest Service. (Newstead)
6. Publish an information report on the status of all airtanker/retardant drop patterns compiled and analyzed to date. (Newstead)
7. Complete preliminary analysis of AFS aerial observer report summaries (1976-80) compiled to date. The need for subsequent data collection and/or publication requirements will be determined during the 1981-82 study year. (Newstead)
8. Establish procedures and provide client agencies with the over-winter adjustment to the drought code for 1981 and on a regular, annual basis in subsequent years. (Dubé)
9. Publish information report on spring burns in a 50 year old aspen stand. (Dubé)
10. Publish Forest Management Note on forest fire containment model. (Newstead)

Goals added:

11. Co-author manuscript revisions for submission as a journal article to Canadian Geographer. (Newstead)
12. Prepare and present a paper on the NoFRC initial attack planning model at the annual meeting of the Intermountain Fire Council in Salt Lake City, Utah. (Newstead)
13. Provide technical assistance, training, and technology transfer to user groups interested in application of the NoFRC initial attack planning model. (Newstead)
14. Participate in Parks Canada-Prairie Region fire management workshop at Riding Mtn. National Park. (Alexander)
15. Participate in C.F.S. National Fire Danger Rating Group meetings. (Alexander)
16. Develop fire-oriented programs for the Texas Instrument Model 59 hand-held calculator. (Alexander)

Goals added: (cont'd)

17. Provide technical advice and services on the CFFDRS, including assist Alberta Provincial Parks in development of fire danger rating procedures. (Alexander)
 18. Participate in Central and reactivated Western Region Fire Weather Committees. (Alexander)
 19. Act as external reviewer for unsolicited fire research manuscripts. (Alexander)
 20. Determine fire research needs and priorities in the N.W.T. (Alexander)
 21. Provide technical advice on the Swan Hills fire, (DS3-23) to the Alberta Forest Service. (Alexander)
 22. Continue analysis and writing commitments resulting from lateral transfer from Great Lakes Forest Research Centre. (Alexander)
10. Accomplishments in 1981-82:
1. A contract has been let and fulfilled and a draft report is nearing completion. This information report will incorporate contract and in-house results. (Newstead)
 2. Historical fire weather record forms obtained from PNFI (see CFS Misc. Rep. FF-Y-1) for five central and western national parks covering the period 1940-1969; metric conversion and transcribing for keypunching initiated. Four computer programs associated with the Canadian Forest Fire Danger Rating System placed on NoFRC's PDP 11 and file report drafted. (Alexander)
 3. Regional fire statistics have been compiled, verified and entered on the PDP-11. A fire atlas for Alberta and selected national parks is nearing completion. Publishing costs are high and will determine to some extent, the timing of publication. (Delisle)
 4. Several meetings and discussions have taken place including a national damage appraisal workshop (Ottawa), internal NoFRC discussions between fire research and economics research and discussions between NoFRC (Fire Research) and the A.F.S. (Protection Headquarters and Footner Lake forest). Interest remains high and reasonable progress is expected in 1982-83. (Dubé)
 5. In lieu of revising a resource location-allocation model based on Masters thesis, a contract has been let to develop a similar model compatible with the TI-59 hand-held calculator for localized application rather than for use with centralized computing facilities. (Newstead)

10. Accomplishments in 1981-82: (cont'd)

6. Analysis and tabulation of all drop test patterns has been completed. (Newstead)
7. Preliminary statistical analysis of A.F.S. Aerial Observer Report Summaries is underway. Owing to the nature and quality of information being collected, it is not likely that this goal will be continued beyond the 1982-83 study year. Departure of NoFRC resident systems analyst delayed efforts in 1981-82. (Newstead)
8. Provided user agencies with spring Drought Code starting value look-up tables for 1981 fire season and prepared both a Forest Management Note and a brief Forestry Report article summarizing work and background information. A proposal for determining spring DC starting values in the prairie provinces and far north on a yearly basis was prepared for discussion and formal agreement at the January 1982 Central and Western Region Fire Weather Committee meetings. (Alexander)
9. Additional analysis and writing was completed on the information report entitled "Spring fires in a semi-mature trembling aspen stand, Alberta". Final draft will be submitted to editor by Feb/Mar. 82. (Alexander)
10. A Forest Management Note on the NoFRC fire containment model as an initial attack planning tool has been published. (Newstead)
11. Co-authored revised manuscript on wildfire and airtanker locations for resubmission to Canadian Geographer. (Newstead) (Accepted for publication)
12. Co-authored and co-presented a research paper on an initial attack planning model at the annual meeting of the Intermountain Fire Council at Salt Lake City, Utah. (Newstead) (In press). Council also attended by D. Dubé, M. E. Alexander and R. Lieskovsky.
13. Provided technical assistance and instruction on the performance and application of the NoFRC initial-attack planning model. Sessions included the Canadian Committee on Forest Fire Control, N.W.T. Northern Affairs Program and Alberta Forest Service Division level training course. (Newstead)
14. Attended Parks Canada-Prairie Region fire management workshop (May 20-24) at Riding Mtn. National Park and made a presentation entitled; "Is there a place for prescribed burning in Canada's National Parks?". (Alexander)
15. Attended CFS National Fire Danger Rating Group meetings in Montreal (Apr. 27-30) and Victoria (Dec. 14-18) as NoFRC representative regarding quantification of the CFFDRS. (Alexander)

10. Accomplishments in 1981-82: (cont'd)

15. a) Completed reanalysis of all experimental fire behaviour data on file at NoFRC and analysis of applicable data from U.S. as input into quantification of the CFFDRS and
b) Completed fuel and weather analysis relative to rate of spread of several wildfires and prepared a file report and summary Forestry Report article on Fire Weather Index analysis of the 1968 Lesser Slave Lake fire. Results to be used in quantification of the CFFDRS.
16. Prepared two fire oriented programs for the Texas Instruments model 59 hand-held calculator (spring DC starting values and hourly calculation of the Fire Weather Index) and distributed informally to user agencies and CFS fire researchers. (Alexander)
17. a) Initial work completed on adapting the Canadian Forest Fire Danger Rating System to the Provincial Parks in the prairie region of Alberta; b) Distributed introductory document on the new SFFMC to agencies; c) Assisted AFS Weather Section Staff with Fire Weather Index Severity Rating analyses of the 1980 and 1981 fire seasons. (Alexander)
18. Attend Central (Jan. 14, Winnipeg) and Western (Jan. 21, Edmonton) Region Fire Weather Committee meetings as NoFRC representative. Organized, hosted, chaired and produced minutes of WRFWC meeting.
19. Reviewed the following manuscripts (Alexander):
 - a) Wildland Fires: Hazards and survival (chapter for book on management of wilderness and environmental emergencies) by K.M. Davis and R.W. Mutch.
 - b) Nondirectional sampling of wildland fire spread (Fire Technology article) by A.J. Simard and K.B. Adams.
 - c) Wilderness fire management planning guide (USDA Forest Service General Technical Report) by W.C. Fischer.
 - d) Fire history in southwestern mixed conifer: A case study (Forest Science article) by J.H. Dieterich.
 - e) Synoptic weather change and fire behavior in Alberta, 1981 (Alta. For. Serv. Tech. Rep.) by N. Nimchuk.
 - f) Pyrodendrochronology of a ponderosa pine cross section (scientific journal article) by J.H. Dieterich and T. Swetman.
 - g) Fuel succession in northwestern Montana (Environmental Management article) by C.D. Armour and L.F. Neuenschwander.
 - h) Automated daily fire danger forecasting (AES Technical Memorandum) by R.L. Raddatz and G.B. Atkinson.
 - i) Fire frequency distribution and its role in succession (PNW-Forest succession workshop proceeding) by R.E. Martin.
20. Initial field reconnaissance (2 weeks in July) regarding fire danger and fire behaviour research needs in the N.W.T. completed. (Alexander)

10. Accomplishments in 1981-82: (cont'd)

21. Spent ten days on the Swan Hills fire (DS3-23) in the plans section of the overhead team as fire behaviour officer. (Alexander)
22. Completed rewrite of journal manuscript on Byram's fire intensity concept.

11. Goals for 1982-83:

1. Publish information report on the development and application of the initial-attack planning model, incorporating fire-line productivity, rate-of-spread, fuels and other related information. (Newstead)
2. Publish information report on the status of all airtanker/retardant drop pattern data compiled and analyzed to date. (Newstead)
3. Develop a prototype resource allocation model for use in initial attack planning at the field level. (Newstead)
4. Continue compilation and analysis of AFS aerial attack observer data to determine future data requirements and level of reporting. (Newstead)
5. Prepare file report on NoFRC data on hand towards developing a regional fire data library. (Alexander & Dubé)
6. Complete analysis and reports on a) Pukaskwa National Park fire history and ecology, b) on experimental fires and wildfires associated with GLFRC studies. (Alexander)
7. Initiate study to assess economic impact of fire in relation to fire management objectives and priority-zone considerations. (Dubé)
8. Continue to provide technology transfer, participation on committees, task forces and review boards aimed at improving the protection and use of Canada's forests through efficient fire management. (All)
9. Publish Fire History Atlas for Alberta. (Delisle)
10. Publish Forestry Report. (Dubé)
11. Publish Information Report on spring burns in a 50 year old aspen stand. (Alexander)

12. Signatures:

David Dole
Investigator

P. H. H.
Program Manager

R. H. H.
Investigator

G. H. H.
Director A.D. Kill

^{For}
J. Chiswick [Dole]
Investigator

Martin E. Alexander
Investigator

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 12, 1982

1. Project: Fire management systems and guidelines
2. Title: Fire danger and behavior rating in forest and rangeland environments
3. New: X Cont.:
4. No.: NOR-5-191
5. Study Leader: M.E. Alexander
6. Key Words: Canadian Forest Fire Danger Rating System, wildfire case histories, fire behavior estimation, fire environment.
7. Location of Work: Regional
8. Problem:

This study formalizes the need for continued development, evaluation, interpretation, and application of the Canadian Forest Fire Danger Rating System in the region serviced by the Northern Forest Research Centre in order to extend its usefulness. Secondly, it recognizes the opportunity to formulate improved methods of anticipating and estimating the behavior of wildfires by regional adaptation of existing knowledge and techniques. This study is designed to compliment rather than duplicate the research efforts covered by NOR-5-086.

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. Resources:
 - a. Starting date: 1982
 - b. Estimated year of completion: Indefinite
 - c. Estimated total prof. man-years required: 10
 - d. Essential new major equipment items for 1982-83 with costs: Nil
 - e. Essential new major equipment items beyond 1983 with costs: Nil
 - f. 1981-82 man-years: Prof. 0.5 (M.E. Alexander)
Supp. 0.2 (M.E. Maffey)
Casual -
Total 0.7

11. Progress to Date:

N/A - new study

12. Goals for 1981-82:

N/A - new study

13. Accomplishments for 1981-82:

Some related goals were completed under NOR-5-174.

14. Goals for 1982-83:

1. Prepare FMN on descriptive danger index classes associated with the new Sun-exposed Fine Fuel Moisture Code (SFFMC) and Fast-Drying Spread Index.
2. Prepare FMN on relationship between SFFMC and Cladonia Fire Hazard Index.
3. Participate in cooperative projects on CFS National Fire Danger Working Group, including continued development of the Fire Behavior Index subsystem.
4. Initiate field reconnaissance and prepare study plan on adaptation of CFFDRS to the distinctive weather and fuel conditions in the NWT.
5. Provide advice and services as required, including serving on Central and Western Regional Fire Weather Committees.
6. Compile and analyze data for selected past wildfires.
7. Monitor and document on-site fire behavior of selected fires.
8. Prepare FMN on use of hand-held wind gauges on forest and rangeland fires.
9. Review unpublished experimental fire behavior data on file at NoFRC and summarize.

15. Publications:

N/A - new study

16. Signatures:

Martin E. Alexander
Investigator

B. W. [Signature]
Program Manager

G. S. [Signature]
Director

A.D. Kill

NOR-7

Reduction of Damage from Pollutants in the Atmosphere

1982 - 83

Date: February 2, 1982

1. Project: Reduction of damage from pollutants in the atmosphere.
2. Title: Assessment of air pollution impact on forest systems.
3. New: Cont.: X 4. No.: NOR-7-114
5. Study Leader: P.A. Addison and D.G. Maynard
6. Key Words: Sulphur gases, element sulphur, vegetation, lodgepole pine, white spruce, biomonitoring.
7. Location of Work: Region-wide (with emphasis on west-central Alberta)
8. Goals for 1981-82:
 1. Revise and submit a journal article on the quantification of branch dwelling lichen communities for the detection of air pollution impact.
 2. Study the influence of type and density of plant canopies on the ground level concentration of SO₂.
 3. Examine the effect of SO₂, light and humidity on the stomatal resistance of jack pine.
 4. Initiate a paper on the gradient sites in the vicinity of Athabasca Oil Sands development.
 5. Represent Canadian Forestry Service as a member of the Regional Hydrocarbon Committee.

6. Initiate a study to assess plant ecological effects of sour gas processing in west-central Alberta.
7. Establish and describe a biomonitoring network in the vicinity of Ram River and Strachen sour gas plants.
8. Assess the forest damage resulting from a sulphur block fire at Ram River Gas Plant.

9. Determine the effect of Ram River gas plant tailings pond water on seed germination and initial root growth of lodge-pole pine and white and black spruce.

9. Accomplishments in 1981-82:

1. The article on the quantification of branch dwelling lichen communities for the detection of air pollution impact has been partially revised with the incorporation of data from a fourth year of study. Completion is expected before the end of the fiscal year.
2. Three towers, 2.8 km south of Suncor Inc. were established in each of three forest types (jack pine, aspen and black spruce). Pairs of sulphation plates were placed 3 m above the canopy, at the top of the canopy and at 4 other heights down through the canopy. Samples were changed at 1-2 month intervals and analysed.
3. Owing to a combination of difficulty in obtaining equipment, in maintaining the pollution chamber, a change in staff and the addition of several major goals, this goal was not met. It is anticipated that the experiments will be carried out in 1982-83 and that stomatal response will be incorporated into the study on the combined effects of time of fumigation and concentration of SO₂ on jack pine.
4. A paper entitled "Biomonitoring in the Athabasca Oil Sands area of Alberta: progress and pitfalls" has been written and will be presented to the Alberta Department of the Environment, Canadian Petroleum Association, Oil Sands Environmental Study Group Symposium on Acid Forming Emissions in Alberta and their Ecological Effects. The information on the gradient sites is included in detail.
5. The Regional Hydrocarbon Committee was involved in a variety of ways with the following projects:
 - a. North Davis Strait Drilling Program
 - b. Oil Transport through Parry Channel
 - c. Lancaster Sound Hearings
 - d. Beaufort Sea Oil and Gas Development

Additional Accomplishments:

6. Upon request from industry (Aquitaine Company of Canada and Gulf Canada Ltd.) a proposal was written and submitted to:
 - a. Establish a biomonitoring network in west-central Alberta in the vicinity of Ram River and Strachen sour gas plants.
 - b. Determine the impact of elemental sulphur on the forest system in the area.

7. A set of 26 biomonitoring sites were established and described in lodgepole pine sites surrounding the two sour gas plants. Site locations were based upon air quality information, topography, air-flow pattern, logistics and accessibility. Descriptions included vascular and lichen plant communities, soils and several measurements of the growth and vitality of lodgepole pine. Samples of soils and 5 different plant species (10 reps) were collected for element analysis and sulphation plates were installed (5) at all sites.
 8. An Assessment of the damage resulting from a sulphur block fire in mid-July was carried out upon request from the Air Quality Division of Alberta Environment. Copies of the report have been submitted to Alberta Environment, Alberta Forest Service and Aquitaine Company of Canada.
 9. Seed germination and initial root growth of the dominant tree species in the Ram River area were determined in both tailings water and distilled water. No significant differences were observed in either root growth or germination with the notable exception of lodgepole pine which had greater root growth in pond water.
10. Goals for 1982-83:
1. Work Plan Goals 3 and 12. Under field conditions in the vicinity of sulphur dust sources, measure the movement of sulphur and other elements in forest soil. (Addison-Maynard)
 2. Work Plan Goal 4. In the vicinity of sulphur dust sources determine the variability and distribution of sulphur and other essential macronutrients in the primary soil horizons. (Maynard)
 3. Work Plan Goal 9. Complete description of vegetation and soils plots to provide information of forest condition in west-central Alberta. (Addison-Maynard)
 4. Work Plan Goal 10. Measure the amount and form of sulphur deposition in the vicinity of sulphur dust sources. (Addison-Maynard)
 5. Work Plan Goal 11. Sample and analyse lichen and moss material in the vicinity of Ram River and Strachan Gas Plants. Measure living and dead moss cover in the vicinity of sulphur dust sources. (Addison)
 6. Work Plan Goal 17. Revise and submit an article on the quantification of branch dwelling lichen communities for the detection of air pollution impact. (carried over from 1981-82) (Addison)

11. Publications:

12. Signatures:

P. A. Adkins
Investigator

[Signature]
Program Manager

Doug Montgomery
Investigator

G. D. Hut
Director A.D. Kill

1982 - 83

1. Project: Reduction of damage from pollutants in the atmosphere.
2. Title: Impact of air pollutant mixtures on forest vegetation and soils.
3. New: Cont.: X 4. No.: NOR-7-182
5. Study Leader: D.G. Maynard and P.A. Addison
6. Key Words: Sulphur dioxide (SO_2), nitrogen oxides (NO_x), vanadium nickel, synergistic, additive, antagonistic.
7. Location of Work: Oil sands areas of Alberta, Northern Forest Research Centre.
8. Goals for 1981-82:
 1. Write annual progress report on pollutant mixture effects. (Addison)
 2. Continue studies on the influence of pollutant mixtures on jack pine by soil contamination by measuring plant responses such as photosynthesis, peroxidase activity, growth, visual symptom development and element content. (Addison)
 3. Determine the magnitude and pattern of migration of pollutant elements and changes in soil nutrition caused by the addition of pollutant mixtures. (Baker)
 4. Continue the study on the impact of air pollution mixtures on epiphytic lichens. (Addison)
9. Accomplishments in 1981-82:
 1. Two reports were written and accepted by Research Management Division, Alberta Environment.
 - a. Addison, P.A., A.A. Khan, J. Baker, S.S. Malhotra, F. Theriault, F. Radford and J.I. Ridgway. 1981. Effects of mixed pollutants on soil-plant microcosms. 20 pp.
 - b. Khan, A.A., S.S. Malhotra, F. Radford and P.A. Addison. 1981. Effects of SO_2 on lichen physiology. 8 pp.

2. The effect of litter on the response of jack pine seedlings to pollutants added to the soil was examined. Plants grown in sand with a mantle of litter had greater carboxylase activity than those grown in sand alone. No effect of the pollutant treatments has been demonstrated to date.
3. Owing to technical difficulties, the experiment on soil-plant microcosms had to be terminated. No work was done on the movement of pollutants within the cores.
4. A study on the effects of time of exposure and SO₂ concentration on *Evernia mesomorpha* has been carried out in part. Analyses of physiological responses and tissue S concentrations have been completed. Several statistical tests are currently being performed and follow-up experiments to confirm some results are still required.

10. Goals for 1982-83:

1. Work Plan Goal 1. Continue measuring the effect of pollutants in the soil on vascular plants by developing a closed experimental system and measuring above- and below-ground biomass. (Addison)
2. Work Plan Goals 2 and 13. Initiate leaching and deposition experiments on soil columns to determine the influence of soil LFH on the mobility of pollutants and other elements in the soil. (Maynard)
3. Work Plan Goal 6. Continue experiments on previsible and transitory responses of plants to pollutants to develop methods to assess pollutant injury to plant metabolism. (Addison)
4. Work Plan Goal 7. Measure the response of RU DP carboxylase and stomatal resistance of jack pine to various SO₂ concentrations and times of exposure. (Addison)
5. Work Plan Goal 8 and from NOR-7-114. Measure changes in photosynthetic rate, stomatal resistance and RU DP carboxylase in jack pine during fumigation with SO₂ to attempt to separate biochemical and biophysical components of plant resistance to SO₂. (Addison)
6. Work Plan Goal 14. Submit an article on the sensitivity of boreal forest woody plants to SO₂ and the effect of a contaminated substrate. (Addison)
7. Work Plan Goal 15. Submit an article on the effect of time of exposure and concentration of SO₂ on lichens. (Addison)

8. Work Plan Goal 16. Write a report on the influence of stand type on the patter of S deposition in forests.
(Addison)

11. Publications:

12. Signatures:

P.R. Addison
Investigator

J.M. Kill
Program Manager

Doug Maynard
Investigator

C.D. Kill
Director A.D. Kill

NOR-9

Forest Insect and Vegetation Management Systems

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: Jan. 15, 1981

1. Project: Forest insect and vegetation management systems
2. Title: Chemical Controls of pests and vegetation in managed forests.
3. New: Cont.: X
4. No.: NOR-9-132
5. Study Leader: J. Drouin
6. Key Words: Efficacy, spraying toxicology, pesticides, registrations, residuals, formulations, herbicides, pheromones.
7. Location of Work: Prairie Region
8. Study Objectives:
 1. To develop control methods and assess needs on the use of herbicides and pesticides as a tool in forest management.
 2. Conduct efficacy trials for various dosages, formulations and timing and to determine percent mortality of host species.
 3. Provide data to aid registration recommendations for selected chemical products.
9. Goals for 1981-82:
 1. Continue evaluations with herbicides, selections of herbicides, selection of program and proposals for ground and aerial applications of herbicides in Alberta and Manitoba, monitor and assess existing trials, establish new test sites, and expand to spring and summer applications of herbicides as follows:
 - a) Conifer release from weeds/grass competition:
 - with new 5% grid balls @ 6' spacing
 - foliar application with glyphosate (Roundup)
 - with Velpar L (hexazinone) @ 2, 3, 4, lbs/acre applied in early spring.

Goals for 1981-82: (cont'd)

- b) Conifer release from Brush competition:
 - with Kre ite (no common name) for site preparation and release
 - with glyphosate (Roundup)
- c) Chemical Thinning in Pine:
 - with Hyvar X-L (bromacyl) @ 4 mL/2" stem diameter

2. Assist in the development of attractant (pheremone) studies with N.R.C. Saskatoon; assistance from H. Wong and Survey personnel:
 - continue field tests of pheremone traps for *P. willingana* & *P. crescentana* to distinguish damage larval differences, populations & distribution.
 - set out 6 traps in Manitoba, Alberta, Saskatchewan for *Rhyacionia buoliana* for distribution, populations.
 - set out 6 traps at Devon Nursery to collect the northern pitch twig moth *P. albicapitana* and collect 100 pupae in mid-June for analysis.
3. Participate in the study of Seed and Cone insects in the prairie region by investigating means of control through chemicals.
4. Review, edit, illustrate Pest Leaflets, Information Reports and journal articles.
5. Obtain input from Tree Physiologist.

10. Accomplishments in 1981-82:

1. Continued assessments, monitoring of the established herbicide trials and have expanded these evaluations to spring and fall tests in Manitoba and Alberta to a total of 69 plots in 1981 as follows:

- a) Conifer Release from weed/grass competition; Alberta

Grande Prairie: Velpar L @ 2,3,4, lbs/acre...6 + 1 control plot,..spring
 Hyvar X-L @ 4 ml/2.5 cm stem 2 plots ..fall
 Velpar Granular 20% @ 12.5 lbs/acre.. 1 plot ..fall
 Krenite, 2% solution .. 1 plot ..fall

- 3 -

Accomplishments in 1981-82: (cont'd)

Results: Fair control with Velpar 'L' @ 2, 3, lbs/acre, good @ 4lbs/acre - some chlorosis on host. Hyvar X-L gave 100% defoliation on alder, poplar, willow. Velpar Granular and Krenite will be assessed 1982.

MANITOBA: Agassiz

Velpar Gridballs, $\frac{1}{2}$ cc 20% @ 7.5,15,25 lbs/acre + control
7 plots..spring
Velpar Granular 20% @ 12.5,25 lbs/acre....4 plots..spring
Velpar Gridballs, $\frac{1}{2}$ cc 20% @ 7.5,15, 25 lbs/acre
3 plots..spring

Results: Good to excellent controls with Velpar gridballs - from 70 - 75% defoliation on all species - gridballs more effective in sandy soils, Animal "digs" at pellet drops - damage to white spruce increases with dosage. Granular shows excellent control on all ground cover from 70-100% - Granular adequate at 12.5 lbs/acre in sandy soils.

Piney: Red Pine Release

Velpar Gridballs, 2 cc 10%
 $\frac{1}{2}$ cc 10%..@ 7.5,15,25 lbs/acre,
3 plots ea + 1 control
Velpar Granular 20% @ 12.5 & 25 lbs/acre
2 plots ea + 1 control

Pine Falls

Velpar Gridballs, $\frac{1}{2}$ cc 20% @ 3.75,7.5,12.5/acre + control
Velpar GB, $\frac{1}{2}$ cc 10% @ 3.75,7.5,15.0,25.0 lbs/acre
8 plots..spring
Velpar Granular 20%, 12.5,25.0 lbs/acre...4 plots..spring

Results: Velpar gridballs increasing fair to good in 15 lbs/acre very heavy black ash growth (also elm, maple, cranberry). Velpar G. gave good to excellent results in all 4 plots.

b) Conifer Release from Brush Competition in Alberta, Manitoba;Slave Lake:

Velpar GB, $\frac{1}{2}$ cc 20%, 7.5, 15, 25 lbs/acre 3 plots..spring
 $\frac{1}{2}$ cc 10%, 7.5, 15, 25 lbs/acre 3 plots..spring
1 cc 20%, 10, 20 lbs/acre 2 plots..fall
Velpar Granular 20%, 12.5, 25.0 lbs/acre 4 plots..spring

Results: July 1980 Velpar gridball tests varied fair to good with some "streaking" in higher dosage, -some mortality to host at 30 lbs/acre also. Spring 1981 gridball tests gave fair to excellent defoliation-occasional host chlorosis or mortality. Velpar granular plots were excellent, visible with little host mortality.

Velpar GB, ½ cc 20%, 7.5,15,25 lbs/acre 10 plots,..spring
Velpar Granular 20%, 12.5,25 lbs/acre + control
4 plots,..spring

Pine Falls:

Velpar GB, $\frac{1}{2}$ cc 20%, 3.75,7.5,12.5 lbs/acre..3 plots..spring	
$\frac{1}{2}$ cc 10%, 3.75,7.5,15,25 lbs/acre + control..	
	5 plots..spring
Velpar Granular 20%, 12.5,25 lbs/acre	4 plots..spring

c) Chemical Thinning in Pine and White Spruce, Alberta

Edson: Hyvar X-L bromacil 4 ml/2.5 cm stem diam..
2 plots..spring
@ 6' grid

Results: Hyvar X-L (bromacil) for chemical thinning was very good but causing mortality to a group of trees. Dosage is too high and was reduced in subsequent trials to 4 ml/2.5 stem diam. @ 6 foot grid.

Grande Prairie: Hyvar X-L, @ 4 ml/2.5 cm stem diam, alder,
willow ..2 plots
4 ml/2.5 cm stem diam, alder,
willow and poplar, summer applications

Results: Hyvar X-L (bromacil) to remove alder, willow, poplar clumps. Excellent results, no mortality to hosts (w. spruce and lodgepole pine).

Accomplishments in 1981-82 (cont'd)

2. Assisted in the development of attractants (pheromone) studies with National Research council, Saskatoon personnel with Dr. Wong, D. Szlabey and survey personnel:
 - mass collection of northern pitch twig moth pupae (200) in early spring for rearing and attractant identification. These were reared and used in extration of attractants. The first series were not successful but the second resulted in excellent catches, identification and distribution.
 - continued field testing of attractants traps (41) for P. willingana, P. crescentana and P. aesculana, rearings, biologies, populations and distribution attractant successfully trapped these three species where we thought only P. willingana existed - identifications were made as well as some biologies of each species.
 - Set out 6 traps respectively in Manitoba, Saskatchewan and Alberta for Rhyacionia buoliana for distribution, populations. No pine shoot moths were found in the traps when retrieved in the fall.
 - Set out traps at Devon (30), Edson (14) and Hinton w/W.G.H. Ives program (9) to test a variety of attractants for the Northern Pitch Twig Moths, Petrova albicapitana, and metallica for distribution, populations and effectiveness of chemicals. Second batch of attractant proved to be efficient and attracted good catches of both species. The 1982 chemical will be even further refined and should be superior.
 3. Participate in Seed and Cone collections for J. Muldrew.
 4. Review, edit Pest Leaflet, Illustrate 3 covers for Information Reports.
 5. Obtained input from tree Physiologist.
 6. CFS representation, reporting, handling requests, surveys, consultations talks and papers were provided to the following:
 - Western Committee on Crop Pests (ECPUA)
 - Expert Committee on Weeds (ECW)
 - National Research Centre
 - Plant Industry Lab Alta, Agric., Brooks Horticultural Res. Ctr., general public industry.
- Drouin, J. A. and H. R. Wong. 1981. Insects attacking the fruits of Saskatoon and Chokecherry and their Chemical Controls, 1982. Environ. Canada, Can. For. Ser., North. For. Res. Cent. Edmonton, Alberta File Report.

Drouin, J. A. and H. R. Wong, 1981. Birch Leaf Miners and their Chemical Controls in Alberta. 1982. Environ. Canada, Can. For. Ser., Nor. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X

Wong, H. R., J. A. Drouin, D. Szlabey and W. Dang. 1981. Identification of species of Proteoteras in the Canadian Prairies. 1982. Can. Ento.

11. Goals for 1982-83:

1. Continue assessment, monitoring of established plots, continue to expand field testing of Velpar Granular for spring application, Velpar L at lower dosage and of Krenite at Grande Prairie (Saddle Hills) and at Faust, Slave Lake.

- a) Conifer Release and Site Preparation, from weed/grass competition;

Velpar G 20% @ 8, 12.5 lbs/acre..Faust, Saddle Hills, Piney, Agassiz, Manitoba

Velpar L @ 2, 3 lbs/acre.....Economy Tower, Grande Prairie

Krenite 48%, 1, 2% spray solution....Saddle Hills, Grande Prairie

2. Continue and complete evaluation of pheromones with NRC Saskatoon;

- for the Boxelder Twig Borer complex, clarify biologies and (taxonomy) of the species (3) with Wong, Szlabey, Dang.
- continue evaluation of attractants for the northern pitch twig moth w/large scale field testing in the Edson-Hinton areas with W. G. H. Ives' study
- continue to cooperate in monitoring for the detection of the pine shoot moth, R. buoliana.
- cooperate with NRC Saskatoon, in the evaluation of new attractants for assessing the abundance of white pine weevil, root collar weevil, by mass collections of adults, population and distribution in forest regeneration in Hinton-Edson areas with W. G. H. Ives' study.

3. Participate in the Seed and Cone study and chemical controls with J. A. Muldrew using the systemic insecticide as soil drenches that have proven to be most successful to date, i.e. orthene, dimethoate and carbofuran.

12. Publications:

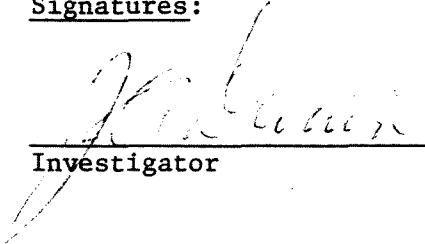
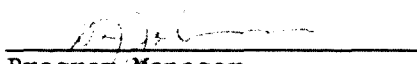
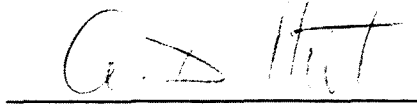
1981-82

Drouin, J. A. 1981. Expert Committee on Weeds, Research Report
Vol. 3. Western Canada Section Meeting, Banff, Alberta,
pp. 126-131.

Drouin, J. A. 1981. Annual revision of insect pests and controls on
berry crops. In WCCP Report (1981). 5 pp.

Cerezke, H. F., J. A. Drouin and B. Neill. 1981. Annual revision
of insect pests and controls on shelterbelts, ornamentals and
shrubs. In WCCP Report (1981). 18 pp.

Soehngen, U. and J. A. Drouin. 1981. Annual revision of insect
pests and controls on houseplants and on greenhouse woody
ornamentals. In WCCP Report (1981). 14 pp.

13. Signatures:
Investigator
Program Manager
Director

A. D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982-83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 15, 1982

1. Project: Forest insect and vegetation management systems
2. Title: Evaluation of mortality in stands of young trees in plantations and scarified areas.
3. New: Cont: X
4. No.: NOR-9-181
5. Study Leader. W.G.H. Ives, K. Froning
6. Key Words: Jack pine, *Pinus banksiana* Lamb., lodgepole pine, *Pinus contorta* Dougl., red pine, *Pinus resinosa* Ait., white spruce, *Picea glauca* (Moench) Voss, insect damage, tree diseases, stocking standards, site classes, reforestation, browsing, rodent damage.
7. Location of Work: Prairie Provinces and Edmonton.
8. Study Objectives:

To determine whether or not pine tree survival from establishment to age 35 years is related to site conditions, and if so, to prepare a set of survival curves for each site class.
9. Goals for 1981-82:
 1. Select a number of sampling areas to represent several age groups and sites in lodgepole pine regeneration on scarified and planted sites in the Hinton area of Alberta.
 2. Establish 40 10 m² plots in each of the above areas, recording the numbers of trees on each plot. A total of about 3000 plots are planned (Three sites, two planting methods, six age groups, two replicates, 40 plots).
 3. Locate the 18 jack pine plots established by DeBoo in Manitoba in 1967 and measure height to base of current growth. Record numbers of living and dead trees and re-stake and re-tag trees as necessary.

- 2 -

Goals for 1981-82 (cont'd)

4. If time permits, establish additional plots to give representation in additional age groupings to those represented by DeBoo's plots.

10. Accomplishments in 1981-82:

1. A total of 59 sampling areas in several age classes were selected in the Hinton, Alberta area. These areas were distributed among the various working circles as follows: McLeod II--8; McLeod VI--17; McLeod IX--6; Embarras III--2; Athabasca XIX--15; Berland III--7; and Marlboro VII--4. The poor representation in Embarras III and Marlboro VII was due to the difficulty encountered in working these areas from a base at the Hinton trailer camp. There was simply too much travel involved.

2. A total of over 2,000 plots were established in these areas, of which 1,829 contained one or more lodgepole pine. The planned replication could not be followed for a number of reasons;
 - 1) site classes, as such, could not be recognized reliably with our limited expertise;
 - 2) scarification was almost universally utilized by St. Regis, planting was used only to fill in gaps;
 - 3) only limited cut-over areas were available in some age categories, particularly in the early years of operation;
 - 4) because of the previously mentioned problems, strict equality in representation was impossible; and
 - 5) not all areas had 40 plots, for various reasons.

What we attempted to achieve instead was to have plots in a representative cross-section of the pine areas. We avoided problem areas, where adequate stocking had not been achieved, simply because the small-plot concept was not satisfactory for such areas. As it was, a number of the plots contained only 1 or 2 pine, the rest of the sample trees were around the plot area. All information relating to the plots near Hinton, has been transferred to data sheets preparatory to key punching. This includes data on tree height and condition, stand density in each of the plots, a crude description of the vegetative cover in most of the plots and information on each of the cut-over areas sampled, such as a number of positive and negative plots and aspect.

3. Information on the 18 jack pine plots established by DeBoo in 1967 was not obtained until the fall, so it was not possible to do any work with the plots. Ten of the plots were located, however, and the areas containing the remaining eight plots are known. On the

Accomplishments in 1981-82 (cont'd)

basis of limited checking in plots that were examined, it should be possible to resurrect most or all of them. The plots will have to be re-staked, and the trees re-tagged, but this should not be too difficult, as the trees were planted in furrows. Ingress may present some problems, but the amount of natural regeneration seems to be low.

4. A number of plantations were selected, five from each 5-year age class, over a planting span of 25 years. Plots were established in 7 of these areas, at the rate of 40 per area, to give a total of 280 plots in all. Other commitments limited the amount of time available for plot establishment.

11. Goals for 1982-83:

1. Establish additional plots in lodgepole pine regeneration near Hinton, Alberta, to fill in gaps. These plots will probably be in the Marlboro and Embarrass working circles, as these areas were poorly represented, due to the difficulty in working them from Hinton.
2. Assess first-year mortality of lodgepole pine in the plots near Hinton.
3. Prepare an establishment report outlining the procedures used in establishing the lodgepole pine plots near Hinton, and summarizing information on tree condition and first-year mortality.
4. Locate the 18 jack pine plots established by DeBoo in Manitoba in 1968 and measure height to base of current growth. Record numbers of living and dead trees and re-stake and re-tag trees as necessary.
5. Complete the establishment of plots in plantations of jack pine in Manitoba to provide a cross sectional representation of plantings varying from 1 to 25 years in age.

12. Publications:

Nil

13. Signatures:

Investigator



Program Manager



Investigator

Director

A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 1983

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 15, 1982

1. Project: Forest insect and vegetation management systems
2. Title: Insects and diseases affecting seed production in the Prairie Region.
3. New: X Cont.: 4. No.: NOR-9-185
5. Study Leader: J. A. Muldrew
6. Key Words: Seed production, seed and cone insects, seed orchards, white spruce, *Picea glauca*, Jack pine, *Pinus banksiana*, Lodgepole pine, *Pinus contorta*, *Dioryctria abietivorella* (fir coneworm), *D. reniculelloides* (spruce coneworm), *Laspeyresia youngana* (spruce seed moth), *Hylemia anthracina* (spruce cone maggot), *Megastigmus atedius*.
7. Location at work: Prairie Provinces
8. Study Objectives:
 1. Determine the species and abundance of cone and seed insects and their importance in the production of coniferous seed, primarily white spruce.
 2. To study the natural enemy complexes of each pest species and the extent of mortality exerted by these natural enemies.
9. Goals for 1981-82:
 1. To contact the seed producing agencies in each of the Prairie Provinces to arrange to obtain samples of cones from a representative series of the areas in which the cones are collected. Each sample should be between 100 and 200 cones and ideally should be removed from the collection before any seeds have come loose from the cones.
 2. Cones will be collected at weekly intervals at two selected locations near Edmonton from the time of early cone formation to the time of seed fall. Some cones will be dissected and some reared to determine the insects attacking the cones and seeds and the extent of the damage caused by them.

3. Insect pests of cones will be dissected to study the natural enemies attacking them and they will be reared to obtain adult specimens of these natural enemies for identification.

10. Accomplishments in 1981-82:

1. Contact was made with workers at the Pine Ridge Nursery, Alberta; the St. Regis Ltd. Nursery, Alberta; the Prince Albert Nursery, Saskatchewan and the Pineland Nursery in Manitoba (the latter via K. Froning). In all cases either no cones or very few had been collected by these nurseries. Some collectors in Alberta had reported that in the few locations where cones were fairly abundant, the damage to the seeds by insects was so high as to make collecting impractical.
2. Cones on selected trees at the Devon Nursery and in Elk Island Park, Alberta, were marked in early June shortly after they appeared and were checked at bi-weekly intervals. At Devon, 1,860 cones were marked on five trees and at Elk Island, 1,172 were marked on ten trees. Loss of cones during the summer was low; less than 5% on each tree. Missing cones appeared to be due to removal by squirrels. All cones examined showed at least some insect damage and those checked late in the season, when feeding by insects was complete, showed over 90% damage to the seeds, varying up to 98%. Cones removed by squirrels found on the ground had a few scales removed but were mostly rejected by the squirrels for food, probably due to the high rate of insect damage.
3. Attempts to rear both the insect pests and their natural enemies were unsuccessful. Methods attempted were (a) placing branches bearing white spruce cones in jars of water over a layer of peat moss in cages and (b) rearing the larvae recovered during examination in the rearing medium developed for the spruce budworm.
In the latter case the dipterous pest commonly found (almost certainly Hylemya anthracina) died before forming puparia. The common lepidopterous pest (almost certainly Laspeyresia youngana) fed to pupation in several cases but the pupae did not survive.

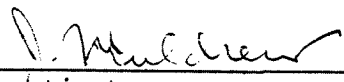
11. Goals for 1982-83:


1. Cooperate with the F.I.D.S. in the assessment of damage due to seed and cone insects in the Region.
2. Study the phenology of cone insects on white spruce and elaborate losses due to insects during the season.
3. Assess the importance of insect pest problems related to nursery production of conifers in cooperation with the F.I.D.S.
4. Assess mortality of seed and cone pests due to natural enemies and relate to biological control.
5. Initiate preliminary studies on the use of systemic insecticides to control seed and cone insect pests on white spruce.
6. Complete publication "Dispersal of Olesicampe benefactor Hinz, an introduced parasite of the larch sawfly.


12. Publications:

N/A

13. Signatures:


Investigator


Program Manager


Director


A. D. Kiil

NOR-10

Silviculture Investigations

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982-83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982

1. Project: Silvicultural investigations
2. Title: Nursery operations
3. New: Cont.: X 4. No.: NOR-10-039
5. Study Leader: R.F. Huber
6. Key Words: Root pruning, storage and packing, storage mold, disease control, *Septoria*, *marssonina*, seedling mortality, *Populus*, *Pinus*, *Picea*, conifer seedbed culture, containerized seedling rearing, quality control.
7. Location of Work: Northern Forest Research Centre, Edmonton, Alberta; Provincial Tree Nursery, Oliver; Alberta Forest Service Nurseries, Smoky Lake, Alberta Horticultural Research Centre, Brooks; Saskatchewan Department of Tourism and Renewable Resources Nurseries, Big River, Chitek Lake, MacDowall, Prince Albert; PFRA Tree Nursery, Indian Head, Saskatchewan; Pineland Nursery, Hadashville, Manitoba; Northwest Pulp & Paper, Hinton; Simpson Timber, Whitecourt, Alberta and Hudson Bay, Saskatchewan; B.C. Forest Products, Grande Cache, Alberta.
8. Study Objectives:
 1. To improve general nursery practices, including seedling handling, disease control, weed control, cultural operations, and innovations for seedbed treatments.
 2. To advise on container production of seedlings.
9. Goals for 1981-82:
 1. To survey regional nurseries for problem assessment and to perform related liaison functions, such as seed data collection, nursery production records, etc.

9. Goals for 1981-82: (cont'd)

2. Install demonstration plots at various bareroot nurseries to show the effect of seedbed density and monitor soil fertility. These will be accomplished if resources are available.
3. Contact regional nursery personnel to obtain input into a regional meeting to discuss problems and developments. To be held at P.F.R.A. Tree Nursery, Indian Head, Sask. Obtain a guest speaker to give seminar on a nursery related subject.
4. Act as co-chairman for the 1981 Intermountain Nurserymen's Assn. meeting to be held in Edmonton, August 11-13 publication.
5. O.E.C.D. seed certification as required.
6. Co-author a paper with Ivor Edwards to be presented at Canadian Containerized Seedling Symposium, Toronto, Ontario, Sept. 1981.

10. Accomplishments in 1981-82:



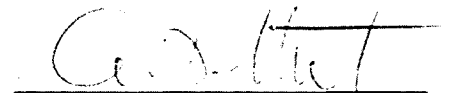
1. All regional nurseries were visited in 1981. Typical problems relate to fertility, seedbed covering, seedbed density, germination, etc.
2. Plots were installed at all nurseries to demonstrate seedbed density. Soil and foliage samples were collected at Saskatchewan and Manitoba nurseries for monitoring soil fertility.
3. Meeting was held at P.F.R.A. nursery, Indian Head, Sask. Thirty plus in attendance. L.W. Carlson from Headquarters was guest speaker.
4. Completed. Publication of Proceedings in progress.
5. No O.E.C.D. inspections required.
6. Completed. Paper submitted for publication in proceedings.

11. Goals for 1982-83:

1. Provide advisory services on nursery culture and production schedules as required.
2. Monitor spacing demonstration plots at the various nurseries.
3. Analyse soil and foliage samples for regional bareroot reforestation nurseries.

11. Goals for 1982-83: (cont'd)

4. Monitor irrigation systems in all container growing facilities in the region and report. (File)
5. Help organize regional nursery meeting and workshop. No report.
6. Explore and prepare for growing container stock using alternate facilities in comparison to conventional greenhouses. Inform, gathering, 1982.
7. Grow container and bareroot stock for physiology work and assist growing container stock for nutrient regimes and hardening trials.
8. Do O.E.C.D. field inspection work as required.

12. Signatures:
Investigator
Program Manager
Director A.D. Kii1

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982

1. Project: Silvicultural Investigation
2. Title: Nursery soil fertility and seedling growth
3. New: Cont.: X
4. No.: NOR-10-135
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, and Smoky Lake, Alberta; Prince Albert, Saskatchewan
8. 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.
9. Goals for 1981-82:
 1. To publish the report 'Effect of nitrogen, phosphorus and potassium on growth of lodgepole pine and white spruce in peat culture'. (Journal)
 2. To prepare a paper for presentation at a meeting of the Inter-mountain Nurserymen's Association in Edmonton in August.
 3. To prepare a paper (jointly with Huber) for presentation at the containerized seedling symposium in Toronto in September.
 4. To publish the report 'Fertilization and soil fertility in conifer seed production'. (Forest Management Note)

9. Goals for 1981-82: (cont'd)

5. To publish the report, 'Soil fertility and forest site productivity rating'. (Information Report)
6. To publish the report, 'Erodibility index and its application to the Biogeoclimatic Classification of Alberta'. (Information Report)
7. To complete the manuscript, 'Relationship between soil phosphorus and uptake by conifer seedlings'.
8. To provide advisory service in soil fertility and tree nutrition as required by industry and government agencies.
9. To review the study objectives and to realign them to be compatible with existing and developing goals.

Goals added:

10. To assist with the development of a proposal for an ENFOR contract (P-205) "Nutrient Cycling in Aspen", to assist with the selection of a contractor, and to assist with the supervision of the contract.

10. Accomplishments in 1981-82:

1. The manuscript was revised as suggested by the Editor, Canadian Journal of Plant Science. It is being resubmitted as an Information Report.
2. The paper was prepared and presented at the August meeting of the Intermountain Nurserymen's Association in Edmonton. It was entitled, "Maintenance of soil fertility in prairie forest nurseries". It has been submitted for publication in the Proceedings of the meeting.
3. The paper was prepared and presented at the Canadian Containerized Tree Seedling Symposium in Toronto in September. It was entitled, "Contrasting approaches to containerized seedling production - the prairie provinces". It has been submitted for publication in the Proceedings of the symposium.
4. The manuscript has been revised to conform with format specifications for Forest Management Notes. It is being resubmitted to the Review Board.
5. The manuscript is being revised as suggested by the Review Board. New bibliography has been included.

10. Accomplishments in 1981-82: (cont'd)

6. The manuscript is being revised as suggested by the Review Board. Instead of focussing on the Biogeoclimatic Classification of Alberta, its scope will be more general.
7. The statistical analysis of data has been completed but preparation of the manuscript is incomplete.
8. Advisory service in soil fertility and tree nutrition has been provided to industry and government agencies in the Prairies region and British Columbia.
9. Study objectives have been revised. Earlier objectives have been achieved and current ones reflect the thrust of nursery investigation over the next 5 years. Emphasis will be on hardening off of bareroot and containerized stock, residual soil fertility, and water use efficiency.
10. ENFOR contract (P-205) was awarded and work began on plot selection prior to freeze-up. Supervision of the contract is continuing. Also assisted the contractor in preparation of a subject profile for a computer search of the literature.

11. Goals for 1982-83:

1. To provide advisory service in soil fertility and tree nutrition to industry and government agencies.
2. To prepare the following 5 manuscripts for publication:
 - i) Effect of N,P, and K on growth of lodgepole pine and white spruce.
 - ii) Fertilization and conifer seed production.
 - iii) Erodibility index for forest land.
 - iv) Soil fertility and site productivity.
 - v) Soil phosphorus levels and phosphorus uptake in conifer seedlings.
3. To conduct an experiment to determine nutrient requirements for growth of containerized black spruce and red pine.
4. To review literature on hardening-off of container stock and conduct an experiment to determine nutrient requirements for hardening-off lodgepole pine, white spruce, black spruce, and red pine.
5. To initiate an experiment to determine the effect of residual fertility on growth of bareroot seedlings.

12. Signatures:

J. K. Edwards
Investigator

[Signature]
Program Manager

A. D. Kil
Director A.D. Kil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982

1. Project: Silvicultural Investigations
2. Title: Conditioning, winter storage and initial field performance of containerized conifer seedlings.
3. New: Cont.: X 4. No.: NOR-10-155
5. Study Leader: H. Zalasky
6. Key Words: Conditioning, winter storage, *Pinus* sp., *Picea* sp., container seedlings, dormancy, field performance.
7. Location of Work: Northern Forest Research Centre, Edmonton, various locations in Prairie Provinces.
8. Study Objectives:
 1. To develop a method for winter storage of containerized conifer seedlings and monitor early field performance.
 2. Develop overwintering guidelines for containerized seedlings.
 3. To develop a method to bring about dormancy in containerized conifer seedlings.
 4. To initiate a new study on the effects of microclimate and INA on cold tolerance of seedlings and use knowledge gained to develop more effective overwintering guidelines and to enhance field performance of seedlings.
9. Goals for 1981-82:
 1. Publish information report on "Guidelines to overwintering container stock", and "Forest Management Note on optimizing container stock performance".
 2. Outplant and tally 1980-81 NoFRC stored seedlings on a site at Whitecourt to determine their 1981 and 1982 growth performance and survival.

3. Finalize data bank for all field data and begin analysing performance of seedlings, those that were outplanted before and after storage, respectively, at Grande Prairie and Edmonton.
 4. Prepare a summary report of the Grande Prairie work, tying conditioning to field performance (growth, growth habit and mortality) within clearly stated limitations of the site.
 5. Develop a method of determining frost damage in containerized stock overwintered outside by using a color difference meter as an aid to nursery operations at industrial and provincial nurseries.
 6. Prepare and complete illustrative posters with information relating to frost damage, overwintering of conifer seedlings, storage and storage conditions for display at a nurserymen's symposium on containerized seedlings to be held in 1981 in Toronto.
 7. Prepare manuscripts a) field root cellar storage, b) frost heaving problem at Grande Prairie.
10. Accomplishments in 1981-82:
1. Information report on "Guidelines to overwintering container stock" revised on advice of an outside reviewer. To be published. Forest Management Note on optimizing container stock performance accepted for publication.
 2. Tally of Whitecourt outplanted seedlings completed and data processed.
 3. Work completed and most of the Grande Prairie and Edmonton out-plant seedling and temperature data bank information was processed on the Hewlett Packard 9862A plotter and 9825A calculator. Grande Prairie report is under review. Edmonton data are held for a later special report.
 4. Manuscript with summary entitled "Field performance of containerized conifer seedlings in the lower Foothills south of Grande Prairie, Alberta is under review.
 5. Colorimetric and photographic methods are currently under test.
 6. Poster session paper on "Conditioning, overwintering and frost effect on multi-crop container production was presented at the Canadian Containerized Tree Seedling Symposium September 14-16 in Toronto. Abstract was submitted for publication.
 7. Forest Management Note on "Field storing containerized conifer seedlings" is under revision.
- Information report on "Field performance of containerized conifer seedlings in the lower Foothills south of Grande Prairie, Alberta" is under review.

11. Goals for 1982-83:

1. Publish Information Report "Guidelines to Overwintering Container Stock".
2. Publish Forest Management Note "Field Storing Containerized Conifer Seedlings".
3. Publish Information Report "Field Performances of Containerized Conifer Seedlings in the Lower Foothills, South of Grande Prairie, Alberta".
4. Complete Whitecourt data collection and data bank storage and do analysis.
5. Develop a method for early detection of frost damage in container seedlings and determine the actual duration for each freezing event.
6. Initiate a field and laboratory investigation of ice nucleating agents (INA) and their competitors.
7. Advisory and consulting services on seedling storage, health of trees and shrubs, identification and other professional tasks.

12. Publications:

Up to 1981-82

Journal Articles	4
Information Reports	2
File Reports	2

1981-82

Zalasky, H. 1981. Preplanting conditioning and overwintering of container seedlings. Forestry Report No. 24. p. 11.

Zalasky, H. 1981. Conditioning, overwintering and frost effect in multicrop container production. In Proceedings to the Canadian Containerized Tree Seedling Symposium. Toronto, Ontario.

Zalasky, H. 1981. Optimizing containerized conifer seedling performance. Forest Management Note. In Press.

Zalasky, H. 1981. 1976 weather data for Proctor and Gamble clear-cuts at Grande Prairie in tabular and graph form for use by AFS committee discussing aspects of a drainage project.

Zuyus, M. and H. Zalasky. 1981. Samples of NoFRC white spruce analyzed for frost damage and compared with healthy spruce using a D25-9 Hunterlab color difference meter. File Report.

Zalasky, H. 1981. Assessment and field testing of overwintered containerized conifer seedlings from private, federal and provincial nurseries. NOR-10-155. File Report.

13. Signatures:

Harry Zalasky
Investigator

R. W. L.
Program Manager

A. D. Kill
Director A. D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982

1. Project: Silvicultural Investigations
2. Title: Development of Silviculture Data Base and Management Tools
for Forest Resource Planners.
3. New: Cont.: X
4. No.: NOR-10-176
5. Study Leader: L.G. Brace
6. Key Words: Silvicultural prescriptions, models, guidelines, planning,
computer data bank.
7. Location of work: NoFRC
8. Study Objectives:
 1. To co-ordinate all NOR-10 studies with other NoFRC projects.
 2. To promote the development and dissemination of silvicultural knowledge as part of the forest management options program. This includes work with national, regional and local committees, development of data bank criteria, establishment of the silviculture component of a data bank (to include stock performance and silviculture mechanization components) and cataloguing and assessment of silviculture guidelines and decision models.
 3. To publish scientific and technical reports of silvicultural interest, regionally and nationally, stressing regeneration silviculture.
 4. To provide liaison and input as required to relevant rational programs, including the Canadian Forest Resource Data Program, and the mechanization of Silviculture program.
 5. Supervise research contracts and develop in-house research studies as an outgrowth of contracts where appropriate.

9. Goals for 1981-82:

1. Act as project leader - NOR-10- and coordinate the activities of NOR-10 with those of other projects at NoFRC.
2. Continue as chairman, Regional Reforestation Technical Committee.
3. Complete publication of silviculture issue of Forestry Report.
4. Participate with site specialist in planning a field demonstration project - particularly the silviculture prescriptions aspect.
5. Co-ordinate the establishment of a regional silviculture data bank, including choice of data for entry, standardization of codes, and criteria for judging utility and reliability of data for use in regional data bank.
6. Co-author report on site preparation, regeneration and prescribed burning for all regions of Canada, as required by CFRDP for 1981. (NOR-29-173)
7. Co-author a report on container performance for the "Canadian Containerized Seedling Silviculture Symposium" Sept. 14-16, 1981.

Added goals:

8. Develop and negotiate contract in nutrient content and biomass in boreal aspen (with I.K. Edwards) and act as scientific authority in the contract (ENFOR P-205).

10. Accomplishments in 1981-82:

1. Acted as project leader for NOR-10. Two new scientists were added to the project in 1981, a site productivity specialist and a physiologist.
2. Acted as chairman, Regional Reforestation Tech. Committee. Chaired annual meeting, June 1981, and prepared reports for members and for Regional Senior Advisory Committee.
3. Completed co-ordination of Forestry Report 24 (Silviculture) which has now been published. Authored and co-authored 4 reports in the publication. (See 15)
4. The co-operative field demonstration project did not progress past discussion stage. Such a project may not be feasible as both the AFS and U of A, the potential co-operators have established their own plans for field demonstration areas.

10. Accomplishments in 1981-82: (cont'd)

5. Silviculture data bank work is being initiated through the CFRDP questionnaire and report. A national questionnaire was prepared in 1981 (Brace and Golec) and distributed. Completed responses have been returned by all regions.
6. Preparation of National Silviculture report is underway. Draft expected in early 1982.
7. Report completed and presented by Ball at Canadian Containerized Tree Seedling Symposium in Toronto - Sept. 14-16, 1981. (see 15)
8. ENFOR contract P-205 was developed and negotiated and duties of Scientific Authority assumed.

11. Goals for 1982-83:

1. Continue as project leader and coordinator of NOR-10.
2. Continue as chairman, Regional Reforestation Technical Committee.
3. Coordinate and establish silviculture data bank by building regional data into national data format where appropriate.
4. Publish CFRDP National Silviculture Report (with Golec)
5. Prepare Journal report on regional hare damage (with Ball)

12. Signatures:

L.S. Grace
Investigator

[Signature]
Program Manager

[Signature]
Director A.D. Kii1

1982 - 83

Date: January 26, 1982

1. Project: Silvicultural Investigations
2. Title: Field Performance of Planted Stock
3. New: Cont.: X 4. No.: NOR-10-190
5. Study Leader: W.J. Ball
6. Key Words: Silvicultural prescriptions, field performance, container seedlings, bare-root stock, silvicultural data bank.
7. Location of Work: Northern Forest Research Centre and Western and Northern Region
8. Study Objectives:
 1. To carry out research required to improve regeneration silviculture, especially in the area of field performance of planted stock. This may involve either in-house research or co-operative research with other agencies, including companies and provincial governments in the region.
 2. To publish results of research on field performance of coniferous seedlings.
 3. To provide advice and consultation to provincial and industrial clients regarding plantation performance.
 4. To participate in the establishment and development of a silviculture data bank at Northern Forest Research Centre.
9. Goals for 1981-82:
 1. a) To cooperate with Pine Ridge Forest Nursery in monitoring three 1981 seedlings of white spruce and lodgepole pine in Spencer-Lemaire 5's and 6's for use in the cooperative field performance trial with the AFS. This will involve 3 destructive samplings.

9. Goals for 1981-82: (cont'd)

- b) To plant 3 sizes of overwintered spruce and pine container stock on 3 sites south of Grande Prairie. This involves spring planting of both spruce and pine and fall planting of pine containers.
- c) To carry out demonstration placement plantings of bare-root spruce and pine on same plots as (b).
- c) To record after-planting heights, 1981 height increments and mortality on stock planted in fall 1980 and spring 1981.

Note: The 1981 spring planting will require additional manpower of 6-8 man-weeks. Arrangements will be made with Proctor and Gamble to stay at their camp.

- 2.
 - a) To obtain 10-yr heights and survival on lodgepole pine and white spruce container seedlings at Carrot Creek, Sundre and Lac La Biche, Alberta.
 - b) To obtain 5-yr heights and survival on white spruce in 5 sizes of container plus bare-root seedlings planted on Finn-ploughed furrows south of Hudson Bay, Sask.
 - c) To obtain 10-yr heights and survival on white spruce and jack pine container seedlings and bare-root stock near Candle Lake, Saskatchewan.
- 3.
 - a) To co-author a report to the "Canadian Containerized Seedling Silviculture Symposium" Sept. 14-16, 1981.
 - b) To prepare an establishment file report entitled "White spruce container planting on two Finn-ploughed sites in Saskatchewan".
 - c) To prepare a file report on plot establishment at Grande Prairie referred to in goal 1 (b) (c) (d).
 - d) To report significant plantation performance results in the Forest Management Note series.
- 4. Cooperate with study NOR-10-176 and the Resource Data Specialist at NoFRC assigned to duties under the Canadian Forest Resource Data Program (CFRDP) by providing consultation on silviculture data criteria and sources. Concurrently, continue to collect seedling performance data for a regional silviculture data bank.

10. Accomplishments for 1981-82:

1. White spruce container stock was destructively sampled once and lodgepole pine twice at P.R.F.N. (one more sample of each will be taken in mid May 1982). Spring and fall planting were carried out on 3 sites south of Grande Prairie. Bare-root placement plantings were carried out and after-planting heights were recorded on all stock.
2. Survival and heights were taken on 5-and 10-year-old container seedlings in Alberta and Saskatchewan. (Lac La Biche spruce have been badly browsed. Height differences among various container stock types on the Saskatchewan Finn plough study have been obliterated both south of Hudson Bay and at Rice River by hare browsing. Many jack pine at Candle Lake < 3.5m in height have been girdled by hares).
3.
 - a) The paper on use and performance of container seedlings in the prairie provinces was presented at Toronto and has been accepted for publication.
 - b) Severe height reductions have ruined this study as far as the original objective of comparing field performance of the 6 stock types is concerned. However, data from approximately 3,000 pinned seedlings--alive in September 1981, but badly clipped--have been recorded on 80-column sheets. The development of these damaged seedlings in terms of growth, form and survival should be followed which would require upgrading tags and further measurements
 - c) Plot layout is complete
Sites have not yet been described fully.
 - d) No field performance results have been prepared this year for Management Notes.
4. Cooperation with the Resource Data Specialist was provided.

11. Goals for 1982-83:

1. To continue the AFS cooperative container study by
 - a) sampling stock at Smoky Lake
 - b) spring and fall planting on 3 sites south of Grande Prairie
 - c) recording after-planting heights, height increments and mortality.

Note: The 1982 spring planting will require additional manpower of 6-8 man-weeks. Arrangements can be made with Proctor and Gamble to stay at their camp.

2.
 - a) To obtain 10-yr heights and survival of styro-2 plugs and ARC sausages at Lac La Biche, Whitecourt and Grande Prairie, Alberta. (wS and lP)
 - b) To monitor the growth form and survival of 4,5 and 6 year old seedlings at Rice River and south of Hudson Bay, Saskatchewan.

11. Goals for 1982-83: (cont'd)

- c) To measure 10-year field performance of operational planting (NWPP NOR-118) of small container stock. Alta. (1P and wS)
- d) To measure 10-year field performance of wS and jP container seedlings and bare-root stock in central Saskatchewan.
- 3. To remeasure IPFF plots in Alberta (60+10-yr. old wS).
- 4. To prepare an Information report on 5-yr. container seedling field performance on prepared burns in central Saskatchewan.

12. Signatures:

W. J. Ball
Investigator

R. W. K.
Program Manager

G. D. Hill
Director A.D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982 .

1. Project: Silvicultural investigations
2. Title: Forest tree seed and seedling physiology
3. New: X Cont.: 4. No.: NOR-10-192
5. Study Leader: I.J. Dymock
6. Key Words: Cone and seed production and physiology, post-harvest physiology; tree seedling physiology, cold hardiness, dormancy, physiological and biochemical testing, influence of environmental parameters, bareroot and container stock production.
7. Location of Work: Northern Forest Research 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, and 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. There are many factors which affect the development of usable cone and seed stock, that are not well understood.

Our understanding of cone and seed maturation remains far from complete. Artificial ripening procedures are being applied more frequently to seeds collected earlier in the ripening season. Yet methods for monitoring that ripening, while the cone remains attached to the parent tree, or after it has been harvested, and the processes involved in that ripening, remain elusive for many species. The concept of just what is a mature seed, is still uncertain. Some investigators have related maturation to peak germination, while others have related it to build-up of organic constituents within the seed and the attainment of peak dry weight. Morphological maturity is a key stage for many species; the development of maximum germinability usually occurs after

the embryo has become fully elongated, at least in conifers. Completion of organic accumulation within seeds, like the attainment of full embryo development, is another key stage in the maturation process. Morphological and physiological maturity usually occur concurrently, although at different rates. In some species, organic accumulation has been shown to be complete, the embryo is fully developed, yet the seeds require an "after-ripening" period before germinability can be realized. This stage in conifers, during which dessication occurs, has been associated with a change in the state of embryo dormancy or degree of delayed germination (that is, not true dormancy).

This peak germination may not always provide a satisfactory index of ripeness, since some species are suspected of at least partially entering the "resting stage" as they mature. Full ripeness is usually associated with cone or seed drop from the parent plant, yet such seeds do not always germinate readily. However, the most reasonable method presently available, germination testing, like biochemical evaluations, is an unwieldy method for assessing maturation. Several rapid methods for determining seed quality (tetrozolium, x-ray, excised embryo, hydrogen peroxide tests) may provide some additional means of evaluating ripeness; none of these methods is satisfactory on its own at present.

Until recently, almost all investigations have tended to concentrate on the cones/seeds themselves, paying little attention to the environmental conditions in which cone and seed development occurs. Few efforts have been made to directly relate summer weather and seed ripeness in a quantitative manner, although it has been long understood in a general way, that ripening progressed more fully if the climate were warmer and drier than if it were cooler and more moist. The summation of degree-days over and above a given minimum temperature threshold, and the beginning of some biological reference date such as that of pollen flight, have been shown to be a means of assessing maturation. Refinements based on weather variables, such as radiation and precipitation, in conjunction with degree day summation could be made. Thus estimations based on such environmental parameters, combined with the cone and seed parameters, could result in more consistent and reproducible means of estimating maturation.

Expanding reforestation programmes will continue to increase seed demands, and in many instances, maximum protraction of the collection season will remain a necessity. The concept of collecting prematurely and artificial ripening needs to be further investigated. Once a critical stage in the development of the cone and seeds has been reached, in some species, the cones can be removed from the parent plant and artificially ripened during storage. Ideal conditions for this must be more clearly identified.

The post-harvest conditions, extraction procedures, and seed storage conditions bear close monitoring in order to determine the effects of the various procedures on viability and germinability, particularly in the case of some species (*Picea glauca*) which are apparently more susceptible to damage during post-harvest procedures.

The increased demands for quality seeds to meet the expanding reforestation programmes make it essential that applied research is carried out on maturity as discussed in terms of seed quality as assessed by extractability, storability, and disease resistance, as well as the potential to produce seedlings.

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 as well. Much effort has 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, winter storage, 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, 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 practices.

Therefore the investigations in this study will be carried out to plan, develop and conduct applied physiological research in the areas of:

(a) cone and seed production, (b) seedling conditioning and testing, and (c) seedling field performance by the study leader.

9. Study Objectives:

1. Plans, develops, and conducts investigations into physiological aspects of: (a) cone and seed production, (b) conditioning and physiological testing of bareroot and container seedlings, and (c) field performance of seedlings, in support of improved reforestation and forest management strategies.

9. Study Objectives: (cont'd)

2. Analyse and interpret existing and new research data and procedures and assess reliability and applicability of results in support of new or improved reforestation and management strategies including cone and seed production in seed production areas and seed orchards, stock conditioning and physiological testing up to the planting phase, and initial field performance of bareroot and container seedlings.
3. Disseminates and promotes research findings and provides consultative services to federal, provincial, and industrial forest management agencies concerning tree physiology as it relates to cone and seed production, seedling conditioning and physiological testing, field performance of seedlings, and related areas of tree growth and productivity.
4. Performs the duties of a registered Seed Analyst within the O.E.C.D. scheme for certification of forest reproductive material moving in international trade.

10. Resources:

- a. Starting date: 1982
- b. Estimated year of completion:
- c. Estimated total man-years required:
- d. Essential new major equipment items required: 1982-83
 - (1) Hewlett Packard Model 18803A Electron Capture
Detector for HP Model 5830A Gas Chromatograph: \$7000.00
 - (2) Hewlett Packard Model 18848A Alkali Flame
Ionization Detector for HP Model 5830A Gas
Chromatograph: \$6000.00
- e. Essential new major equipment items required beyond 1982:
 - (1) Hewlett Packard Model 11084B Liquid Chromatograph
System \$60,000.00
Complete system price includes:
 - HP 1084B Liquid chromatograph with variable wavelength UV
detector/scanner, auto-injection system,
 - HP 79850B LC Terminal/programmer system
 - HP 79841A/HP 79842A LC Autosampler system
- f. 1982-83 person-years: Professional: 1.0 (Dymock)
Support:
Casual:
Total: 1.0

11. Progress to date: New study

12. Goals for 1981-82:

1. Initiate a study of forest tree seed and seedling physiology at NoFRC, particularly in the area of rearing, storage and field performance of bareroot and container seedlings.
2. Complete requirements for Ph.D. at University of Calgary.

Goal added:

3. Provide consultation on forest trees, seeds and seedling physiology to federal, provincial and industrial forest management agencies regarding cone and seed production, conditioning and testing of seedlings, field performance of seedlings and related areas of tree growth and productivity.

13. Accomplishments in 1981-82:

1. (a) Surveyed literature on cone and seed production and tree seedling physiology in relation to rearing, storage, physiological testing and field performance of bareroot and container stock.
- (b) Performed preliminary tests on methods to determine shoot and root apex mitotic indices and developed methods for detecting root primordia in seedlings.
- (c) Visited nurseries at Smoky Lake and Oliver, Alberta, and Prince Albert, Saskatchewan to discuss physiological testing of tree seed and seedlings.
- (d) Attended Intermountain Nurserymen's Assoc. meeting Aug. 11-13, 1981 in Edmonton as a CFS representative.
- (e) Attended CTIA workshop on "Seed Technology and Seed Orchards" in Duncan, B.C., Aug 17, 1981, as CFS representative.
- (f) Attended 18th Biennial Meeting of the CTIA in Duncan, B.C. Aug. 18-20, as CFS representative.
- (g) Attended CFS "Workshop on Cone and Seed Research" at PFRC, Victoria, B.C. Aug. 21, 1981.
- (h) Planned a phenological/physiological test of wS and 1P container seedlings for Jan.-March, 1982.

13. Accomplishments in 1981-82: (cont'd)

2. (a) Completed and successfully defended Ph.D. thesis entitled "An Investigation Into the Gibberellin Status of *Helianthus Annuus* L. CV. Russian at Two Stages of Vegetative Growth", on Dec. 9, 1981, in the Biology Department, U. of C.
- (b) Attended joint meeting of Canadian and American Societies of Plant Physiologists at Laval University in Ste. Foy, P.Q. June 14-18, 1981, as CFS representative. Presented oral report entitled "The influence of two growth retardants on growth and the Gibberellin status of young sunflowers" at the session on Cytokinins and Gibberellins, June 18, 1981.
3. Provided consultative services to entomologists and pathologists at NoFRC regarding (i) evaluation of uptake and influence of pathogenic toxins in conifer seedlings and (ii) the response of trees to insect invasion and subsequent physiological adaptations. Also provided consultative services to other federal, provincial and industrial forest agencies regarding cone and seed production, seedling conditioning, physiological testing of seedlings, and field performance of seedlings.

14. Goals for 1982-83:

1. Seedling physiological research

- a) Establish environmental monitoring systems for bareroot and container stock monitoring on site at NoFRC.
- b) Establish 1982 stock (wS, 1P) at NoFRC, both bareroot and container, in sufficient numbers for monitoring and sampling for up to three years (minimum) for cold hardening/dormancy investigations.
- c) Commence phenological/physiological testing of 1982 NoFRC stock during active growth; testing to continue at weekly intervals for cold hardening/dormancy investigations; results of testing will help establish the criteria for the screening of endogenous growth regulator levels during various stages of active seedling growth, cold hardening, and dormancy.
- d) Initiate experiment to determine nutrient requirements for hardening 1982 container stock (wS, 1P, jP, bS, rP) at NoFRC (Edwards)

2. Cone and seed physiological research

- a) Monitor environmental parameters and phenology of wS cone/seed development in selected areas around Edmonton and Slave Lake area in cooperation with Ives and Muldrew. Use data to establish criteria for pursuing cone/seed research.

14. Goals for 1982-83: (cont'd)

- b) Initiate investigations of role of endogenous growth regulators in cone/seed maturation and post-harvest physiology of wS; dependent on size and yield of 1982 wS cone crop (Huber).
- 3. Perform O.E.C.D. seed analyst duties as may be required (Huber).
- 4. Prepare related manuscripts on plant growth regulators from Ph.D. thesis for submission to refereed journals.
- 5. Provide consultative services to federal, provincial, and industrial forest management agencies concerning tree physiology as it relates to cone and seed production, seedling conditioning and physiological testing, field performance of seedlings, herbicide uses and effects, and related areas of tree, seed or seedling growth and productivity.

15. Publications:

- a) Up to 1981-82

Nil

- b) 1981-82

Refereed journal publications: Nil

Refereed symposia/workshop papers: Nil

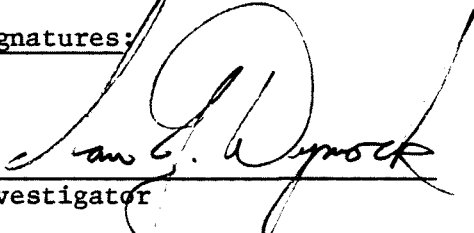


Contributed papers at conferences/symposia/workshops: 1

I.J. Dymock and D.M. Reid. 1981. The influence of two growth retardants on growth and the Gibberellin status of young sunflowers. Plant Physiology 67:147 Supplement 826.

- published abstract/contributed paper at the joint meetings and symposia of the Canadian and American Societies of Plant Physiologists at Laval University, Ste. Foy, Quebec, June 14-18, 1981.

Information reports: Nil

File reports: Nil

16. Signatures:
Investigator
Program Manager
Director

A.D. Kiil

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 26, 1982

1. Project: Silvicultural investigations
2. Title: Forest ecology and site productivity
3. New: X Cont.:
4. No.: NOR-10-193
5. Study Leader: I.G.W. Corns
6. Key Words: Forest ecology, site productivity, forest soils, succession,
ecosystem classification
7. Location of Work: Northern Forest Research Centre, Edmonton;
Boreal Forest in our 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 growth and for new methodology for site evaluation and classification of boreal forest ecosystems.
2. Preliminary efforts directed towards a biogeoclimatic classification of Alberta forest ecosystems have ordinated these ecosystems according to inferred soil moisture and nutrient regime gradients, which were regarded as criteria of high significance from an ecological and forest management point of view. To date the influences of soil moisture regime, nutrient regime (trophotope), climate and other environmental gradient upon the floristic composition and productivity of boreal forest ecosystems have not been demonstrated or quantified for the biogeoclimatic data.
3. Large scale pulpwood clearcutting operations in Alberta foothills have resulted in large areas of young (<25 yr.) forest. The rate

- 2 -

and extent to which the productivity , structure and species composition of these forests is proceeding toward that of mature forests on similar situations is not well documented. An opportunity is thus available to increase our understanding of forest dynamics in the foothills.

4. Tree root development and subsequent growth appears to be strongly influenced by physical and biological characteristics of the forest floor (organic layers) and surface soil horizons. Modification of the soil surface environment, e.g. altering soil physical properties or introducing nitrogen-fixing plants may provide conditions favorable for enhancement of tree growth.

9. Study Objectives:

1. Quantification of site/forest productivity relationship through development of growth prediction equations.
2. To determine the relative contribution of site nutrient regime (trophotope) and other environmental factors such as climate and soil moisture in determining the composition and productivity of boreal forest ecosystems.
3. To further document plant succession and early tree growth in young (< 25 yr.) lodgepole pine forests originating from pulpwood clearcutting in western Alberta.
4. To initiate a study to evaluate the effects of modifying soil physical and biological properties. Possibilities are:
 - a. Test the influence of introducing nitrogen-fixing herbs to young forest stands.
 - b. Test the influence of the introduction of earthworms as a means of ameliorating Luvisolic soils.

10. Resources:

- a. Starting date: 1981
- b. Estimated year of completion: 1985 except for study of soil surface modification (continuing).
- c. Estimated professional man-years required: 3
- d. Essential new major equipment for 1982-83 with costs: Nil
- e. Essential new major equipment beyond 1983 with costs: Nil
- f. 1982-83 man-years:

Prof.	1.0
Supp.	-
Casual	-
Total	<u>1.0</u>

11. Progress to Date: N/A - new study

12. Goals for 1981-82:

1. Initiate a study of forest site productivity using the Alberta Biogeoclimatic data base.
2. Plan future forest site research, and conceptualize a demonstration project which will incorporate application and testing of a forest land classification system(s) and silviculture prescriptions.

Goal added:

3. Presentation of paper and chairing session on "Delineation of Information Gaps in the Data Base at request of P. van Eck, Univ. Calgary, Kananaskis Centre, for workshop on Integrated Data Base for Wildland and Forest land Use in Alberta.

13. Accomplishments in 1981-82:

1. a) Preliminary examination of biogeoclimatic classification and data base has been made and procedures for initial data evaluation and analysis have been decided.

b) Initiated work on separation of subalpine subzones in Alberta in cooperation with the Resource Evaluation and Planning Branch (REAP) of Alberta Energy and Natural Resources. Some plot selections were done and submitted to Forest Planning System of Vancouver for analysis. Further data analysis and synthesis of these and other data from the Alberta Biogeoclimatic study will continue into 1982-83, as described in new study NOR-10-193.
2. a) Consultation was initiated with Procter and Gamble Cellulose and suggestions made to them regarding application of available forest land classification information to silviculture and management prescriptions by myself, Brace and Pluth (U of A). Procter and Gamble have developed a preliminary field guide which we have reviewed.

b) Participated in a field trip with B.C. Forest Products personnel and G. Krumlik (consultant), dealing with development of forest land management prescriptions for the new BCFP lease, as part of the biogeoclimatic classification for the lease area.

c) Field trips to Grande Prairie, Fox Creek and Swan Hills areas with Resource Evaluation and Planning (Alberta Energy and Natural Resources) personnel to provide vegetation descriptive information on Alberta Forest Service lodgepole pine progeny test sites set up by F. Daniels (AFS).

13. Accomplishments in 1981-82: (cont'd)

- d) Field trip to Sundre and area with Alberta Resource Evaluation and Planning group to provide consultation on criteria for separating Upper and Lower Subalpine subzones in the upper Red Deer River area.
- e) Chaired session on "Information Gaps" in the workshop entitled "Integrated Data Base for Wildland and Forest land use in Alberta" sponsored by University of Calgary, Kananaskis Centre.
- f) Meeting with J. Benson and staff of Saskatchewan Dept. of Tourism and Renewable Resources, Forestry Branch concerning development of a cooperative site classification program for Saskatchewan.
- g) Preparation of preliminary site classification for W. Ives pine mortality plot areas near Hinton.
- h) Described soils and vegetation and prepared report for W. Johnstone's pine spacing trials at Teepee Pole Creek on forestry trunk road.

14. Goals for 1982-83:

- 1. Continue with synthesis and analysis of data originating from Alberta biogeoclimatic study.
- 2. Conduct statistical analyses to determine the relative contribution of site nutrient regime (trophotope) as well as other environmental properties such as climate, soil moisture, etc. in determining the composition and productivity of boreal forest ecosystems and pursue related research on soil/site factors and forest productivity.
- 3. Sampling of vegetation and tree regeneration on selected 18-24 year old clearcuts in St. Regis' lease area northwest of Edson in order to further document plant successional trends.
- 4. Prepare papers for publication on:
 - a) Vegetation - Environmental relationships in Banff and Jasper parks.
 - b) Vegetation Indicators as Independent Variables in Forest Growth Prediction in West-Central Alberta.
 - c) Publish manuscript 'Distribution of Forest Ecosystems of West-Central Alberta in Relation to Selected Environmental Factors'.
 - d) Publish manuscript 'Rare Plants of Banff and Jasper National Parks'.

15. Publications:

Corns, I.G.W. 1982. Delineation of Information Gaps in the Data Base. Proc. Workshop on Integrated Data Base for Wildland and Forest Land Use Management in Alberta. Univ. Calgary, Kananaskis Centre, Aug. 13-14, 1981

16. Signatures:

Jan B.W. Coors
Investigator

P. Van
Program Manager

C. S. Hill
Director A.D. Kiil

NOR-12

Tree Improvement

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1982

1. Project: 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-12-050
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, Sundown and Carberry, Manitoba; Holbein, Indian Head, and P.A. Pulp Camp 6, Saskatchewan; Reno, Alberta .
8. Study Objectives:
 1. To screen populations of conifer species for possible usefulness for planting in various areas within the Northern Region .
 2. To obtain an indication of the probable usefulness of further provenance testing or similar research with the species under trial and to guide the planning of such research.
 3. To obtain information on patterns of geographic variation in the species under trial.

8. Study Objectives: (cont'd)

4. To identify adapted genotypes among the introduced populations for further breeding use.

9. Goals for 1981-82:Jack pine

1. Measure the test plantation near Sundown, Manitoba following the tenth growing season after planting.

Black spruce

1. Complete the File Report entitled "Establishment of Black Spruce Geographic Variation Plantations in the Prairie Provinces, 1975".

10. Accomplishments in 1981-82:Jack pine

1. The test plantation near Sundown, Manitoba was measured following the tenth growing season after planting.

Black spruce

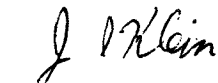
1. The File Report entitled "Establishment of Black Spruce Geographic Variation Plantations in the Prairie Provinces, 1975" was not completed owing to lack of sufficient time.

11. Goals for 1982-83:Red pine

1. Measure the test plantation near Piney following the 25th growing season after planting.

Black spruce

1. Complete the File Report entitled "Establishment of Black Spruce Geographic Variation Plantations in the Prairie Provinces, 1975".
2. Send report along with tape of five-year measurement data to Dr. Khalil of NeFRC for combined report.

12. Signatures:

Investigator

Program Manager

Director

A.D. Kil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982-83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

January 28, 1982

1. Project: Tree improvement
2. Title: Breeding jack pine for the Northern Region. I. First Selection cycle.
3. New: Cont.: X
4. No.: NOR-12-051
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: Sundown, Marchand, Stead, Oakbank, Boggy Creek, and Birch River, Manitoba; Smeaton, Meadow Lake, and Hudson Bay, Saskatchewan; Whitecourt and Wildwood, Alberta.
8. 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.
9. Goals for 1981-82:
 1. Publish the Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan".

9. Goals for 1981-82: (cont'd)

2. Publish a Forest Management Note dealing with application of study results.
3. Complete the File Report entitled "Establishment of Jack Pine Family-Test Plantations in Eastern Saskatchewan and Western Manitoba, 1976".
4. Select superior parent genotypes based on fifth-year progeny mean height in the central breeding district family test, and graft scions of these genotypes for a Province of Manitoba seed orchard.
5. Graft 1,500 scions to continue filling of the clone bank, transplant larger ramets of difficult-to-graft clones from Whitecourt to Chip Lake clone bank, maintain clone bank, plant about 120 vigorous 1979 and 1980 grafts, and rear understocks for 1982 and 1983 grafting.
6. Thin the seedling seed orchard plantation at Birds Hill.
7. Remeasure the eastern breeding district family test following the tenth growing season after planting.
8. Submit a progress report to the 18th meeting of the Canadian Tree Improvement Association.
9. Contribute information on costs and benefits of tree improvement procedures to the core forestry program, as required.
10. Act as Tree Seed Inspector under the Canada Seeds Act as required.

10. Accomplishments in 1981-82:

1. The Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan" has not yet been published. A revised draft approved by reviewers was submitted to the NoFRC Editor in October, 1981.
2. A revised draft of a Forest Management Note entitled "Genetically Improved Jack Pine for Manitoba and Saskatchewan" was submitted for review on January 13, 1982.
3. The File Report entitled "Establishment of Jack Pine Family - Test Plantations in Eastern Saskatchewan and Western Manitoba, 1976" has been completed and distributed to cooperaters.

10. Accomplishments in 1981-82: (cont'd)

4. Central district parent clones were selected on the basis of erroneous height means, owing to use of a coding convention that was not reported to Computer Services. Correct means were computed later in the year.
5. Clone bank grafting in 1981 yielded 684 grafts in 1210 tries. More than 60 grafts of difficult-to-graft clones were transplanted to the Chip Lake clone bank from the Whitecourt preliminary clone bank in May 1981, with few losses by October. One hundred twenty-three vigorous 1979 and 1980 grafts were planted, and clone bank maintenance was done. Understocks were reared with virtually no time input by the study leader, but at the cost of lower size and quality of output, and reduced student time for clone bank maintenance. There is little opportunity for further refinement of rearing technique in the present facilities.
6. The seedling seed orchard plantation at Birds Hill was thinned to the one best tree on each plot, of 20 originally planted.
7. The eastern breeding district family test was measured following the tenth growing season from planting. Check measurements on several hundred trees having anomalous height to diameter relationships, indicated the presence of gross measurement errors in sufficient frequency to reduce confidence in the results. A repeat of this measurement is recommended.
8. A report entitled "Genetic Improvement of Jack Pine for the Prairie Provinces, 1979-81" was pre-printed for the 18th meeting of the Canadian Tree Improvement Association.
9. There was no requirement to contribute information on costs and benefits of tree improvement procedures to the cone forestry program.
10. Apart from commenting on proposed regulators for tree seeds, there was no requirement to act as Tree Seed Inspector under the Canada Seeds Act.

11. Goals for 1982-83:

1. Publish the Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan".
2. Publish the Forest Management Note entitled "Genetically Improved Jack Pine for Manitoba and Saskatchewan".
3. Prepare an Information Report on design and selection thinning of the seedling seed orchard plantation at Birds Hill nursery near Oakbank.

11. Goals for 1982-83: (cont'd)

4. Produce a special report of maps and source lists for the breeding program.
5. Prepare a voluntary poster paper for the joint meeting of IUFRO working parties on genetics on breeding strategies, at Escherode, Federal Republic of Germany.
6. Label and classify photo transparencies of breeding program materials, for use in illustrated talks on the program.
7. Graft about 800 scions to increase inventory of required grafts from 2650 to 2900, and plant grafts now in pots to increase clone bank stocking from 2000 to 2200 grafts, of 3185 required.
8. Repeat the tenth-year measurement of the eastern breeding district family test, and record pest attack in family test plantations.
9. Select superior parent clones based on fifth-year progeny mean height in the central breeding district family test, and graft scions of these clones for a Province of Manitoba seed orchard.
10. Produce additional seed orchard grafts based on fifth-year progeny mean height in the eastern and western breeding district family tests, to increase the number of families selected, to increase and balance the number of grafts for each selected family, and to include eastern district families having progeny grafts in the clone bank.
11. If data processing can be done promptly, select clone bank grafts of the best eastern district families at 10 years from planting, and control-pollinate selected grafts in a single-pair mating design for seed or propagule orchards and a second generation population.
12. Begin polycross mating of western district grafts selected for fifth-year progeny height for eventual selection of second generation parents.
13. Organize and conduct a technical workshop to include controlled pollination at the Chip Lake clone bank.
14. Fulfill responsibilities under integrated cone forestry program, the Canada Seeds Act, and the national improvement program.

12. Signatures:

J. I. Klein
Investigator

R. W. Wain
Program Manager

C. S. Hill
Director A.D. Kill

NOR-13

Forest Hydrology and Microclimate Research

STUDY STATEMENT

1982 - 83

Date: February 3, 1982

1. Project: Forest Hydrology and Microclimate Research
2. Title: Research coordination in the Alberta Watershed Research Program; Marmot, Streeter, Tri Creeks, Spring Creek Experimental Basins.
3. New: Cont.: X
4. No.: NOR-13-017
5. Study Leader: R.H. Swanson
6. Key Words: Hydrology, forest climate, gauged basin
7. Location of Work:

Marmot Basin	115°09'05"W	50°56'57"N
Streeter Basin	114°03'48"W	50°06'59"N
Cache Percotte	117°30'00"W	52°23'00"N
Tri-Creeks	117°15'00"W	53°09'00"N
Spring Creek	117°51'11"W	54°55'06"N
8. Goals 1981-82:
 1. Continue evaluation of Marmot Creek and Streeter treatments.
 2. Ascertain usefulness of PROSPER simulation model for evaluation of cabin sub-basin treatment effect on entire Marmot streamflow (Swanson, Hillman - NOR-177).
 3. Publish information report on Streeter treatment. (Swanson, Golding, Hillman, Telfer--CWS).
 4. Prepare detailed integrated forest management forest product proposal for pilot program in East Slopes watershed subject to cabinet approval. (CFS, AFS, Alberta Water Resources)
 5. Continue as member NRC associate committee on Hydrology.
 6. Advise and assist cooperating agencies as requested.

Goals added - 1981-82:

 7. Prepare section, describing drainage and hydrology of Banff and Jasper National Parks, for ecological (biophysical) land classification report. (G. Hillman)

9. Accomplishments 1981-82:

1. Worked in close consultation with Canada Atmospheric Environment Service to allow them to reduce their data collection programs at Marmot and Streeter in light of AES staff reductions and re-assignments. Procured digital data loggers via Alberta Watershed Research Program Trust fund to automatic climatic data collection and compilation from Marmot. These will be installed during 1982-83.

The post-treatment snow survey on Marmot Twin was conducted in March 1981. A last survey is planned for March 1982. These snow surveys are conducted by the University of British Columbia under a Research Grant to D.L. Golding.

Streamflow data from both Streeter Basin and Marmot has been assembled up to 1980. (1981 on Streeter) Preliminary analysis of the Marmot-Twin data indicates increased late season streamflow as predicted. However, both 1980 and 1981 were abnormal snowmelt years in that peak flows occurred in April-May rather than in June as in the 1963-79 pretreatment period. Thus we have no previous streamflow data of a similar temporal sequence with which to compare either the 1980 or 1981 hydrographs.

2. The resident version of the simulation model was applied to 1971 Marmot streamflow main gauge. Some problems were encountered in the operation of the model that could not be quickly resolved. This evaluation was, therefore, postponed indefinitely pending either the acquisition of a Research Scientist familiar with PROSPER or sufficient time for Swanson or Hillman to become familiar with its inner workings and structure.
3. The data for the evaluation of streamflow change on Streeter was obtained in September. All materials are now available and this publication should be out in 1982-83.
4. Discussions are continuing with the Provincial agencies involved (AFS Alberta Environment). A committee consisting of 6 provincial members and Swanson from the CFS is to prepare the proposal for consideration by the ministers of the two departments - by May 1982.
5. Attended ACH meeting in Kingston, Ont. in June; executive committee meeting in Ottawa in December. Served on committee nominating individuals to represent Canada at the Northern Research Basin Workshop in Norway (April 1982).
6. Conducted several field trips for interested provincial-university persons to Marmot and/or Streeter.

Accomplishments added - 1981-82:

7. Completed, report at printers:

Holland, W.D., G.R. Hillman, and D.T. Allan. Physiography In
 Holland, W.C. and G.M. Coen, Eds. 1982. Ecological (biophys-
 ical) land classification of Banff and Jasper National Parks.
 Canadian Forestry Service and Alberta Institute of Pedology,
 Edmonton.

10. Goals for 1982-83:

1. Continue evaluation of Marmot Creek and Streeter Basin treatments.
2. Apply PROSPER and snowmelt simulation models to Marmot (whole basin) data to speed up evaluation of Cabin Creek treatment. (Vice Steppuhn if hired)
3. Initiate discussions with provincial agencies regarding possible 2nd phase treatment on Streeter Basin.
4. Complete last year of intensive snow survey on Marmot Twin (UBC - Golding)
5. Publish Information Report on "Effect of Cabin Creek treatment on water yield and quality".
6. Present and publish conference paper on preliminary results at Marmot-Twin Creek treatment on snow distribution and streamflow.
7. Publish information report on Streeter Basin treatment effects.
8. Continue as CFS Member on NRC associate committee on hydrology.
9. Prepare and present keynote address at CHS-82 on Forest Hydrology in Canada.
10. Advise and assist cooperating agencies as requested.
11. Participate as part of team developing CFS position paper on mountain pine beetle problem. Supply hydrologic analysis of effects of beetle induced death and alternative control measures. - cooperation with NOR-1
12. Publish application guidelines for USFA-WRENS in Alberta. (management note)
13. Publish Forestry Report on watershed research.
14. Initiate discussions with projects NOR-10,31 re integrated research.

11. Publications:

12. Signatures:

Robert H. Swanson
Investigator

Investigator

A. D. Hill
Program Manager

A. D. Hill
Director A.D. Hill

1982 - 83

Date: February 3, 1982

1. Project: Forest Hydrology and Microclimate Research
2. Title: Disposition of water in forest soils.
3. New: Cont.: X 4. No.: NOR-13-083
5. Study Leader: G.R. Hillman
6. Key Words: Unsaturated flow, evapotranspiration, infiltration,
redistribution, modelling.
7. Location of Work: Southwestern and west central Alberta
8. Goals for 1981-82:
 1. Complete development of subsurface flow finite element model
(SYBFEM).
 2. Run SUBFEM to simulate flow through profiles of Marmot Creek basin.
 3. Complete Ph.D. thesis.
 4. Complete section, on the effect of forest cover removal on soil moisture, in an Information Report describing the effects of the Streeter basin treatment (NOR-13-017).
 5. Check and report on the longevity of the effects of Streeter basin treatment on soil moisture by
 - a) analyzing 1978 and 1980 soil moisture data and
 - b) starting to write a report for publication in the Journal of Range Management.
 6. Publish Information Report entitled Forest floor characteristics on subalpine forest sites in Alberta.
 7. Analyze Cabin Creek (Marmot) basin soil moisture/groundwater data for the period 1972-1980.

Goals added - 1981-82:

5. c) Obtain additional soil moisture measurements and carry out survey of poplar regeneration in the patches cut in the aspen stands.

9. Accomplishments in 1981-82:

1. Development of the subsurface flow finite element model (SUBFEM) was completed.
2. Not completed. It was decided that the model validation process could be speeded up by using data from a study in which the hydraulic characteristics of a small hillside have been carefully defined, and all components of the water balance measured. The investigator met with Dr. C. Troendle of the Rocky Mountain Forest and Range Experiment Station, who has carried out several field studies of this type. Dr. Troendle suggested that the investigator use data from his study on the Parsons Watershed in West Virginia. Preliminary model runs on SUBFEM, using these data, indicate that water withdrawal by trees - represented by "sinks" in the model, and unsaturated flow can be successfully simulated. The saturated flow simulation portion of the model is still being tested.
3. Not completed
4. Section completed, entire report to be published 1982-83 - see NOR-017
5. a) The 1978 and 1980 soil moisture data analyses for Streeter basin were completed.
b) Preliminary sections of report completed.
6. Completed. Information Report NOR-X-234 published and distributed November, 1981.
7. Not completed. Some data were analyzed.

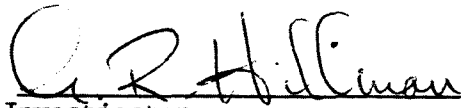
Accomplishments added - 1981-82:

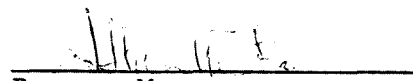
- 5c) Completed. Soil moisture measurements were taken during September and November. In May, before leaf-out, a poplar restocking survey was completed using Batcheler's joint point and nearest neighbor method. Weight samples were obtained to determine above-ground biomass production.

10. Goals for 1982-83:

1. Continue to analyze Cabin Creek (Marmot) basin soil moisture/ groundwater data for the period 1972-1981.
2. Run the subsurface flow, finite element model (SUBFEM) to simulate flow through profiles of Marmot Creek basin.
3. Write report on the longevity of the effects of Streeter basin treatment on soil-moisture, for publication in the Journal of Range Management.
4. Write journal article on the application of a two-dimensional, finite element subsurface flow model to simulate the hydrological effects of forest tree removal.
5. Complete Ph.D. thesis.

11. Publications:12. Signatures:


Investigator


Program Manager

Investigator

Director A.D. Kiil

1982 - 83

- 8b. Goals for 1981-82:

8b. Goals for 1981-82: (cont'd)

3. Ascertain relative potential evaporation from small and large forest clearings for modification of evapo-transpiration equations in simulation model. (Swanson)
4. Publish conference paper on water use by New Zealand plantation species in pure, mixed and thinned stands. (Swanson)

9. Accomplishments 1981-82:

1. All but one growth room and/or field test was completed. Thesis is being written but will not be completed and published before May-June 1982.
2. A field portable model is under construction and should be ready for field testing in early 1982.
3. Preliminary design work on both a sampling scheme and suitable instrumentation was done. Several days' test data for two sizes of clearings and the uncut forest confirm the utility of the technique.
4. Paper published as scheduled.

10. Goals for 1982-83:

1. Complete growth room test of recommended heat pulse velocity instrumentation and practical theory. (Swanson)
2. Conduct field and growth room tests of digital heat pulse velocity recorder. (Hurdle-Swanson)
3. Complete design of relative potential evaporation study. Try to reduce manpower requirement by some automation of evaporation measurements. (Swanson-Hurdle)
4. Publish journal article on axial-radial numerical analyses of heat pulse velocity theory and practice. (Swanson)
5. Prepare preliminary design and prototype of heat pulse velocity -evaporation measurement adaptor for CR-21 microloggers. (Swanson-Hurdle)

11. Signatures:

Robert W. Swanson
Investigator

William V. B.
Program Manager

C. D. Kil
Director A.D. Kil

1982 - 83

Date: February 3, 1982

1. Project: Forest Hydrology and Microclimatic Research
2. Title: Snow accumulation and ablation in forest openings.
3. New: Cont.: X 4. No.: NOR-13-103
5. Study Leader: R.H. Swanson, Vice Steppuhn
6. Key Words: Snow melt, radiation, wind, lodgepole pine, aspen,
James River, Marmot, Streeter Basin
7. Location of Work: Alberta East Slopes
8. Goals for 1981-82:
 1. Complete design and development of prototype data logger based around RCA 1802 microprocessor. (Hurdle - Swanson)
 2. Locate areas of reduced height lodgepole pine forest and clear height-dimension openings to ascertain extrapolative capability of James River accumulation and ablation results. (Steppuhn).
 3. Initiate empirical snow evaporation studies in James River clearings. (Steppuhn - Hurdle)
9. Accomplishments 1981-82:
 1. Design and development deferred pending completion of similar development for HPU system in NOR-084.
 2. Suitable areas were identified in the area between Drayton Valley and Alberta Highway 16. Clearings were not done due to resignation by Steppuhn.
 3. Not done due to resignation of Steppuhn prior to winter season.

10. Goals for 1982-83:

1. Recruit replacement scientist for this study (and NOR-177).

11. Publications:12. Signatures:

P. H. Swanson
Investigator

Investigator

[Signature]
Program Manager

C. D. Hill
Director

A.D. Kill

1982 - 83

Date: Feb. 3, 1982

1. Project: Forest Hydrology and Microclimatic Research
2. Title: Vegetation manipulation-hydrologic modelling.
3. New: Cont.: X 4. No.: NOR-13-177
5. Study Leader: Hillman, Vice Steppuhn, Swanson
6. Key Words: Hydrologic modelling, snowmelt, evapotranspiration, soil water movement.
7. Location of Work: Alberta.
8. Goals for 1981-82:
 1. Become familiar with the operation of the snow accumulation and melt submodel of HYVEM as programmed on the PDP 11/60. (Steppuhn)
 2. Begin development of a routine for areal and temporal allocation of precipitation inputs for the different bio-physiographic (including alpine) areas which constitute a watershed. (Steppuhn)
 3. Determine the capabilities of HYVEM by simulating the effects of the following treatments on discharge from Marmot:
 - a. Undisturbed watershed condition (Calibration period data, 1963-1973; and prediction period data, 1974-1980).
 - b. Circular openings 1H in diameter cut in the Twin portion of the watershed (1979-1980 data).
 - c. Large openings or cut blocks on Cabin (1974-1980 data).Compare simulation results with observed results where possible. (Hillman)
 4. Write an user's manual to describe input requirements, operating procedures, and outputs for HYVEM (Hillman).
 5. Assist other agencies that wish to use HYVEM.

Goals added - 1981-82:

6. Develop plotting routines to produce hydrographs from HYVEM output. (Hillman).
7. Conduct evaluation of USFS WRENS (Water Resources Evaluation of Nonpoint Silvicultural Sources) procedure for estimating hydrological effects of forest cutting practices. (Swanson)

9. Accomplishments in 1981-82:

1. Completed, but investigator (Steppuhn) resigned.
2. The routine was not developed but a survey of bio-physiographic zones above tree line on Marmot Creek basin, for the purpose of delineating snow-accumulating and snow-wasting areas, was completed, and a map produced. (Steppuhn).
3. HYVEM was tested using Marmot data for one year only. Comparison of simulated hydrographs with observed data indicated that the snowmelt model (SNOW) melts the snow too early resulting in a simulated hydrograph that peaks several days sooner than the actual hydrograph. Substituting observed snowpack data for simulated snowmelt data produced other problems which also led to differences between observed and simulated hydrographs. Simulations b) and c) were not attempted. (Hillman).
4. An user's manual describing SNOW, CONV, PROSPER and SUBFLOW has been completed. (Hillman).
5. Assisted Alberta Forest Service personnel in running HYVEM using Poll Haven (Oldman River basin) data. (Hillman).

Accomplishments added - 1981-82:

6. Completed. Hydrographs can be obtained using the Tektronix 4081 plotter. (Hillman).
7. Evaluated use of streamflow estimating portion of WRENS on several sets of local watershed data. Conducted 2-day workshop for Alberta Forest Service watershed management personnel to help them use this technique in their regular management activities. (Swanson).

10. Goals for 1982-83:

1. Use HYVEM to simulate and evaluate the effects of Marmot basin treatments on streamflow for:
 - a) the calibration period 1963 to 1973, and
 - b) the prediction period 1974 to 1981. (Vice Steppuhn).

10. Goals for 1982-83: (cont'd)

2. Adapt HYVEM to output soil moisture or water yield in order to interface with fibre production models. (Hillman).
3. Initiate development of local WRENS (Water Resources Evaluation of Nonpoint Silvicultural Sources) user's guide for evaluation of bark beetle and/or control effects on water yield and flooding. (Swanson).
4. Publish a management note entitled Application of USFS WRENS guidelines for AFS needs. (Swanson).
5. Develop procedural guidelines for subsurface routing portion of WRENS. (Hillman).

11. Publications:12. Signatures:

C. R. Hillman
Investigator

Alvin [unclear]
Program Manager

R. H. Swanson
Investigator

C. D. [unclear]
Director

A. D. Kill

NOR-17

Forestry Services

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 15, 1982

1. Project: Forestry Services
2. Title: Liaison and technical advisory services - Winnipeg Sub-office
3. New: Cont.: X 4. No.: NOR-17-118
5. Study Leader: K. Froning
6. Key Words: Silviculture, appraisals, demonstrations. photogrammetry, mensuration, insects, disease.
7. Location of Work: Manitoba.
8. Study Objectives:

To establish strong lines of communication with various forest management agencies, to ensure that the results of departmental research are known and utilized, and to advise the Program Management Committee on forest management problems.

9. Goals for 1981-82:

1. Tasks of the appraisal crew will be determined after project reviews.
2. Effective communications will be maintained in Manitoba through a CFS sub-office located in Winnipeg. The purpose of this contact is to keep CFS well informed of forestry activities, to transfer technology and to identify opportunities and requirements for research.
3. A report will be prepared on a review of jack pine research and operational information related to reforestation in the Sandilands Forest Reserve. Tentative silvicultural prescriptions will be presented.
4. To participate as an active member on the steering committee and related sub-committees in the organizing of a CFS cosponsored Symposium on Dutch Elm Disease, to be held in Winnipeg in 1981.

10. Accomplishments in 1981-82:

1. Appraisal Crew Accomplishments:

<u>Assignment</u>	<u>Man-Months</u>
NOR-9-181 (Ives)	1.0
NOR-5-086 (Chrosciewica)	2.0
NOR-10- (Ball)	2.0
NOR-31-179 (Powell)	1.0
NOR-4-122 (Yang)	12.0
NOR-1-184 (Moody)	2.0

2. Effective communications were maintained in Manitoba through the Winnipeg Sub-Office. Technology transfer and liaison services were supplied to provincial government agencies and forest industry.
3. A draft report is nearing completion on a review of jack pine research and operational information related to reforestation in the Sandilands Forest Reserve, Manitoba.
4. Participated as a member of the Steering Committee and related sub-committees in the organization of a CFS co-sponsored symposium on Dutch Elm Disease held in Winnipeg.
5. Assisted NoFRC researchers in the measurement of studies in Manitoba.

11. Goals for 1982-83:

1. To maintain contact, liaison and technology transfer to Manitoba clients via the Winnipeg Sub-office.
2. To initiate development of a series of co-operative reforestation trials in the Mixedwood Section of Manitoba.
3. To publish an information report "Guidelines to regeneration silviculture - Sandilands Forest Reserve, Manitoba".
4. To assist various NoFRC studies in Manitoba.

12. Publications:

Up to 1981-82

Information reports	12
Journal Reports	1
File reports	15

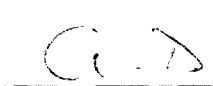
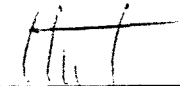
1981-82

Nil

13. Signatures:


Investigator


Program Manager

 
Director A. D. Kil

NOR-22

Remote Sensing and Technical Advisory Services

STUDY STATEMENT

1982 - 83

Date: January 18, 1982

1. Project: Remote Sensing and Technical Advisory Services
2. Title: Remote sensing and technical advisory services
3. New: Cont.: X 4. No.: NOR-22-142
5. Study Leader: Vice C.L. Kirby
6. Key Words: Assessment, environment, forest regeneration, forest growth and yield, inventory, large-scale-photo sampling satellite imagery, biomass, forest management.
7. Location of Work: Alberta, Saskatchewan, Manitoba and Northwest Territories
8. Goals for 1981-82:
 1. To direct remote sensing project providing functional guidance in large-scale photo sampling, satellite image interpretation, aerial photo interpretation, computer mapping and forest inventory sampling design.
 2. To continue as member of the Alberta advisory committee on remote sensing.
 3. To continue as chairman of the CIF technical committee for remote sensing.
 4. To provide 3 to 4 seminars on remote sensing as requested by Alberta Remote Sensing Centre and Universities.
9. Accomplishments in 1981-82:
 1. Modifications and improvement of NoFRC's large-scale photo sampling system were completed through three contracts. The system can accommodate a tip and tilt indicator and the hardware is enclosed in an Enviropod which contains the cameras so that they may be externally mounted on a Bell 206 helicopter or Cessna 172 with MOT approval.

9. Accomplishments in 1981-82: (cont'd)

2. Continued as a member of the Alberta Advisory Committee on remote sensing and provided assistance in one week training seminar at U of A.
3. Continued as chairman of the CIF technical committee on remote sensing.
4. Provided seminar to UBC graduate class.

10. Goals for 1982-83:

1. Provide demonstration of LSP to Yukon Forest Service.

11. Publications:12. Signatures:

Ran Hall
Investigator

~~John~~ H. H. H.
Program Manager

Ce. D. Hill
Director A.D. Kil

1982 - 83

Date: January 18, 1982

1. Project: Remote Sensing and Technical Advisory Services
2. Title: Development and application of large-scale photo and image analysis techniques to forestry.
3. New: Cont.: X 4. No.: NOR-22-188
5. Study Leader: R.J. Hall
6. Key Words: Large scale photography, aerial photography, photo mensuration, photogrammetry, satellite imagery, image analysis, inventory, assessment.
7. Location of Work: Alberta, Saskatchewan, Manitoba and Northwest Territories.
8. Goals for 1981-82:
 1. To complete a joint project with Abitibi-Price in Pine Falls, Manitoba, in the assessment of regeneration status using large scale photos (LSP). A report will be completed with presentation of results to be given to Abitibi and Manitoba Forest Service staff.
 2. To provide technology transfer for large-scale photo sampling in the assessment of immature conifer under aspen on a 4200 km² area in co-operation with Proctor and Gamble. A sampling design will be defined and supervision of a contract to obtain LSP will be provided.
 3. To co-operate with FIDS, NoFRC (NOR-1-033) in obtaining LSP for further assessment of mountain pine beetle in Cypress Hills.
 4. To obtain MOT approval of the aerial camera system for helicopters. Future considerations include having a contract for both aerial camera maintenance and photo procurement.
 5. To advise and assist with technology transfer as required with government and industrial agencies in the region. Expected in-house CFS co-operative efforts includes NOR-30-175 and NOR-5-174.

8. Goals for 1981-82: (cont'd)

6. To complete a lecture and lab manual on elementary photogrammetry for the Foren 201 course that is now given to 2nd year forestry students at the University of Alberta.
7. To initiate a project through a M.Sc. program under Dr. Peter Crown tentatively titled "An analysis of remote sensing alternatives for forest cover classification in the N.W.T.". The project will involve comparing the current Landsat with airborne digital data (flown to simulate Landsat D resolution), with conventional photography. The new image analysis system at the University of Alberta will be used for the digital image classifications. Estimated completion date: 1983-84.

9. Accomplishments in 1981-82: (Reference goals 1981-82)

1. A seminar was presented in Winnipeg on June 1st and a paper has been written and is in final preparatory stages for entry into the formal manuscript review process.
2. A project was not initiated despite several meetings as Proctor and Gamble stated that funding was going to be a problem.
3. Initial photo specifications were outlined and were used by the province by the Cypress Hill's Parks staff. 1:6000 scale color prints was ordered for FIDS.
4. A camera modification to one Vinten was made by the installation of fiducial marks. Additionally, evaluation was made on several optical point transfer devices with the most suitable one ordered for the purpose of increasing precision and uniformity in measurement procedures.
5. A lecture and lab manual was not produced due to time. However, the lecture and lab materials developed was provided to the Alberta Remote Sensing Centre for their use in this year's course instructions. Agreement was also made for collaboration in producing a joint ARSC-NoFRC course manual by 1983. Advice was also provided for course set-up.
6.
 - a) Assisted in formulating the approach with respect to the mapping procedure and provided map publishing considerations and cost estimates for the construction of a fire history Atlas for the Province of Alberta. (NOR-5-174)
 - b) A seminar was organized on behalf of FIDS to review the uses of remote sensing in forest pest damage appraisal. Outside speakers were invited. The proceedings are in the final stages for publishing as an Information Report.
 - c) Other advice and assistance was provided when requested.

9. Accomplishments in 1981-82: (cont'd)

7. Course work for the M.Sc. Program in Remote Sensing has commenced. Airborne digital data for the Landsat D simulation study was not acquired due to smoke and cloud problems. Excess funds were transferred from budget and the data acquisition for the study will be again requested for the summer of 1982, under a joint funding approach with the Canada Centre for Remote Sensing.
8. Attended Numerical Analysis course at Purdue University in June and obtained valuable material for use in digital image analysis projects.

10. Goals for 1982-83:

1. Test and evaluate the new 70-mm camera system, and provide a demonstration and instruct on system operation and photo acquisition procedures to the Yukon Forest Service. \$5000.00
2. Further work on M.Sc. Project on the Analysis of simulated Landsat-D digital data for forest cover classification in the NWT. Obtain airborne data and develop legend system. Residual course work to be completed. Estimated funding requirements for data acquisition and field travel - \$8000.00
3. Provide advisory services in Remote Sensing for NoFRC clients and colleagues as required.
4. Publish Information Reports:
 1. Use of large-scale aerial photographs for regeneration assessment on a township in Manitoba.
 2. Uses of remote sensing in forest pest damage appraisal. Proceedings of a seminar.
5. To provide annual guest lecture and lab. to the Alberta Remote Sensing course given through Faculty of Extension, Univ. of Alberta.
6. Supervise contract for construction of modernized intervalometer for cycling of the Vinten cameras.

11. Publications:12. Signatures:

Ron Hall
Investigator

William T. ...
Program Manager

G.D. ...
Director A.D. Kiil

NOR-23

Ecological Land Classification of National Parks

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 3, 1982

1. Project: Ecological land classification of National Parks
2. Title: Land and vegetation resource inventory of Banff and Jasper National Parks
3. New: Cont.: X 4. No.: NOR-23-148
5. Study Leader: W.D. Holland
6. Key Words: Resource inventory, land inventory, biophysical mapping
 vegetation inventory, land use interpretation guides
7. Location of work: Banff and Jasper National Parks and Northern Forest
 Research Centre, Edmonton
8. Goals for 1981-82:
 1. Continue Banff-Jasper project completion and publication of final reports, and consultative advice as required by Parks Canada and others; e.g. in environmental impact studies, development of a fire management plan, etc.
 2. Prepare manuscript(s) for journal publication dealing with vegetation of Banff and Jasper National Parks.
 - a. Vegetation-habitat relationships in Banff and Jasper National Parks. (Corns)
 - b. Rare and unusual vascular plants collected in Jasper and Banff National Parks. (Corns)
 - c. Rare and unusual lichens collected in Jasper and Banff National Parks. (Corns)
 - d. Rare and unusual mosses collected in Jasper and Banff National Parks. (Corns)
 - e. As time permits prepare brochure - "Applications of the Banff-Jasper Resource Inventory". (Holland)

8. Goals for 1981-82: (cont'd)

- f. As time permits prepare a paper on soils with deep Ae horizons in Jasper National Park. (Holland)
- 3. As time permits, explore ways and means by which the Banff-Jasper data bank can be used to further develop our understanding of soil/site-vegetation relationships in forest and non-forest environments. (Corns, Holland)

Goals Added: (Carried over from 1980-81)

- 4. As time permits, preparation of thesis manuscripts for publication.
 - a. Vegetation Indicators as Independent Variables in Forest Growth Prediction Equations.
 - b. Forest Types of Western Alberta Foothills in Relation to Environmental Factors.

9. Accomplishments in 1981-82:

- 1. The main portion of the Banff-Jasper project is complete. Twenty-four maps are printed out of a total of 24. Vol. II, Soils and Vegetation, is at the printers. Vol. I, Introduction and Summary, is ready for the word processor and editing. The 25th Sheet, the legend, was not satisfactory and a reprint has been requested.
- 2.
 - a) No progress (Goal transferred to NOR-10)
 - b) The first draft of the manuscript reporting rare and unusual vascular plants collected in Banff and Jasper National Parks is nearly complete. Rare and unusual lichens and mosses (goals 2c and 2d) are included in this manuscript.
 - c) No progress.
 - d) No progress.
- 3. No progress; time did not permit analysis of Banff-Jasper soil/site-vegetation relationships. (This goal was terminated).
- 4.
 - a) The first draft of "Vegetation indicators as independent variables in forest growth prediction in West-Central Alberta" was prepared by I.G.W. Corns and D.J. Pluth, and is with the review committee.
 - b) The first draft of "Distribution of forest ecosystems in West-Central Alberta in relation to selected environmental factors" is in preparation by I.G.W. Corns.

These goals were transferred to NOR-10)

10. Goals for 1982-83:

1. Finalize Banff-Jasper publication details for Parks Canada, (Vol. I and Vol. II) and terminate study in 1983. (Holland)
2. In co-operation with NOR-10, publish a journal article on "Rare and unusual vascular plants, lichens, and mosses collected in Banff and Jasper National Parks". (Holland, Corns)
3. Publish brochure on "Application of the Banff-Jasper resource inventory". (Holland)
4. Prepare journal article on "Soils with deep Ae horizons in Jasper National Park". (Holland)
5. Continue data collection for Cryosolic, Brunisolic, and Chernozemic soil climate study in Banff National Park.

11. Publications:12. Signatures:

W.D. Holland 9 March 8/82
Investigator

Investigator

J. H. H. H.
Program Manager

C. D. H. H.
Director A.D. Kii1

1982 - 83

Date: February 3, 1982 .

1. Project: Ecological land classification of National Parks
2. Title: Ecological land classification of Kootenay, Mount Revelstoke, and Glacier National Parks.
3. New: Cont.: X 4. No.: NOR-23-187
5. Study Leader: W.D. Holland
6. Key Words: Resource inventory, land inventory, biophysical mapping, vegetation inventory, land use interpretation guides, wildlife resources, aquatic resources.
7. Location of Work: Kootenay, Mount Revelstoke, and Glacier National Parks and Northern Forest Research Centre, Edmonton
8. Goals for 1981-82:
 1. Commencement of field work in all 3 Parks.
 2. Closer integration of philosophical concepts and ecological land classification techniques (including field work) with the wildlife biologists of CWS.
 3. Integration of the aquatic resource into the resource inventory of the 3 Parks being studied. A forest hydrologist will be employed through the AIP.
 4. Interim report for 1981-82.
9. Accomplishments in 1981-82:
 1. Approximately 40% of the field work was completed in all 3 Parks, exclusive of sampling. The slower rate of progress was caused by rougher terrain, field logistics differences involving 3 parks, and closer integration with the wildlife inventory team.
 2. Closer integration of field work was accomplished with the wildlife resource component. Approximately 30% of the sample plots had CWS input in spite of the fact that the wildlife team was not completely staffed until October.

9. Accomplishments in 1981-82: (cont'd)
3. Integration of the aquatic resource was not accomplished because the funds for a forest hydrologist were not forthcoming. Consequently, CWS transferred Dave Donald from the Jasper limnology work. Our input involves minimal logistics support.
 4. The interim report is scheduled to be ready March 31, 1982.
10. Goals for 1982-83:
- 1) Continue project leadership and coordination in Kootenay, Glacier, Mount Revelstoke National Parks, including advice and workshops to Parks, as required. (Holland)
 - 2) Continue field work in 3 B.C. Parks named above. (Holland, Dudynsky)
 - 3) In cooperation with FIDS (NOR-1) and Forest Hydrology (NOR-13), establish permanent plots in pine beetle infested areas of Waterton and Kootenay National Parks to assess the impact of tree mortality on successional rates and pathways in different lodgepole pine forest vegetation types. (Holland, Dudynsky)
 - 4) Begin preparation of final report for Kootenay, Mount Revelstoke, and Glacier National Parks. (Holland, Dudynsky)
 5. Completion of thesis: "Ecophysiology of *Arctostaphylos uva-ursi*". (Dudynsky)
11. Publications:
12. Signatures:

W. D. Holland March 8/82
Investigator

[Signature]
Program Manager

H. Dudynsky
Investigator

[Signature]
Director A.D. Kill

NOR-28

Environmental Impact Assessments and Peatland Ecology

1982 - 83

Date: January 8, 1982

1. Project: Environmental Impact Assessments and Peatland Ecology
2. Title: Environmental Assessment and Impact of Developments on Terrestrial Environment
3. New: Cont.: X 4. No.: NOR-28-171
5. Study Leader: S.C. Zoltai
6. Key Words: Arctic, land use, development, impact, vegetation, terrain
7. Location of Work: Western and Northern Region
8. Goals for 1981-82:
 1. Participate in assessment processes of development proposals as required.
 2. Develop expertise in assessing the impact of development proposals on the terrestrial environment in various parts of the Region.
 3. Continue to serve as the chairman of the Regional Transportation Committee, assessing and co-ordinating responses on environmental impacts.
 4. Act as CFS representative on the Regional Screening and Co-ordinating Committee.
9. Accomplishments in 1981-82:
 1. As member of the Regional Transportation committee, contributed to the environmental assessment of sections of the Liard Highway, and the twinning of Trans-Canada Highway, Banff National park.
 2. Participated in the evaluation of the role of DOE in the Norman Wells pipeline development hearings.
 3. Served as chairman of the Regional Transportation Committee, co-ordinating the responses of five DOE and 1 DFO agencies.

10. Goals for 1982-83:

11. Publications:

12. Signatures:

C.D. Kifl
Director A.D. Kifl

1982 - 83

Date: January 8, 1982

- None - study terminated

- C. D. Kil
Director A.D. Kil

1982 - 83

1. Examined and sampled 52 different peatlands in central Alberta.
2. a. Collected, identified, and curated 150 different species of vascular plants, 85 species of mosses, 20 species of liverworts, and 40 species of lichens.

b. Plant remains in 1400 peat samples were identified.
3. Chemical properties of 1400 peat samples are being analyzed.
4. Radiocarbon dates of 25 peat samples are being determined.

10. Goals for 1982-83:

1. Conduct field work by examining and sampling in detail the vegetation, peat deposits, and surface water in at least 30 different peatlands in north-central Saskatchewan.
2. Identify and curate collected plant samples.
3. Identify plant remains in collected peat samples.
4. Determine the chemical properties of collected peat samples.
5. Obtain radiocarbon dates of selected peat samples.
6. Prepare three chapters for the book "Wetlands of Canada".
7. Prepare journal paper on "Earth hummocks in the Sunshine area".

11. Publications:12. Signatures:

S.C. Zetser
Investigator

[Signature]
Program Manager

J. D. Johnson
Investigator

A.D. Kil
Director A.D. Kil

NOR-29

Forest Resource Data

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 12, 1982

1. Project: Forest resource data
2. Title: Forest resource and operations statistics in Prairie Provinces and N.W.T.
3. New: Cont.: X 4. No.: NOR-29-173
5. Study Leader: P.J. Golec
6. Key Words: Regional and national forest statistics; growth, depletion, accrual and inventory data.
7. Location of Work: Prairie Provinces and N.W.T.
8. Study Objectives:
 1. To develop, operate and maintain a computerized system for compilation and analysis of appropriate forestry statistics to satisfy regional and national requirements.
 2. To report at regular intervals on the changes in growing stock as a result of disasters, harvesting, silviculture, etc.
 3. To provide consultation and advice to provincial, federal and industrial forest management agencies concerning the availability, interpretation, and application of forestry data.
 4. To contribute to the development of improved resource management guidelines by examining and testing simulation models based on regional research and operational data.
9. Goals for 1981-82:
 1. Participate with PNFI in the development and implementation of the CFRDP, as required.
 2. Determine data requirements and format for national silvicultural report, with study NOR-10.
 3. Identify data requirements and standards and prepare an implementation plan for a regional resource data program.

9. Goals for 1981-82: (cont'd)

4. Initiate compilation and storage of economics and change data according to specifications and schedule established in goal 3.
5. Represent the NoFRC on the Regional Committee on FORSTATS.

Added goal:

6. Prepare Alberta and Manitoba forest inventories for use in CFRDP.

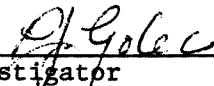
10. Accomplishments in 1981-82:


1. Attended various meetings with both federal and provincial personnel as part of implementation of CFRDP.
2. Developed silviculture questionnaire and collected data for 9 provinces, with study NOR-10.
3. Requirements identified on an individual basis.
4. Change data storage initiated.
5. Attended 3 meetings in Petawawa.
6. Developed computer programs for conversion of Manitoba and Alberta forest inventories to CFRDP format.


11. Goals for 1982-83:

1. Participate with the Forestry Statistics and Systems Branch in the development and implementation of the CFRDP, as required.
2. Publish a national silviculture report, with study NOR-10.
3. Standardize NoFRC permanent sample plot information as part of a national data sharing program developed by the Canadian Forest Inventory Committee and determine regional permanent sample plot data requirements.
4. Supply CFRDP with updated inventory information for the region as it becomes available.
5. Establish a working group to decide regional data base requirements.
6. Represent the NoFRC on the Regional Committee on FORSTATS which meets 4 times per year.

12. Signatures:


Investigator


Program Manager


Director A.D. Kiil

NOR-31

Climatic Studies

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 4, 1982

1. Project: Climatic Studies
2. Title: Impact of Climatic variation on Boreal Forest Biomass Production
3. New: Cont.: X
4. No.: NOR-31-179
5. Study Leader: J.M. Powell
6. Key Words: Climatology, climatic change, climatic variation, forest biomass, proxy data, dendrochronology, tree-rings, paleobotany, pollen analysis, X-ray densitometry, isotopic measurements, historical records, forest growth, Boreal Forest Region (B)
7. Location of Work: Edmonton Laboratory, Prairie Provinces, N.W.T.
8. Goals for 1981-82:
 1. Continue a literature gathering and review of information concerning climatic fluctuations and forest biomass productivity, with special emphasis on the boreal forest zone. This will be undertaken in conjunction with the ENFOR contract literature survey, for which assistance will be provided as required.
 2. Continue to locate and gather data sources utilizing instrumental climate data and various proxy records of climate which relate to the boreal forest zone. Emphasis will be given to analysing climate records from selected stations in the boreal forest zone, especially where these will provide background information for the N-S tree-ring transects.
 3. Maintain liaison with the Canadian Climate Centre and other agencies as the NOR-31 project is identified as part of the Department's integrated Canadian Climate Program. Also continue involvement on the Climate Advisory Committee and three of its committees, the Expert Committee on CO₂, the Committee on Climatic Fluctuations and Man, and the Regional Climate Advisory Committee for Alberta. This will include attendance at the CCREM meeting on Climate change and Variability, and their Impact on Canada's Resources and Environment.

8. Goals for 1981-82:(cont'd)

4. Continue progress towards summarizing all temperature and other climatic parameter data collected in connection with two earlier studies on climate of clearcut forested areas, with emphasis on data associated with the seedling growth study related to stand edge.
5. Continue to provide climatic advice and information to colleagues and others as requested in my role as Regional Climatology Advisor. This will include the reporting of climate related studies within CFS and NoFRC to various advisory committees or groups.

9. Accomplishments in 1981-82:

Many of the goals were only partially accomplished due to a ten month assignment as Acting Program Manager, Forest Resources Research.

1. Some new literature was gathered but no progress was made in reviewing the information. Progress continued in this area through the ENFOR contract for a literature survey concerning growth, yield and biomass in the boreal forest zone with reference to different climatic parameters. A brief report on the project was published in Syllogeus, and two notes in BIOENERGY DIRECTORY 1981.
2. Climate records from 62 climatological stations in the region were obtained and further analysis of 34 of them undertaken for comparison with tree ring width and density chronologies obtained through an ENFOR contract. Assistance was provided to the contractor in selecting and collecting tree-ring disc samples for the N-S transect in Manitoba and Saskatchewan from six locations.
3. Contact was maintained with the Canadian Climate Centre and the Canadian Climate Program (CCP) mainly through attendance at CCP Committee meetings and the CCREM Seminar. At the CCREM Seminar I acted as Rapporteur for the Forestry Discussion Group and prepared the Recommendations which were published on pages 162-3 in the Climate Change Seminar Proceedings. The Proceedings of the CCP Forestry-Climate Workshop held in January 1980 were published and included a paper entitled "Climate Input to Forestry Courses at Postsecondary Institutions" pp. 21-26 I presented at the Workshop. I also had major input to the published Recommendations and to helping put the proceedings together. I also contributed to the published report of the Proxy Data Working group in the CCP Water-Climate Workshop Proceedings. I attended two meetings of the National Climate Advisory Committee (CAC), and two meetings of the CFS-AES CCP Working Group as representative for the NoFRC which put together a package of recommendations for consideration by the two services. Discussion about a Regional

CAC was covered at the annual Alberta Climatological Association meeting when representation and terms of reference were discussed.

4. Summarizing of temperature data collected in connection with two earlier studies was continued. Tables were provided on climate data collected in association with the seedling growth study to W. Johnstone for possible inclusion in a report he is preparing on other aspects of the study. Climate data for the area was also supplied to a consultant.
5. Advice on climatic information was provided to colleagues and others. A chapter for the SAF Handbook on "Meteorology and Climatology" was reviewed for the US Forest Service. The annual report on the Centre's activities and publications of interest to geographers was published in the Canadian Association of Geographers Directory 1981. I compiled the CFS report for the "Meteorology and Atmospheric Sciences" section of the 1981 volume of the Canadian Geophysical Bulletin, while the 1980 report I compiled was published. I represented the CFS on the Canada Department of Agriculture Expert Committee on Agrometeorology presenting a report, while the 1980 report was published. I represented the NoFRC at the Alberta Climatological Association meeting presenting a report which was published in the Proceedings. I served on the Western Research Program of Forintek Subcommittee on "Characterization of Wood" which reviewed their research program in this area which included their work in dendroclimatology. I represented the NoFRC on the NAIT Biological Sciences Advisory Committee. I completed my term as Past President of the Canadian Meteorological and Oceanographic Society. Represent them on the Editorial Board of the Climatological Bulletin and on the national Climate Advisory Committee, and am on the Long Range Committee of the Society. I am now the Chairman of the Local Arrangements Committee for the 1983 CMOS Congress to be held in Alberta.

10. Goals for 1982-83:

1. Continue review of information concerning climatic fluctuations and forest biomass productivity in the boreal forest zone.
2. Continue as Scientific Authority for two ENFOR Contracts related to the project. Assist in presentation of a poster session paper resulting from the tree-ring and climate contract at two meetings. Oversee the publishing of reports from the contract studies under the following titles -
 - a. A literature survey of the growth, yield and biomass of different tree species and other vegetation present in the boreal zone with reference to the effect of different climatic parameters.
 - b. The impact of climatic variation on boreal forest biomass through use of tree ring analysis based on samples from two north-south transects.

10. Goals for 1982-83: (cont'd)

3. Continue progress towards summarizing all 'climatic data' collected in connection with two earlier studies on climate of forest clearings with emphasis on 'data associated' with the seedling growth study related to stand edge.
4. Continue to provide climatic advice and information to colleagues and to represent CFS and NoFRC on various advisory committees including those associated with the Canadian Climate Program.

11. Publications

a) Up to 1981-82

Proceedings:	1
Proceedings papers:	2
Book chapter:	1
Other reports:	11

b) 1981-82

Powell, John. 1981. Northern Forest Research Centre, Environment Canada. pp. 92-95. In K.R. Leggat and J.T. Kotylak (compilers) The Impacts of Climatic Fluctuations on Alberta's Resources and Environment. Proceedings of the workshop and annual meeting of the Alberta Climatological Association, February 1981. Environ. Can., Atmos. Environ. Serv., Western Region, Edmonton, Rept. No. WAES-1-81. 107 pp.

Powell, J.M. 1980. Forest Meteorology. pp. 24-28, Appendices I & II. In Report of the 22nd Annual Meeting of the Expert Committee on Agrometeorology, November 12-13, 1980. Agric. Can., Ottawa. 45 pp.

Powell, J.M. 1980. Alberta (Report) pp. 16-17. In Report of the 22nd Annual Meeting of the Expert Committee on Agrometeorology. November 12-13, 1980. Agric. Can., Ottawa. 45 pp.

[Powell, J.M.] 1980. Canada/Canadian Forestry Service, Northern Forest Research Centre, Environmental Management, Environment Canada. pp. 129-132. In Barr, B.M. (compiler & editor). The Canadian Association of Geographers Directory 1980. 193 pp.

[Powell, J.M.] 1980. Canadian Forestry Service. pp. 158-160. In Canadian Geophysical Bulletin Vol. 33. Energy, Mines & Resources Canada, Earth Physics Branch, Ottawa. 239 pp.

[Powell, J.M. Rapporteur] 1981. Forestry (Discussion Group Report) pp. 162-163. Climate Change Seminar Proceedings, Regina, Sask., March 17-19, 1981. Published by Environ. Can., Atmos. Environ. Serv., Canadian Climate Centre, Downsview, Ont. for Can. Council of Res. and Environ. Ministers. 170 pp. Appendices.

Powell, J.M. 1981. Climate Input to Forestry Courses at Post-secondary Institutions. pp. 21-26. In Proc. of the CCP Forestry-Climate Workshop. Jan. 29-30, 1980, Toronto.

Powell, John M. 1981. Impact of Climatic Variation on Boreal Forest Biomass Production. pp. 189-194. In Harington, C.R. (Editor). Climatic Change in Canada 2. Nat. Museums of Can., National Museum of Natural Sciences, Ottawa, Syllogeus. No. 33. 220 pp.

12. Signatures:

J.M. Powell
Investigator

Investigator

A. D. Kill Nov 17/82
Program Manager

G. D. Hill
Director A.D. Kill

NOR-32

Long-range Transport of Air Pollutants

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 2, 1982

1. Project: Long range transport of air pollutants.
2. Title: Impact of air pollutants from major regional sources on forest vegetation and soils.
3. New: Cont.: X 4. No.: NOR-32-178
5. Study Leaders: G. Hogan, D. Maynard
6. Key Words: Pollutant, sulphur, metals, vegetation, soils, diagnosis, impact, restoration.
7. Location of Work: Region wide.
8. Goals for 1981-82:

1. Complete a report on the baseline study in Thompson. (Hogan)
2. Prepare a journal article on the soil and vegetation work which forms a part of the Thompson study. (Hogan)
3. Write a journal article on the lichen work which was part of the Thompson study. (Hogan)
4. Prepare a journal article on the use of the moss bag technique and resultant data. (Hogan)
5. Publish a journal article entitled "Pollutant distribution and containment within a forest system as a function of distance from a smelter source. (Hogan)
6. Continue to investigate metal toxicity symptoms and metal tolerance in native vegetation, (hydroponic studies) and examine the physiological effects of metals. (Hogan)

Added goals

7. Supervise the delivery installation and quality assurance of the ICAP-AES.
8. Design and construct an acid misting chamber and initiate experiments on the effects of acid mists on photosynthesis and nutrient composition of white spruce.

9. Investigate air pollutant damage to forest in the Yellowknife area at the request of EPS regional headquarters.
10. Continue to monitor bulk (wet & dry) deposition in expanded gradients around the Thompson and Flin Flon smelters. Continue to monitor particulate input to these sites using moss bags.
11. Initiate studies of sulphur and metal particulates introduced by deposition of forest soil processes and chemistry.
12. Initiate studies on the cycling of metals and sulphur within affected and control stands.

9. Accomplishments in 1981-82:

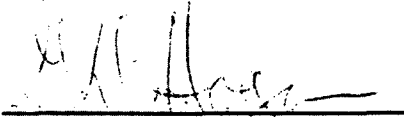
1. A report on the studies carried out in Thompson, to date, has been written. This report has been submitted to the Manitoba Clean Environment Commission to be considered as evidence during a public hearing to be held in March 1982.
2. This goal has not been met because of the expended in completing #7, defer to 1982-83.
3. This goal has not been met because of inconsistencies in the data which were collected over a two year period. Further sampling and analysis will be required before this goal can be met.
4. This goal has not been met because of the time expended in completing goal #7, defer to 1982-83.
5. A rough draft of this article has been completed and is ready for the initiation of the review process.
6. A study of the role of malic acid in metal tolerance in native grasses was carried out. These preliminary results indicate that the classical interpretation of this phenomenon does not apply to the species tested. Further work will be done in this area when time permits.
7. The installation of the ICAP-AES was initiated in May and was not completed until September. This lengthy process required the constant attention of professional staff during a three month period. The outcome of this objective is that the instrument is operational and adds significantly to the analytical capacity of this lab.
8. An acid misting facility has been designed and built and experiments on the effects of acid mists on three year old white spruce seedlings have begun. The first results of this study will not be available until late April of 1982.

9. An investigation of air pollution damage in the Yellowknife area was carried out. The results of this survey showed that an SO₂ fumigation event had occurred north and west of the smelter. Significant damage to white birch was evident up to 5 km from the source.
 10. Monitoring of bulk deposition was carried out in Flin Flon and Thompson. The samples have been analysed and the data is being compiled. Monitoring of particulate deposition has been carried out at 22 stations using moss bags around two sources. The samples have been analysed and the results are being compiled.
 11. Initiation of studies on metal and sulphur deposition and their effects on soil biological processes were carried out. Samples were taken on a monthly basis throughout the summer. Analysis of the samples has not taken place. This work was delayed because the soil chemist position was not filled until November.
 12. This work could not be initiated because of delays in hiring a soil chemist.
10. Goals for 1982-83:
1. Initiate investigations into the effects of acid rain and dry deposition individually and in combination on the physiology and biochemistry of lichens and vascular plants. (Hogan)
 2. Investigate and report on current and historical data on acid rain within the region (Forestry report) (Hogan)
 3. Continue to investigate the effects of heavy metals and sulphur dioxide on soil chemical and biological processes, with particular reference to studies on soil respiration. (Maynard & Hogan)
 4. Reexamine the sampling plots in Thompson and Flin Flon to determine effects of additional inputs of pollutants since the 1977/78 sampling. (Hogan & Maynard)
 5. Prepare a report on the soil and vegetation work which forms part of the Thompson study. (Hogan)
 6. Prepare an article on the use of the moss bag technique and resultant data. (Hogan)
 7. Prepare a paper on the Flin Flon study entitled "Pollutant distribution and containment within a forest system as a function of distance from a smelter source". (Hogan)


8. Prepare a report (Forest Management Note) on the hazards of remote precip monitoring and the interpretation of data. (Hogan)
9. Reexamine lichen data from Thompson, if it warrants publication submit it as a quarterly report. (Hogan)

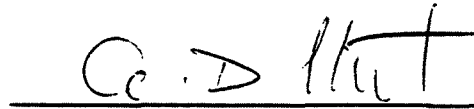
11. Publications:

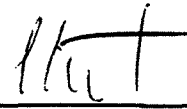
12. Signatures:


Investigator


Program Manager


Investigator


Director


A.D. Kill

1982 - 83

Date: February 3, 1982

1. Project: Longrange transport of air pollutants.
2. Title: Transport of airborne radionuclides released during uranium mining and milling operations and their effects on forest vegetation and soils.
3. New: Cont.: X
4. No.: NOR-32-186
5. Study Leaders: M.J. Apps and G.D. Hogan
6. Key Words: ^{222}Rn , airborne radioactivity, uranium mining and milling, forest vegetation and soils.
7. Location of Work: Uranium City - Wollaston Lake, Sask. and Northern Forest Research Centre, Edmonton, Alberta
8. Goals for 1981-82:
 1. Set up laboratories and develop methods for the determination of ^{226}Ra , ^{210}Pb , and ^{210}Po in plants and soils.
 2. Collect various plant and soil samples from the study area and analyze these for ^{226}Ra , ^{210}Pb and ^{210}Po .
 3. Determine the soil-plant radionuclide transfer coefficients and the fluxes of ^{210}Pb soils.
 4. Complete a review article on airborne radioactivity and plants.
9. Accomplishments in 1981-82:
 1. This goal could not be met because of the lack of funds for capital equipment. Funding for capital equipment must be forthcoming in 1982-83 if the objectives of this programme are to be met.
 2. Some samples from the Uranium City area were collected and an analysis for Uranium was carried out. Determinations of ^{226}Ra , ^{210}Pb and ^{210}Po cannot be carried out on existing equipment.
 3. This goal was not met because of the lack of instrumentation.

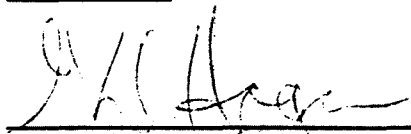
4. This review article has been completed and has been submitted to the journal "Science of the Total Environment" for publication.

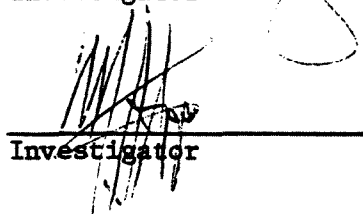
10. Goals for 1982-83:

1. Select study sites to investigate pathways for the transport of radionuclides to vegetation in the Uranium City area. (Hogan & Apps)
2. Select species as monitors for radionuclide accumulation and migration. (Apps & Hogan)
3. Establish analytical facility to measure $U^{210}Pb$, and ^{226}Ra and other toxic elements commonly associated with the Uranium mining and milling industry. (Apps)
4. Initiate a study to differentiate between wind blown dust and the emission component derived from tailings areas. (Apps)
5. Establish a benchmark and baseline monitoring system around a proposed representative mine site to study deposition of radionuclides during the mining and milling process. (Apps & Hogan)


11. Publications:

12. Signatures:


Investigator


Investigator


Program Manager


Director A.D. Kill

NOR-33

Scientific and Technical Information

1982 - 83

Date: February 4, 1982

1. Project: Technical and scientific information.
 2. Title: Technical information.
 3. New: Cont.: X
 4. No.: NOR-33-145
 5. Study Leader: R.M. Waldron
 6. Key Words: Displays, audio-visuals, publications, resource managers, industrial managers, general public.
 7. Location of Work: Region wide.
 8. Goals for 1981-82:
 1. Publish 3 Forestry Reports
 - (i) Silviculture - L. Brace
 - (ii) Fire - D. Dube
 - (iii) Watersheds - R. Swanson
 2. Edit "Insects of the Prairie Provinces" by H. Cerezke, and "Diseases of the Prairie Provinces" by Y. Hiratsuka for technical content and presentation.
 3. Publish 5-10 Forest Management Notes.
 4. Reprint 15 Pest Leaflets incorporating recently revised control recommendations.
 5. Continue responsibility for the distribution of NoFRC publications, maintenance of the mailing list, responding to requests for information, and carrying out necessary correspondence.
- Goals added:
6. Contribute to the development of a CFS publications policy.
 7. Write, publish, and distribute the Annual Program Review, 1980-81, Northern Forest Research Centre.
 8. Combine this study with NOR-33-146 and terminate this study.

9. Accomplishments in 1981-82:

1. (i) A 16-page Forestry Report on Silviculture has been published and distributed; L. Brace was the Forestry Report Coordinator.

(ii) The first draft of the Forestry Report on Fire was received from D. Dube. It is proposed to release this report by late April, 1982.

(iii) The proposed Forestry Report on Watersheds by R. Swanson has ~~not~~ yet been submitted for review.
2. Neither of the two proposed technical reports (Insects of the prairie provinces - H. Cerezke, and Diseases of the prairie provinces - Y. Hiratsuka) have been submitted for review.
3. Seven Forest Management Notes were published and distributed.
4. Twelve Pest Leaflets incorporating recently revised control recommendations were published and distributed.
5. Continued responsibility for the distribution of NoFRC publications, maintenance of the mailing list, responding to requests for information, and carrying out necessary correspondence. It is estimated that requests for information via personal contact, telephone, letters, and telex increased by at least 10% over the past year.

Accomplishments added:

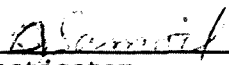
6. In cooperation with J. Lalonde, Chief, Scientific and Technical Publications Unit in Ottawa, developed a CFS publications policy statement as requested by the Director-General, Research and Technical Services. A revised draft will be discussed by CFS directors prior to its implementation.
7. Wrote, published, and distributed the 1980-81 NoFRC annual program report.
8. Combined this study with NOR-33-146 and this study terminated.

10. Goals for 1982-83:

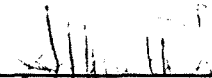
None - Study terminated.

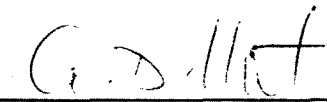
11. Publications:

12. Signatures:


Investigator

Investigator


Program Manager


Director

A.D. Kill

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 4, 1982

1. Project: Scientific and technical information.
2. Title: Scientific and technical information.
3. New: Cont.: X 4. No.: NOR-33-146
5. Study Leader: J.K. Samoil and vice Waldron
6. Key Words: Journal articles, information reports, editing, displays,
Resource managers, industrial managers, publishing,
printing, general public.
7. Location of Work: Region wide.
8. Goals for 1981-82:
 1. Assist the reaearch staff, through the provision of editing
and publishing services, in the preparation and publication
of approximately 15 Information Reports and 25 journal articles.
 2. Assist the project leader, through the provision of editing
and publishing services, in the preparation and publishing
of three Forestry Reports, 5-10 Forest Management Notes, and
two special technical reports.
 3. Oversee printing and reprinting of locally published scientific
and technical information.
 4. Prepare a draft of an author's style guide for NoFRC publications.
 5. Introduce revised procedures for manuscript typing using the
Xerox word processor and the IBM composer.
 6. Continue to respond to requests from the public for general
information and specific publications.

Goal added:

 7. Integrate NOR-33-145 with this study.

9. Accomplishments in 1981-82:

1. Assisted staff in the publication of 7 Information Reports (588 printed pages) and 38 journal and miscellaneous articles (estimate 380 printed pages). A list of 1981 publications (total of 62) appears in Section 15.
2. Assisted in the preparation of one Forestry Report (16 printed pages) and 7 Forest Management Notes (26 printed pages).
3. Wrote specifications for and monitored the printing and reprinting of locally published scientific and technical information. Renewed the standing offer agreement for printing (Waldron).
4. Prepared a draft of an author's style guide for NoFRC publications.
5. Revised procedures were introduced for manuscript typing using the Xerox word processor and the IBM composer.
6. Responded to requests by mail and telephone or in person for information and NoFRC publications.

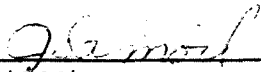
Accomplishment Added:

7. Studies NOR-33-145 and NOR-33-146 were integrated and the former terminated.


10. Goals for 1982-83:

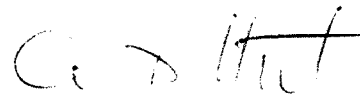
1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately 15 Information Reports and 25 journal articles.
2. Provide editing and publishing services in the preparation and publishing of two Forestry Reports, 5-10 Forest Management Notes, and one special technical report (Diseases of the prairie provinces by Y. Hiratsuka)
3. Prepare and publish the Annual Program Review 1981-82, Northern Forest Research Centre.
4. Oversee printing and reprinting of locally published scientific and technical information.
5. Finalize an author's style guide for NoFRC publications.
6. Continue responsibility for the production and printing of the monthly NoFRC Forestry Newsletter.

7. Continue responsibility for the distribution of NoFRC publications, maintenance of the mailing list, responding to requests for information, and carrying out necessary correspondence.
8. Continue to respond to requests from the public for general information and specific publications.
11. Publications:
12. Signatures:


Investigator


Program Manager


Investigator


Director A.D. Kil

NOR-34

Forest Biomass as an Energy Source

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1982-83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 13, 1982

1. Project: Forest biomass as an energy source.
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-34-180
5. Study Leader: J. M. Powell
Co-operators: L. Brace, W. Chow, I. Edwards, W. Ondro, T. Singh
6. Key Words: Biomass, energy, fuels, climate, productivity, simulation models, resource data.
7. Location of work: Western and Northern Region.
8. Goals in 1981-82:
 1. To coordinate and develop NoFRC ENFOR projects insuring their implementation and to act as establishment representative on national and regional committees.
 2. To develop approved projects and provide Scientific Authority for effective implementation of Projects P-207 (Harvesting & Chipping), P-205 (Nutrients) and P-169 (Northern Biomass tree equations).
 3. To develop project proposals for 1981-82 and subsequent years.
 4. To continue to act as scientific authority of (P-148) for the cooperative demonstrations of computer mapping and data base management for estimation of forest biomass using provincial forest inventory data on test sites in Alta., Sask., and Man. and two million - ha data base previously obtained in the N.W.T. Maps digitized by Statistics Canada for the CFRDP will be obtained and used to display regional data. Updating of map information for recent cutovers and burnovers will be obtained using satellite digital tapes and integrated into the data base using the computer mapping program. (Kirby)

5. To continue to act as Scientific Authority for two existing ENFOR contracts: 1) Impact of Climatic Variation on Boreal Forest Biomass through use of tree-ring analysis (P-149), and 2) Extensive Literature Survey of the growth, yield and Biomass of different tree species and other vegetation present in the Boreal Zone, with reference to the effect of different Climatic Parameters (P-150). Assistance will be provided in collecting tree-ring samples from sites in Manitoba and Saskatchewan for one ENFOR contract. (Powell)
6. To complete biomass equation (P-92) analysis and publish information report on equations. (Singh)
7. To establish NoFRC ENFOR project data base on PDP-11.
8. To prepare or obtain from contractors reports and publish where warranted on the following projects;
 - a. Use of the line intersect method for sampling of forest biomass. (P-23)
 - b. Upper limits of standing crop density and growth rates for woody species. (P-51)
 - c. Development of a growth model for aspen in the Prairie Provinces. (P-102)

Added

- d. Costs of harvesting and chipping of aspen stands for energy production. (P-163) (Scientific Authority: W. Ondro).

9. Accomplishments in 1981-82:

1. Attended ENFOR coordination meetings in Victoria, B. C. and at the National Forestry Institute in Petawawa. Attended contractors meeting in Ottawa. Reports were submitted to the Bio-Energy Council (Washington, D. C.) for the 1981 and 1982 Bio-Energy Directory.
2. The three new ENFOR projects for 1981-82 were prepared and contractors selected as follows:
 - P-169. Northern biomass tree equations for 6 species. (Scientific Authority - T. Singh). Timmerlinn Ltd. completed the field sampling for this study and submitted their report entitled "Biomass equations for N.W.T. and northern parts of Prairie Provinces. Data acquisition phase" in December, 1981.
 - P-205. Determination of biomass and nutrient content in trees, ground vegetation and soils of aspen stands in Alberta. Alan Moss and Associates were awarded this 3-year contract in the fall. A third of the sample plots have been established, the rest and the field sampling will be completed in 1982.

- P-207. Development of an integrated harvesting and processing system for hardwood sawmilling and energy production. Woodland Resource Services Ltd. were awarded this contract in December 1981. The study and reporting will be completed by March 1982.
3. Prepared project proposal for demonstration of computer mapping and application of tree biomass equations. This proposal is now on the short list of potential projects for 1982-83. Other proposals were developed and submitted but have not been supported at this time.
 4. A state of the art computer mapping system for operation on a HP1000 will be delivered by Systemhouse to NoFRC in March 1982.
 5. The two-year contract on the impact of climatic variation on Boreal forest biomass through use of tree-ring analysis is in progress (P-149). Assistance in sampling six spruce stands in Manitoba and Saskatchewan was provided. The contractor will complete the report by March 1982. A preliminary report entitled "Tree-ring width and density chronologies of white spruce along a transect through the Canadian Boreal Forest" was received in March 1981. A poster presentation on the study was given at the Third Bioenergy R&D Seminar under the title "The Effect of climatic variation on tree rings of spruce from the western Canadian Boreal Forest" and published in the Proceedings, pp. 36-40. The two-year contract for a literature survey on the growth, yield and biomass in the Boreal Forest Zone with reference to different climatic parameters is nearing completion, with the final report expected by March 1982 (P-150). A preliminary report covering the first year was received in March 1981 entitled "Impact of climatic variation on biomass accumulation in the Boreal Forest Zone: Selected references".
 6. A draft of an information report was completed on tree biomass equations for ten species in the Prairie Provinces and is currently under review.
 7. A data base on ENFOR projects and literature was established on NoFRC's PDP 11/60 computer.
 8. Contractors reports were obtained for P-23, 51, 102 and 163 as follows:
 - a. P-23. A report by D. Quintilio entitled "Downed-dead wood estimates in Alberta Forest Cover Types", 20 pp. was received.
 - b. P-51. A report from Western Ecological Services entitled "Upper limits of standing crop density and growth rates for woody species". This report has been reviewed and is in final stages of preparation for publishing.

- c. P-102. A report by T. Grabowski, J. D. Heidt and S. J. Titus entitled "An improved stand growth model for trembling aspen in the Prairie Provinces of Canada" was received in March 1981. A poster presentation on the study was given at the Bioenergy Seminar and published under the above title in the Proceedings. pp. 60-64.
- d. P-163. A report from the Coban Institute entitled "Costs of harvesting aspen stands for energy production" was received in September 1981. Assistance was provided for the field operations on the Rocky Mountain House Grazing Reserve in February and March. As an offshoot from this study a separate FMN has been prepared on the Dika Side Cutter and its application and is presently under review.

10. Goals for 1982-83:

- 1. To demonstrate a state of the art computer mapping and data base management system on test areas selected in cooperation with the forest services of Alberta, Saskatchewan, Manitoba and the Northwest Territories. On these test areas the conventional forest inventory information obtained from the provinces will be converted into biomass estimates by applying the tree biomass equations developed and some local sampling for testing and adjusting the general equation for local conditions. (P-230). (Scientific Authorities: T. Singh, W. Chow & Other).
- 2. Supervise the remaining field plot establishment and monitor the detailed biomass and nutrient sampling procedures for the "Determination of nutrient and biomass status of aspen ecosystems in Alberta" (P-205). This is a three-year contract with Alan Moss and Associates which will continue through 1983-84. (Scientific Authorities: L. Brace, I. Edwards).
- 3. Complete the publishing of the report by E. B. Peterson *et al* on "Upper limits of standing crop density and growth rates for wood species" (P-51) (Scientific Authority: L. Brace).
- 4. The contract (P-149) on "Impact of climatic variation on Boreal Forest biomass through use of tree-ring analysis" will be completed by March 1982 with a final report which is to be published. (Scientific Authority: J. Powell).
- 5. The contract (P-150) on "Literature survey on the growth, yield, and biomass in the Boreal Forest with reference to climatic parameters" will be completed by March 1982 with a final report which is to be published. (Scientific Authority: J. Powell).
- 6. The contract (P-207) on "Development of an integrated harvesting and processing system for hardwood sawmilling and energy production" will be completed by March 1982 with a final report which is to be published. (Scientific Authority: W. Ondro). A related additional contract to look at summer harvesting of aspen, possibly in Manitoba, will be awarded for 1982-83.

7. Continue coordination of NoFRC ENFOR projects insuring their implementation and to act as establishment representative on national and regional committees. Have Scientific Authorities attend Bioenergy Seminar in Winnipeg, and continue to submit reports to Bioenergy Council on studies.

11. Signatures:

J. M. Powell
Investigator

[Signature]
Program Manager

[Signature]
Director A. D. Kiil

1982-83

Date: January 13, 1982

1. Project: Forest biomass as an energy source.
2. Title: Development of integrated biomass prediction equations for Western and Northern Region.
3. New: Cont.: X
(Study transferred from NOR-30)
4. No.: NOR-34-183
5. Study Leader: T. Singh
6. Key Words: Biomass, regional and national forest statistics, energy, inventory, simulation, Prairies Region, prediction equations, mathematical models.
7. Location of Work: Western and Northern Region.
8. Study Objectives:
 1. To synthesize the available biomass data for the regionally important tree species for predicting biomass in the Western & Northern Region.
 2. To develop and test regional biomass equations, for their accuracy and bias, in a pilot-scale demonstration for converting a conventional forest inventory to a biomass inventory.
9. Goals for 1981-82:
 1. Prepare Information Report on biomass prediction equations for commercially important tree species of the Prairie Provinces (ENFOR Project P-92).
 2. Complete synthesis of regional biomass data and participate in demonstration project to convert conventional inventory to biomass inventory as required (in cooperation with NOR-34-180).
 3. Prepare journal article on specific gravity and its interrelationships with various tree variables.
 4. Complete and publish manuscripts from the previous review period if time permits. (Goal transferred to NOR-53-175)

Added Goals:

5. Undertake analysis of ENFOR P-92 Project biomass data and derive prediction equations for 10 tree species in the prairie provinces.
6. Act as Scientific Authority for ENFOR P-169 Contract for biomass field data collection, laboratory analysis, computer data key-punching and preparation of computer files.
7. Supervise two contracts for specific gravity determination and statistical analysis of ten prairie tree species.

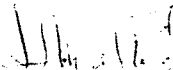
10. Accomplishments in 1981-82:

1. An information report entitled "Biomass equations for ten main tree species of the prairie provinces" was prepared. This has gone through the first review. Revised draft has been prepared in light of the comments received.
2. The biomass equations have been derived for regional biomass data on provincial and regional basis. The choice thus offered would help in assessing the pilot-projects to be undertaken for the forthcoming demonstrations for converting the provincial conventional inventories to biomass inventories. All data synthesis for this purpose has been completed.
3. The laboratory work for tree sample specific gravity determinations and the statistical analyses have been completed. Because of the delay in receiving the results and report from the contractor, the final preparation of the proposed manuscript was deferred, although some tables for the publication have been prepared.
4. Reporting of goal transferred to NOR-53-175.
5. Worked as Scientific Authority for ENFOR contract on Project P-92 (Biomass equations for northern parts of prairie provinces) and completed analysis of data to provide prediction equations for 10 tree species. Project was provided guidance and direction for successful completion.
6. Worked as Scientific Authority for the ENFOR contract on Project P-169 (Biomass equations for N.W.T.) and provided needed guidance and direction for successful completion in all phases of field data collection, laboratory analysis and preparation of computer data files.
7. Worked also as Scientific Authority for two ENFOR related contracts for the determination of specific gravity of wood samples obtained from 10 tree species in the prairie provinces, and provided extensive guidance and advice for their successful completion, especially the statistical aspects.

11. Goals for 1982-83:

1. Publish a report on biomass prediction equations for 10 commercial tree species in the prairie provinces.
2. Prepare and publish a report on specific gravity and its interrelationships with various tree variables for 10 tree species of the prairie provinces.
3. Complete analysis of various tree components for 6 tree species of N.W.T., derive prediction equations for green and dry biomass prediction equations for the 6 tree species sampled in the N.W.T.
4. Determine specific gravity relating to the 6 tree species sampled in the N.W.T.
5. Prepare computer data files for the field and laboratory biomass data collected to date for the regional biomass inventory.
6. Contribute to the pilot project to be undertaken for demonstrating the conversion of conventional forest inventories to biomass inventory. (NOR-34-180)
7. Prepare a Forest Management Note on biomass weight prediction of the 10 main tree species of the prairie provinces, using DBH and H as predictor variables.

12. Signatures:

Investigator

Program Manager

Director

A.D. Kill

NOR-35

Tree Disease Research

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

1. Project: Tree Disease Research

3. New: Cont.: X

5. Study Leader: Y. Hiratsuka

7. Location of Work: Edmonton (laboratory, greenhouse and mycological herbarium), Western North America with particular emphasis on Northern Region (field).

General:

Specific:

9. Goals for 1981-82:

1. Publish a paper on a new species of fungi isolated from a pine stem rust with Dr. A. Tsuneda.
2. Help revise a book entitled "Illustrated Genera of Rust Fungi" with Dr. C. B. Cummins (University of Arizona).

3. Complete analysis of data and the first draft of a paper on pine stem rusts plot study with Dr. A. Van Sickle (PFRC) and Dr. J. M. Powell (NoFRC).

4. Publish a paper on rodent damage of pine stem rusts (Powell).

10. Accomplishments in 1981-82:

1. A journal paper has been published on a new species of fungi isolated from a pine stem rust (see 15. Publications below).
2. Continued to help revision of a book entitled "Illustrated Genera of Rust Fungi" with G. B. Cummins (University of Arizona).
3. Analysis of data and publication of a paper on pine stem rusts plot study with Drs. Van Sickle and Powell was not completed.
4. A paper on rodent damage of pine stem rusts is submitted to a journal (Powell).

Added Accomplishments:

5. Conducted herbicide control trials of the alternate hosts of comandra blister rust at Pine Ridge Tree Nursery and prepared two reports for AFS. Funds for this work was made available by AFS.
6. Cooperated with Dr. M. Pickard (Dept. of Microbiology, University of Alberta) on isolation and characterization of antifungal metabolites produced by mycoparasites of pine stem rusts and prepared a report for AFS who supported this work.
7. Gave an invited talk at the XVII IUFRO World Congress in Kyoto, Japan entitled "Host relationship, life cycle, and species concept of *Cronartium* and *Endocronartium*", and the paper was published in the proceedings.

11. Goals for 1982-83:

1. Initiate and propose research plan for western gall rust of young lodgepole pine and screening methods for the disease. This plan will involve several cooperators including Dr. W. A. Ayer (Dept. of Chemistry, U. of A.), Dr. M. Pickard (Dept. of Microbiology, U. of A.), Dr. N. Dhir (AFS) and a graduate student in forest pathology (U. of A.).
2. Continue to help Dr. G. B. Cummins (University of Arizona) to revise a book entitled "Illustrated Genera of Rust Fungi" as a co-author.

3. Complete analysis and prepare a publication of a paper on pine stem rusts plot study with Drs. Van Sickle and Powell.
4. Results of herbicide control trials of the alternate hosts of comandra blister rust (second year results) will be reported.

12. Publications:

Up to 1981:

Journal articles: 35
Information reports, notes, etc.: 7
File reports: 2

1981-82:

Journal articles:

Hiratsuka, Y. 1981. Host relationship, life cycle, and species concept of *Cronartium* and *Endocronartium*. Proceedings XVII IUFRO World Congress Division 2: 247-255.

Tsuneda, A. and Y. Hiratsuka. 1981. *Scopinella gallicola*, a new species from rust galls of *Endocronartium harknessii* on *Pinus contorta*. Can. J. Bot. 59:1192-1195.

Tsuneda, A. and Y. Hiratsuka. Biological control of pine stem rusts by mycoparasites. Proceedings of Japan Academy 9:337-341.

Information reports, notes, etc.:

Hiratsuka, Y. 1981. Some developments in tree disease studies: Dutch elm disease and pine stem rusts. Proceedings of Western Society of Horticulturalists Convention, Regina, Saskatchewan.

Hiratsuka, Y. 1981. Western gall rust infections of nursery origin on jack pine in Manitoba. Northern Forest Research Centre, Canadian Forestry Service. Forest Management Note No. 5, 2 p.

Hiratsuka, Y. and S. Sato. Morphology and taxonomy of rust fungi. In: K. J. Scott (Ed.) "The Rust Fungi". Academic Press (In press).

File reports:

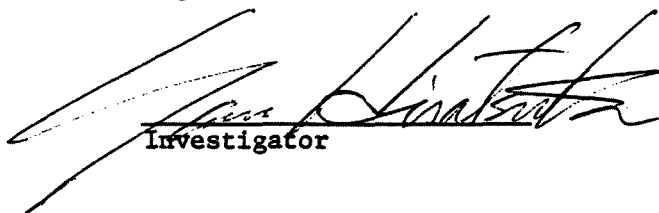
Hiratsuka, Y. and E. Allen. 1981. Eradication trials of comandra blister rust alternate hosts at Pine Ridge Tree Nursery, Smoky Lake, Alberta. Unpublished report submitted to AFS.

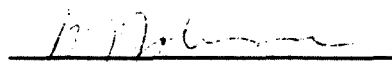
Pickard, M. A., N. Fairbairn and Y. Hiratsuka. 1981. Isolation and characterization of antifungal substance(s) produced by *Scytalidium uredinocola*, a hyperparasite of *Endocronartium harknessii*, the western gall rust. Unpublished report submitted to AFS.

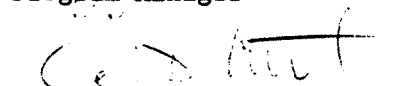
Hiratsuka, Y. and E. Allen. 1981. Second-year results of the eradication trials of comandra blister rust alternate hosts at Pine Ridge Tree Nursery, Smoky Lake, Alberta. Unpublished report submitted to AFS.

Hiratsuka, Y. and E. Allen. 1981. Fungicide control of western gall rust - Establishment of control plots, 1981. Unpublished report submitted to AFS.

13. Signatures:


Investigator


Program Manager


Director A. D. Kill

1982 - 83

Date: January 14, 1982

1. Project: Tree Disease Research
2. Title: Forest diseases: Research and technical transfer services
3. New: Cont.: 4. No.: NOR-35-153
5. Study Leader: Y. Hiratsuka
6. Key words: Mycology, herbarium, culture collection, nomenclature, identification.
7. Location of work:
8. Study Objectives:
 1. To provide diagnostic and taxonomic service of tree diseases and other forest fungi.
 2. To maintain and improve diagnostic and taxonomic service capabilities of tree disease pathogens and other forest fungi in the region.
 3. To prepare check lists of forest fungi of important areas (e.g. national parks, provincial parks, etc.), diagnostic keys for identification, and other related publications.
9. Goals for 1981-82:
 1. Complete the first draft of an information publication on major tree diseases of the Prairie Provinces by the end of 1981 to be able to be published in 1982-83 fiscal year.
 2. A journal paper on a new poplar leaf spot fungus will be published.
 3. Two pest leaflets (western gall rust and silver leaf) will be published.
 4. Provide diagnostic and identification service of tree and shrub disease.

Goals for 1981-82: (cont'd)

5. Maintain and upgrade the Mycological Herbarium and a fungus culture collection.

10. Accomplishments for 1981-82:

1. Significant progress (80%) was made to complete the first draft of an information publication on major tree disease of the prairie provinces.
2. A journal article on a new poplar leaf spot fungus has been prepared and under review.
3. Two pest leaflets (silver leaf and western gall rust) were prepared and under review.
4. Provided diagnostic and identification service of tree and shrub diseases, and other fungi.
5. Maintained and upgraded the Mycological Herbarium and a fungus culture collection.

Added goals:

6. Cooperated with Dr. W.A. Ayer (Dept. of Chemistry, Univ. of Alberta) on biologically active metabolites of selected forest disease pathogens.
7. Cooperated with Dr. S. Takai (GLFRC) on DED research and two journal publications are under review. Gave an invited talk at DED Symposium and Workshop.

11. Goals for 1982-83:

1. Complete the first draft of an information publication on major tree diseases of the Prairie Provinces by the end of 1982.
2. Provide diagnostic and identification service of tree and shrub diseases.
3. Maintain and upgrade the Mycological Herbarium (forest disease reference collection) and a fungus culture collection.

Goals for 1982-83: (cont'd)

4. Cooperate with Dr. W.A. Ayer (Dept. of Chemistry, U. of A.) on biologically active metabolites of selected forest disease pathogens.
5. Cooperate with Dr. S. Takai (GLFRC) on DED research and prepare two mss for publication.
6. Supervise the thesis research of a Ph.D. candidate in forest pathology on Armillaria root rot of young coniferous forests.

12. Publications:

Up to 1980:

Journal articles: 3
 Information reports, notes, etc.: 6
 File reports: Nil

1981-82:

Journal articles:

Hughes, S. J. and Y. Hiratsuka. 1981. *Capnobotrys sessilispora*
 Fungi Canadensis No. 201: 1-2.

Information reports, notes, etc.:

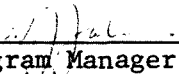
Hiratsuka, Y. and S. Takai. 1981. Scanning electron micrographs of cerato-ulmin and *Ceratocystis ulmi* induced vascular symptoms in elm. Symposium and Workshop on Dutch elm disease, Winnipeg, Manitoba. p. 24.

Takai, S. J. Kryweincyk, Y. Hiratsuka, W. C. Richards and B. A. Mathieson. 1981. Cerato-ulmin, the Dutch elm disease toxin. Poster Session, IUFRO World Congress, Kyoto, Japan.

Hiratsuka, Y. 1981. Conifer seed pathology. In: R. Huber (ed.) High quality collection and production of conifer seeds. Northern Forest Research Centre, Information Report NOR-X-235 p. 62-63.

13. Signatures:

 Investigator


 Program Manager


 Director

A. D. Kiil

NOR-53

Computer and Biometric Services

1982 - 83

Date: January 13, 1982 .

1. Project: Computer and biometric services
2. Title: Biometric and data analysis services
3. New: Cont.: X 4. No.: NOR-53-175
5. Study Leader: T. Singh
6. Key Words: Forest management, alternatives, simulation models,
 systems analysis, forest statistics, forest renewal,
 forest depletion.
7. Location of work: Western and Northern Region
8. Study Objectives:
 1. To test and evaluate the applicability of selected simulation
models and data systems in support of resource management
activities in the Western and Northern Region.
 2. To provide advice and assistance to forest researchers and
managers on biometrics and numerical analysis, and on related
computer programs and computations.
9. Goals for 1981-82:
 1. Publish paper "Comparison of correction methods for the bias
due to the logarithmic transformation in the estimation of
biomass", to Canadian Journal of Forestry Research.
 2. Provide advice and assistance to the scientists and technicians
of NoFRC, and client agencies, on biometrics, including improved
prediction models in forestry.
 3. Estimate rates of spread and line productivity rates for various
fuel types for use in the elliptical fire growth model.
 4. Participate in the evaluation, calibration and demonstration (if
required) of the FREP and CSGS tree and stand growth simulators.

9. Goals for 1981-82: (cont'd)

5. Participate in the development and operation of an economic data base and the regional Forest Resource Data System.
6. Complete analysis of aerial observer report summaries (1976-80) provided by the Alberta Forest Service (integrate with study NOR-5-174; goal 7).
7. Investigate the theoretical foundation of the line intersect method using existent data provided by DTRR and other sources (integrate with study NOR-22-187).

Added Goals:

8. Prepare text for presentation of a paper on time series modelling at the FAO and IUFRO joint meeting to be held at Grenoble, France, June 1-7, 1981.
9. Goal 4 transferred from Study NOR-30-183: Complete and publish manuscripts from previous review period if time permits.

10. Accomplishments in 1981-82:

1. The paper was written and submitted to a journal; it came back for revisions which have now been completed and the paper is being resubmitted.
2. Advice and assistance was provided to the NoFRC staff, and other agencies, as follows:
 - Y.P. Kalra and I.K. Edwards. Advice on statistical evaluation of extrants for the determination of available Mn in forest nursery soils.
 - J. Klein. Advice on statistical significance tests to be used in cubic lattice design.
 - J. Ball. Advice on evaluation of the performance of various planting stock in the field.
 - W. Baker. Reforestation and Reclamation Branch, Alberta Energy and Natural Resources. Advice on statistical aspects of the Tree Breeding Program of Alberta Forest Service.
 - W. Koch. Forestry Branch, Department of Tourism and Natural Resources, Saskatchewan. Advice on the information needed for adapting the Timber Resources Economic Estimation Model of Oregon State University to Saskatchewan forests.
 - M. Campbell. Air Standards Branch, Winnipeg. Advice on use of biomass information on prairie trees as currently available from NoFRC.
 - R.G. Newstead. Programming and program modifications to fire growth and containment routines now operational on TI-59, Tektronix 4051, PDP 11/60. Canadian Fire Weather Index System programmed on TI-59. Modification of associated FORTRAN programs on PDP 11/60.

10. Accomplishments in 1981-82: (cont'd)

- W. Ondro. Assistance and advice on computer file structure for the Alberta survey data, including summarizing programs.
- 3. Not undertaken because of non-availability of data.
- 4. No real involvement needed; Harjit Grewal has full-time involvement in this simulation modelling work.
- 5. Advice and assistance given on the Alberta survey data, primarily on summary programs and computer file structure.
- 6. Only preliminary work was done because of the resignation of Chi Lee from NoFRC during July, 1981.
- 7. Not undertaken because of resignation of Chi Lee.
- 8. A paper entitled "Time series analysis of hydrolic data from a mountain catchment in Rocky Mountains of Alberta, Canada" was prepared and presented at the joint meeting of FAO and IUFRO (subject group Sl.04-00) held in Grenoble, France, Juen 1-7, 1981.
- 9. (a) An information report entitled "A proposed method for preliminary assessment of erosion hazards in the forests of west-central Alberta" has been reviewed and is now with the Editor.

(b) A preliminary draft entitled "Predicting yields of geo-chemical constituents in the natural waters of a sub-alpine system in Alberta, Canada" was prepared and has received first review. Revised draft will now be prepared following the receipt of clarification on some comments offered in the preliminary review.

(c) A paper entitled "Time series modelling of runoff from a forest catchment in Alberta, Canada" was prepared and presented at the International Symposium on rainfall-runoff modelling held in Mississippi during May 18-21, 1981.

(d) A manuscript and poster session presentation entitled "Effects of progressive clear-cutting on export of nutrients from forest lands" has been prepared for the 12th International Congress of Soil Science being held in New Delhi during Febraury 1982.

11. Goals for 1982-83:

- 1. Provide assistance in developing and testing models for the various resource research programs; e.g. growth models, fire models, other models.

11. Goals for 1982-83: (cont'd)

2. Provide assistance on biometrics and other statistical and numerical computation tasks.
3. Prepare a Forest Management Note on the recently developed computer programs (PDP 11/60) for determining the biomass of tree components from the field and sub-sampling data.
4. Preliminary investigation of linear programming as an optimization technique for allocation of forestry resources.
5. Continue development, testing and documentation of computer programs for statistical and numerical analyses, and plotting subroutines, to aid statistical and simulation modelling.
6. Initiate assessment of the line intersect method and its applicability and performance in specific vegetation types.
7. Publish report on estimating erosion hazards in the forests of west-central Alberta.
8. Publish report on predicting the yields of geochemical constituents in the natural waters of a sub-alpine system in Alberta, Canada.

12. Signatures:

Investigator

Program Manager

Director

STUDY STATEMENT

1982 - 83

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 18, 1982

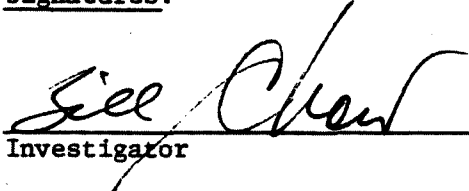
1. Project: Computer and biometric services
2. Title: Computing and data processing services
3. New: Cont.: X 4. No.: NOR-53-4804
5. Study Leader: W. Chow
6. Key Words: Computer, data precessing, programming, system analysis,
simulation modelling
7. Location of Work: Edmonton
8. Study Objectives:
 1. To provide an up-to-date computer service, including data processing, programming, system analysis, and simulation modelling, to NoFRC research staff and administrative personnel.
9. Goals for 1981-82:

N/A study previously accounted for under Administration and therefore the service provided was not subjected to the annual review process.
10. Accomplishments for 1981-82:

See 9 above
11. Goals for 1982-83:
 1. Provide consulting in all aspects of data processing, including system analysis, statistics, programming and simulation modelling (4804)
 2. Provide in-house courses for potential users of computer services.

11. Goals for 1982-83: (cont'd)

3. Test, adapt, or write programs and systems as required for research data analysis including tree growth and fire growth models.
4. Participate in the adaptation of the AFMAS accounting system at NoFRC (4804)
5. Install and test HP 1000 mini-computer for image analysis and interface with PDP 11/60 (4804)
6. Provide keypunch and data entry service, back up and restore facilities as required by various projects (4804)
7. Assist in the interpretation of the ion analysis floppy disk output by reading data in machine language (NOR 7); assist in the interpretation of the paper tape output for project NOR 4 (4804)
8. Install, test, and evaluate the TEKTRONIX PLOT 10 features for possible purchase. Evaluate a multi-color pen option for our current TEKTRONIX plotter. (4804)
9. Develop contour and general X-4 plotting systems for the TEKTRONIX computer. (4804)

12. Signatures:
Investigator
Program Manager
Director

A.D. Kill