STUDY STATEMENTS

1983-84

NORTHERN FOREST RESEARCH CENTRE

CANADIAN FORESTRY SERVICE

APRIL 1983

I N D E X

NOR-1 Detection and Appraisal of Tree Pests and Vegetation Disturbances

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 14, 1982

1. Project: Detection and appraisal of tree pests and vegetation disturbances

2. Title: Forest insect and disease survey

3. New: Cont.: X 4. No.: NOR-1-033

5. Study Leader: B. Moody and H. Cerezke

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 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 Region).

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.

10. Accomplishments in 1982-83:

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. Airtime for surveys is largely provided by outside agencies.

2. Many special surveys for particular pests or of designated areas were conducted. Examples are as follows:

   a. Special surveys were conducted of mountain pine in southern Alberta and several national parks in cooperation with study NOR-1-143.

   b. Scleroderris canker detection survey was conducted in Manitoba with Dr. Y. Hiratsuka, but the disease was not found.

   c. Conducted field experiments to test spruce budworm pheromones in two types of traps for use in monitoring budworm populations. This was in cooperation with Dr. Sanders (CFS, GLFRC).

   d. Elm bark beetle surveys were conducted with Alberta Agriculture but beetles were not detected in Alberta.

e. Special pests surveys were conducted in three forest nurseries, white spruce plantations and jack pine seed orchard in Saskatchewan and pine plantations in Manitoba.

3. Compiled and published information report on the forest pest situations in the region for 1981 and made predictions for 1982. Draft copy of the report was sent to Ottawa for FIDS national report.

4. Pest extension services were provided and about 1500 inquiries were processed. Information booths on tree pests were displayed to the general public, on numerous occasions, and pest leaflets and other material were distributed.

   a. Workshops, lectures, and talks on forest pests were presented on 20 occasions, e.g. to Parks Canada staff, courses sponsored by Alberta Agriculture, staff of tree nurseries, AFS staff, Parks and Recreation, etc.

   b. Pest Leaflets on Western gall rust and Silver-leaf are under review.

5. Represented NoFRC and CFS on various committees and advisory groups:

   a. Representation and report prepared for the Alberta Pest Control Advisory Council.

   b. Representation and three reports prepared for the Forest Pest Control Forum (Ottawa).

   c. Also provided representation and reports for:

      - Saskatchewan Advisory Council - Plant Disease (Saskatoon)

      - Saskatchewan Advisory Council - Insect Control (Saskatoon)

      - D.E.D. Advisory Council - Saskatchewan (Regina)

      - Alberta Horticultural Environment Subcommittee (Edmonton)

      - Alberta Extension Horticultural Committee (Red Deer)

6. Annual interagency FIDS review and planning meeting was conducted at NoFRC with representations from three prairie provinces, the Northwest Territories and Parks Canada.

7. Survey methodology from other regions have been analyzed and a start was made toward producing the first draft for major pests.

8. Completed map of major aspen and balsam poplar distribution in Alberta. Collaborated with study NOR-22-188 and completed study to determine the applicability of multidate Landsat data for the areal assessment of aspen defoliation. A draft of a proposed joint (Hall and Still) report was written.

9. Conducted road and plot surveys to detect and map intensity of dwarf mistletoe infection in jack pine stands in the Nisbet and Fort à la Corne Provincial Forest, Saskatchewan.

11. Goals for 1983-84:

1. Survey, map and report on major forests pests of the region, i.e. mountain pine beetle, spruce bark 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 1982 and make predictions for 1983. Draft copy of the report will be sent to FIDS coordinator in Ottawa for national compilations.

4. Provide pest extension service and technology transfer 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 Region).

7. Publish Forestry Report on FIDS.

8. Publish Forest Management Notes on forest pest conditions and forecast for each of the prairie provinces and the NWT.

9. Collaborate with project NOR-35 for diagnostic and taxonomic service of tree and shrub diseases and the upkeep of the Mycological Herbarium.

10. Work towards the production of the first draft of a standard survey methodology manual suitable for the region.

11. Continue dwarf mistletoe surveys and report on provincial forests surveyed.

12. Assess operational use of satellite imagery to delineate areas of severe defoliation by forest tent caterpillar and other aspen-poplar defoliators.

13. Collaborate with Bill Ives and Herb Cerezke and provide assistance with photography for the illustrated report on the "Common forest insects of the Region".

12. Publications 1982-83:

Information Reports, Notes etc.

Hiratsuka, Y. and J. Petty. 1981. Important forest insects and diseases. Prairie Region. In: Forest Insect and Disease Annual Report 1977. Environ. Can., Can. For. Serv. Ottawa.

Hiratsuka, Y., H.F. Cerezke, B.H. Moody, J. Petty, and G.N. Still. 1982. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba and the Northwest Territories in 1981 and predictions for 1982. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-239.

Hiratsuka, Y., H.F. Cerezke, B.H. Moody, J. Petty, and G.N. Still. 1982. Contribution In: Forest Insect and Disease Condition in Canada 1981. Compiled by T.E. Sterner and A.G. Davidson. Environ. Can., Can. For. Serv. Ottawa.

Still, G.N. 1982. 1982 forecast for the forest tent caterpillar in the prairie provinces. Forest Management Note 13.

File Reports

Grandmaison, M. 1982. Trembling aspen defoliation in Alberta during 1982 and predictions for 1983. File Report.

Grandmaison, M. 1982. Forest tent caterpillar (*Malacosoma disstria* Hbn.) post hatch survey for Alberta, 1982. File Report.

Grandmaison, M. 1982. Forest insect and disease history in Wood Buffalo and Nahanni national parks. File Report.

Still, G.N. and M. Grandmaison. 1982. Forest insect and disease conditions in Nahanni and Wood Buffalo national parks, 1982. File Report.

Still, G.N. and M. Grandmaison. 1982. Forest insect and disease conditions in the Northwest Territories, 1982. File Report.

Petty, J. and M. Grandmaison. 1982. Forest insect and disease survey, Elk Island National Park. To be part of a National Park survey report.

Petty, J., M. Grandmaison, and B. Moody. 1982. Insect and disease conditions in Waterton, Banff, Jasper, Kootenay, Yoho and Elk Island national parks, 1981. File Report.

Still, G.N. 1982. A post-hatch assessment of overwinter survival of the forest tent caterpillar in Saskatchewan (81-82). File Report.

Still, G.N. and B.H. Moody. 1982. Spruce and jack pine budworms in Saskatchewan 1982 and forecast for 1983. File Report.

Still, G.N. 1982. Trembling aspen defoliation in Saskatchewan 1982 and forecast for 1983. File Report.

Tidsbury, C. 1982. Spruce budworm infestations in Manitoba 1982 and forecasts in 1983. File Report.

Tidsbury, C. 1982. Forest tent caterpillar infestations in Manitoba 1982 and defoliation forecasts for 1983. File Report.

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

Emond, F.J. 1982. Tree pest extension report 1982. File Report.

Moody, B.H. 1982. Status of major forest insects and diseases in the prairie provinces and the NWT, 1981-82. Contribution to report to working group on forest insect and diseases, North American Forestry Commission, October 1982.

Moody, B.H. 1982. Highlights of forest insect and disease research in the prairie region. Contribution to the Canadian report to the North American Forestry Commission, October 1982.

Moody, B.H. 1982. Report to the 26th Annual Meeting of the Alberta Pest Control Advisory Committee.

Moody, B.H. 1982. Report on the mountain pine beetle in the prairie provinces. Report prepared for the 10th Annual Forest Pest Control Forum, Ottawa.

Moody, B.H. 1982. Report on the spruce budworm in the prairie provinces. Report prepared for the 10th Annual Forest Pest Control Forum, Ottawa.

Moody, B.H. 1982. Report on the status and control of other pests in the prairie provinces and NWT. Report prepared for the 10th Annual Forest Pest Control Forum, Ottawa.

13. Signatures:

B.H. Moody
Investigator

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 10, 1983

1. Project: Detection and appraisal of tree pests

2. Title: Sawfly systematics

3. New: Cont.: X 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 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.

10. Accomplishments in 1982-83:

1. a. Identified over 400 larval and adult sawflies for the Forest Insect and Disease Survey of the Northern Forest Research Centre, Canadian National Collection, regional clients, in-service personnel and the Ohio State University, Columbus, Ohio.

   b. Reviewed two sawfly manuscripts submitted to the Proc. Ent. Soc. Washington for publication, and one local Information Report.

   c. The introduced pine sawfly was detected for the first time in the Canadian prairies. It was collected in southeastern Manitoba on Scots pine.

   d. The European spruce sawfly has extended its range in 1982 to near Winnipeg. It was first collected in southeastern Manitoba in 1969.

2. The following morphological characters of the six genera of Diprionidae have been illustrated:

   a. lateral view of head and thorax

   b. frontal view of head

   c. lateral view of third abdominal segment

   d. left and right mandibles

   e. antennae

   f. mouth parts

3. Information Report on the birch leaf miners in Alberta has been written and reviewed by the editorial board.

4. Updated the synoptic catalog of the described species of *Pristiphora* of the world.

11. Goals for 1983-84:

1. Identify sawflies for research personnel, institutions, and laboratories.

2. Draft a paper on the larvae of the North American genera of Diprionidae (Hymenoptera, Symphyta).

3. Prepare a Forest Management Note on the introduced pine sawfly in Manitoba.

4. Collaborate with J.A. Drouin in completing the revision of the Information Report on the seasonal development and chemical control of the birch leaf miner in Alberta.

5. Identify fossil sawfly about 30 000 B.P. for the Department of the Army, U.S. Army Cold Regions Research and Engineering Laboratory, Alaskan Project Office, Fort Wainright, Alaska.

6. When time permits, redescribe the known species of *Pristiphora* in North America for use in the study of this genus.

12. Publications 1982-83:

Nil.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 10, 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, parks, plantations, seed orchards, tree nurseries, pesticides, integrated control, growth losses, damage impact, population monitoring, sampling methodology, pheromones, mountain pine beetle, woodborers, spruce budworm, jack pine budworm, seed and cone insects, regeneration pests.

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 develop information on specific insect problems of the region with respect to distribution, abundance, hazard, damage impact, and control and to report this information to various client agencies and to the scientific community.

9. 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 Interagency 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.

10. Accomplishments in 1982:

1. Provided lead role at NoFRC with FIDS (NOR-1-033) in coordination of Mountain Pine Beetle survey, monitoring, infestation spread and population trend evaluation within the region.

(a) Provided coordination with FIDS staff on biological assessment of MPB in Alberta, Saskatchewan and Rocky Mt. National Parks, and much of the survey functions related to aerial-ground surveys and mapping. Cooperation on these functions was provided with Alberta Forest Service, Parks Canada and Provincial Parks personnel.

(b) Established guidelines for aerial-ground surveys to standardize reporting of results with that of PFRC on MPB.

(i) In cooperation with FIDS staff, data were obtained for preparing a map detailing areas of 1981-MPB tree mortality. Estimated tree kill (1981) in Bow-Crow Forest was 576,000 stems or about 190,160 m^3.

(ii) Conducted surveys with FIDS for overwinter MPB brood mortality. File report prepared summarizing the results.

(iii) Conducted a follow-up spring larval survival study with FIDS in several areas; conveyed results to agencies concerned.

(iv) Obtained low-level aerial photography over a major portion of MPB outbreak in Kootenay Nat'l. Park (jointly funded by PC and NoFRC) to assess current infestations. Established and monitored a series of ground plots in K.N.P. for ground truthing and aerial photo interpretation. Based upon aerial photographs and ground plots estimated numbers of trees killed in the photographed area are: pre-1981 - 2034 trees; 1981 - 2833 trees and 1982 - 830 trees. With FIDS assistance, derived the following estimates of 1981 tree mortality within the parks:

Kootenay N. P.	3400 stems
Yoho N.P.	710 stems
Banff N.P.	7 stems (9-1982)
Cypress Hills (Alta. & Sask.)	300 stems
Kananaskis P.P.	few (>30-1982)

Provided aerial photos to Parks Canada to assist in their 1982-83 control strategy.

(c) Provided a training session (with J. Petty - FIDS) to Warden staff in Jasper N.P. Provided on-site training to AFS control crew to recognize successfully attacked trees.

(d) Assisted AFS in preparation of MPB brochure; provided literature search and report to AFS on merits of biological control studies using *Medetera* predator; identified several bark beetle samples; answered a variety of correspondence on MPB.

(e) Represented NoFRC on MPB Technical Committee to review aspects of current problems in western Canada; attended three meetings in 1982 with representatives from AFS, P.C., B.C.F.S. and PFRC.

(f) Provided input as requested into Can./U.S. Agreement on MPB, now in final draft stage.

(g) Attended and presented technical information on MPB at two meetings scheduled by Alberta Environment Conservation Authority to review aspects of the current outbreak in Alberta, control and salvage operations and concerns of non-forestry groups.

(h) Completed a rearing experiment to provide additional data on MPB susceptibility to jack pine host, using logs from Prince Albert and Lac La Biche. Data not yet analyzed.

(i) Conducted two field experiments to test the application of MPB aggregation pheromones; one experiment in cooperation with Dr. J. Borden (Simon Fraser Univ.) and Alta. Parks in Cypress Hills Prov. Park, and one experiment in Bow-Crow Forest in cooperation with Drs. H. Wieser and E. Dixon (Univ. of Calgary). First experiment demonstrated considerable potential for baited-tree method of pheromone application for detection, a means of concentrating beetles and for integrated control. Second experiment compared the attraction of various analogs of one of the pheromone components baited in "Lingren" funnel traps. Data tally and collection are complete but analysis is still incomplete.

2. Reports listed as (a), (b) and (c) were note finalized. Some revisions were made on report (c), and data from report (a) were utilized in report 4(c) below.

3. (a) CFS-NoFRC representation was provided at Western Committee on Crop Pests and Western Forum for annual pest and pesticide review. Two reports were prepared for updating control recommendations for 1983 (e.g. on "Shelterbelts, Ornamental Trees and Shrubs" and "Seasoned Wood and Timber Structures").

   (b) Report prepared for annual review pest conditions, Saskatchewan Advisory Council on Insect Control.

   (c) Representation and report prepared for annual review of Environmental Sub-committee of Alta. Horticultural Advisory Committee.

4. Additional Accomplishments, 1982

   (a) Participated as one of five panel speakers at an informational meeting on forest tent caterpillar to acreage owners near Edmonton.

   (b) Provided examinations for FIDS of forest tent caterpillar egg bands to determine causes of non-hatch and larval mortality.

   (c) Gave a presentation at Saskatchewan's Forest Congress, 1982, on the topic "Insects and Diseases: Present status and what must be done to meet Saskatchewan's potential". Presentation to be published in a Proceedings. Talk included slide illustrations of Saskatchewan's major and minor pests, data on damage impact and recommendations to help meet Saskatchewan's potential in forest management and productivity.

   (d) Assessed an ant-tourist problem in Danielson Provincial Park, Sask., and prepared a report suggesting solutions.

   (e) Examined a woodborer problem at request of Canfor Ltd., Grande Prairie; identified causal insects and provided a report to Co. Forester with management recommendations.

   (f) Provided lecture and field guide on forest insects to U. of A. forestry students during spring camp at Hinton.

   (g) Added some new slides and reference material toward preparation of the publication "Common Forest Insects of the Prairies Region". Sorted and selected slides in preparation for cooperative undertaking with W.G.H. Ives.

   (h) Provided advice and technology transfer on a variety of insect related problems (e.g., root collar weevil, woodborers, terminal weevils, shelterbelt pests, forest tent caterpillar, pesticides, nursery pests).

11. Goals for 1983:

1. Continue role in assessment of MPB within the region as in 1982 with FIDS cooperation:

   (a) Continue representation on MPB Tech. Committee as required.

   (b) Provide input into Can./U.S. MPB Action Plan as requested.

2. Prepare reports of the two pheromone experiments jointly with cooperating persons after data analysis complete.

3. Prepare a report on MPB rearing experiment when data analysis complete.

4. Contribute to preparation of FIDS Ann. Inf. Rep. (Regional) on MPB Story and for National FIDS "Grey Report".

5. Finalize reports as listed under 2(a), (b) and (c).

6. Provide representation at provincial and regional committees as in previous years.

7. Cooperate with W. Ives (Study NOR-9-181) toward preparing a preliminary draft of "Common Forest Insects of the Region".

12. Publications 1982:

Hiratsuka, Y., H. F. Cerezke, B. H. Moody, J. Petty, and G. N. Still. 1982. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1981 and predictions for 1982. Environ. Can. Inf. Rep. NOR-X-239: 11 p.

Anon. 1982. A review of mountain pine beetle problems in Canada. p. 9-10. Environ. Can., PFRC, Apr. 1982.

Cerezke, H. F. 1982. Insects and diseases: present status and what must be done to meet Saskatchewan's potential. To be published in Proc. Saskatchewan Forest Congress, 1982. Typed manuscript 24 p.

Unpubl. Reports

Cerezke, H. F. 1982. Mountain pine beetle winter survival studies, Alberta and Kootenay National Park, 1982. File Rep. NOR-143: 8 p.

Cerezke, H. F. 1982. Report on log deck examinations, Canadian For Ind., Grande Prairie. 3 p.

Cerezke, H. F. 1982. Report on ant problem in Danielson Prov. Park, Sask., 2 p.

Cerezke, H. F. 1982. Report to the 18th Ann. Meeting of the Saskatchewan Advisory Council. 3 p.

Cerezke, H. F. 1982. Report to the Environmental Subcommittee of the Alberta Horticultural Advisory Committee, 7 pp.

Cerezke, H. F. 1982. *Medetera aldrichi* (Diptera: Delichopodidae)--a predatory insect of the mountain pine beetle, 3 pp.

Cerezke, H. F., J. Drouin and B. B. Neill. 1982. Revised chapter in WCCP report on insect control in "Shelterbelt, Ornamental Trees and Shrubs" 18 p.

Cerezke, H. F. and J. Drouin. 1982. Revised chapter in WCCP report on insect control in "Seasoned Wood and Timber Structures", 3 p.

13. Signatures:

H Cerezke
Investigator

Program Manager

Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 14, 1982

1. Project: Detection and appraisal of tree pests and vegetation disturbances
2. Title: Forest insect diagnostic and biosystematic 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 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 2850 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.

10. Accomplishments in 1982-83:

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. Over one hundred and forty specimens determined by specialists in Ottawa and by myself have been incorporated into the insect reference collection.

   b. Nearly four hundred immature insects were reared and about one hundred and twenty overwintered to obtain biological information and specimens for the reference collection.

   c. Over two hundred specimens were pinned, spread, labelled or preserved for the reference or store collection.

3. Biological information and/or specimens were provided to the following:

   Dr. D. Dang, Biosystematic Research Institute, Ottawa, Ontario
   Mr. H. Copland, Man. Mus. of Man and Nature, Winnipeg, Manitoba
   Mr. J. Maxwell, Surrey Nursery, Surrey, B.C.
   Mr. C. Crichton, 203 - 120 Silver Cr., Calgary, Alberta
   Miss B. Beaven, Man. Forestry Ass., Winnipeg, Manitoba

4. Instructed Yvonne Beaubien, Manitoba Dept. of Natural Resources, on the identification and curating of insects for three weeks in the latter part of January and early February.

5. Instructed Bert Bailey, National Research Council, Saskatoon, Sask., on how to identify species of *Proteoteras* for one week in early February.

6. Four hundred and forty insects were prepared and sent to the Manitoba Forestry Association Inc. for display in their new museum at Hadashville, Manitoba.

7. Approximately 2850 insects were identified for the Forest Technology School, Hinton, Alberta.

8. Paper on the identification of *Proteoteras* in the Canadian prairies was submitted to the Canadian Entomologist for publication.

9. A file report on the insect pests of saskatoon and chokecherry in Alberta and their control has been prepared.

10. A Forest Management Note on some insect pests of forest tree nurseries in the Canadian prairies has been published.

11. Goals for 1983-84:

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. Identify approximately three hundred and fifty insects for the Forest Technology School, Hinton, Alberta.

5. Determine the spread of introduced insects in the Canadian prairies.

6. Collect and determine the more common insects of young trees in plantations and scarified areas at Hinton, Alberta.

7. Collaborate with Bill Ives and Herb Cerezke in the preparation of an illustrated report of the common forest insects of the region.

8. Revision of the introduction, and republication of the "Common insect and mite galls of the Canadian prairies", Information Report NOR-X-196.

12. Publications 1982-83:

Drouin, J.A. and H.R. Wong. 1982. Insects attacking the fruits of saskatoon and chokecherry in Alberta and their chemical control. File Report. February.

Wong, H.R. 1982. Some insect pests of forest tree nurseries in the Canadian prairies. Forest Management Note 15.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 14, 1982

1. Project: Detection and appraisal of tree pests and vegetative disturbances

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 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.

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.

10. Accomplishments for 1982-83:

1. Tree condition was re-assessed in 37 impact plots for damage by the mountain pine beetle in pine stands in the national parks. Additional plots were established in lodgepole pine stands in Waterton Lakes National Park and Kootenay National Park. A report is being prepared. Data have been transfered to computer tape and a program written to calculate volume of live trees and beetle-killed trees.

2. The preparation of a first draft of a literature review on the effects of major forest pests on tree mortality and growth in the forests of the region is in progress. Changes have been made in initial outline to include estimates of pest-caused depletion losses from 1977-80.

3. Current defoliation and tree mortality of white spruce and balsam fir were recorded for the second year, in spruce budworm impact plots in Manitoba. Previously spruce budworm infested white spruce stands sampled in 1959-69 for budworm egg-masses and defoliation estimates were relocated in Manitoba. Four areas that had several years of severe defoliation and two areas that suffered only light defoliation were relocated. Samples of increment cores from three trees in each of the six areas, and discs from three felled trees were taken for growth impact studies. Ten impact plots (prism) were established in dwarf mistletoe-infected stands in the Nisbet and Fort à la Corne provincial forests, Saskatchewan.

4. Remote sensing techniques to assess pest damage were demonstrated by staff at Petawawa at the annual FIDS Head meeting and detail reports circulated. Supported trials on the applicability of multidate Landsat data for areal assessment of aspen defoliation with NOR-22.

5. Informal meetings held with forestry personnel in Alberta, Manitoba and Saskatchewan to discuss pest-caused damage appraisals in provincial high-value forests.

11. Goals for 1983-84:

1. Re-assess impact plots and assess damage by the mountain pine beetle in Waterton Lakes, Yoho, and Kootenay national parks. Analyze three years data and prepare a report.

2. Complete first draft of a literature review on the effects of major forest pests on tree mortality and growth in forests of the region, including estimates of depletion losses for 1977-80.

3. Assess and record spruce budworm damage in impact plots established in 1981 in Manitoba. Record annual measurements of impact of dwarf mistletoe on jack pine in Saskatchewan and establish additional plots if required.

4. Continue to investigate the use of remote sensing techniques as a tool to assess pest-caused damage to the forests.

5. Continue to develop effective working relationships with officials of provincial and industrial forest resource management agencies.

12. Publications 1982-83:

Moody, B.H. 1982. The role, informational requirements and pest problems of the forest insect and disease survey. In: Hall, R.J. (compiler). Uses of remote sensing in forest pest damage appraisal. Proceedings of a seminar held May 8, 1981. Inf. Rep. NOR-X-238.

13. Signatures:

B.H. Moody
Investigator

Program Manager

Director A.D. Kiil

NOR-3 Resource Opportunities and Policy Guidelines

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 8, 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, Fort Smith

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 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, 1979/80".

   3. Prepare an Information Report on the "Forest Industry in the Economy of Saskatchewan, 1979/80".

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 Dika 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.

Goals Added:

12. Prepare a computer Regional Economic Data System.

13. Jointly prepare (with A. D. Kiil) paper "Saskatchewan's Forest Industry: Present Status and Future Opportunities for Research and Development". P.A. June 1-3, 1982.

14. Prepare Regional Economic Profiles for Forestry Sector in Alberta, Saskatchewan and Manitoba.

10. Accomplishments for 1982-83:

1. Information Report on the "Forest Industry in the Economy of Alberta, 1978/79" is with the editor.

2. Information Report on the "Forest Industry in the Economy of Manitoba, 1979/80" was prepared.

3. Information Report on the "Forest Industry in the Economy of Saskatchewan, 1979/80" was prepared and reviewed.

4. Forestry Report (Forestry Facts) for Alberta and Saskatchewan were published and for Manitoba prepared.

5. Information Report on the "Capacity of Forest Industry and Demand for Forest Products in N.W.T." is being prepared at present. The report includes Directory of wood-using industry.

6. A follow-up report "Availability and Utilization of Mill Residues in Alberta" not prepared yet due to other priorities.

7. Forest Management Note "Harvesting of Aspen Biomass by Dika Side Side Cutter" is with the editor ready for publication ENFOR.

8. Thesis on the "Production Functions in the Forest Industry in Alberta" is being prepared.

9. Contract Information Report on the "Return on Investment in Sawmill Industry" prepared, and reviewed.

10. Economic expertise and data provided in support of concept papers, government submissions and long-term economic and forestry plans in the Prairie Provinces on request.

11. Subject areas, needs and scope for economic analysis on the economic effects of intensive forest management were identified.

Added Accomplishments

12. Computer Regional Economic Data System was prepared and is being put into operation.

13. Paper "Saskatchewan's Forest Industry: Present Status and Future Opportunities for Research and Development" was prepared jointly with A. D. Kiil.

14. Regional Economic Profiles for Forestry Sector in Alberta, Saskatchewan and Manitoba were prepared upon request from HQ.

12. Goals for 1983-84:

1. Publish Information Report "Forest Industry in the Economy of Saskatchewan, 1979-80".

2. Publish Information Report" Forest Industry in the Economy of Manitoba, 1979-80".

3. Publish Information Report "Capacity of Forest Industry and Demand for Forest Products in the N.W.T., 1981".

4. Publish Forestry Report "Manitoba Forestry Facts".

5. Publish Information Report "Availability and Utilization of Mill Residues in Alberta".

6. Publish Forest Management Note "Harvesting of Forest Biomass by Dika Side Cutter".

7. Publish Information Report "Economic Returns in Sawmill Industry in Alberta".

8. Initiate study "Guidelines for benefit/cost analysis; factors to consider when assessing forestry program in forestry development agreements".

9. Continue to provide economic data for national statistics program. Update and maintain regional economic data system.

10. Continue to provide economic expertise and conduct feasibility studies to ensure effective implementation of subsidiary agreements in the Prairie Provinces as required.

11. Continue to identify subject areas for economic analysis in intensive forest management.

12. Complete requirements for M.Sc.F. degree, including acceptance of the thesis.

12. Publications:

Up to 1982-83:

Information Resports - 1

Forestry Report article contributions - 2

1982-83:

Ondro, W. J. and T. B. Williamson. The forest industry in the economy of Alberta, 1978/79. Infor. Report NOR-X-246.

Ondro, W. J., T. B. Williamson, R. A. Bohning, J. P. DeFranceschi and H. M. Stewart. Alberta forestry facts. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta.

Ondro, W. J., T. B. Williamson, R. A. Bohning, J. P. DeFranceschi and H. M. Stewart. Saskatchewan forestry facts. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Rep. 26.

Kiil, A. D. and W. J. Ondro. 1982. Saskatchewan Forest Industry: Present status and Future Opportunities for Research and Development. Proceedings from Sask. For. Congress, Prince Albert, June 1-3, 1982.

13. Signatures:

Investigator

Program Manager

Investigator

Director A. D. Kiil

NOR-4 Yields of Managed Stands

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 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-4-45

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, lodgepole pine and jack pine, 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 planted: 4 X 4, 6 X 6, 8 X 8, and 10 X 10 feet; 49 trees (7 X 7 matrix) per plot with a surround of two rows. Each spacing was replicated four times. Trials established for the three species were:

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

Pinus banksiana and *P. resinosa* - Sandilands Forest Reserve on fresh sand.

Alberta:

P. contorta var. *latifolia* - 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 on 3 site types.

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

Tepee Pole Creek: 25-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. 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.

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: (see also summary table):

   Plots were established; seedlings planted in Manitoba; in Alberta, dense fire-origin stands were thinned to the required spacing following a prescribed procedure. Trees were measured and remeasured as required. Interim results have been published as became available.

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.

11. 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 seizmic 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 lP following logging and scarification in the Edson Forest compared to burned-over areas.

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.

Added goal:

7. Publish a note on response to commercial thinning mature lP.

12. Accomplishments in 1982-83:

1. Tepee Pole Creek spacing study was remeasured and the analysis of data - excluding current measurement - is completed and a report published.

2. The analysis of the seismic-line growth response study has been completed and a final report submitted to the Forest Research Branch, AFS.

3. Some preliminary planning has been done on a study to determine the cause and duration of accelerated early growth of lodgepole pine logging and scarification in the Edson Forest.

4. The measurement of aspen thinning studies in Turtle and Riding Mtns., Man., has been completed; that at Pelly, Sask., and the precommercial thinning study in jack pine in S.E. Manitoba has been rescheduled for the spring of 1983.

5. Report on the "Influence of stand edge on the performance of white spruce and lodgepole pine seedlings" is in the final review stage.

6. Contributed a paper on regeneration stocking - density relationships at the symposium "Regeneration in Northern Latitudes" August 16-19, 1982, Hinton, Alberta.

7. A note on response to commercial thinning mature lP was published.

13. Goals for 1983-84:

1. Direct (Bella) the remeasurement (Kolabinski) of precommercial thinning (Study 2-jP) and a commercial thinning (Study 3-jP) in jack pine stands in southeastern Manitoba to assess growth and yield 30 years and 25 years after treatment, respectively, (NOR-4-45, Bella, Kolabinski)

2. Direct (Bella) the remeasurement (Kolabinski) of precommercial thinning (Study 2-tA) in aspen stands near Pelly, Saskatchewan to assess growth and yield 30 years after treatment (NOR-4-45, Bella)

3. Complete the analysis and publish a Forest Management Note on the spacing study in lodgepole pine at Tepee Pole Creek, Alberta. Growth and yield 15 years following treatment will be reported (NOR-4-45, Bella)

4. Contribute to the organization of the annual meeting of the Canadian Poplar Council. As part of this contribution, relocate and measure, if feasible, a study at Hudson's Bay, Saskatchewan on the effect of logging practices on the development of new aspen stands (NOR-4-45, Bella)

5. Publish a Forest Management Note on tree growth response to line (seismic) openings in forest stands of west-central Alberta (NOR-4-45, Bella)

6. Coordinate the publication of a Forestry Report on "Growth, Yield and ENFOR" (NOR-4-45, Bella)

7. Plan and direct (Bella) a survey (Lux) to determine the incidence of damage (insect, disease, and small mammal(s)) that leads to mortality in thinned juvenile stands of lodgepole pine as a basis for deriving some general spacing guides for this species (NOR-4-45, Bella, Lux)

8. Explore the feasibility of expanding the Gregg Burn lodgepole pine spacing study at Hinton to obtain stand development information following spacing at age 25. The initial spacing study was conducted at age 7 and reports have been prepared. Spacings and procedures will be the same as in the original plan (NOR-4-45, Bella)

9. Initiate field work to determine the magnitude of accelerated early growth of lodgepole pine following logging and scarification as compared to early growth of fire origin stands in the Edson Forest (NOR-4-45, Bella, Lux)

10. Contribute to the development of a symposium on lodgepole pine in western Canada by serving on the organizing committee composed of USA, B.C. and Alberta representatives. (NOR-4-45, Bella)

11. Continue to provide advice on mensurational problems including thinning, growth and yield and stand-growth modelling. (NOR-4-45, Bella)

12. Publish an Information Report on the "Influence of stand edge on the performance of white spruce and lodgepole pine seedlings (NOR-4-45, Johnstone)

14. Publications 1982-83:

Publications:

Bella, I.E. and J.P. DeFranceschi. 1982. Growth of lodgepole pine after mechanical strip thinning in Alberta; 15-year results. For. Chron. 58:131-135.

Johnstone, W.D. 1982. Juvenile spacing of 25-year-old lodgepole pine in western Alberta. Environ. Can., Can. For. Serv., North For. Res. Cent., Edmonton, Alta, Info. Rep. NOR-X-244.

_____ 1982. Heavy thinning accelerates growth of 77-year-old lodgepole pine. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta, For. Man. Note No. 16.

Reports:

Bella, I.E. 1982. Effect of line clearing in forest stands on tree growth in western Alberta. Work carried out under contract with the Forest Research Branch, Alberta Forest Service, Alberta Dept. Energy and Natural Resources.

_____ 1982. Regeneration stocking. Paper presented to the 4th International Workshop on Forest Regeneration on Northern Latitude Forest Lands held in Hinton, Alberta, August 16-18, 1982.

15. Signatures:

Investigator

Program Manager

Director

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS

1983

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
1-1P	Alberta	Varied	Varied	1951 1952 1953	1961 1974 (1984)	100	0.1 0.5	N.A.; these are permanent growth and yield plots	
2-jP	Sandi-lands, Man.	Stratified sand and gravel outwash; moist	15	1952	1957 1962 1967 1971 1977 (1983 Spr.)	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	Sandi-lands, Man.	Medium sand; fresh	40	1958	1963 1968 1973 1978 (1983 A)	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	Sandi-lands Forest Res., Man.	a. Sand, fresh	9	1964	1965 1968 1973 1978 (1983 Spr.)	15	.002 - .007	Mechanical Strip-thinning	Control: 5 plots Thinned 1-way: 5 plots Thinned 2-way: 5 plots
		b. Sand, fresh	11	1967	1969 1976 1981	5	.002 - .007	Mechanical Strip-thinning	Thinned 1-way: 5 plots

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS

1983 (Continued)

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.*	No. of plots	Plot size (acres)	Method	Intensity
		c. Sand, moist	9	1964	1965 1968 1973 1978 (1983) Spr.	15	.002 - .007	Mechanical Strip-thinning	Control: 5 plots Thinned 1-way: 5 plots Thinned 2-way: 5 plots
4-jP	Sandilands Forest Reserve, Man.	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-lP	McKay, Alberta	Silt loam to sandy loam	22	1954	1960 1969 1979 (1984)	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, SPACING AND YIELD STUDIES IN CONIFERS

1983

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
6a-jP -rP	Sandi-lands Forest Reserve	Sand, fresh	3 y.o. seedlings planted	1963	1973 1978 (1983 A)	32	variable	49 trees in a 7x7 matrix at 4x4, 6x6, 8x8, 10x10 ft. spacing plus a 2-row surround. Four replications.	
6b-wS	Sandi-lands and Riding Mtns.	Sand, Fresh. Fresh till	3 y.o. seedlings planted	1963 1962	1973 1978 (1983 A)	32	variable	as above	
7-1P	a. Gregg burn	three site types	7	1964	1966 1971 1976 1981 (1986 A)	30	variable	100 trees in a 10x10 matrix at densities 200, 400, 800, 1600, 3200 stems/ac.	
	b. Tepee Pole Creek	three site types	25	1967	1972 1977 1982 (1987 A)	30	variable	as above	

SUMMARY OF ACTIVE THINNING AND OTHER GROWTH STUDIES IN ASPEN

Study No.	Location	Soil and site	Stand age at establishment	Date of	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 (1983 Spr.)	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.

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 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-4-75

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

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 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 cooperation with provincial inventory divisions.

   2. Revise STEMS program so that it can be run on the PDP 11/60 mini computer at NoFRC.

   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.

Goals added:

6. Remeasure aspen thinning studies (No. 1 and 2) in Turtle and Riding Mountain (See study NOR-4-45)

7. Establish 10 permanent sample plots in lodgepole pine for STEM's model calibration.

10. Accomplishments for 1982-83:

1. A demonstration of the STEMS model was presented at the C.I.F. Rocky Mountain Sections's seminar on computer applications to forest management held at NoFRC in March, 1982.

2. A simplified version of the model has been tested on the PDP computer at NoFRC.

3. Work has begun to calibrate the model for lodgepole pine. Testing of the model for white and black spruce and red pine was postponed to 1983-84.

4. Tests on the STEMS model for management routines was initiated.

5. Development leave towards a Ph.D at the University of British Columbia was commenced in September, 1982.

6. Remeasured aspen thinning studies No. 1 and 3. (17 PSP) in Turtle and Riding Mountains, Manitoba in May, 1982.

7. Established 10 permanent sample plots for lodgepole pine in the Hinton, Alberta area for model calibration.

11. Goals for 1983-84:

1. Complete residence requirements towards a Ph.D at the University of British Columbia. Continue thesis research at NoFRC and prepare the first draft of a thesis entitled "Adaptation of the STEMS model for the Prairie Provinces". (NOR-4-75, Grewal)

2. Organize a demonstration of STEMS and a workshop on stand models for forest industries and provincial forest services to assess the usefulness of STEMS to their inventory and management programs (NOR-4-75, Grewal, Waldron)

3. Complete calibration of the STEMS model for growth and yield predictions for lodgepole pine and white spruce and revisions of the STEMS model for use on the PDP 11/60. (NOR-4-75, Grewal)

12. Publications 1982-83:

Nil

13. Signatures:

Investigator

Program Manager

Investigator

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 1982

1. Project: Yields of managed stands

2. Title: Transformation and movement of applied fertilizer elements N, P, S) in selected lodgepole pine stands.

3. New: Cont.: X 4. No.: NOR-4-102

5. Study Leader: J. Baker

6. Key Words: Acid soluble-alkali labile nitrogen, acid soluble alkali stable nitrogen, acid insoluble humin nitrogen, aluminum sulfur, sulfate-sulfur.

7. Location of Work: Edmonton, Hinton, Alberta (Edson map sheet 83F)

8. Study Objectives:

To determine the influence of a soil series on the transformation of N, P and S fertilizers and the accumulation and distribution of these in the various inorganic and organic soil fractions. To also determine the association, if any, of a specific nutrient fraction with growth.

9. 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

10. Accomplishments in 1982-83:

1) Analysis of sampled plots for 10-year residual effects of fertilization in regard to N, P & S distribution in both soils and foliage is underway; Soils have been analyzed for water & KCl pH changes, total soil N, total organic carbon. About one-half of the foliage samples have been analyzed for N.

2) Five year residual effects of selected treatments on both soils and foliar concentrations were completely re-written and subjected to in-house review.

3) Further sampling of 70-year old stands for additional control soil samples was not attempted for the following reasons -

   a) support help unavailable
   b) both 70-year old stands were inaccessible by vehicle.

4) Additional accomplishment -

The source of soil N & S and to a large extent P (in forest soils) is organic. Consequently a method had to be developed that would make a differention between N, S & P readily available for uptake and those organic forms less readily available. Such a method has been devised and found to be fairly reproducible. Its use is likely to bring about a reduction in the total number of analyses required to explain important relationships between soil and growth.

11. Goals for 1983-84:

1. Complete laboratory determinations of essential soil nutrients (N,P,S) associated with the fertilization of lodgepole pine project (NOR-4-122) by June 1983 (NOR-4-102, Baker)

2. Complete analysis of all data relevant to the preparation of a journal article entitled "Nutrient shifts and composition change in two luvisol soils following fertilization". A draft of the proposed publication to be ready for review by September (NOR-4-102, Baker)

3. Prepare a first draft copy of a Forest Management Note entitled "Guidelines for fertilizing 30 and 70-year old lodgepole pine stands in the foothills of Alberta" for the practicing forester. Information to be presented on growth response, fertilizer and nutrient residual responses 10 years after fertilization and extrapolation of the results using the biogeoclimatic site classification system developed for Alberta (NOR-4-102, Baker and Yang)

4. Terminate study

12. Publications 1982-83:

File reports

Baker, J. 1982. Five year residual effects of nitrogen, phosphorus and sulfur fertilization on the concentrations and distribution of these nutrients in the soil profiles of two luvisols.

Baker, J. 1982. Five year residual effects of nitrogen, phosphorus and sulfur fertilization on the foliar composition of lodgepole pine current growth.

13. Signatures:

Joseph Baker
Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 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. Study Objective: To assess the effects of fertilizing 70-year-old and 30-year-old lodgepole pine stands on stand growth and yield.

9. 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 70-year-old fertilized lodgepole pine 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 lodgepole pine 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

Goal added:

5. Participate and contribute to the Fourth International workshop on Forest Regeneration on North Latitude Forest Lands.

10. Accomplishments in 1982-83:

1. An article on response surface methodology developed from the greenhouse trial has been submitted to a journal for review. A manuscript on growth response of white spruce seedlings to fertilization was prepared. Another manuscript on nutrient uptake and its relation to growth will be available for review shortly.

2. The ring measurements of tree discs sampled from the 70-year-old stands and statistical analyses of the growth data have been completed. A manuscript on 10-year growth response of the 70-year-old stands to N, P, and S fertilization is currently under preparation.

3. A total of 432 trees were sampled from the treated 30-year-old stands and some 4 000 stem analysis discs were collected. Ring measurements to determine growth response are now completed and statistical analysis is in progress.

4. In cooperation with Dr. M. Micho, University of Alberta, specific gravity and fiber length of 7 fertilized 70-year-old lodgepole trees were determined at 8 height positions along the stem and 10-ring intervals within each height position. Statistical analysis to determine the fertilization effects on lodgepole pine wood properties is in progress.

5. Preliminary results of the Hinton fertilization trial were presented at the Fourth International Workshop on Forest Regeneration on North Latitude Forest Lands held at Hinton, Alberta, August 16-18, 1982.

11. Goals for 1983-84:

1) Publish journal article "Response surfaces for predicting seedling growth". (NOR-4-122, Yang)

2) Publish an Information Report on the effects of fertilization treatment on the 10-year-growth of 70-year-old lodgepole pine stands in west-central Alberta (NOR-4-122, Yang)

3) Complete data analyses of the 10-year-growth response of fertilized 30-year-old lodgepole pine stands and prepare a draft report for review (NOR-4-122, Yang, Lux)

4. In cooperation with Dr. M. Micho, complete the analysis of specific gravity and fiber length data and prepare a journal article on the effects of fertilization on these wood properties. (NOR-4-122, Micho, Yang)

5. Provide advice and carry out technology transfer on mensurational problems relating to forest fertilization. (NOR-4-122, Yang)

12. Publications 1982-83:

Publications:

Nil

Reports:

Yang, R.C. 1982. Preliminary results of the Hinton fertilization trial in 70-year-old lodgepole pine. Paper presented to the 4th International Workshop on Forest Regeneration on November 2, Latitude Forest Lands held in Hinton, Alberta, August 16-18, 1982.

13. Signatures:

Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 1982

1. Project: Yields of managed stands.

2. Title: Fertilization and thinning of semimature lodgepole pine stands.

3. New: X Cont.: 4. No.: NOR-4-195

5. Study Leaders: R.C. Yang, J. Baker

6. Key Words: *Pinus contorta*, tree nutrition, photosynthesis, nutrient prescription, nitrogen, thinning, nitrogen fractionation, immobilization, mineralization

7. Location of Work: Hinton, Alberta

8. Problem:

Although fertilizing preharvest stands can give crop trees a final boost in nutrient and improves yields, the utilization of added nutrients may not be as effective as that of fertilizing semimature stands because of the reduced physiological activities and photosynthetic capacity of the preharvest stands. The waiting period for return on investment is longer after fertilizing young stands, but this drawback may be offset by reduced rotation due to compound growth of forest trees. A large increase in diameter and height from fertilization during the physiological active age may considerably reduce the rotation age and consequently return on all forestry investments is realized sooner.

Generally, overstocked stands seldom show much net growth response to fertilization; lodgepole pine responds significantly to fertilization only where ample growing space for crown expansion is available. Thinning, the removal of undesirable trees, improves light quality and quantity on leaves, provides space for both crown and root expansion, raises soil temperature during growing season and increases soil moisture. In all, thinning creates a favourable environment for translocation and uptake of added nutrient by forest trees. It is thus reasonable to expect that fertilization and thinning combined will markedly enhance tree growth through increased photosynthetic capacity.

9. Study Objectives:

To assess the effects of thinning and fertilizing semimature lodgepole pine on stand growth, to assess the contribution of individual fertilizer elements to the growth response; and to develop a diagnostic technique for prescribing nutrient requirements for lodgepole pine stands in the foothills of Alberta.

10. Goals for 1982-83:

Nil - new study

11. Accomplishments for 1982-83:

Nil - new study

12. Goals for 1983-84:

1. Prepare a detailed study plan outlining study objectives; criteria for stand selection; thinning and fertilizer regimes; sampling procedures and laboratory work requirements; and locate suitable stands (age, site, and density) for the study (NOR-4-195, Yang and Baker)

13. Publications: 1982-83:

Nil - new study

14. Signatures:

Investigator

Joseph Baker

Program Manager

Director

NOR-5 Fire Management Systems and Guidelines

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 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

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 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.

10. Accomplishments in 1982-83:

1. In co-operation with the Alberta Forest Service spent two weeks in the Slave Lake and Edson Forests evaluating the performance and effectiveness of air tankers and retardants in their initial attack roles on wildfires. Information was compiled on six fires and an interim report on findings was presented to A.F.S. bird-dog and air attack officers at their annual review meeting.

2. Provided technical assistance to S.E.I. Industries and Okanagan Helicopters in the development of a prototype vinyl heli-bucket. This revolutionary bucket design and construction was operationally tested in Alberta during the 1982 fire season, and was demonstrated to interested fire control agencies on several occasions. Participated in helitanker delivery system discussions at a helicopter management workshop in Kelowna, B.C. and during drop trials in Missoula Montana. Constructed a new 1000 container drop grid system.

3. There were no further accomplishments in the testing and calibration of the laboratory retardant application system and combustion table owing to delays in construction and installation of a retardant release valve and burning table output amplifier. Resignation of Research Technician R. Lieskovsky contributed to these delays.

4. Provided technical assistance, training, and technology transfer to regional, national, and international fire control agencies and industries as follows:

   a) Advised Canadair Ltd. in the development of an on-board injection system for use with liquified water thickening compounds.

   b) Conducted laboratory evaluation of a liquified water thickening compound, Fire-Kill, at the combined request of Canadair Ltd. and Sanitek Inc. of Los Angeles, the product manufacturer.

c) Provided technical guidance to Saskatchewan Dept. Tourism and Renewable Resources Fire Control Branch on the comparative performance of water skimming air tankers and helitankers being considered for future fire control operations in Saskatchewan. Similarly advised A.F.S. and B.C.F.S. on the relative effectiveness of water and long term retardants in consideration of future air attack requirements.

d) Conducted laboratory evaluations of separation and settling characteristics of gum thickened liquid concentrate fire retardant (Fire-Trol 931) mixtures, simulating storage on board air tankers.

e) Participated in a retardant development workshop at Kamloops, B.C. sponsored by Chemonics Industries Ltd. in conjunction with the introduction and demonstration of a new gum-thickened sulphate (G.T.S.) retardant product.

11. Goals for 1983-84:

1. Provide technical assistance, training and technology transfer on matters pertaining to aerial fire control technology including fire retardants and delivery systems to regional, national, and international fire control agencies and industrial organizations as requested.

2. In co-operation with the Alberta Forest Service, continue on-site evaluation of retardant/air tanker effectiveness with emphasis on factors affecting retardant performance at the fire's edge. Results to date to be prepared for submission as a Forestry Report article.

3. Direct the testing and calibration of a prototype retardant application system and combustion table for use under controlled laboratory conditions.

4. Review and assess the role and usefulness of foaming and wetting agents in forest fire control. Report findings to date.

12. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-5-086

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 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 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 regneration 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 understory 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.

Goals Added:

11. Continuation of chemical foliar analyses for major conifers in central Alberta.

10. Accomplishments in 1982-83:

1. The write-up, reviews and editorial work on "Forest ecosystems and fire hazard in central Saskatchewan" were completed, and the paper is now ready for publication.

2. The write-up, reviews and editorial work on "Failures and successes in jack pine regeneration following postcut burning and seeding treatments in southeastern Manitoba" were completed, and the paper should be ready for publication early in 1983.

3. The write-up, reviews and editorial work on "Jack pine and other forest regeneration following postcut burning and seeding treatments in central Saskatchewan" were completed, and the paper should be ready for publication early in 1983.

4. The preparation of paper on "Foliar moisture variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" is nearing completion, and the manuscript will be available for review early in 1983.

5. All relevant combustion data were converted to joules, and the paper on "Foliar calorific variations in jack pine, black spruce, and balsam fir, central Alberta" will be completed and available for review early in 1983.

6. Contribution of several authors involved was much less than expected and the publication of the proposed international monograph on white spruce regeneration was indefinitely postponed until further deliberations in mid-1983. Completion of the second chapter mentioned depends to a degree on cooperation by some of the outside authors.

7. All computer work re.categorized biomass of six major understory shrub species in central Alberta was completed as planned.

8. A substantial progress was made in the analysis of data on relationships between fuels, fire behavior and weather for semimature jack pine stands in central Alberta.

9. Numerous regressions were computed for the 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. When requested, routinely information was provided to interested individuals and user agencies.

11. Sugar and starch contents were determined in some 180 foliar samples from major conifers in central Alberta.

Goals for 1983-84:

1. Publish "Failures and successes in jack pine regeneration following postcut burning and seeding in southeastern Manitoba" (Information Report).

2. Publish "Jack pine regeneration following postcut burning and seeding in central Saskatchewan" (Information Report).

3. Publish "Foliar moisture variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" (Canadian Journal of Forest Research).

4. Publish "Foliar calorific variations in jack pine, black spruce, white spruce, and balsam fir, central Alberta" (Canadian Journal of Forest Research).

5. Continue data analysis on relationships between fuels, fire behavior and weather for semimature jack pine stands in central Alberta.

6. Publish "Forest ecosystems and fire hazard in central Saskatchewan" (Forestry Report).

12. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-5-131

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 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 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.

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.

10. Accomplishments in 1982-83:

1. The scan extender is now M.O.T. approved for use from Prince Albert Air's Navaho. Flights were made to test the 7^{o}, 12^{o} and 20^{o} lenses for the Thermovision. The 12^{o} lens provides the most workable combination of sensitivity and coverage and was chosen for operations. Using the Navaho searches, can now be conducted at 200 mph and 10,000 ft. which results in scanning 800 sq. miles per hour.

2. Have received information on 3 new handheld scanners; two of these, the Xedas and Lentech machines are pyroelectric videocons that need no external cooling and the third from Inframetrics uses a detector medium and is cooled by liquid N_2. In addition a test flight was made using an AGA 782 machine in the scan extender.

3. By accompanying an initial attack crew working out of La Ronge 5 lightning fires were visited to gather data to be used for supporting the lightning fire prediction model. Data such as holdover time, burning characteristics (spread rate pattern), and moisture contents and bulk densities of fuels at the point of ignition will be combined with weather indices to quantify the parameters affecting the ignition and smouldering process.

4. The Forest Management Note on the NoFRC Fire Finder is in review.

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

   a) Provided information on and loaned the scan extender to Ellis Hancock of the Newfoundland Forest Service.

   b) Drew profiles and completed field work in preparation for constructing seen area maps for 11 towers in R.M.N.P. and one tower in Sask.

   c) Supplied 6 NoFRC Fire Finders constructed by P. Bihuniak to Sask. DTRR.

   d) Supplied plans for Fire Finder to Yukon Forest Service and Cape Breton Highlands National Park, Nova Scotia.

11. Goals for 1983-84:

1. Publish FMN report on "Construction and use of NoFRC portable fire finder". Terminate.

2. Test and calibrate a prototype retardant application system and combustion table for use under controlled laboratory conditions.

3. Collect lightning fire origin data to be used for supporting the lightning fire prediction model. Data, including holdover time, burning characteristics, and moisture contents and bulk densities of fuels at the point of ignition will be combined with weather indices to quantify the parameters affecting the ignition and smouldering process.

4. Provide seen area maps for eleven detection towers in Riding Mountain National Park.

5. Prepare file report on currently available infrared systems; operational procedures availability, sensitivity, accuracy and costs.

6. Refine operational use of AGA infrared system and LLP system in Saskatchewan.

7. Compile fire weather and fire report data for calibration and performance of CFWI in Sask.

8. Provide technical services and training to client agencies.

12. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-5-168

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 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, Gilles Delisle

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 1982-83:

   1. Publish information report "Early plant succession following wildfire, 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.

10. Accomplishments in 1982-83:

1. No progress made. This goal will be advanced to 1984-85.

2. No progress made.

3. This study should continue to facilitate CFS/Parks Canada cooperative efforts, including completion of the Nahanni and Wood Buffalo studies. a proposed fuel description for Jasper National Park, prescribed burning in Elk Island National Park and Prince Albert National Park, technology transfer and advisory services to all levels of park administration [park. regional. national]. A summary of fire related activities with Parks Canada in 1982 follows.

JAN:: Reviewed fire research activities with Parks/C.W.S./C.F.S.

FEB.: Met with Prairie Region/Parks Canada to discuss resource management planning in Nahanni National Park.

APR.: Met with E.I.N.P. personnel to discuss plans for spring burning program.

MAY: Collected research information before, during and after prescribed burn in E.I.N.P.

JULY: Met in Jasper to confirm Jasper fuel description study.

AUG.: Met with University of New Brunswick faculty to discuss fire research proposal submitted by U.N.B. to Parks Canada.

OCT.: Made a presentation at the Intermountain Fire Council, Jackson, Wyoming. reviewing fire management activities in Canada's National Parks.

DEC.: Attended (Delisle) annual CFS/Parks meeting.

11. Goals for 1983-84:

1. Complete and submit fire management studies for Nahanni [Mar. 31] and Wood Buffalo [Nov. 30] National Parks. [Dubé].

2. Prepare a study plan by Feb. 1/83 presently titled "Forest Fuels and Fire Potential in Jasper National Park". This is a M.Sc. project conducted by G. Delisle.

3. Conduct fieldwork. in the summer of 1983. on forest fuels in Jasper National Park. [Delisle].

4. Provide advisory services to National Parks with emphasis on fire management guidelines [Dubé].

5. Collect research data in support of prescribed burning in Elk Island National Park [Delisle, Dubé].

11. Signatures:

Investigator

Program Manager

Director A. D. Kiil

NOR-5-174

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 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, G. Delisle, 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 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. Initiage 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 mangement. (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)

Added Goal:

12. Present paper at I.F.C. meeting, Salt Lake City, Utah. (Newstead)

10. Accomplishments in 1982-83:

1. An initial draft of an information report on the development and application of the NoFRC initial-attack planning model is in the final stages of preparation. A review draft is expected to be in circulation early in 1983. (Newstead)

2. The resignation of Research Technician R. Lieskovsky (co-author) has delayed preparation of the initial draft of an Information Report on the status of accumulated NoFRC retardant/airtanker drop test results. A review draft is expected to be in circulation early in 1983. (Newstead)

3. A contract was let to develop a prototype location-allocation model suitable for application to forest fire suppression problems involving multiple resource allocation alternatives. The contract report on file provides two generalized solution techniques programmed for the TI-59 calculator. However, these algorithms, in conjunction with the limited capacity of the TI-59 calculator, are not likely to offer the scope to handle the multitude of resource and fire occurrence variables and alternatives encountered in pre-attack planning. (Newstead)

4. Correlation analyses of the results of the A.F.S. aerial observer data compiled to date showed that weak relationships exist between most variables. Coupled with the poor quality and paucity of data

collected, these results indicate further statistical analysis is not warranted. Interim "manual" interpretation of these data and summary reports have been prepared and have proved beneficial to the A.F.S. (Newstead)

5. Not completed due to other duties. Some related progress made: (a) D.L. Martell's PBWX computer program (fire weather prescription testing/frequency analysis) placed on NoFRC's PDP-11 and (b) metric conversion and transcribing of historical fire weather record forms (1940-69) for Riding Mtn., Prince Albert, Waterton Lakes, Banff, and Jasper National Parks completed and ready for keypunching. Responsibilities for regional fire data library to be transferred to incumbent Fire Operations Research Officer. (Alexander and Dubé)

6. Not completed in its entirety. Spent one week at GLFRC on Pukaskwa fire history study. Undertook preliminary analysis of data collected on permanent regeneration plots on wildfire sites in NW Ontario. (Alexander)

7. No progress towards this goal has been achieved and it will be deleted from further consideration owing to ongoing research at PNFI, alternate regional research priorities, and work load. (Dubé)

8. Provided technology transfer, instructional training and participation in workshops, meetings and committees as follows:

   a) Attended Canadian Committee on Forest Fire Control Annual Meeting and participated in a poster session to demonstrate the NoFRC initial-attack planning model. (Newstead)

   b) Provided instructional training at several A.F.S. in-service courses at the Forest Technology School (Hinton) including the sector and division level courses and the helicopter management course. (Newstead)

   c) Attended Intermountain Fire Council Annual and Organizational meetings as a steering committee representative to discuss organizational requirements and theme options for the 1983 meeting to be held in Banff. (Newstead)

   d) Attended the annual A.F.S. forest protection officers meeting and presented a progress summary of the fire management systems project activities. (Newstead)

   e) Reviewed three internal (NoFRC) and two external (U.S.F.S. and A.F.S.) draft manuscripts. (Newstead)

   f) Reviewed one manuscript at the request of the Can. J. For. Res. editor. (Alexander)

g) First draft of annotated bibliography, CFS fire research publication in the W&N Region (1962-82) placed on word processor. (Alexander and Dubé)

h) Participated in updating CFS position paper on Mountain Pine Beetle. (Dubé and Alexander)

i) Assisted in selection of head of fire control for N.W.T. (Dubé)

j) Discussed fire research program with two school groups and students from technical college at Ft. Smith on three separate occasions. (Dubé)

k) Presented an overview of the Mountain Pine Beetle program to the Environment Council of Alberta. (Dubé)

l) Attended the Environmental Nongovernmental Organization (ENGO) meeting in Calgary, representing NoFRC.

m) Attended three "fire management program committee" meetings in Yellowknife, N.W.T. (Dubé)

n) Discussed fire research project with a delegation from the Peoples Republic of China. (Dubé, Alexander, Newstead)

o) Appointed committee member to review and evaluate the "Water Quality and Reclamation Technology Program" at Lakeland College, Vermilion. (Dubé)

p) Served as Acting Program Manager for three weeks in October/82 and performed other administrative functions associated with the Project Leader responsibilities. (Dubé)

q) Attended the program review of the fire research section at P.F.R.C. (Dubé)

9. The fire history atlas for Alberta has been completed and is ready for review. (Delisle)

10. Forestry report is nearing completion and a draft is currently in review. (Dubé)

11. No further progress since last review. Goal being transferred to NOR-5-191 for completion in FY 83-84. (Alexander)

Added Accomplishment:

12. Published: Newstead, R.G. & M.W. Potter. 1981. An initial attack planning model. In Proceedings, Intermountain Fire Council Computer Modeling: Its Application in Fire Management. (J.E. Lotan, Editor.)

11. Goals for 1983-84:

1. Publish Forestry Report. Terminate. (Dubé)

2. Complete analysis and reports on (a) Pukaskwa National Park fire history and ecology by Mar. 31/83, and (b) experimental fires and wildfires associated with GLFRC studies. (Alexander)

3. Publish an Information Report on the status of all airtanker/ retardant drop pattern data compiled and analyzed to date. (Newstead)

4. Assist in the organization of and prepare for publication of the Proceedings of the 1983 Intermountain Fire Council. (All)

5. Publish: Hodgson, M.J. and R.G. Newstead. 1983. Location-allocation models for control of forest fires by air-tankers. Can. Geog. Vol. XXVII No. 2. (Newstead)

6. Publish an Information Report on the development and application of the initial-attack planning model, incorporating fire-line productivity, rate-of-spread, fuels, and other related information. (Newstead)

7. Publish fire atlas for Alberta. (Delisle)

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. Supervise and coordinate the regional fire research program. (Dubé)

10. Initiate a mission-oriented problem analysis in operations research for forest fire management. (O.R.)

11. Initiate a regional fire data library, including information from fire reports, daily fire weather records and fire statistics. (O.R.)

12. Signatures:

Investigator

Investigator

Martin E. Alexander
Investigator

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1982

1. Project: Fire management systems and guidelines

2. Title: Fire danger and behavior rating in forest and rangeland environments

3. New: Cont.: X 4. No.: NOR-5-191

5. Study Leader: M. E. Alexander

6. Key Words: Canadian Forest Fire Danger Rating System, wildfire case histories and studies, fire behavior estimation, fire environment.

7. Location of Work: Regional

8. Study Objectives:

   1. To develop, evaluate, interpret and apply the Canadian Forest Fire Danger Rating System.

   2. To improve the assessment and prediction of wildfire behavior in terms and by methods which are useful to fire management agencies.

9. Goals for 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.

Goals added:

10. Revise the former CFFBS Fine Fuel Moisture Code diurnal adjustment table supplement.

11. Prepare an annotated bibliography on the Canadian Forest Fire Danger Rating System.

12. Prepare a journal note on fire behavior in aspen slash fuels as related to the Canadian Fire Weather Index.

10. Accomplishments for 1982-83:

1. Provided interim descriptive danger index classes (Low, Moderate, etc.) associated with the proposed Fast-Drying Spread Index (FDSI) and a fire danger climatology for the new Sun-exposed Fine Fuel Moisture Code (SFFMC) to all user agencies in the W & N Region. Arranged for field trials of the FDSI and SFFMC during the 1982 fire season (e.g., tables, instructions, computer program). Final preparation of publication placed in abeyance pending finalization of SFFMC and FDSI equations by PNFI. Correspondence documenting work to date on file.

2. Fire weather data and Cladonia Fire Hazard Index (CFHI) values acquired for Lambert Creek Lookout in northeastern Alberta (1972-1982). Computer calculated values of the SFFMC and Fine Fuel Moisture Code (FFMC) determined. Provided Alberta Forest Service with an interim relationship between the CFHI and (a) the SFFMC and (b) the FFMC (correspondence on file). Final preparation of originally intended publication placed in abeyance pending finalization of SFFMC and FDSI equations by PNFI.

3. A national fire behavior data base by fuel type (experimental fires and selected wildfires from Canada and U.S.) was assembled during two working group meetings in 1982. Preliminary fire spread equations and graphs have now been produced from this data during two working group meetings in 1981.

bank. A proposal[1] outlining the future development of the Fire Behavior Indices subsystem of the CFFDRS was prepared for distribution and comment by user agencies.

4. Objective altered to accommodate request by Dept. of Indian and Northern Affairs to participate in a short-term (10 days) experimental burning project in the black spruce-lichen woodland fuel complex at Porter Lake, Caribou Range, N.W.T. Coordinated CFS efforts involving fire research staff from PFRC, GLFRC, PNFI, and NoFRC (study leader on site June 28-July 10). Other permanent NoFRC staff participating in project include: D.E. Dubé, G.P. Delisle, P. Golec, M.E. Maffey, and R.M. Smith. Ten experimental (7 line and 3 point source ignitions) and one wildfire documented under low to extreme fire danger conditions. Diurnal fuel moisture content sampling also undertaken. Preliminary data analysis nearly completed.

5. (a) Presented guest lecture and prepared handout (Alexander 1982b) on an overview of the CFFDRS to University of Alberta undergraduate forest fire management class. (Feb. 15)

   (b) Organized 4-day advanced fire behavior course for Alberta Forest Service fire staff in cooperation with Hinton Forest Technology School (D. Quintilio). Served as one of three instructors. (Apr. 5-8)

   (c) Requested to give expert opinion evidence by Alberta Forest Service in a court case involving violations of the Forest & Prairie Protection Act. Met with Crown Counsel in Peace River for strategy session (Apr. 30) and attended two trial sessions in High Prairie. (May 3 and Aug. 23)

   (d) Attended 8th annual meeting of the Central Region Fire Weather Committee in Prince Albert, Sask. (Dec. 7) Attended 21st meeting of the Pacific Region Fire Weather Committee in Vancouver, B.C. as current chairman of the Western Region Fire Weather Committee. (Nov. 19)

   (e) Acted as external reviewer for two unsolicited manuscripts: (1) Probe Rapidly Measures Fuel Moisture Content (Fire Management Notes article) by R.W. Blank and others; (2) Can. J. For. Res. article on crown fuel weights by CJFR Associate Editor for Fire.

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[1] Van Wagner, C.E., M.E. Alexander, B.D. Lawson and B.J. Stocks. 1982. Proposed extension of the Canadian Forest Fire Danger Rating System (CFFDRS). Can. For. Serv. Fire Danger Group, Mimeo Rep. 12 pp.

(f) Requested by Northern Affairs Program - Regional Fire Centre to assess applicability of Compu-Trac Moisture Analyzer to determining moisture content of N.W.T. fuels. Preliminary testing carried out.

(g) Demonstrated use of the Forest Technology Systems Ltd. automatic fire weather station to approximately a dozen persons from the University of Alberta, Alberta provincial government agencies, and DOE.

6. Compilation and organization of fuels, surface fire weather observations, fire danger ratings, climatological conditions, and meteorological characteristics associated with the behavior of seven major wildfires partially completed. Considerable progress made on two case histories/studies (1980 Rolling River/Manitoba, 1980 DND-4-80/Alberta). File report listing the world literature on the subject of wildfire case histories/studies and recommended outline for the preparation of wildfire case histories/studies prepared (Alexander 1982e).

7. Major commitment to N.W.T. experimental burning project prevented any major progress towards meeting this goal. Documented surface fire weather observations associated with operational prescribed burn at Elk Island National Park (May 12).

8. Preparation of Forest Management Note not completed. However, progress made in: (a) developing a table for estimating the standard 10-min/10 m wind speed from maximum gust observed at "eye-level" with a hand-held wind meter (e.g., Dwyer); (b) survey of commercially available hand-held wind speed indicators; and (c) review of applicable literature.

9. All experimental rate of fire spread data and associated information on file at NoFRC was assembled for the CFFDRS national fire behavior data bank (e.g., computer calculation of FWI and associated components). An initial plan of attack formulated to ensure adequate documentation of data (e.g., daily fire weather observations) and publication.

10. Published a revision of the Fine Fuel Moisture Code diurnal adjustment table as a Forest Management Note (Alexander 1982f).

11. Submitted proposal to and obtained permission from CFS-HQ to publish an annotated bibliography on the Canadian Forest Fire Danger Rating System as a Forestry Technical Report. Prepared first draft and placed on word processor. G.P. Delisle completed French translations of titles and abstracts.

12. Published journal note (Alexander 1982g).

11. Goals for 1983-84:

1. Publish Information Report on Fire Behavior in the Black Spruce-Lichen Woodland Fuel Complex: the Porter Lake Project, N.W.T.

2. Publish Information Report on Spring Fires in a Semi-Mature Trembling Aspen Stand.

3. Publish Forest Management Note "Tables for Determining Spring Drought Code Starting Values in West-Central and Northern Canada".

4. Publish Can. For. Serv. Res. Notes article "Prescribed Fire Behavior and Impact in an Eastern Spruce-Fir Slash Fuel Complex".

5. Publish paper "Extreme Fire Behavior: a wildfire case study from east-central Alberta" in the proceedings of the Seventh Conference on Fire and Forest Meteorology.

6. Publish French (co-authored with G.P. Delisle) and English versions of Forestry Technical Report "An Annotated Bibliography on the Canadian Forest Fire Danger Rating System".

7. Coordinate national CFS inter-establishment documentation team effort associated with an experimental burning project in the lowland black spruce fuel type, N.W.T. (July 1983).

8. Participate as W & N Region representative in cooperative projects of the CFS National Fire Danger Working Group, including continued development of the Fire Behavior Indexes subsystem.

9. Provide advice and services as required, including serving as the CFS W & N Region representative on the Central and Western Region Fire Weather Committees.

12. Publications/Reports:

Alexander, M.E. 1982a. The 1968 Lesser Slave Lake Fire: historical analysis of the Canadian Forest Fire Weather Index. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Study NOR-5-191 File Rep. No. 1. 31 pp.

Alexander, M.E. 1982b. Canadian Forest Fire Danger Rating System: an overview. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Study NOR-5-191 File Rep. No. 2. 10 pp.

Alexander, M.E. 1982c. Calculating spring Drought Code starting values in the prairie provinces and Northwest Territories. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Manage. Note 12. 4 pp.

Alexander, M.E. 1982d. Calculating and interpreting forest fire intensities. Can. J. Bot. 60(4):349-357. (erratum: 60(10):2185.)

Alexander, M.E. 1982e. Bibliography of wildfire case histories and studies. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Study NOR-5-191 File Rep. No. 4. 7 pp.

Alexander, M.E. 1982f. Diurnal adjustment table for the Fine Fuel Moisture Code. Environ. Can., Can. For. Serv., North. For. Res. Cent.. Edmonton. Alta. For. Manage. Note 17. 3 pp.

Lee, C.Y. and M.E. Alexander. 1982. Calculating spring Drought Code starting values with the Texas Instruments Model 59 hand-held calculator. Environ. Can., Can. For. Serv., North. For. Res. Cent.. Edmonton. Alta. Study NOR-5-191 File Rep. No. 3. 7 pp.

Alexander. M.E. 1982g. Fire behavior in aspen slash fuels as related to the Canadian Fire Weather Index. Can. J. For. Res. 12(4):1028-1029.

13. Signatures:

Martin E. Alexander
Investigator

Program Manager

Director A.D. Kiil

NOR-7 Reduction of Damage from Pollutants in the Atmosphere

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 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. Project Objectives:

   1. Describe and assess changes in the forest ecosystem as a result of two sour gas plants in west-central Alberta.

   2. Determine the mechanism of elemental sulphur dust impact to the forested soil-plant system.

9. 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 macro-nutrients in the primary soil horizons. (Maynard)

   3. Work Plan Goal 9. Complete vegetation and soils descriptions, plant and soil chemical analyses, growth measurements, and seed production and viability measures to provide information on forest condition in west-central Alberta. (Addison, Maynard)

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

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)

Additional Goals:

7. Determine the chemistry of precipitation at specific sites in the vicinity of sour gas proecessing. (Addison)

8. Determine the variability in volume and chemistry of precipitation within a forest stand.

9. Develop a photographic technique for the determination of air pollution impact to forest canopies.

10. Determine the precision of vegetation description for the detection of air pollution injury.

11. Re-examine and describe soils of the biomonitoring sites.

12. Present preliminary results at international conferences.

13. Develop a method for accurately estimating elemental sulphur content in soils.

10. Accomplishments in 1982-83:

1. Three sites at various distances from elemental sulphur dust sources were established at each of Strachan and Ram River sour gas plants. At Strachan, 5 lysimeters at each of two depths (LFH-Ae and B-AB interfaces) were installed whereas at Ram River 3 lysimeters at the LFH-Ae interface were installed at each site. Samples were collected every two weeks, from June to October. Samples were filtered, acidified and analysed by ICAP-AES.

10. Accomplishments in 1982-83: (cont'd)

2. At the same sites as in #1, soils were collected monthly. Ten replicate samples of each of the LFH, Ae, Bm and Ae horizons were taken at each of the Strachan sites. Five replicate samples of the LFH and upper mineral soil horizons were taken at each of the Ram River sites. The samples were frozen and will be extracted moist for elemental S (LFH and Ae horizons only) and available nutrients.

3. The elemental analysis of five plant species (10 reps) from each of the 26 sites is in progress (ICAP-AES) as are the lichen community descriptions. The plant communities have been described using tabulation, ordination and cluster techniques and the final interpretation will be finished once tissue analysis is complete. Growth rates determined from lateral and terminal branch measurements are being synthesized, however, wood production determinations have not been started due to delays in equipment delivery. Needle retention and seed production data are being synthesized. Sulphation plates have been discontinued after 18 months. Analysis of extracts is currently underway (ICAP-AES). The soil descriptions and analyses have been completed.

4. At the sites, described in #1 deposition collectors (137cm^2 in area) with cotton surfaces were installed and exchanged every two weeks from June to October. Nine replicates were used at each Strachan site and five at the Ram River sites. The solution was filtered and analysed by ICAP-AES. The collecting surface was dried and awaits extraction for elemental S and digestion for total deposition.

5a. Samples of *Hypogymnia physodes* and *Pleurozium schreberi* were collected from 110 locations in the vicinity of the two sour gas plants. Sampling sites were dictated to some extent by deposition modelling attempts by the Air Quality Division of Alberta Environment. Samples were dried, ground and digested and currently await analysis by ICAP-AES.

5b. Two transects were established in the lodgepole pine forest east of the sulphur block at the Strachan gas plants. The first was 360 m long and had 25 plots (every 15 m) along it while the second was 255 m long and had 18 plots. At each plot, an 80 point intercept quadrat was used to record first plant and moss layer hits. The data are being analysed.

6. An article entitled "Quantification of Branch Dwelling Lichen Communities for the Detection of Air Pollution Impact" has been revised partially and two additional years of data have been incorporated into the results. Statistical analysis is complete.

Additional Accomplishments:

7. Precipitation collectors were placed at 5 locations that produced a transect of the area where Ram River and Strachan gas plants are situated. Collectors were serviced daily for a total of 15 days. The pH of any precipitation was measured and the sample was acidified and analyzed by ICAP-AES.

8. Twenty-four precipitation collectors were placed at 2 m intervals in a 10 x 10m plot. Samples were collected on two occasions after a 30 d exposure. Samples were filtered and the filtrate analysed by ICAP-AES. The filter paper and residue was digested and analysed by ICAP-AES.

9. Photographs of the forest canopy were taken to develop a biomonitoring technique to measure changes in the canopy cover of lodgepole pine forests in the vicinity of the Ram River and Strachan sour gas plants. The slides were taken at twenty permanently marked plots at each of six sites adjacent and distant from the sources. Owing to technical difficulties, the photographs are not of sufficient quality for analysis. Testing of this technique is scheduled for the spring of 1983.

10. Cover determinations of all plant species in the twenty permanently marked quadrates at each of site 1 and 5 were carried out on 9 consecutive days to evaluate the precision of the permanent plot biomonitoring technique.

11. At 21 of the 26 permanent plots and with the help of the Biophysical Staff, soils were described and sampled for classification. The soil samples have been dried and ground and are being analysed by Analytical Services personnel.

12. A paper entitled "Impact of elemental sulphur dust deposition on soils and vegetation of *Pinus contorta* stands in west-central Alberta" was presented verbally at the International Symposium on the Dynamics of Boreal Forest Ecosystems in Thunder Bay, Ontario and on a poster at the 12th International Meeting for Specialists in Air Pollution in Oulu, Finland.

13. A method for the determination of elemental S in contaminated organic and mineral soils has been developed. The method is a combination of two techniques. The sensitivity is about 100 $\mu gS\ g^{-1}$ soil but work is continuing to improve the sensitivity.

11. Goals for 1983-84:

1. Submit for review (by January 15, 1983) an article on lichen effects caused by air pollutants. (Addison)

2. Publish information report on baseline condition of lodgepole pine stands near two sour gas plants in west-central Alberta. (Addison, Maynard)

3. In cooperation with study leaders in projects NOR-7 and NOR-32, prepare a forestry report on Air Pollution and Forests. (Addison)

4. Develop biomonitoring techniques. (Addison)

   a. Test canopy photographic system
   b. Submit for review a journal article on the effect of elemental S dust on moss communities.
   c. Submit for review a journal article on the deposition of pollutants from sour gas processing as measured by lichen and moss element content.

5a. Continue to measure the rate of pollutant deposition to soils and the magnitude of the various forms. Information will be submitted for publication in 1984-85. (Addison, Maynard)

5b. Continue to measure the effect of pollutant deposition on soil chemistry by measuring the movement of S and other elements using zero tension lysimeters and by measuring total and available elements in each soil horizon at monthly intervals during the frost-free period. Information will be submitted for publication in 1984-85. (Addison, Maynard)

6. Determine the factors that influence the response of mosses and vascular plants to elemental S. (Addison)

7. Determine the factors that control the mobility and form of pollutants and other elements in the soil. (Maynard)

8. Provide consulting services to Government, University and Industry staff as well as to the general public. Participate in workshops and symposia. (Addison, Maynard)

12. Publications 1982-83:

Maynard, D.G., P.A. Addison and K. Kennedy. 1982. Impact of elemental sulphur dust on soils and vegetation of *Pinus contorta* stands in west-central Alberta. International Symposium on Dynamics of Boreal Forest Ecosystems, Thunder Bay and at the 12th International Meeting for Specialists in Air Pollution, Oulu, Finland

13. Signatures:

P.N. Addie
Investigator

Program Manager

Doug Maynard
Investigator

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1982

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. Project Objectives:

   1. Determine the sensitivity of boreal forest plant species to air pollutants and the influence of environmental factors including soils on that sensitivity

9. 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 experimentatl system and measuring above- and below-ground biomass. (Addison)

   2. Work Plan Goals 2 and 13. Initiate leaching and depostition 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 plan metabolism. (Addison)

   4. Work Plan Goal 7. Measure the response to RUDP carboxylase and stomatal resistance of jack pine to varuous SO_2 concentrations and times of exposure. (Addison)

5. Work Plan Goal 8 and from NOR-7-114. Measure changes in photosynthetic rate, stomatal resistance and RUDP carboxylase in jack pine during fumigation with SO_2 to attempt to separate biochemical and biophysical components of plant resistance to SO_2. (Addison)

6. Work Plan Goal 14. Submit an article on the sensitivity of boreal forest woody plants to SO_2 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 SO_2 on lichens. (Addison)

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

Goals added:

9. Determine the variability of nutrient content in soils in the impingement zone of oil sands operations.

10. Present an overview of mixed pollutant effects on forests to the Forest industry in British Columbia.

11. Present an overview of biomonitoring studies in the Athabasca Oil Sands Area.

10. Accomplishments in 1982-83:

1. This goal was deferred until further information on soil chemistry could be provided.

2. Bulk samples from the four surface horizons (LFH, Ae, Bm and BC) of an uncontaminated site near Fort Mackay have been collected and are stored frozen. The design of the experiments to determine the influence of pollutant addition on soil chemistry is underway.

3. An experiment on the influence of SO_2 on the Superoxide Dismutase activity of jack pine has been completed. The influence of SO_3 and HSO_3 on jack pine metabolism has been examined.

4 - 5. Work plan goals 7 and 8 were combined in one major experiment in which the response of jack pine seedlings to various concentrations of SO_2 and durations of exposure was determined by measuring four variables. Initially, these were stomatal resistance, xylem tension, RUBP carboxylase and sulphur uptake. Because RUBP carboxylase showed no consistent response to fumigation at 0.4 ppm SO_2, it was not pursued. Fructose level in leaf tissue did respnd to SO_2 fumigation and was measured instead of RUBP carboxylase. Experiments have been carried out at SO_2 concentrations of 0, 0.1, 0.2, 0.6 and 1.0 ppm for up to 8 days. Statistical analyses are being performed.

10. Accomplishments in 1982-83: (cont'd)

6. An article entitled "Sulphur dioxide sensitivity of woody boreal forest species grown on native soils and tailings" has been submitted to the Journal of Environmental Quality.

7. Owing to discrepancies and variability in the data base, a number of experiments on the effect of SO_2 concentration and duration of exposure on ^{14}C incorporation by *Evernia mesomorpha* had to be repeated. This has been accomplished and all data is in hand with the exception of 200 measurements of S content.

8. Owing to technical problems in the analysis of Huey Plate extracts by ICAP-AES, the data on SO_2 distribution in the forest is not available. The problem appears resolved and samples await analysis.

Additional accomplishments:

9. Twenty-five replicate samples of each of the 4 soil horizons were sampled from a $25m^2$ plot in the vicinity of the Suncor oil sands plant. This sampling will allow a measure of the variability in soil chemistry to be determined. Samples are frozen and await extraction and analysis.

10. A paper entitled "Synergisms of Contaminant Interaction" was presented to the Council of Forest Industries Workshop, Vancouver in February 23-24, 1982.

11. A paper entitled "Biomonitoring in the Athabasca Oil Sands area of Alberta: Progress and Pitfalls" was presented and published in the symposium on Acid Forming Emissions in Alberta and Their Ecological Effects, Edmonton, March 9-12, 1982.

11. Goals for 1983-84:

1. Prepare and submit to the Research Management Division of Alberta Environment the annual report on research accomplishments. (Addison)

2. Submit a journal article on the influence of SO_2 concentration and duration of exposure on the ^{14}C incorporation by *Evernia mesomorpha*. (Addison)

3. Prepare a short publication on the distribution of SO_2 in forest canopies. (Addison)

4. Continue to study the influence of SO_2 concentration and duration of exposure on jack pine metabolism. Prepare a journal publication. (Addison)

11. Goals for 1983-84: (cont'd)

5. Determine the variation in soil chemistry in contaminated forest soils. (Maynard)

6. In conjunction with Dr. A.A. Khan of the Alberta Environmental Centre

   a. Submit a journal article on plant metabolic changes caused by soil contamination.

   b. Submit a journal article on the effect of SO_2 on superoxide dismutase activity in jack pine.

12. Publications 1982-83:

Malhotra, S.S. and A.A. Khan. 1982. Sensitivity of various metabolic processes to SO_2 in an epiphytic lichen *Evernia mesomorpha*. (in press)

Khan, A.A. and S.S. Malhotra. 1982. Protein biosynthesis in pine needles and its inhibition by SO_2. (in press)

Malhotra, S.S. and A.A. Khan. 1982. Biochemical and physiological impact of major pollutants. (in press)

Khan, A.A. and S.S. Malhotra. 1982. Ribulose diphosphate carboxylase and glycollate oxidase from jack pine. (in press)

Khan, A.A. and S.S. Malhotra. 1982. Peroxidase activity as an indicator of SO_2 injury in jack pine and white birch. (in press)

Addison, P.A., S.S. Malhotra and A.A. Khan. 1982. Sulphur dioxide sensitivity of woody boreal forest species grown on native soils and tailings. (submitted)

Addison, P.A. 1982. Synergisms of Contaminant Interaction. Proc. of Council of Forest Industries workshop on the Assimilative Capacity of the Environment. Vancouver.

Addison, P.A. 1982. Biomonitoring in the Athabasca Oil Sands area of Alberta: Progress and Pitfalls. Symposium on Acid Forming Emissions in Alberta and their Ecological Effects. Edmonton.

13. Signatures:

Investigator

Investigator

Program Manager

Director

NOR-9 Forest Insect and Vegetation Management Systems

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1982

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 and evaluate pheromones 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 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 and maple seed borer, 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. Aldicarb, dimethoate and carbofuran, and injection systems with Metasystox and terbufos.

4. Review, edit, illustrate Pest Leaflets, Information Reports and journal articles.

5. Training of National Research Council personnel in identification of Proteoteras species.

6. Applications for Research Permits for CFS field trials of pesticides and herbicides in Manitoba/Alberta for Proposed Uses of Pest Control Products.

10. Accomplishments in 1982-83

1. Continued assessments, monitoring of established plots, expanded field testing of Velpar Granular and Liquid to spring applications, with DPX 6376 pre-emergent herbicide at Slave L. Velpar Liquid, spring applied at Grande Prairie at lower dosages. Krenite and Velpar Grid Balls were dropped from further trials as product will no longer be available.

   a) Conifer release, white spruce, weed/grass competition; Velpar G. 20% @ 8 lbs/acre, spring applied Faust, Slave L., Alta., Agassiz P.F. and Piney, Manitoba. Results of controls on heavy clay soils at Faust were poor, while good controls on the light sandy soils at Agassiz and Piney.

Velpar L., spring application @ 2, 3 lbs/acre, Grande Prairie; good controls to date, less W. spruce mortality or chlorosis. DPX 6376, spring, summer and fall applications at Slave Lake.

A summary of all assessments was made for second and third year growing season results for Alberta and Manitoba.

2. Continued with evaluation of pheromones with National Research Council, Saskatoon personnel. Drs. Underhill and Speck, and Dr. Wong, C. Rentz, W.G.H. Ives, D. Szlabey, W. Dang and Survey personnel;

   a) field testing of attractant traps (80) for *P. willingana*, *P. crescentana* and *P. aesculana* as well as biologies, populations, damage and distribution, further advances made in biology, damage and populations. (see reports).

   b) Set out 6 traps in each of Manitoba, Saskatchewan and Alberta to monitor distribution. No pine shoot moths were recovered in 1982.

   c) field testing of attractant traps at Devon (17), Edson (8) and in Hinton area with W.G.H. Ives and Cam Rentz (38) to test further refined attractants for the Pitch Twig Moths, *Petrova albicapitana* and *metallica* to obtain biology, populations, damage and distribution pattern. Baits were efficient over time span in the field, contaminate rate (inter-species) for P.*a* and P.*m* were 38 and 75 percent respectively. (see report).

3. Participated with J. Muldrew in chemical control trials and cone collections on the Seed and Cone Study by; conducting chemical control field tests with aldicarb 10 and 15G, carbofuran 10G, dicrotophos and metasystox.

4. Review, edit, illustrate Information/File Reports and 2 pest leaflets on silver leaf and rust galls.

5. CFS representation, reporting, extension requests, surveys, consultations, talks and papers were provided to the following:
   - Western Committee on Crop Pests (ECPUA)
   - Expert Committee on Weeds (ECW) Western
   - National Research Council, Saskatoon
   - Brooks Horticultural Center, Alberta Agriculture, Alberta Forest Service, Industry & Vegetation Management, and general public.

11. Goals for 1983-84:

1. Continue assessment, monitoring of established plots in Alberta/ Manitoba, field test Velpar G on slopes, Velpar L with mist-blower.and DPX6376 applications on 1/10 acre plots at Slave Lake, Grande Prairie and chemical thinning at Edson and Slave Lake with bromacil.

   a) Conifer release, site preparation from weed/grass competition
   -Velpar G. 20% @ 8, 12.5 lbs/acre, Saddle Hills, G. Prairie
   DPX6376 spring application @ 3, 6 g/2 L
   Hyvar X-L (bromacil) chemical thinning, Edson, Slave Lake
   TF1169 weed/grass control and tolerance of conifers
   Garlon and Roundup - trials if cleared by Agric. Can. Pesticide Branch.

2. Continue and complete evaluation of pheromones with NRC.
   - Continue evaluation of pheromone effectiveness, contamination rates and clarify biologies of *P. willingana, aesculana* and a seed feeding species.

   - Continue evaluation for *Petrova albicapitana, metallica* re distribution, inter-tree height, with W. G. H. Ives and low attraction baits. Obtain distribution in Alberta.

   - Continue to monitor for detection of pine shoot moth, *R. buoliana.*

   - Pest leaflet should be considered on seed/cone insects.

   - Continue with chemical controls/soil drench trials and cone study with J. A. Muldrew, w/aldicarb, bidrin, MSR, dimethoate, terbufos, carbofuran.

12. Publications:

1982-83

Drouin, J. A. 1982. Expert Committee on Weeds Research Report Vol. 3 Western Canada Section, Regina, pp. 104-107.

Drouin, J. A. 1982. Annual revision of Insect Pests and controls on Berry Crop. In WCCP Report (1982). 4 pp.

Cerezke, H. F., J. A. Drouin, and B. Neill. 1982. Annual revision of insect pests and controls on shelterbelts, ornamentals and shrubs. In WCCP Report (1982). 18 pp.

Cerezke, H. F., J. A. Drouin. 1982. Insect pests and controls in seasoned wood and timber structures. In WCCP Report (1982). 3 pp.

Soehngen, U. and J. A. Drouin. 1982. Annual revision of insect pests and controls on houseplants and on greenhouse woody ornamentals. In WCCP Report (1982). 13 pp.

13. Signatures:

Investigator

Program Manager

Director A. D. Kiil

CANADIAN FORESTRY SERVICE
STUDY STATEMENT
1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 9, 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 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 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 Embarras 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 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.

10. Accomplishments in 1982-83:

1. Additional plots were established in lodgepole pine regeneration near Hinton, Alberta. Four areas in Marlboro III working circle were selected, as well as another area in Embarras III. We had hoped to include Embarras IX, but there were no access roads open.

2. First-year mortality of lodgepole pine was assessed in all plots established near Hinton in 1981.

3. A file report outlining field methods used in establishing lodgepole pine plots near Hinton and showing location of these plots was prepared. Another file report summarizing first-year mortality is planned, pending transfer of data to computer tape.

4. The 18 jack pine plots established by DeBoo in Manitoba in 1968 were located and the trees re-tagged and remeasured. Irregular planting and natural regeneration made interpretation of mortality since 1970 almost impossible in three of the plots. Survival in the remaining plots was relatively high.

5. Approximately 500 additional plots were established in jack pine plantations to provide representation for plantations established between 1956 and 1975. Heights of trees were measured in 25% of the plots in each sample area.

11. Goals for 1983-84:

1. Assess second-year mortality in lodgepole pine plots near Hinton.

2. Prepare a file report summarizing second-year mortality of trees in lodgepole pine plots near Hinton.

3. Conduct a literature review of the common forest insects of the region and, in co-operation with Dr. Cerezke, prepare a preliminary draft of an illustrated report describing their occurrence, damage and life history. Attempt to obtain illustrative material to fill gaps in what has already been acquired. Transferred from Project 17.

4. Maintain continuity in documentation of the effectiveness of biological control of the larch sawfly by collecting larvae near Pine Falls and Seddon's Corner, Manitoba and Obed, Alberta to determine rates of parasitism by the introduced parasite *Olesicampe benefactor* Hinz and its hyperparasite *Mesochorus dimidiatus* Holmgren. Recent trends indicate that the three species may eventually be reaching an equilibrium in Manitoba, more than 20 years after *O. benefactor* was first released, but additional data are required to confirm this supposition.

12. Publications:

W.G.H. Ives. Insect and disease pests and allied problems affecting lodgepole pine in Alberta. Proceedings of the Fourth International Workshop on Forest Regeneration on Northern Latitude Forest Lands, Hinton, Alberta, August 17-19, 1982. 19 pp. (In press).

A non-technical discussion of the problems, concentrating on the major pests.

W.G.H. Ives and C. L. Rentz. Growth and survival of young lodgepole pine regeneration in west-central Alberta. August, 1982.

A one-page handout summarizing objectives of study and scope of coverage, prepared for delegates to the Fourth International Workshop on Forest Regeneration on Northern Latitude Forest Lands, Hinton, Alberta, August 17-19, 1982.

W.G.H. Ives and C. L. Rentz. 1982. Growth and survival of young lodgepole pine regeneration in west-central Alberta. 1. Field methods and plot locations. Environment Canada, Canadian Forestry Service, Northern Forest Research Centre, Edmonton, Alberta. File report, Study NOR-9-181, October 1982. 7 p. plus 8 figures and 1 table.

Presents maps showing locations of plots and gives a brief description of the field methods used in establishing the plots.

13. Signatures:

Investigator

Program Manager

Investigator

Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 9, 1982

1. Project: Insect and disease 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), *Hylemya anthracina* (spruce cone maggot), *Megastigmus atedius*.

7. Location of 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 1982-83:

   1. Cooperate with the FIDS 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 FIDS.

   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.

10. Accomplishments in 1982-83:

1. No collections of spruce or other cones were received by the FIDS for assessment of damage due to insect pests.

2. Some work was done to relate the life histories of the various pests and their parasites to the phenology and stage of development of white spruce cones. Data will be collected for a series of years to cover a range of conditions.

   To obtain information on losses in various parts of the Province of Alberta 12 collections of 100-200 cones each were obtained from the Pine Ridge Nursery and represent the major cone-collection areas of the province. These will be sampled for damage in early 1983.

3. No work on this was carried out in 1982.

4. Some spruce cones collected in 1981, mainly from Elk Island Park and the Devon Nursery, were reared individually in 1982. Many adults of the pest species and their parasites were obtained and, in cooperation with the FIDS, these are being prepared for shipment to Ottawa for identification.

   In early and mid-June 58 funnel traps were set out under spruce trees bearing considerable numbers of cones, in an attempt to catch dropping larvae of *Hylemya anthracina*. Additionally, 26 sleeve cages containing sand covered with a layer of duff and litter were tied around cone-bearing branches on spruce in the Devon Nursery.

5. In this study two plots containing cone-bearing trees were selected near Slave Lake. In the "Mitsue" plot 25 trees were chosen; 5 each for treatment with the insecticides Bidrin and Metasystox-R (using the "Mauget" injection technique); 5 each for treatment using Temik 10G and Temik 15G (using the soil-drench technique) and 5 for controls. In the "Saulteaux" plot 30 trees were selected. The above schedule was repeated but with the addition of 5 trees treated with carbofuran (Furadan) using the soil-drench technique.

   Most trees were sampled at about the mid-period of cone development and at the end of cone development. Many trees were climbed to obtain the samples but at the end of the season many samples of squirrel-dropped cones were collected beneath

the crowns of selected trees to compare with the samples obtained by climbing.

To date the results indicate that Bidrin and Metasystox R gave relatively good control with about 6% of the cones showing extensive insect damage. The soil-drench chemicals appear to have given little control with the degree of cones showing extensive damage being approximately 50%; about the same as in the control samples. This is thought to be due to the fact that insufficient water was applied at the time of treatment and no heavy rains fell during a 10-day period after treatment.

6. Following reviewers' comments, an extensive revision of this paper was carried out and this version has been submitted for typing.

11. Goals for 1983-84:

1. Cooperate with the FIDS in the assessment of damage due to seed and cone insects in the region and in the identification of their natural enemies.

2. Study the phenology of cone development on white spruce in relation to life-histories of seed and cone insects.

3. Assess the mortality of seed and cone pests caused by natural enemies and relate to biological control. Obtain information on the abundance of enemies and assess their impact. Prepare an interim report.

4. Continue to assess systemic insecticides for the control of insect pests of white spruce seeds and cones. Assess the viability of the treated seeds if time permits.

5. Under the leadership of W. Ives to initiate an analysis of the within-and between-tree distribution of insect-damaged cones in an attempt to develop a practicable sequential sampling technique. The work will probably be carried out in conjunction with studies on selected spruce undertaken by Alberta Energy and Natural Resources, Genetics Section, at Peace River, Alberta.

6. To continue to gather comprehensive data on the position of damaged seeds within insect-attacked cones and to develop a rapid and accurate method of quantitatively assessing damage to each cone.

7. To complete the work necessary to bring the paper "Dispersal and impact of the larch sawfly parasite *Olesicampe benefactor* and the hyperparasite *Mesochorus dimidiatus*" to publication.

12. Publications:

N/A

13. Signatures:

Investigator

Program Manager

Director A. D. Kiil

NOR-10 Silviculture Investigations

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 1982

1. Project: Silviculture investigations

2. Title: Nursery operations

3. New: Cont.: X 4. No.: NOR-10-39

5. Study Leader: Vacant

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 and Paper, Hinton; Simpson Timber, Whitecourt, Alberta and Hudson Bay, Saskatchewan; B.C. Forest Products, Grande Cache, Alberta.

8. Study Objectives:

   1. To conduct lab, greenhouse, and field research into seedling production, handling, and storage.

   2. To improve general nursery practices, including seedling handling, disease control, weed control, cultural operations, and innovations for seedbed treatments.

   3. To advise on container production of seedlings.

9. 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. Analyze soil and foliage samples for regional bareroot reforestation nurseries.

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 report 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.

10. Accomplishments in 1982-83:

1. Advisory services continued until June 1982 resignation of incumbent, after which liaison continued by other professional staff in NOR-10.

2. Established plots and records turned over to individual nurseries in mid-1982.

3. Continued by I. Edwards after June 1, 1982.

4. Discontinued with resignation of incumbent June 1982.

5. Done by I. Edwards. Held at Smoky Lake in November 1982.

6. Discontinued with resignation of incumbent.

7. Continued by I. Dymock after June 1, 1982, who also undertook all greenhouse and nursery supervision at NoFRC pending refilling of this position.

8. No work required.

11. Goals for 1983-84:

1. Conduct laboratory, greenhouse, and field research into seedling production, handling, and storage. (NOR-10-39 - vacant)

2. Trouble-shoot greenhouse and nursery problems and provide routine advisory services to regional nurseries. Maintain soil and foliar analysis service. (NOR-10-39 - vacant)

3. Produce bareroot and container stock for physiology, nutrient, and hardening trials and administer greenhouse and nursery facilities and NoFRC. (NOR-10-39 - vacant)

4. Organize nursery workshops and cooperate in organization of regional nurserymen's meeting. (NOR-10-39 - vacant)

5. Undertake OECD seed inspection work as required. (NOR-10-39 - vacant)

12. Publications 1982-83:

Huber, R.F. (compiler) 1982. Proceedings of the 1981 Intermountain Nurserymen's meeting, Aug. 11-13, 1981, in Edmonton, Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-241.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 1982

1. Project: Silvicultural investigations

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 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:

      a. Effect of N, P, and K on growth of lodgepole pine and white spruce.

      b. Fertilization and conifer seed production.

      c. Erodibility index for forest land.

      d. Soil fertility and site productivity.

      e. 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.

Added Goals

6. Provide 2 lectures and lead laboratory period for Forest Science 517 (Advanced Silviculture) class at University of Alberta.

7. Prepare and present a paper "Nutrient requirements of coniferous tree seedlings" at Alberta Soil Science Workshop held in Edmonton, Alberta.

8. Prepare and present a paper "Rearing tree seedlings in the nursery environment" at the annual Federal-Provincial Nurserymen's Meeting held in Smoky Lake, Alberta.

10. Accomplishments in 1982-83:

1. a. Advisory service in soil fertility and tree nutrition problems was provided to Pine Ridge and Pineland nurseries. At Pine Ridge, data from a leaching study was reviewed and recommendations were made. Growth problems in bareroot and containerized stock were investigated and corrective action recommended.

   b. For Pineland, samples of peat were tested for their suitability as seedbed amendments.

   c. Prepared an addendum to the manual "Guidelines for rearing containerized conifer seedlings in the prairie provinces" (NOR-X-214). It prescribes fertilizers to be used in making concentrated stock solutions.

2. Additional work was done on each of the 5 manuscripts:

   a. The report is ready for review as an Information Report.

   b. The report is ready for review as a Forest Management Note.

   c. The report has been revised and is ready for the second review as an Information Report.

   d. The report has been revised and is ready for the second review as an Information Report.

e. The report is incomplete. Graphical work needs to be done. It is being prepared for Canadian Journal of Soil Science.

3. Black spruce and red pine were grown under various N, P, and K regimes in the greenhouse and growth measurements (height, dry weight, and root collar diameter) were taken. Preparation of the data to fit a computer format for analysis is incomplete.

4. Lodgepole pine was grown in the greenhouse and treated with different N, P, and K solutions to determine their effect on hardening-off. The seedlings have been set outside and are being tested physiologically (Dymock).

5. The study was planned and a sampling program established. Four fallow fields at Prince Albert nursery were sampled at intervals of 15 cm to a depth of 60 cm.

6. Gave 2 one-hour lectures and led a 2-1/2 hour laboratory period at University of Alberta for the Advanced Silviculture class (Forest Science 517). The topic was "Forest nursery soil management" (Feb. 2-4).

7. Prepared and presented a paper "Nutrient requirements of coniferous tree seedlings" at Alberta Soil Science Workshop held in Edmonton, February 24-25.

8. Prepared and presented a paper "Rearing tree seedlings in the nursery environment" at the annual Federal-Provincial Nurserymen's Meeting held in Smoky Lake, Alberta, November 16-17.

11. Goals for 1983-84:

1. To provide adivsory service, investigate problems, and offer recommendations in soil fertility and tree nutrition as requested by industry and government agencies. (NOR-10-135 Edwards)

2. To publish the following manuscripts:

a. Fertilization and conifer seed production--as a Forest Management Note.

b. Erodibility index for forest land--as an Information Report.

c. Soil fertility and site productivity. (NOR-10-135 Edwards)

3. To analyze data and prepare a file report on nutrient requirements for growth of containerized black spruce and red pine. The report will be submitted to the Manitoba Department of Natural Resources. (NOR-10-135 Edwards)

4. To continue the experiment on the effects of residual fertility on jack pine and white spruce at Prince Albert. Two fields will be seeded to each species in spring. Sampling of soil and foliage will be collected in the fall. (NOR-10-135 Edwards)

5. Cooperate with NOR-10-192 in physiological hardening experiments by providing advice in planning and establishing the nutrient regimes required. (NOR-10-135 Edwards and NOR-10-192 Dymock)

12. Publications 1982-83:

Edwards, I.K. 1982. Soil management in bareroot nurseries. Presented as lectures and laboratory period at Dept. of Forest Science, University of Alberta, February 2-4.

Edwards, I.K. 1982. Nutrient requirements of coniferous tree seedlings. Presented at the annual Alberta Soil Science Workshop held in Edmonton, February 24-25.

Edwards, I.K. 1982. Rearing tree seedlings in the nursery environment. Presented at the annual Federal-Provincial Nurserymen's Meeting held at Smoky Lake, November 16-17.

13. Signatures:

I.K. Edwards
Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 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 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.

10. Accomplishments in 1982-83:

1. Revised copy "Guidelines to overwintering container stock" under review.

2. Forest Management Note "Field storing containerized conifer seedlings" is with the Editor.

3. Information Report "Field performance of containerized conifer seedlings in the lower foothills, south of Grande Prairie, Alberta", is with the Editor.

4. Whitecourt data analyzed and draft paper is in preparation.

5. Preliminary 1981 set of data on freeze damage of non-conditioned seedlings were processed on the Hewlett Packard. Minor changes were made in the procedures for colorimeter use in 1982. Colorimeter readings of several crops of 1982 preconditioned pine and spruce containerized stock have not yet been completed.

6. Progress has been made with INA isolations, identifications to genus and with some INA drop tests. Results may provide material for a short paper.

7. Seedling storage:

Have spent some time September-October with Blue Ridge nursery staff on how to rejuvenate 2/3 M frost damaged container stock seedlings. Some seedlings have been analyzed on the colorimeter and samples of irrigation water were brought to the lab for INA isolation. A Pseudomonas was isolated from seedlings and from irrigation water.

Health of trees and shrubs:

Most inquiries came from private home owners and from research people.

Identifications and professional:

Have given advice to several AFS staff on frost damage work and use of equipment; U of A students on techniques in histology, disease control in experimental material and fungus identification. Have identified 16 fossil specimens to species for Professor Karrow, Waterloo University, Department of Earth Sciences. Have identified a fossil specimen for Steve Zoltai. Have provided references on INA literature to a consulting firm on poplar decay to a researcher from ARC. Have identified hardwoods and conifers for a private collector specializing in cane making. Have advised NoFRC and AFS staff on frost damage requirements for testing of seedlings receiving different nutritional regimes. Have assisted Wil Holland on how to interpret frost damage on the basis of topography, area involved, severity, elevation, uniformity, frequency and time of occurrence. Have participated in a workshop on review of pathological research in Canada.

11. Goals for 1983-84:

1. Publish the following as required by editorial schedule.

   a. Forest Management Note "Field storing of containerized conifer seedlings" with the Editor.

   b. Third copy of Information Report "Guidelines to overwintering container stock" with the Review Committee (Lorne Brace).

   c. Information Report "Field performance of containerized conifer seedlings in the lower foothills, south of Grande Prairie, Alberta" with the Editor.

   d. Forest Management Note "Overwintered lodgepole pine and white spruce containerized seedlings field-tested in a Whitecourt Forest clearcut of Alberta" to be reviewed by the Committee and Editor for publication. (NOR-10-155 Zalasky)

2. Continue with completion of data collection and analysis of frost damage in container seedlings to determine the duration for each freezing event and prepare first draft of paper. (NOR-10-155 Zalasky)

3. Provide advisory and consulting services to provincial and industrial forest agencies with regards to seedling storage and outplanting. (NOR-10-155 Zalasky)

4. INA goals transferred to project NOR-35-194. (NOR-10-155 Zalasky)

5. Terminate study.

12. Publications 1982-83:

Zalasky, H. 1982. Frost hazards in forest nurseries, plantations and natural stands. Presented at the Working Group on Soil Interpretation for Forestry, a Subcommittee of the Canada Expert Committee on Soil Survey. Victoria, B.C.

Zalasky, H. 1982. Tree seedling ecology of frost in the nursery, plantations, and forest. Presented at Smoky Lake Federal/Provincial Nurserymen's Meeting, November 16-17.

Zalasky, H. 1982. Procedure to condition lodgepole pine and white spruce seedlings at Blue Ridge Simpson Timber Co. Ltd. Nursery. File Report.

Zalasky, H. 1982. Summary of frost types and damage to forests. File Report.

13. Signatures:

Harry Zalasky
Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 1982

1. Project: Silvicultural investigations

2. Title: Development of silvicultural 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: Northern Forest Research Centre

8. Study Objectives:

   1. To coordinate 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 silvicultural component of a data bank (to include stock performance and silviculture mechanization components) and cataloging and assessment of silviculture guidelines and decision models.

   3. To publish scientific and technical reports of silvicultural interest, regionally and nationally, stressing regeneration silviculture.

   4. To provide liaison and input as required to relevant national programs, including the Canadian Forest Resource Data Program, and the Mechanization of Silviculture Program.

   5. Supervise research contracts and develop in-house research studies as an outgrowth of contracts where appropriate.

9. Goals for 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).

Added Goals:

6. Act as Scientific Authority on ENFOR P-205.

7. Coordinate review of Initial Environmental Evaluation (I.E.E.) for logging plans in Wood Buffalo National Park, as requested by RSCC.

8. Act as a member of the Canada/USA lodgepole pine/mountain pine beetle program committee.

10. Accomplishments in 1982-83:

1. Carried out routine coordination role. Developed mechanization of silviculture study and prepared for restaffing of NOR-10-039 vacancy.

2. Organized and chaired regional meeting in Manitoba in June 1982 and provided liaison within committee. Results of meeting forwarded to NoFRC Regional Advisory Committee.

3. No progress on data bank entry of performance data. Regional data on silviculture statistics established in bank by Golec. Planned entry of mechanization of silviculture inventory on datatreive.

4. Report at publication stage.

5. Draft prepared but still not reviewed.

6. ENFOR P-205 continued to completion of field phase and into laboratory analysis. Provided consultation and supervision as needed in 1982.

7. Undertook initial committee establishment and made on-site visit to company involved.

8. Made input to report on development of pine management strategies. Report now to be redrafted for November 1983 submission as status report.

11. Goals for 1983-84:

1. Continue as project leader and coordinator of NOR-10. Fill vacancy in NOR-10-039--Nursery Operations Research Officer. (NOR-10-176 Brace)

2. Continue as chairman of Regional Reforestation Technical Committee. Organize-coordinates 1983 meeting and related technology transfer and research communications. (NOR-10-176 Brace)

3. Act as review coordinator for an Initial Environmental Evaluation (I.E.E.) of a logging plan in Wood Buffalo National Park. Present report to RSCC. (NOR-10-176 Brace, Thompson, Carbyn)

4. Publish information report on hare damage in prairie provinces. (NOR-10-176 Brace, Ball)

5. Complete regional inventory and data bank entry for mechanization of silviculture project. Plan mechanization of silviculture workshop (coop. with GLFRC). Attend NACMEC meeting as regional CFS representative. Undertake equipment evaluation in cooperation with GLFRC. (NOR-10-176 Brace)

6. Cooperate with Regional Resource Data Specialist in updating information for National Silviculture Report which is on DATATRIEVE SYSTEM at NoFRC. Publish a Forest Management Note covering 1980-81, 1981-82 data. Establish liaison with CIF silviculture data committee. (NOR-10-176 Brace)

7. Continue as Scientific Authority on ENFOR Contract P-205 (Aspen Nutrient Study). Report due August 1983. (NOR-10-176 Brace, Edwards)

8. Contribute to revision of silviculture paper as member of Canada/USA Lodgepole Pine/Mountain Pine Beetle Committee. (NOR-10-176 Brace)

12. Publications 1982-83:

1. Brace, L.G. and P. Golec. 1982. Silviculture statistics for Canada. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-245.

2. Contributed to:

Anon. 1982. Forest management concerns and opportunities. In: a review of mountain pine beetle problems in Canada. Environ. Can., Can. For. Serv., Pac. For. Res. Cent. Victoria, B.C.

3. Ball, W.J. and L.G. Brace. 1982. Production, use and field performance of container seedlings in the prairie provinces. In: Proceedings of the Canadian Containerized Tree Seedling Symposium. Sept. 14-16, 1981, Toronto. COJFRC Symposium Proc. O-P-10.

13. Signatures:

L. F. Grace
Investigator

Program Manager

C. D. Kiil
Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 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, bareroot stock

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 cooperative 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.

9. 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 plus 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.

   c. To measure 10-year field performance of operational planting (NWPP NOR-118) of small container stock. Alberta (lP and wS).

   d. To measure 10-year field performance of wS and jP container seedlings and bareroot 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.

10. Accomplishments in 1982-83:

1. The work was carried out as outlined in goal #1 viz. the destructive sampling was carried out on 3 occasions at Smoky Lake; the second spring planting (of spruce and pine) and the third fall planting (of pine) took place on 3 sites south of Grande Prairie. A file report on 1982 activities will be prepared this winter as required by AFS contract.

2. a. Ten-year field performance of white spruce that were reared in 40-cm^3 ARC sausages and BC styroblocks and outplanted at Lac La Biche, Whitecourt, and Grande Prairie were recorded.

   b. Height and survival of 5-year-old browsed wS seedlings were taken at Rice River only. This stock was in 5 container sizes (from 2.4 to 45 $in.^3$) plus 2+2 transplant stock.

   c. The operationally reared and planted (small) container stock from the first set of 10-year-old plantations were measured (wS and lP) at Hinton.

   d. The second set of 10-yr wS and jP container and bareroot stock were measured in central Saskatchewan.

3. The (60+10)-yr-old wS IPFF plots were remeasured at Slave Lake. Data were sent to Bob Dobbs.

4. These data are all punched and analysis is half complete.

5. Since August I have been acting in a new term position with job creation and now Regional Development.

11. Goals for 1983-84:

1. To continue the AFS-CFS cooperative container study by:

   a. Sampling stock in May at Smoky Lake. (Walker)

   b. Spring planting of spruce and pine on 3 sites south of Grande Prairie. (Ball, Walker)

   c. Recording first and third year performance data in July and August. (Walker)

   d. Preparing a progress report on establishment in fall. (Walker)

   e. Prepare Forest Management Note on rearing of 3 sizes of container stock. (Ball)

   Note: The 1983 spring planting will require additional manpower of 6-8 man weeks. Arrangements may be made with Proctor and Gamble to stay at their camp. (NOR-10-190 Ball)

2. a. Complete remeasurement and undertake analysis of the second last set of 10-year-old 40-cm^3 styroblock and sausage container seedlings in Alberta. (Between 1971 and 1974 styroblock and sausage container seedlings were outplanted in 54 plantations in 6 forest districts in Alberta; 10-15 of these 1000-seedling plantations are worth remeasuring.) These seedlings were reared for 10-15 weeks in the greenhouse. (Walker)

   b. Obtain the third (and final) 10-yr remeasurement of 40-cm^3 styroplug and bareroot seedlings outplanted on prepared burns in central Saskatchewan. (NOR-10-190 Ball)

3. To contribute plot data toward publication of an Information Report on hare damage in the prairie region. (NOR-10-196-190 Brace, Ball)

4. To publish an Information Report on 5-yr performance of container and bareroot seedlings on prepared burns in Saskatchewan. (NOR-10-190 Ball)

~~5. Establish experiment to monitor development of browsed spruce seedlings in eastern Saskatchewan and northeastern Alberta. (NOR-10-190 Ball)~~

12. Publications 1982-83:

Ball, W.J. and L.G. Brace. 1982. Production, use and field performance of container seedlings in the prairie provinces. Proceedings, Canadian Containerized Tree Seedling Symposium, Sept. 14-16, 1981. Toronto, Ontario.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 1982

1. Project: Silviculture investigations

2. Title: Forest tree seedling and seed physiology

3. New: Cont.: X 4. No.: NOR-10-192

5. Study Leader: I.J. Dymock

6. Key Words: Tree seedling physiology, cold hardiness, dormancy, physiological and biochemical testing, influence of environmental parameters, bareroot and container stock production, cone and seed production and physiology, post-harvest physiology

7. Location of Work: Northern Forest Research Centre, Edmonton, Alberta; locations within Western and Northern Region as may be required

8. Study Objectives:

   1. Plans, develops, and conducts investigations into physiological aspects of: 1) growing, conditioning, and physiological testing of container and bareroot seedlings, 2) field performance of seedlings, and 3) cone and seed development and production, in support of improved reforestation and forest management strategies.

   2. Analyze 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.

9. 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.

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 of 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.

Goal Added:

6. Perform duties of acting greenhouse and nursery manager at NoFRC as interim replacement for Huber from 82.06.01.

10. Accomplishments in 1982-83:

1. Seedling physiological research.

a. Environmental monitoring of stock at NoFRC.

- Temperature monitoring system (24 channel input, Honeywell Model EL-15) modified to increase reliability of timing mechanism.

- System installed for hourly monitoring of root, stem, apex, and air temperature of overwintering containerized 1982 stock (wS, 1P). Temperature data collection continues.

b. Establishment of 1982 stock (wS, 1P) at NoFRC.

- Grew 24 trays each wS and 1P for cold hardening and dormancy studies.

- Grew 144 trays 1P for study on nutrient requirements for hardening container stock.

- Established two direct-seeded beds (each 1 X 35 m) at NoFRC nursery; one each for bareroot wS and 1P stock.

c. Phenological/physiological testing of 1982 containerized stock (wS, 1P) during cold hardening and dormancy.

- Performed weekly sampling of 1982 containerized stock (wS, 1P commencing end of August 1982.

- Carried out measurements of growth parameters, performed phenological/physiological tests on root, stem, and bud samples.

- Collected and stored additional seedlings (wS, 1P) for further microscopic and biochemical analyses related to cold hardiness and dormancy studies.

- Presented a research paper entitled "Changes in mitotic index and electrical resistance during the breaking of dormancy in seedlings of *Pinus contorta* and *Picea glauca*" at the joint meeting of the Canadian Society of Plant Physiologists and the Canadian Botanical Association at the University of Regina, Regina, Saskatchewan, June 20-24, 1982. The data for this report comprised the preliminary results from the phenological/physiological testing of wS and 1P containerized seedlings during the natural and induced breaking of dormancy during February-May 1982.

- Presented a research paper entitled "Changes in stem electrical resistance during cold hardening of lodgepole pine and white spruce seedlings" at the Western Regional Meeting of the Canadian Society of Plant Physiologists at the University of Alberta, Edmonton, Alberta, February 24-25, 1983.

d. Nutrient requirements for hardening container stock.

- Initiated investigation on 1982 1P container stock. Set up 36 hardening fertilizer regimes for N/P/K, with all micronutrients kept constant.

- Measured initial growth parameters at beginning of hardening fertilizer treatments; measured growth parameters every two weeks for eight-week treatment period.

- Performed cold hardiness testing at weekly intervals to early December 1982.

- Analyzed data on growth parameter changes for different hardening fertilizer regimes and for cold hardiness tests.

- Presented a research paper entitled "The influence of nutrients on the cold-hardening of container-grown lodgepole pine seedlings" at the Western Regional Meeting of the Canadian Society of Plant Physiologists at the University of Alberta, Edmonton, Alberta, February 24-25, 1983.

2. Cone and seed physiological research.

a. wS cone/seed phenology and development.

- Visited three AFS wS seed production areas with Muldrew and Rentz to investigate feasibility of field studies in Slave Lake area.

- Tested PFRC method of sampling branches using rifle/projectile/portable cutters. Ives and Muldrew have constructed necessary equipment for NoFRC use.

- Bud samples (wS) collected to evaluate PFRC/BCFS method of predicting cone crops (Muldrew) at Slave Lake sites.

b. wS cone/seed maturation and post-harvest physiology and role of endogenous growth regulators.

- Continued literature investigations for role of endogenous growth regulators in seed maturation and post-harvest physiology.

- No field or laboratory investigations during 1982-83.

3. O.E.C.D. seed analyst duties.

   a. No requests for O.E.C.D. seed certification during 1982-83.

   b. Tested seed germination equipment for use by pathology group (Hiratsuka) and provided X-ray equipment/materials for use of toxic substances group (Addison).

4. Manuscript preparations from Ph.D. thesis.

   a. Presently four manuscripts in development. Expect to be ready for manuscript review early in 1983-84.

   b. Presented a research paper entitled "Transport and metabolism of kaurene in *Helianthus annuus*" at the Eleventh International Conference on Plant Growth Substances at the University College of Wales, Aberystwyth, Wales, U.K., July 12-16, 1982.

5. Consultative services.

   a. Provided consultative services to entomologists, herbicide specialist, and pathologists at NoFRC as requested on matters of seedling/tree physiology, environmental parameters and influences on growth, and cone and seed production.

   b. Provided extensive consultative services to AFS Forest Research Branch; provided use of greenhouse, cold room, and laboratory facilities to AFS Spruce Grove researchers. Prepared a memorandum of understanding to cover AFS (Spruce Grove) use of NoFRC facilities during 1982-83.

   c. Attended the 1982 Federal/Provincial Nurserymen's Meeting, hosted by AFS (PFRN) at Smoky Lake, Alberta, November 16, 1982.

   d. Provided consultative services to industrial forest agencies and individuals as requested on matters relating to seedling/tree growth and physiology.

   e. Provided consultative services as a scientific reviewer for manuscript reviews, unsolicited proposals and policy statements and documents as requested.

6. Duties of acting greenhouse/nursery manager at NoFRC.

   a. Coordinated and supervised daily operations and maintenance of NoFRC greenhouse and nursery in conjunction with one full-time (half-time) greenhouse assistant and two COSEP students (Haley and Jass).

   b. Coordinated greenhouse space allocation requests for 1983. Assigned space allocations for 1983 to NoFRC researchers and on contract basis for requests from AFS (Spruce Grove) and AFS (Smoky Lake-PFRN genetics group).

c. Advised greenhouse/nursery users on perceived problems with research materials as these arose; recommended corrective actions to be taken.

11. Goals for 1983-84:

1. Seedling physiological research. (NOR-10-192 Dymock)

a. Produce growing container and bareroot stock for all research needs under NOR-10-192.

b. Continue sampling wS and 1P stock for phenological, physiological, and biochemical testing during cold hardening, dormancy, and dormancy breaking. Evaluate 1982-83 data. Prepare interim report.

c. Initiate methods/bioassays development for investigating role(s) of endogenous growth regulators in seedling physiology studies--cold hardening and dormancy.

d. Continue study on nutrient requirements for hardening containerized seedlings; study black spruce (bS); prepare draft report on bS data and compile with 1982 1P data (with Edwards).

2. Cone and seed physiological research. (NOR-10-192 Dymock)

a. Initiate methods/bioassays development for investigating role(s) of endogenous growth regulators in cone/seed physiological research.

b. Develop collaborative research project with A.K. Hellum on lodgepole pine seed maturation.

3. Perform O.E.C.D. seed analyst duties as required. (NOR-10-192 Dymock)

4. Continue preparation, review, and submission of the following growth regulator papers from Ph.D. thesis. (NOR-10-192 Dymock)

a. The gibberellin status of *Helianthus annuus* at two stages of vegetative growth.

b. The transport and metabolism of ent-kaurene in *Helianthus annuus*.

5. Provide consultative services to federal, provincial, and industrial forest management agencies concerning tree physiology as it relates to seedling growth, conditioning, physiological testing, field performance of seedlings, physiological aspects related to pathology, entomology, and herbicide/pesticide uses and effects, and any related areas of tree, seed, or seedling growth and productivity. (NOR-10-192 Dymock)

12. Publications 1982-83:

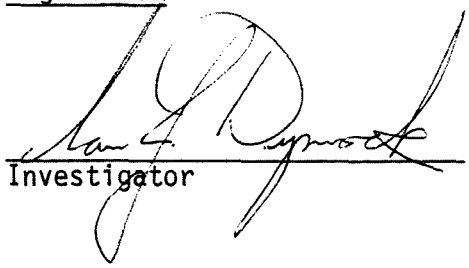
Dymock, I.J. 1982. Changes in mitotic index and electrical resistance during the breaking of dormancy in seedlings of *Pinus contorta* and *Picea glauca*. Presented as a poster session report at the joint meeting of the Canadian Society of Plant Physiologists and the Canadian Botanical Association June 20-24, 1982, at the University of Regina, Regina, Saskatchewan.

Dymock, I.J. 1982. Transport and metabolism of kaurene in *Helianthus annuus*. Presented as a poster session at the Eleventh International Conference on Plant Growth Substances, July 12-16, 1982 at the University of Wales, Aberystwyth, Wales, U.K.

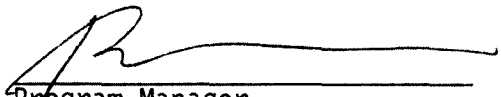
Dymock, I.J. 1983. Changes in stem electrical resistance during cold hardening of lodgepole pine and white spruce seedlings. Presented as an oral report at the Western Regional Meeting of the Canadian Society of Plant Physiologists, February 24-25, 1983 at the University of Alberta, Edmonton, Alberta.

Dymock, I.J. 1983. The influence of nutrients on the cold hardening of container-grown lodgepole pine seedlings. Presented as an oral report at the Western Regional Meeting of the Canadian Society of Plant Physiologists, February 24-25, 1983 at the University of Alberta, Edmonton, Alberta.

13. Signatures:



Investigator



Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 6, 1982

1. Project: Silvicultural investigations

2. Title: Forest ecology and site productivity

3. New: Cont.: X 4. No.: NOR-10-193

5. Study Leader: I.G.W. Corns

6. Key Words: Forest ecology, site productivity, forest soils, site modification, succession, ecological classification

7. Location of Work: Northern Forest Research Centre, Edmonton; Boreal Forest in Western and Northern Region

8. Study Objectives:

   1. Quantification of site forest productivity relationships through multivariate analysis.

   2. To present Alberta forest ecological classification data in a field guide format readily comprehensible to government and industrial operational foresters, providing interpretations of the data for forest management purposes.

   3. To characterize and analyze environmental influences upon tree growth on highly productive forest sites in our region, with the objective of learning potentially manageable chemical and physical factors responsible for growth. The role of some micronutrients, still unknown for our area, would be evaluated.

   4. To further document plant succession and early tree growth in young (<25 yr) lodgepole pine forests originating from pulpwood clearcutting in western Alberta.

   5. To initiate a study on tree root development and subsequent growth in relation to modification of soil properties through logging and subsequent site preparation activities. The study would be conducted in an ecosystematic framework. In addition to monitoring effects of compaction, erosion, alteration of drainage etc., several methods of site "rehabilitation" would be tested.

9. 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".

Goals Added

5. Keynote speaker presentation on "Recent ecological land classification activities in Alberta" to the B.C. Ministry of Forests, Annual Ecology Meeting, Kelowna, March 9-11, 1982.

6. Preparation of paper "Productivity of conifers in western Canada boreal forests in relation to selected environmental factors--a review" for the IUFRO Symposium - Site and Continuous Productivity, Seattle, August 22-27, 1982. The paper was coauthored by D. Pluth, Dept. Soil Science, University of Alberta.

7. To provide field consultation to provincial government agencies involved in ecological land classification in Alberta's forest.

10. Accomplishments in 1982-83:

1. Work is underway on a field guide to provide forest ecosystem identification and management interpretation in cooperation with the AFS Research Branch. Several field workshops were conducted

with Alberta government and industrial foresters in western Alberta. The field guide will provide a synthesis and applications of the biogeoclimatic and other relevant Alberta ecological data. A draft should be ready by summer 1983 contingent upon continued AFS support.

2. The goal in relation to evaluation of trophotope was dropped when the field guide goal was assumed.

3. Twenty-five-year-old lodgepole pine stands northwest of Edson, Alberta were resampled (previously done in 1970 as part of my M.Sc. project) to further document plant succession and early tree growth after clearcutting. Plant cover by species and tree biomass estimates were determined.

4. The following papers were prepared for publication:

   a. No progress in 1982-83.

   b. "Vegetation indicators as independent variable in forest growth prediction in west-central Alberta". This paper was co-authored by Dr. D. Pluth, Dept. Soil Science, U of A, submitted to Can. J. For. Res. but was returned "not acceptable" after having been reviewed. Alternative publication routes are being considered.

   c. "Distribution of forest ecosystems of west-central Alberta in relation to selected environmental factors". This paper was also submitted to Can. J. For. Res. and has been returned for major revision, especially condensation.

   d. "Plants new to Alberta from Banff and Jasper National Parks" has undergone one internal review and is being prepared for submission to Canadian Field-Naturalist. This paper is co-authored with P. Achuff, AIP.

5. Made keynote speaker presentation on "Recent ecological land classification activities in Alberta" to the B.C. Ministry of Forests, Annual Ecology Meeting, Kelowna, March 9-11, 1982.

6. Paper presentation, "Productivity of conifers in western Canada boreal forests in relation to selected environmental factors, a review" to the IUFRO Symposium - Site and Continuous Productivity, Seattle, August 22-27, 1982. The paper was co-authored with D. Pluth, Dept. Soil Science, University of Alberta. Proceedings will be published by USDA Forest Service, PNW Forest and Range Experiment Station.

7. Field consultation was provided to the Site Classification unit of the Resource Evaluation and Planning Branch, Alberta Energy and Natural Resources, as part of the on-going ecological (biogeoclimatic) classification of Alberta's forest land. REAP is providing the necessary computer runs and support to accomplish goal no. 1 above (i.e., field guide).

11. Goals for 1983-84:

1. Complete and publish field guide for forest ecosystem identification and interpretation. Complete draft of detailed report describing ecosystem types of western Alberta, in cooperation with Alberta Forest Service Research Branch. (NOR-10-193 Corns, Annas, REAP)

2. Complete the following publications:

   a. Vegetation indicators as independent variables in forest growth prediction in west-central Alberta. (NOR-10-193 Corns, Pluth)

   b. Distribution of forest ecosystems of west-central Alberta, in relation to selected environmental factors. (NOR-10-193 Corns)

   c. Plants new to Alberta from Banff and Jasper National Parks. (NOR-10-193 Corns, Achuff)

3. Prepare draft report on forest succession 24 years after clear-cutting (Edson Forest). (NOR-10-193 Corns)

4. Initiate analysis and characterization of highly productive forest sites in our region. Locations, environmental and growth data from such sites previously sampled (biogeoclimatic and other) will be compiled and compared. Plans will be made for sampling new sites and to fill in information gaps. (NOR-10-193 Corns)

5. Carry out a literature review of research on soil modification during logging and site preparation. (NOR-10-193 Corns)

12. Publications 1982-83:

Annas, R.M., P.J. Behman, I.G.W. Corns, Z. Nemeth, and S. Kish. 1982. Field data summary of the Alberta Ecosystem Classification. Alberta Forest Service, Research Branch, Canadian Forestry Service and Alberta Resource Evaluation and Planning. File Report.

Holland, W.D. and G.M. Coen (eds.). In press. Soil and vegetation resources. Vol. 2, Ecological (biophysical) land classification of Banff and Jasper National Parks, Alberta, Canada. North. For. Res. Cent., Edmonton, Alberta. AIP Rep.

I.G.W. Corns has authored several sections of the above report.

Pluth, D.J. and I.G.W. Corns. In press. Productivity of conifers in western Canada boreal forests in relation to selected environmental factors--a review. Proc. IUFRO Symposium - Site and Continuous Productivity, Seattle, August 22-27, 1982.

Corns, I.G.W. 1982. Recent ecological land classification activities in Alberta. Paper presented at the B.C. Ministry of Forests Annual Ecology Meeting, Kelowna, B.C., March 9-11, 1982.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 11, 1982

1. Project: Silvicultural investigations

2. Title: Silvicultural research and technology transfer, Manitoba and Saskatchewan

3. New: X Cont.: 4. No.: NOR-10-196

5. Study Leader: J. Ball

6. Key Words: Silviculture, research, demonstrations, appraisals, liaison, technology transfer, spruce, pine, poplar

7. Location of Work: Manitoba and Saskatchewan

8. Study Objectives:

   1. To establish strong lines of communication with various forest management agencies in Manitoba and Saskatchewan.

   2. To assess, maintain and conduct silvicultural research, field trials, and demonstrations in Manitoba and Saskatchewan.

   3. To observe forest management in the field providing up-to-date silvicultural information directly to the agencies involved, identifying forest management problems requiring research.

9. Goals for 1982-83:

   Nil - new study.

10. Accomplishments in 1982-83:

    Nil - new study.

11. Goals for 1983-84:

    1. To assist J. Klein grafting jack pine for the Hadashville seed orchard. (NOR-10-196 Dyck)

    2. To assist I. Bella remeasuring jack pine thinning plots in southeastern Manitoba. (NOR-10-196 Dyck)

3. To initiate remeasurement of projects MS 226, 227, and 190 (at Pine Falls, Fish Road, Montago Ridge, and West Hawk Lake) for data analysis and preparation of case histories. (NOR-10-196 Ball and Dyck)

4. To carry out assessments of existing silvicultural research projects in Manitoba and Saskatchewan to determine their suitability for remeasurement and the preparation of reports. (NOR-10-196 Ball and Program Managers).

5. To carry out contact, liaison, and technology transfer with Manitoba and Saskatchewan forestry clientele via the Winnipeg Sub-office. (NOR-10-196 Ball)

6. To publish a Forest Management Note "Increase of red pine seed production through fertilization". (NOR-10-196 Dyck and Froning)

7. To publish a Forest Management Note "Guidelines to regeneration silviculture--Sandilands Forest Reserve, Manitoba. (NOR-10-196 Froning)

12. Publications 1982-83:

Nil - new study.

13. Signatures:

W G Ball
Investigator

Program Manager

Director A.D. Kiil

NOR-12 Tree Improvement

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 13, 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-12-50

5. Study Leader: J.I. Klein

6. Key Words: Geographic variation, seed sources, seed zones, Alberta, Manitoba, Saskatchesan, 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 1982-83:

Red pine

1. Measure the test planatation 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.

10. Accomplishments in 1982-83:

Red pine

1. Height and diameter were measured in the test plantation at Piney following the 25th growing season after planting.

Black spruce

1. The file report entitled "Establishment of Black Spruce Geographic Variation Plantations in the Prairie Provinces, 1975" was completed and distributed to cooperators for the range-wide study.

2. A copy of the above report and a tape of the five-year measurement data were sent to Dr. Khalil of NeFRC.

11. Goals for 1983-84:

Nil (NOR-12-50, Klein)

12. Publications 1982-83:

Nil

13. Signatures:

Jerome A Klein
Investigator

Program Manager

Director

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 13, 1982

1. Project: Tree improvement

2. Title: Breeding jack pine for the Northern Region. L. First selection cycle.

3. New: Cont.: X 4. No.: NOR-12-51

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 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.

9. 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 core forestry program, the Canada Seeds Act, and the national tree improvement program.

Goal added:

15. Prepare a draft plan for cooperative development of seed orchards for the Province of Manitoba.

10. Accomplishments in 1982-83:

1. The Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan", submitted to the NoFRC editor in October 1981, is still with the editor. Copies of the current draft were provided to cooperators.

2. Forest Management Note No. 18, entitled "Genetically Improved Jack Pine for Manitoba and Saskatchewan", has been published.

3. Preparation of a draft for an Information Report on the seed orchard at Birds Hill nursery was postponed in favor of the added goal (15) of a seed orchard development plan.

4. Production of a special report of maps and source lists for the breeding program was not completed owing to lack of sufficient time.

5. A voluntary paper entitled "A Jack Pine Breeding Program in Western Canada', and a poster paper on the same subject, were presented on my behalf by a colleague at the Joint Meeting of IUFRO Working Parties on Genetics about Breeding Strategies, at Escherode, Federal Republic of Germany.

6. Labelling and classification of photo transparencies was not completed owing to lack of sufficient time.

7. Of 699 grafts made for the clone bank 637 were successful for a success rate of 91%. The inventory of required grafts was increased to about 3060. Planting of grafts in the clone bank was curtailed in favor of lining out most potted grafts on hand, in the NoFRC nursery compound. Clone bank stocking was increased to about 2100 grafts of 3185 required.

8. The tenth-year measurement of the eastern breeding district family test was repeated. Gall rust incidence was tallied in two plantations, lean resulting from a windstorm was tallied in a third, and the remaining plantation had no important damage.

9. Two hundred grafts were made of 28 central breeding district parent clones having a mean progeny height superiority at five years of 9.4%. These grafts are being tended by the Manitoba Forestry Branch pending development of a seed orchard site.

10. Just under 200 grafts were made of 35 eastern breeding district families selected for 5-year height superiority, including families having progeny grafts in the clone bank, for a Province of Manitoba seed orchard. Grafts of 14 families which are of select rank at 10 years, will be used in the first seed orchard. Selection of western breeding district clones was revised, but understocks and time were not available for seed orchard grafting of the selected clones.

10. Accomplishments in 1982-83: (cont'd)

11. Data processing of 10-year eastern breeding districts results was done too late to select clone bank grafts for mating, and pollen production in the clone bank is insufficient for controlled breeding at present.

12. Pollen production was insufficient to initiate controlled breeding of selected western district grafts.

13. A technical workshop for staff of cooperating agencies was conducted in June 1982.

14. There was no action required under the integrated core forestry program, the Canada Seeds Act, or the national tree improvement program.

15. The first draft of a plan for cooperative development of Province of Manitoba seed orchards has been forwarded to the Manitoba Forestry Branch.

11. Goals for 1983-84:

1. Complete the final draft of the plan for cooperative development of Province of Manitoba seed orchards, in collaboration with Manitoba Forestry Branch staff. (NOR-12-51, Klein)

2. Publish the Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan". (NOR-12-51, Klein)

3. Publish a Forest Management Note on selection for seed orchard use of the best eastern breeding district families at 10 years from planting. (NOR-12-51, Klein)

4. Label and classify photo transparencies of breeding program materials, for use in illustrated talks on the program. (NOR-12-51, Klein)

5. Prepare and present an illustrated talk on the program to the Manitoba Section of the Canadian Institute of Forestry. (NOR-12-51, Klein)

6. Produce a special report of maps and source lists for the breeding program (NOR-12-51, Klein)

7. Graft scions of selected eastern district families for a Province of Manitoba seed orchard. (NOR-12-51, Klein)

11. Goals for 1983-84: (cont'd)

8. Measure the western breeding district family test at 10 years from planting. (NOR-12-51, Klein)

9. Publish an Information Report on design and selection thinning of the seedling seed orchard at Birds Hill nursery. (NOR-12-51, Klein)

10. Graft about 150 scions and tend clone bank grafts (planted, lined out, or in pots) to increase the inventory of grafts required for clone bank completion to 3150 of 3185 required. (NOR-12-51, Klein)

11. Produce seed orchard grafts for cooperating agencies of (a) western and (b) central breeding district parent clones selected for superior five-year progeny height. (NOR-12-51, Klein)

12. Provide advice to cooperators and others on tree improvement techniques (NOR-12-51, Klein)

13. Act as regional contact for the national tree improvement program and promote and coordinate greater use of tree improvement activities in the region. (NOR-12-51, Klein)

12. Publications 1982-83:

Publications

Klein, J.I. 1982. Genetically improved jack pine for Manitoba and Saskatchewan Environ. Can., Can. For. Serv. North. For. Res. Cent., Edmonton, Alta, For. Man. Note No. 18.

Reports

Klein, J.I. 1982. A jack pine breeding program in Western Canada. A paper presented at the Joint Meeting of IUFRO Working Parties on Genetics about Breeding Strategies at Escherode, Federal Republic of Germany, September 1982.

13. Signatures:

Jerome I Klein

Investigator

Program Manager

Director

NOR-13 Forest Hydrology and Microclimate Research

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 23, 1982

1. Project: Forest Hydrology and Microclimate Research

2. Title: Research coordination in the Alberta Watershed Research Program; Marmot, Streeter, Tri Creeks, Spring Creek Experiment 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. Study Objectives:

To coordinate the efforts of cooperating agencies toward fulfilling the following:

1. To learn how to manage forested public lands for the protection of existing water supplies and the enhancement of future supply by alteration of regimes or yield through timber harvesting.

2. To broaden the overall knowledge base in hydrology of range lands, forest land and alpine areas.

3. To propose and to test specific land management practices designed to increase annual water yield, retard flood peaks or improve on-site watershed condition.

4. To evaluate and test existing land management practices with respect to their influence on the hydrologic regime of specified test areas.

5. To act as consultant and adviser in proposing and evaluating the influence of various land management practice on the local and regional surface and groundwater hydrology.

9. 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 USFS-WRENS in Alberta. (management note)

13. Publish Forestry Report on watershed research.

14. Initiate discussions with projects NOR-10, 31 re integrated research.

Goal added:

15. Prepare Review of Watershed Management for Pilot Study.

10. Accomplishments 1982-83:

1. Continued. Replaced existing AES Mat instrumentation with automated data loggers.

2. Replacement scientist hired. Some progress but not completed.

3. Scheduled for Jan-Feb 1983.

4. Completed.

5. Deferred pending completion goal 15.

6. Completed - see Swanson-Golding below.

7. Deferred pending completion goal 15.

8. Continued.

9. Completed - see Swanson below.

10. Advised as required.

11. Completed as assigned.

12. Prepared calculator program and assisted AFS users. Defer publication of management note to 1983-84.

13. Cancelled.

14. Discussions took place 7 November 1982.

15. Completed as assigned. Submitted to joint Alberta Forest Service - Alberta Environment Committee on the Watershed Management Pilot Project.

11. Goals 1983-84:

1. Publish Information Report on Marmot-Cabin Creek treatment and evaluation.

2. Publish Information Report on Streeter Basin treatment effects.

3. Publish Forestry Report on Marmot-Streeter Experiments (to be submitted for review by Oct. 1/83)

4. Continue evaluation of Marmot Creek treatment.

Goals 1983-84: (cont'd)

5. Apply Watbal (Vice PROSPER) to whole of Marmot (Bernier)

6. Prepare 2nd phase treatment plan for Streeter Basin.

7. Publish management note on WRENS.

8. Continue as CFS member on NRC Associate committee on Hydrology.

9. Continue efforts toward pilot watershed management study with integration NOR-10, 31.

10. Advise and assist cooperating agencies and participate in meetings and seminars as required as requested.

12. Publications:

Swanson, R.H. 1982. Problems and opportunities in Canadian Forest Hydrology. In Canadian Hydrology Symposium - 82, p. 1-13. National Research Council, Ottawa.

Swanson, R.H. and D.L. Golding. 1982. Snowpack management on Marmot Watershed to increase late season streamflow. In Proceedings 50th Annual Meeting, Western Snow Conference, p. 215-218.

13. Signatures:

Robert H. Swanson
Investigator

Program Manager

Director

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 23, 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. Study Objectives:

   1. To develop from Darcy's Law and the continuity equation a mathematical model of two dimensional transient unsaturated and saturated flow through porous media applicable under natural conditions.

   2. To incorporate the mathematical model as part of a physically-based synthesis of the hydrologic cycle.

9. 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.

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

   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.

10. Accomplishments in 1982-83:

   1. Analyses of Marmot Creek soil moisture data were completed. No differences were detected between soil moisture under cut blocks and soil moisture under forest, due to location of "in forest" tubes in boggy areas.

   2. Not done due to time limitations.

   3. All data analyses have been completed. Article is about 50% complete.

   4. Not done.

   5. First draft completed.

11. Goals for 1983-84:

   1. Publish report on the longevity of the effects of Streeter basin treatment on soil-moisture, for publication in the Journal of Range Management.

   2. Write and submit for internal review a journal article on the application of a two-dimensional, finite element subsurface flow model to simulate the hydrological effects of forest tree removal.

   3. Complete Ph.D. thesis.

   4. Establish soil moisture plots to evaluate HYVEM, PROSPER, and SUBFEM models in conjunction with studies NOR-084, 177 (Hillman, Bernier, Swanson)

12. Publications:

   Nil

13. Signatures:

L R Hillman
Investigator

Program Manager

Director

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 23, 1982

1. Project: Forest Hydrology and Microclimatic Research

2. Title: Measuring evapo-transpiration of forests and clearings.

3. New: Cont.: X 4. No.: NOR-13-084

5. Study Leader: R.H. Swanson

6. Key Words: Heat pulse velocity, conducting xylem, sap velocity, sap flow, moisture content, lodgepole pine, Radiata pine, evapo-transpiration

7. Location of work: Kananaskis Forest Experimental Station; Marmot, Streeter Experimental Basins, James River Snow study site.

8. Study Objectives:

   1. To evaluate transpiration of stands on experimental plots and catchments for use in treatment evaluations.

   2. To develop theoretical and/or empirical relations between microclimatic parameters, transpiration and evapotranspiration for use in hydrologic land use models.

   3. To develop theoretical and/or empirical relations describing evapotranspiration of residual stands and clearings in partial forest arrangements.

9. 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)

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

   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)

10. Accomplishments in 1982-83:

   1. Completed as scheduled.

   2. Tests conducted and a prototype recorder was constructed.

   3. Deferred - see similar goal NOR-103.

   4. Defer to 1983-84.

   5. Design completed. Prototype under construction.

   6. Submitted Ph.D thesis for defence (scheduled 16 Dec. 1982).

11. Goals for 1983-84:

   1. Establish evapo-transpiration plots for joint study. See related goals NOR-083, NOR-177.

   2. Initiate study to ascertain usability of thermal diffusivity to measure greenwood moisture content.

   3. Complete all Ph.D requirements.

12. Publications:

   Nil

13. Signatures:

Robert H. Swanson
Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 23, 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, P.Y. Bernier

6. Key Words: Snow melt, radiation, wind, lodgepole pine, aspen, James River, Marmot, Streeter Basin

7. Location of work: Alberta East Slopes

8. Study Objectives:

To determine the influence of small forest openings on snow accumulation amounts, melt rates and snow melt runoff patterns through:

1. Development of a physically-based conceptual hydrologic model incorporating differential areal precipitation input to predict the snow manipulative aspects of timber harvest schemes applied to experimental watersheds, on the resultant outflow hydrographs, and to test these models on experimental watersheds.

2. Quantitative determination and theoretical process description of differential snow accumulation amounts in a 10 treatment block of circular openings from 1/4 to 6 tree heights in diameter.

3. Quantitative determination and theoretical process description of differential snow ablation rates within the above 10 treatment blocks.

4. Small scale pilot testing of proposed harvesting patterns to ascertain their general effect on snow melt runoff.

9. Goals for 1982-83:

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

10. Accomplishments 1982-83:

    1. Pierre Bernier recruited. Position filled July 1982.

11. Goals for 1983-84:

    1. Design study to rank evaporation from snow in forest clearings. (Swanson). Possible collaboration NOR-10,31.

    2. Conduct literature review to familiarize self with passive microwave method for measuring snow accumulation. (Bernier) Report if warranted.

12. Publications:

    Nil

13. Signatures:

Robert H. Swanson
Investigator

Program Manager

Pierre Y. Bernier
Investigator

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 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: P.Y. Bernier, G. Hillman, R. Swanson

6. Key Words: Hydrologic modelling, snowmelt, evapotranspiration, soil water movement.

7. Location of work: Alberta

8. Study Objectives:

   1. Develop vegetation manipulation-hydrologic models applicable to the Saskatchewan River headwaters.

   2. Incorporate the results of other NoFRC studies dealing with individual components of the hydrologic cycle into the watershed model.

   3. Communicate the models to forest-water resources managers in provincial and federal governments.

9. 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)

   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)

10. Accomplishments in 1982-83:

1. Work started upon recruitment of Bernier. Intend to use WATBAL model because its better adapted to the subalpine forest.

2. Talks held with scientists in NOR-10 to initiate this work.

3. Initiated and programmed on 9825A desk top calculator.

4. Defer to 1983-84.

5. No progress.

11. Goals for 1983-84:

1. Continue efforts to integrate soil moisture-fibre production research. Possible joint studies. (Hillman) (NOR-10)

2. Continue efforts to apply WATBAL to Marmot data. (Bernier)

3. Develop local routing procedures for WRENS. (Hillman, Bernier)

4. Conduct stormflow analysis Marmot data. (Bernier)

5. Publish journal article on use of variable source area simulator in small forested basins. (Bernier)

12. Publications:

Nil

13. Signatures:

Investigator

Program Manager

Investigator

Director

Investigator

NOR-17 Forestry Services

NOR-17-118

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

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 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 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.

10. Accomplishments in 1982-83:

1. Contact, liaison and technology transfer was maintained via the Winnipeg Sub-office.

2. Development of a series of co-operative research trials was deferred pending the signing of a forestry development agreement.

3. This goal was transferred to NOR-10-196 (Froning).

4. Various research programs in Manitoba were assisted.

11. Goals for 1983-84:

1. Project 17 terminated.

12. Signatures:

Investigator

Program Manager

Director A. D. Kiil

NOR-22 Remote Sensing Applications

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: 30 November 1982

1. Project: Remote Sensing Applications

2. Title: Remote Sensing and Technical Advisory Services

3. New: Cont.: X 4. No.: NOR-22-142

5. Study Leader: W.C. Moore
Cooperators: J.M. Powell and W. Chow

6. Key Words: photo/imagery interpretation, computer mapping, assessment, environment, large-scale photo sampling (LSP), satellite imagery, aerial photography, forest inventory, biomass, monitoring, mapping and analysis of resources system (MARS).

7. Location of Work: Alberta, Saskatchewan, Manitoba, Northwest Territories

8. Study Objectives:

(1) to evaluate, develop and apply new remote-sensing and interpretation techniques for forest inventories and environmental management purposes in collaboration with Centre colleagues, other federal agencies, provincial governments, educational institutions and industries;

(2) to develop improved forest management information systems and apply the data bases in simulation models to test various management strategies; and,

(3) to provide advisory services in survey design, interpretation methods and analyses as required.

9. Goals for 1982-83:

(1) Provide demonstration of LSP to Yukon Forest Service.

(2) Added Goal: Supervise installation and evaluate computer mapping system.

(3) Added Goal: Prepare manuscript on burned area monitoring.

10. Accomplishments in 1982-83:

(1) LSP was successfully demonstrated in the Yukon. (R.J. Hall)

(2) MARS has been installed, an evaluation of the system prepared under contract, a "version-2" update has been completed, and example forest inventory maps from each province and territory of the region have been digitized for demonstration purposes. (W.C. Moore)

(3) A burned area monitoring manuscript has been written and reviewed. (W.C. Moore)

11. Goals for 1983-84:

(1) Complete development, testing and demonstration of the capabilities of the computer mapping system, determine the availability and interfacing requirements for digital format map exchanges with other agencies, and publish an Information Report (i.e. a User's Manual) "Evaluation of the Development and Testing of Computer Mapping". (W. Moore)

(2) Document approximately six representative test areas within the Region and initiate evaluations of new types of satellite imagery for the development of integrated imagery/photo/map interpretation techniques. (W. Moore)

(3) Investigate the potential for cooperation in environmental assessments with the development and demonstration of multi-stage remote sensing interpretation applications for change and trend predictions. (W. Moore)

(4) Prepare a report on cost-effective monitoring of extensive forest inventory depletions by fire in the Northwest Territories with satellite imagery for the Forestry Statistics and Systems Branch of the CFS. (W. Moore)

(5) Initiate consultations with PFRC, DIAND and other agencies for a common approach to forest inventory designs north of 60° North latitude. (W. Moore, R. Hall)

(6) Provide advisory services in remote sensing to NoFRC clients and colleagues as required, and particularly as follows:

(a) examine rapid, yet reliable, assessments of burned forest areas for salvage decisions with existing capabilities in Saskatchewan; and,

(b) initiate cooperation with the Remote Sensing Geographic Information Project of the Canada Centre for Remote Sensing. (W. Moore)

12. Publications:

13. Signatures:

Investigator

Program Manager

Director

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: 30 November, 1982

1. Project: Remote Sensing Applications

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 (LSP), aerial photography, photo mensuration, photogrammetry, satellite imagery, image analysis, inventory, assessment, vegetation damage, statistical analysis.

7. Location of Work: Alberta, Saskatchewan, Manitoba, Northwest Territories and Yukon Territory.

8. Study Objectives:

   1. To utilize new techniques and apply appropriate sampling designs in the application of large-scale photography in acquiring resource inventory data.

   2. To provide advisory and technology transfer services in the acquisition, uses, and analyses of remote sensing imagery; mapping; and, in the operation of interpretation equipment.

   3. To maintain an image acquisition and analysis laboratory for co-operative studies.

   4. To assess and apply image analysis techniques in the interpretation and classification of forest resources.

   5. To provide advisory services in survey design, interpretation methods and analyses as required.

9. 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.

9. Goals for 1982-83: (Cont'd)

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.

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.

Added Goals:

7. To determine the applicability of multidate Landsat data for the aerial assessment of aspen defoliation (collaborators: P.H. Crown-Univ. of Alta. and G.N. Still)

8. To investigate the use of multivariate linear discriminant analysis for change detection in feature selection for classification using 2-date Landsat digital data. The data analyzed was derived from the project on aspen defoliation.

9. To participate in workshop on image analysis and remote sensing in Vancouver, 3-5 May, 1982.

10. Accomplishments in 1982-83: (ref. goals 1982-83)

1. Procured MOT aeronautical approval for the extensively modified camera system and conducted demonstration to staff of DIAND-Forest Resources Yukon with their provision of a Bell 206B helicopter. To facilitate data analysis, 14 computer programs written for the HP 9825 were provided. However, as DIAND has a HP 9826 and different peripherals, some program modification is necessary to render them operational. Supervision of the DIDEC contracts for the pod and rack were provided.

   A presentation was given in October on the status of the camera system and on the role of the photo mensuration system for NoFRC management and to DIAND.

10. Accomplishments in 1982-83: (Cont'd)

2. Airborne digital data acquired for M.Sc. project. Updated forest inventory maps were acquired from DIAND-Forest Resources NWT. Data analysis is in progress. Course work will be completed by April.

3. Advice and assistance was provided to clients and colleagues. Particularly noteworthy were advice and instruction on medium-scale airphoto planning and acquisition for FIDS, assistance with micro-computer operations for statistical routines, and consultations with Parks Canada on large-scale airphoto assessments of vegetation indicators of Park usage.

4. Information Report "Uses of remote sensing in forest pest damage appraisal" NOR-X-238 was published.

   Information Report on use of large-scale aerial photos for regeneration assessment still in review process. Graduate work and work on camera system has slowed progress. Goal to be repeated.

5. Annual guest lecture and lab for the annual Alberta Remote Sensing Course will be given in Feb. of the 82-83 fiscal year.

6. Contract supervision provided to produce the modified Rockwell Aim 65 microcomputer intervalometer. A program to trigger the cameras was designed and a program to compute cycling times was written. The unit works but its physical construction did not turn out to be well suited to an airborne environment.

7. Completed study and a rough draft of the proposed journal report was written.

8. Completed study and wrote file report on the application of discriminant analysis to feature selection for classification using multi-date Landsat digital data and SPSS.

9. Attended workshop in Vancouver May 3-5 on Image Analysis and Remote Sensing hosted by BC Research and the Canada Centre for Remote Sensing. Gave brief synopsis on remote sensing activities at NoFRC and participated in technical discussions.

11. Goals for 1983-84:

1. Complete development of the large-scale photo sampling system and conduct operational trials in the Yukon in the 1983 field season. Also, to assess the cost and feasibility of producing a back-up system for Yukon applications. (R. Hall)

11. Goals for 1983-84: (Cont'd)

2. Conduct further work in developing an operational forest inventory program for timber volume inventory and fuelwood surveys in conjunction with DIAND-Forest Resources Yukon utilizing large-scale photography and a microcomputer-based photo mensurational system. Computer programs written will be transferred to Forest Resources Yukon and NWT. (R. Hall)

3. Complete M.Sc. thesis on the analysis of simulated Landsat-D digital data for forest and land cover classification in the NWT. In addition, to prepare a preliminary report for publication. (R. Hall)

4. To initiate cooperative work as requested by Mark Butler of the NeFRC to produce a user's manual approximately 2 years hence on the use of large-scale aerial photographs for regeneration assessment (project no. 2210, study no. 00221 initiated in 1982). (R. Hall)

5. Provide advisory services in remote sensing for NoFRC clients and colleagues as required, particularly as follows:

   (1) To serve as member of the Forestry Working Group of the Canadian Advisory Committee on Remote Sensing organized by the Canada Centre for Remote Sensing (CCRS). Appointment on committee by CCRS for 1 year term to Oct. 1, 1983. (R. Hall)

6. Publish journal paper on "Image analysis methodology for aerial assessment of aspen defoliation". (coauthors P.H. Crown and G. N. Still). (R. Hall)

7. Publish information report "Considerations for use of large-scale aerial photographs in regeneration assessment". Note change of title from last year's statement. (R. Hall)

8. Participate in consultations for a common approach to forest inventory north of 60°N with outside agencies. (R. Hall & W. Moore)

12. Publications: 1982-83

Hall, R.J. (Compiler) 1982. Uses of remote sensing in forest pest damage appraisal. Proceedings of a seminar held May 8, 1981. NOR-X-238.

Hall, R.J. 1982. Uses of remote sensing in forest pest damage appraisal. pp. 54-60 in R.J. Hall (Compiler) Uses of remote sensing in forest pest damage appraisal. Proceedings of a seminar. NOR-X-238.

12. Publications: 1982-83 (Cont'd)

Hall, R.J. 1982. Application of discriminant analysis to feature selection for classification using multidate Landsat digital data and SPSS. File Report NOR-22-188.

13. Signatures:

Ron Hall
Investigator

Program Manager

Director

NOR-23 Ecological Land Classification of National Parks

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 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. Study Objectives:

To provide a land, soil, and vegetation inventory of Banff and Jasper National Parks, including maps and report, and research studies, plus interpretation of data for land use planning and management within the Parks.

9. 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.

10. Accomplishments in 1982-83:

1. The main portion of the Banff-Jasper project is complete. About 1200 map packages (each containing 24 maps, plus Master Legend and map box) have been collated, packaged, and delivered to NoFRC. There are another 200 at U of A Printing Services. Vol. II, Soils and Vegetation, is ready for printing, pending final cost adjustment and agreement with Printing Services. Vol. I, Introduction and Summary, needs final revision and funding.

2. The journal manuscript reporting rare and unusual vascular plants in Banff and Jasper National Park (Corns and Achuff) is under review.

3. The brochure on applying Ecological Land Classification in Banff-Jasper is in a paste-up model form, ready for initial review. Publication is dependent on funding.

4. The goal of preparation of a journal article on "Soils with deep Ae horizons in Jasper National Park" is terminated because of time and funding restraints.

5. The collection of data for the Crysolic, Brunisolic, and Chernozemic soil climate study in Banff National Park was continued.

11. Goals for 1983-84:

1. Finalize publication details of Vol. I and II of the Banff-Jasper report. (Holland, Coen, Achuff)

2. Submit a journal manuscript reporting rare and unusual vascular plants in Banff and Jasper National Parks. (Corns and Achuff)

3. Redesign and publish the brochure on applying Ecological Land Classification information in Banff-Jasper. (Holland, July 1983)

4. Continue data collection for Cryosolic, Brunisolic, and Chernozemic soil climate study in Banff National Park. (Achuff)

12. Publications:

Holland, W.D. and G.M. Coen, General Editors. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks, Alberta, Canada. Vol. I, Introduction and Summary. AIP Pub. No. SS-82-44. Northern Forest Research Centre, Edmonton. Approx. 130 pp. In Press.

Holland, W.D. and G.M. Coen, General Editors. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks, Alberta, Canada. Vol. II, Soil and Vegetation Resources. AIP Pub. No. SS-82-44. Northern Forest Research Centre, Edmonton. Approx. 600 pp. In Press.

13. Signatures:

_____	_____
Investigator	Program Manager
_____	_____
Investigator	Director

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 1, 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, wild-life resources, aquatic resources

7. Location of work: Kootenay, Mount Revelstoke, and Glacier National Parks and Northern Forest Research Centre, Edmonton

8. Study Objectives:

To provide an ecological land classification of Kootenay, Glacier, and Mount Revelstoke National Parks, including maps and report, and research studies, plus interpretation of data for land use planning and management within the Parks, with integration of land, soil, vegetation, wild-life, and aquatic resource components.

9. 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)

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

   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)

10. Accomplishments in 1982-83:

   1. Contributions were made to two PC-CanSIS meetings and to two papers presented at international symposia. Two interim reports were prepared.

   2. Field work is completed in Kootenay National Park. Mt. Revelstoke and Glacier N.P. require another 20 days of field work to increase the intensity of field truthing and sampling. This additional field work is contingent upon further funding by PC.

   3. Permanent plots were not established in pine beetle infested areas in national parks this year. Time restraints and tightness of funding were the hindrances.

   4. Preparation of the final reports are under way. Kootenay NP is separate from Mt. Revelstoke-Glacier. A logistics plan has been prepared; soil sample preparation and plant identification are in progress; lichen and bryophyte work is going forward under contract; and the base maps have been received.

   5. The thesis by Helen Dudynsky, "Ecophysiology of Arctostaphylos uva-ursi" is expected to be completed in the spring of 1983.

11. Goals for 1983-84:

   1. Completion of both final reports (Kootenay National Park; Mt. Revelstoke-Glacier National Parks) by Dec. 31, 1983. If additional field work is authorized, it is expected that the project termination date will be extended to March 31, 1984. (CFS and AIP team)

   2. Initiation of discussions towards integration of ecological land classification work with other projects; i.e. Mountain pine beetle (Moody, NOR-1), site productivity studies (Corns, NOR-10), and lodgepole pine survival studies (Ives, NOR-9). (Holland)

   3. Completion of thesis by Helen Dudynsky "Ecophysiology of Arctostaphylos uva-ursi".

   4. Continue consultative advice, workshops, research, committees, etc. to client agencies and CFS staff, as required. (Holland)

12. Publications:

1. Walker, B.D., P.L. Achuff, D.T.Allan, W.S. Taylor, J.R. Dyck, and H.A. Dudynsky. 1982. Ecological (Biophysical) Land Classification of Kootenay National Park, Interim Report, 1981-82. Environment Canada, Northern Forest Research Centre, Edmonton. 88 pp. plus Itek photo maps and appendices.

2. Allan, D.T., H.A. Dudynsky, W.S. Taylor, B.D. Walker, P.L. Achuff and J.R. Dyck. 1982. Ecological (Biophysical) land Classification of Mount Revelstoke and Glacier National Parks, Interim Report, 1981-82. Environment Canada, Northern Forest Research Centre, Edmonton. 61 pp. plus Itek photo maps and appendices.

3. Holland, W.D. 1982. Issues and problems in applying the Biosphere Reserve concept: A forest management perspective. Environment Canada, Northern Forest Research Centre, Edmonton, 10 pp. In: "Towards the Biosphere Reserve: Exploring Relationships Between Parks and Adjacent Lands". International Symposium, Kalispell, Montana, June 22-24, 1982. In press.

4. Denford, Keith E., H. Dudynsky, and J.M. Mayo. 1982. Arctostaphylos uva-ursi (L.) Spreng. (Bearberry): The ultimate survivor? Paper presented at Pennsylvania State University to the American Institute of Biological Science meetings, Aug. 1982.

13. Signatures:

_____	_____
Investigator	Program Manager
_____	_____
Investigator	Director

NOR-28 Environmental Impact Assessments
and Peatland Ecology

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 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. Study objectives:

   1. To provide expertise in the development of essential criteria for the design of major industrial developments and for the rehabilitation of disturbed areas.

   2. To assess the impacts of industrial developments on the terrestrial environment and recommend measures for minimizing or mitigating the damaging impacts of the proposed developments.

9. Goals for 1982-83:

   1. Participate in assessment processes of development proposals as required. (Zoltai, Addison, Hogan)

   2. Develop and maintain expertise in assessing the impact of development proposals on the terrestrial environment in various parts of the Region. (Zoltai, Addison, Hogan)

   3. Continue to serve as chairman of the Regional Transportation Committee, assessing and co-ordination responses on environmental impacts. (Zoltai)

   4. Act as CFS representative in the Regional Screening and Coordinating Committee. (Zoltai)

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

5. Continue ecoregion determination, as chairman of the working group.

6. Conduct field work in Bylot Island-Eclipse Sound area to determine the natural resources and the suitability of the area as a National Park.

10. Accomplishments in 1982-83:

1. As members of Regional Transportation Committee (Zoltai), Regional Hydrocarbon Committee (Addison), Regional Mining Committee (Apps, Hogan), and Regional Hydroelectric Committee (Zoltai) contributed to the environmental assessment of sections of Liard Highway, Slave River Dam, Beaufort Sea development, and various mining developments in the N.W.T. As lead agency, effects of logging in Wood Buffalo National park are being assessed (Brace).

2. Conducted field work in the Lancaster Sound area (Bylot Island) along a proposed tanker route (see 6. below).

3. Served as chairman of the Regional Transportation Committee (Zoltai).

4. As CFS representative on the RSCC, attended three regular meetings of this committee, contributing to the evaluation of impact statements and assessments (Zoltai).

5. Data on the ecoclimatic regions of Canada is being assembled by several groups, under my chairmanship of the Ecoregions Working Group (Canada Committee on Ecological Land Classification) with a targeted completion by 1985 (Zoltai).

6. The natural resources of the Bylot Island-Eclipse Sound area were investigated by a reconnaissance Bio-physical land inventory and the suitability of the area as a national park was assessed (Zoltai).

11. Goals for 1983-84:

1. Prepare report on the natural resources of the Bylot Island area in cooperation with CWS staff.

2. Participate in assessment processes of development proposals as required (Zoltai [0.1 PY], Addison [0.1 PY], Apps, Hogan [0.1 PY]; Brace in Wood Buffalo National Park).

11. Goals for 1983-84: (cont'd)

3. Develop and maintain expertise in assessing the impacts of development proposals in the terrestrial environment in various parts of the region as opportunities arise (Zoltai, Addison, Apps).

4. Continue to serve as chairman of the Regional Transportation Committee, assessing and coordinating responses on environmental impacts (Zoltai).

5. Act as CFS representative on the Regional Screening and Coordinating Committee (Zoltai).

6. Continue ecoregion determination, as chairman of the working group (Zoltai).

12. Publications:

Nil

13. Signatures:

S.C. Zoltai
Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1982

1. Project: Environmental Impact Assessment and Peatland Ecology

2. Title: Peatland Development and Ecology

3. New: Cont.: X 4. No.: NOR-28-189

5. Study Leader: S.C. Zoltai and J.D. Johnson

6. Key Words: Peatland, soils, chemistry, peat, vegetation, succession, rehabilitation

7. Location of work: Alberta, Saskatchewan, Manitoba

8. Study objectives:

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

9. 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".

10. Accomplishments 1982-83:

1. Examined and sampled 65 different peatlands in north-central Manitoba.

2. Collected, identified, and curated 200 different species of vascular plants, 107 species of mosses, 21 species of liverworts, and 64 species of lichens.

3. Plant remains in 1460 peat samples were identified.

4. The chemical properties, including 13 elements of 1460 peat samples are being determined.

5. Radiocarbon ages of 20 peat samples are being determined.

6. Information for three chapters for the book "Wetlands of Canada" has been assembled.

7. Journal paper on "Earth hummocks in the Sunshine area" published.

11. Goals for 1983-84:

1. Prepare and publish interim report on field work in the peatlands of central Alberta.

2. Conduct field work by examining and sampling in detail the vegetation, peat deposits, and surface water in at least 40 different peatlands in southeastern Manitoba.

3. Identify and curate collected plant samples.

4. Identify plant remains in collected peat samples.

5. Determine the chemical properties of collected peat samples.

6. Obtain radiocarbon dates of collected peat samples.

7. Continue the preparation of three chapters for the book "Wetlands of Canada".

8. Prepare interim report on field work performed in the peatlands of north-central Manitoba.

12. Publications:

Scotter, G.W. and S.C. Zoltai. 1982. Earth hummocks in the Sunshine area of the Rocky Mountains, Alberta and British Columbia. Arctic, 35:411-416.

12. Publications: (cont'd)

Zoltai, S.C. 1982. From drunken trees to pingos. Abstract of papers, 35 Ann. Meeting, Soc. for Range Management, Calgary.

13. Signatures:

S.C. Zoltai
Investigator

Program Manager

Director

NOR-29 Forest Resource Data

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 8, 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 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.

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

   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.

10. Accomplishments in 1982-83:

   1. Reviewed FORSTATS publications and provided regional data.

   2. Published Information Report NOR-X-245.

   3. A catalogue file of approximately 2000 plots was established and stored on the PDP. Programs for manipulation of the file were written and tested.

   4. No inventory updates were required this year.

   5. A working group was established and 1 meeting was held. A silviculture data base for Canada covering harvesting, reforestation, and stand treatments during 1975-80 is now operational.

   6. Attended 2 Regional Committee on FORSTATS meetings.

11. Goals for 1983-84:

   1. Participate with the Forestry Statistics and Systems Branch (CFS, PNFI) in the development and implementation of the Canadian Forest Resources Data Program (CFRDP) as required. Work involves commenting on conceptual planning, attending committee meetings and reviewing manuscripts.

   2. Prepare and distribute a questionnaire to collect national Silviculture data for 1980-81 and 1981-82 and publish a Forest Management Note (with Brace - NOR-10).

   3. Continue cataloguing NoFRC permanent sample plots as a means of providing ready access to satisfy regional and national needs in the field of forest growth. (Canadian Forest Inventory Committee).

11. Goals for 1983-84: (cont'd)

4. Supply CFRDP with updated forest inventory data for the region, as required.

5. Coordinate updating and expansion of regional data bases. (e.g. mechanization of silviculture, economics, fire).

6. Cooperate with the Forestry Statistics and Systems Branch in the collection of forest depletion (harvesting, fire, insect and disease, etc.) and accrual (growth, afforestation, regeneration, etc.) statistics for the region.

12. Publications 1982-83:

Brace, L.G. and P.J. Golec. 1982. Silviculture statistics for Canada 1975-80. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-245.

13. Signatures:

P. Golec
Investigator

Program Manager

Director

NOR-31 Climatic Studies

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 14, 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 Leaders: J.M. Powell, T. Singh

6. Key Words: Climatology, climatic change, climatic variation, forest biomass, proxy data, dendrochronology, tree-rings, paleobotany, pollen analysis, X-ray densitometry, isotopic measurements, historical records, forest growth, Boreal Forest Region (B)

7. Location of Work: Edmonton Laboratory, Prairie Provinces, N.W.T.

8. Study objectives:

   1. Assess impact of climate on forest vegetation and soils, especially those associated with forest clearcut areas.

   2. Determine extent and degree of past short-and long-term climatic fluctuations and interrelationships between key parameters and measures of forest biomass productivity in selected regions of the boreal forest.

   3. Provide climatic advice and represent CFS and NoFRC on advisory committees and other groups, including those associated with the Canadian Climate Program.

9. 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.

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

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.

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.

Added goals:

5. Prepare an invited contribution on "Designing the Canadian Climate Program" for a new journal "The Operational Geographer", and a book review on a volume on Climatic Change in Canada.

10. Accomplishments in 1982-83:

1. Some limited progress was made in alalyzing climatic fluctuations during the period of record in the central Canadian boreal forest.

2. The two ENFOR Contract reports were received and are presently in final review stages before publishing. One study was highlighted in ENFOR Newsletter Vol. 3, No. 1, June 1982, under 300 titles: Bibliography on climate variations sets Boreal Zone in perspective". Both studies were presented at the 4th Bioenergy R&D Seminar and published in the Proceedings. Aspects of one study were presented in poster sessions at two conferences by the study leader and abstracts published under the following title "The effect of climatic variation on tree rings of spruce from the central Canadian boreal forest".

Accomplishments in 1982-83: (cont'd)

3. Summarizing of temperature data collected in connection with two earlier studies was continued. Information on mean monthly minimum and maximum temperatures, growing degree days above three base temperatures, and frost free period was prepared for 27 short-term (3-6 years) stations for passing on to the Resource Evaluation and Planning Division of Alberta Energy and Natural Resources. Data from the seedling growth study was summarized for growing degree days information.

4. Contact was maintained with the Canadian Climate Centre and the Canadian Climate Program. I attended two meetings of the national Climate Advisory Committee and two meetings related to the Alberta Climate Advisory Committee. I represented the NoFRC at the Climate Inventory Steering Committee meeting of Alberta Energy and Natural Resources, also at the Alberta Climatological Association meeting presenting a report at the latter which was published in the Proceedings. I represented the CFS on the Canada Department of Agriculture Expert Committee on Agrometeorology presenting a report, while the 1981 report was published. I compiled the CFS report for the Meteorology and Atmospheric Sciences section of the 1982 volume of the Canadian Geophysical Bulletin, while the 1981 report I compiled was published. The annual report on the Centre's activities and publications of interest to geographers was submitted for the Canadian Association of Geographers Directory 1982. I again served on the Western Research Program of Forintek Canada Corporation Subcommittee on "Characterization of Wood", and participated in the CFS Forest Pathology Review, and in the ACH Forest Hydrology Symposium. I attended two meetings of the Editorial Board of the Climatological Bulletin. I chaired various planning meetings of the Local Arrangements Committee for the 1983 Congress of the Canadian Meteorological and Oceanographic Society to be held in Banff. I helped coordinate the meeting and field trips for the International Workshop on Management of Lodgepole Pine held at Hinton and attended the regular meetings of the Alberta Fish and Wildlife Advisory Counil. Good progress was made in completing a draft of a joint authored manuscript on "Vascular Plants of the Lake Hazen Region, Northern Ellesmere Island, N.W.T.".

5. A draft of a co-authored (with D. Phillips of AES, Downsview) paper on the History and Development of the Canadian Climate Program" was prepared. A book review of a volume on Climatic Change in Canada was published.

11. Goals for 1983-84: (Some of goals have been transferred from NOR-53-175)

1. Oversee the reviewing and publishing of the two ENFOR Contract reports, a) Impact of climatic variation on biomass accumulation in the boreal forest: selected references, b) The effect of climatic variation on tree rings of spruce from the central Canadian boreal forest. (J. Powell)

2. Complete and publish a joint-authored (with A.E.S.) journal paper on the "History and Development of the Canadian Climate Program". (J. Powell)

3. Complete analysis of long-term climatic variations using 120 stations in the central Canadian boreal forest zone and draft a report. (J. Powell, T. Singh)

4. Prepare a report on the growing season climate of four clearcut areas associated with a seedling growth study (NOR-4-045) (J. Powell)

5. Continue summarizing climate and generated climate data for a report on climate of clearcut forested areas. (J. Powell, T. Singh)

6. Prepare a short contribution in cooperation with Forintek on the use of black spruce in dendrochronology. (J. Powell)

7. Undertake statistical analysis to better establish the climate-growth relationships inherent in the north-south tree-ring transect data from ENFOR Project P-149. (T. Singh)

8. Prepare a joint paper with Forintek on tree-ring analysis and biomass estimates. (J. Powell, T. Singh)

9. Act as Chairman of the Local Arrangements Committee and serve on Scientific Program Committee for the 17th Congress of the Canadian Meteorological and Oceanographic Society to be held in Banff in May 1983. (J. Powell)

10. 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. (J. Powell)

12. Publications:

[Powell, J.M.] 1981. Canadian Forestry Service. pp. 116-117. In Canadian Geophysical Bulletin, Vol. 34. Energy, Mines, and Resources Canada, Earth Physics Branch, Ottawa. 192 pp.

12. Publications: (cont'd)

Powell, J.M. 1981. Canadian Forestry Service. pp. 6-11. In Report of the 23rd Annual Meeting of the Expert Committee in Agrometeorology. November 5-6, 1981. Agric. Can., Ottawa. 41 pp. + Apendices.

[Powell, J.M.] 1981. Canada/Environment Canada, Canadian Forestry Service, Northern Forest Research Centre. pp. 155-158. In Barr, B.M. (compiler and editor). The Canadian Association of Geographers Directory 1981. 216 pp.

Jozsa, L.A., M.L. Parker, P.A. Bramhall, S.G. Johnson, J.M. Powell and N.B. Shultz. 1982. The effect of climatic variation on tree rings of spruce from the central Canadian Boreal forest (Abs.). Atmoshere-Ocean, 16th Annual Congress Issue. May. pp. 47-48.

Jozsa, L.A., M.L. Parker, P.A. Bramhall, S.G. Johnson, J.M. Powell and N.B. Shultz. 1982. The effect of climatic variation on tree rings of spruce from the central Canadian boreal forest. p. 63. Abstracts of papers presented at the Annual Meeting 1982. Canadian Association of Geographers. May. University of Ottawa, Geography, Faculty of Arts. 153 pp.

Powell, John M. 1982. Climatic Change in Canada 2. (Book Review) Atmosphere-Ocean 20(2):183-184.

Powell, John M. 1982. Northern Forest Research Centre. pp. 79-81. In Kuhnke, B. (compiler) Current climatological activity in Alberta. Proceedings of the Technical and Business Sessions of the Sixth Annual General Meeting of the Alberta Climatological Association, 25 February 1982. Alta. Climatological Assoc. November.

13. Signatures:

J. M. Powell
Investigator

Program Manager

Investigator

Director

NOR-32 Long Range Transport of Air Pollutants

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1983

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. Study Objectives:

   1. To determine the state of representative components of terrestrial ecosystems, specifically vegetation and soils, for benchmarking and biomonitoring purposes.

   2. To determine the rate and extent of deposition (wet & dry) of major pollutants from point emitters within the region.

   3. To determine the extent to which local, medium and long range transport of air pollutants is degrading forest ecosystems.

9. 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)

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

4. Reexamine the sampling plots in Thompson 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)

10. Supervise the delivery and installation and quality assurance of the new ICAP-AES.

11. Prepare, publish and present a paper on the Effects of the Mining and Smelting industry on Boreal Forest systems: Past, Present and Future.

12. Carry out daily sampling of total deposition, both wet and dryfall, at six study sites in Thompson during the month of July.

13. Provide input into the review process in relation to duties as a member of the regional mining committee.

14. Plan with other committee members a program for a CFS sponsored conference on "Acid Rain and Forest Resources" to be held in Quebec City in 1983.

15. Participate in the Clean Environment Commission Hearings to be held in Thompson in May 1982.

10. Accomplishments in 1982-83:

1. The chamber for simulated acid rain experiments has been built following extensive redesigning to allow for a more natural deposition of rain droplets. Experiments will proceed in early 1983-84.

2. This goal has not been met and has been carried over to 1983-84.

10. Accomplishments in 1982-83: (cont'd)

3. Soil lysimeters were placed at two plots in Thompson, one at a highly impacted site the other set at a background site. Leachates have been collected in acidified containers on a monthly basis and have been analysed for the movement of metals and sulphur. The results have not been synthesized as of yet. Monthly samples of LFH material were taken from selected sites to allow us to follow the movements of nutrients and pollutants within these layers, these materials await analysis. No progress was made on soil respiration studies because of lack of equipment, however, an IRGA has been obtained on loan form AES to allow us to carry out this work.

4. Resampling of vegetation and soils was carried out in Thompson so that comparisons can be made between data obtained in 1977 and 1982. The analysis of these samples will not be complete until April of 1983.

5. This article is progressing and should be completed for review by Feb. 1, 1983.

6. No progress has been made on this goal because of other commitments it is carried over to 1983-84.

7. This paper has been written and informally reviewed some changes are being incorporated before it is submitted for the formal review process. It will be submitted by Jan. 1, 1983.

8. No progress has been made on this goal because of other commitments. Information obtained will be used instead to prepare a section for the Forestry Report in 1983-84.

9. A reexamination of the lichen data was carried out, it was decided that it would form part of the paper covered under goal #5.

10. The new ICAP-AES was inspected at the factory, quality assurance work was carried out and it was installed at NoFRC. The new instrument has given us excellent service. A total of 3 850 samples have been analysed this year.

11. A paper entitled the "Effects of the Mining and Smelting industry on Boreal Forest Systems: Past, Present and Future" was presented at the boreal forest symposium in Thunder Bay, Ont. The paper is being rewritten for the symposium volume.

12. Daily sampling of total depostion was carried out in Thompson during July. The results indicate that the summation of wet and dry deposition is acidic but that the results are strongly influenced by sample catch.

10. Accomplishments in 1982-83: (cont'd)

13. Reviewed documents relating to mining operations within the region for the Regional Mining Committee.

14. Planned, with other committee members, the scientific program for a CFS sponsored conference to take place in Quebec City in June 1983 entitled "Acid Rain and Forest Resources".

15. Made presentation to the Clean Environment Commission, Prov. of Manitoba with respect to environmental impact of the Thompson smelter operations.

11. Goals for 1983-84:

1. Publish a paper on the Flin Flon study entitled "Pollutant Distribution and Containment within a Boreal Forest System as a Function of Distance from a Smelting Source". To be submitted for review by Jan. 1, 1983. (Hogan)

2. Prepare and publish a report on the soil, lichen and higher vegetation, work that forms a part of the Thompson study. To be submitted for review by Feb. 1983. (Hogan)

3. Prepare a paper on the use of the moss bag technique and resultant data. To be submitted for review by May 1983. (Hogan)

4. In collaboration with NOR-7 prepare a Forestry Report on air pollution and forests. To be submitted for review by Dec. 1983. NOR-32-178 will be responsible for; a) Acid Rain and Forests, b) Metal Particulates and Forests. (Hogan)

5. Prepare a final report on the impact studies carried out in Thompson that includes the results of the five year comparisons (1977-82). To be submitted by Oct. 1983. (Hogan)

6. Continue investigations into the effects of acid rain and dry deposition singly and in combination on the physiology and biochemistry of lichens and vascular plants. Emphasis will be placed on growth measures, ^{14}C - fixation and RUBP carboxylase activity. (Hogan)

7. Continue to investigate the effects of heavy metals on plants and soils particularly in relation to those metals that are likely to be liberated by acid precipitation. In soils CO_2 evolution and (phosphatase, urease) activity will be investigated. (Hogan, Maynard)

11. Goals for 1983-84: (cont'd)

8. Prepare a file report on acid rain and acid rain montoring within the region particularly as it relates to forest growth. To be submitted by Oct. 1983. (Hogan)

9. Provide consultation to regional clients and CFS staff on matters relating to air pollution impact on forests and forest soils and represent CFS on regional and national committees as required. (Hogan)

12. Publications:

G.D. Hogan & D.L. Wotton. The effects of the Mining and Smelting Industry on the Boreal Forest: Past, Present and Future. Boreal Forest Symposium, Thunder Bay, Ont.

13. Signatures:

Investigator

Program Manager

Investigator

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1982

1. Project: Long range transport of air pollutants.

2. Title: Transport of radionuclides released from 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, ^{226}Ra, 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. Study Objectives:

   a. Develop methods for the measurement of various uranium-series radionuclides in plants and soils.

   b. Gather baseline data on the distribution of radionuclides (U, Th, & their daughters) in forest vegetation and soils.

   c. Study the dynamics of cycling of radionuclides and associated elements, and their eventual fate in terrestrial ecosystems.

9. 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)

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

   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)

10. Accomplishments in 1982-83: (to Nov. 82)

   1. Several study locations have been defined in the vicinity of Eldorado's Beaverlodge operations and the Lorado mine and mill tailings area near Uranium City. These locations have been sampled at a series of sites at varying distances from the tailings area to investigate the magnitude and extent of radionuclide transport into the terrestrial environment. Analysis of samples awaits fulfillment of goal 3.

   2. Species of lichen indigenous to the Uranium City area, black and white spruce (needles, twigs and branches), and feather moss have been identified as potential monitors for radionuclide accumulation and migration. Samples of these together with soil LF & H and certain other indigenous vegetation species were collected and await analysis.

   3. This goal has been only partly met due to lack of necessary capital equipment. The EDA radon emanation apparatus (the only radioanalytical equipment currently owned) has been set up and tested. It has been found inadequate for quantitative analysis. Limited progress in developing ^{226}Ra, ^{210}Pb and ^{210}Po analysis has been made using apparatus borrowed from the University of Alberta. Some of the necessary analytical equipment was ordered in October.

   4. Samples obtained in meeting goals 1 & 2 were chosen so as to permit differentiation between wind blown dust and radon daughter components. Analysis of these samples must await fulfillment of goal 3.

   5. This goal was not met. Lack of O & M funds did not permit the field work required.

   Goal added:

   6. a. Alternate member of the RMC. A number of EIS documents for proposed Uranium development in the region have been reviewed.

      b. Reviewed and extensive comments on several draft DOE nuclear policy statements.

      c. Fission track analysis. Unique procedure being investigated for mapping uranium distribution in vegetative tissue. (In collaboration with graduate student at the U of A SLOWPOKE reactor and Dr. Colin Dunn at Saskatchewan Mineral Resources, Regina.

11. Goals for 1983-84:

1. Establish analytical procedures for measurement of U, ^{210}Pb, ^{210}Po, ^{226}Ra and other radionuclides commonly associated with the uranium industry in vegetation and soils. (Apps)

2. Continue investigation of extent and mechanisms of radionuclide transport into the terrestrial environment in the Uranium City area. (Apps)

3. Ascertain the need for and plan a baseline monitoring system for radionuclides in the terrestrial environment of Northern Saskatchewan. Prepare a file report on the recommendations. (Apps)

4. In collaboration with NOR-7 prepare a Forestry Report on air pollution and forests. To be submitted for review by Dec. 1983. NOR-32-186 will be responsible for Radionuclides in Forests. (Apps)

5. Establish and maintain a benchmark and baseline biomonitoring system around a representative newly started uranium development site. (Apps, Hogan)

6. Provide consultation to regional clients and CFS staff on matters relating to radionuclides and the impact of uranium mining, milling and processing on terrestrial systems. Represent CFS on regional and national committees as required. (Apps)

12. Publications:

Nil

13. Signatures:

Investigator

Program Manager

Investigator

Director

NOR-33 Scientific and Technical Information

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 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: Editing, publishing, printing, information reports, journal articles, scientists, resource managers, industrial managers, general public, displays.

7. Location of Work: Region wide.

8. 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 2 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 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.

Goals added:

9. Obtain a second printer for the Xerox 850 word processor system, and move one complete unit, the IBM Composer, and a word processor-typesetter operator next to the information group.

10. Contribute to the development of a CFS style manual.

11. Prepare a national automatic mailing list of key libraries and agencies, based on the NoFRC mailing list. (R. Waldron)

12. Implement CFS publications policy guidelines, and adopt the new standard format for the cover of Information Reports.

9. Accomplishments in 1982-83:

1. Assisted staff in the publication of 10 Information Reports (600 printed pages) and 34 journal articles and miscellaneous publications (340 printed pages). A list of 1982 publications (total of 55) appears in Section 11.

2. Assisted in the preparation of 3 Forestry Reports (36 printed pages) and 7 Forest Management Notes (30 printed pages). The special technical report on diseases of the prairie provinces was not written.

3. The Program Review, 1981-82, was prepared and printed (88 printed pages).

4. Wrote specifications for and monitored the printing and reprinting of locally produced scientific and technical publications. Renewed the standing offer agreement for printing.

5. The author's style guide for NoFRC publications became the draft for a CFS style guide, and the final NoFRC version awaits release of the national guide.

6. The NoFRC Forestry Newsletter was prepared and printed monthly throughout the year.

7. Continued responsibility for the distribution of NoFRC publications, maintenance of the mailing list, responding to requests for information, and carrying out related correspondence. The number of requests for information continued to increase, as did the number of requests for names to be added to the mailing list.

8. Continued to respond to requests from the public by mailing out publications and by having someone in attendance with NoFRC displays in shopping malls, at meetings, and at fairs.

Accomplishments added:

9. Obtained a second printer for the Xerox 850 word processor system, and moved one complete unit, the IBM Composer, and a word processor-typesetter operator to an office next to the information group.

10. J. Samoil was a member of a committee that finalized a CFS style guide.

11. R. Waldron surveyed libraries across Canada regarding preferences for receiving CFS Headquarters and regional centers' publications, and an automatic mailing list for the CFS was prepared for distribution to all centers.

12. The CFS publications policy guidelines were adopted, and Information Reports are being produced with the new cover format.

10. Goals for 1983-84:

1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately 10 Information Reports (including two special technical reports -- Insects of the prairie provinces and Diseases of the prairie provinces) and 40 journal articles and miscellaneous publications. (Samoil, Turtle)

2. Provide editing and publishing services in the preparation and publishing of 7-10 Forest Management Notes and 3 Forestry Reports. (Samoil, Turtle)

3. Prepare and publish the Program Review, 1982-83, of the Northern Forest Research Centre. (Samoil, Turtle)

4. Oversee printing and reprinting of locally published scientific and technical information. (Samoil)

5. Continue responsibility for the production and printing of the monthly NoFRC Forestry Newsletter. (Samoil, Turtle)

6. Continue responsibility for the distribution of NoFRC publications, maintaining the mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence. (Samoil, Turtle)

7. Continue to respond to requests from the public for general information and specific publications. (Samoil, Turtle)

8. Continue responsibility for displays and display equipment. (Samoil, Turtle)

9. Investigate the printing of self-cover Information Reports, where suitable, as an economy measure. (Samoil)

10. Investigate possibilities for integrating the word processing equipment with other typesetting and information systems. (Samoil)

11. Publications:

See attached list.

12. Signatures:

Investigator	Program Manager
Investigator	Director

LIST OF PUBLICATIONS, 1982

INFORMATION REPORTS

Brace, L.G. and P.J. Golec. 1982. Silviculture statistics for Canada, 1975-80. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-245.

Hall, R.J. (compiler). 1982. Uses of remote sensing in forest pest damage appraisal. Proceedings of a seminar held May 8, 1981, in Edmonton, Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-238.

Hiratsuka, Y., H.F. Cerezke, B.H. Moody, J. Petty, and G.N. Still. 1982. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1981 and predictions for 1982. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-239.

Huber, R.F. (compiler). 1982. Proceedings of the 1981 Intermountain Nurserymen's meeting, August 11-13, 1981, in Edmonton, Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-241.

Ives, W.G.H., J.A. Muldrew, and R.M. Smith. 1982. Experimental aerial application of forest tent caterpillar baculovirus. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-240.

Johnstone, W.D. 1982. Juvenile spacing of 25-year-old lodgepole pine in western Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-244.

Klein, J.I. 1982. Establishment and first results of a jack pine breeding program for Manitoba and Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-247.

Ondro, W.J. and T.B. Williamson. The forest industry in the economy of Alberta, 1978-79. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-246.

Peterson, E.B., V.M. Levson, and R.D. Kabzems. 1982. Upper limits of standing crop density for woody species in the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-243.

Singh, T. 1982. Biomass equations for ten major tree species of the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-242.

FOREST MANAGEMENT NOTES

Alexander, M.E. 1982. Diurnal adjustment table for the fine fuel moisture code. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 17.

Alexander, M.E. 1982. Calculating spring drought code starting values in the prairie provinces and Northwest Territories. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Manage. Note 12.

Johnstone, W.D. 1982. Heavy thinning accelerates growth of 77-year-old lodgepole pine. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Manage. Note 16.

Klein, J.I. 1982. Genetically improved jack pine for Manitoba and Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 18.

Singh, T. 1982. Weight tables for important tree species in the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Manage. Note 14.

Still, G.N. 1982. 1982 forest tent caterpillar infestation forecast for the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Manage. Note 13.

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Samoil, J.K. and G.B. turtle (Eds.). 1982. Saskatchewan forestry facts. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Rep. 26.

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Ondro, W.J., T.B. Williamson, R.A. Bohning, J.P. De Franceschi, and H.M. Setwart. 1982. Tables and facts in Samoil, J.K. and G.B. Turtle (Eds.). Saskatchewan forestry facts. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Rep. 26.

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NOR-34 Forest Biomass as an Energy Source

9. Goals in 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, W. Moore).

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.

Added

8. Complete and publish FMN on the Dika Side Cutter and its application in biomass harvesting. (Scientific Authority for P-163: W. Ondro).

9. Goals in 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, W. Moore).

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).

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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.

Added

8. Complete and publish FMN on the Dika Side Cutter and its application in biomass harvesting. (Scientific Authority for P-163: W. Ondro).

6. The contract report on "Development of an integrated operation for aspen wood products and energy from aspen biomass" by Woodland Resource Services Ltd. was received and an "executive summary" is being prepared for publishing (P-207). The related additional contract to look at summer harvesting of aspen in Manitoba did not receive ENFOR funding in 1982-83. The study was part of a presentation at the ENFOR Biomass Harvesting Review in Ottawa, October 28, 1982, along with the earlier P-163 project. (Scientific Authority: W. Ondro).

7. Coordination of the NoFRC ENFOR project continued; new emphasis is being given to completion of contract reporting from some of the earlier studies, some of this is undertaken under Study NOR-34-183. Acted as establishment representative on national and regional committees. Meetings were held with Alberta, Manitoba and Saskatchewan during the year, the latter covered by the Ottawa ENFOR Program Manager who also attended the other meetings. Five Scientific Authorities from NoFRC attended the 4th Bioenergy R & D Seminar in Winnipeg in March along with representatives from the contractees for four studies.

8. Further progress was made in preparing a FMN on "Harvesting forest biomass with a Dika Side Cutter". A draft of this report was also provided for participants at the ENFOR Biomass Harvesting Review in Ottawa, October 28, 1982. (Scientific Authority: W. Ondro)

11. Goals for 1983-84:

1. Demonstrate the RAMS system using conventional forest and biomass estimates by completing selected maps for the region (W. Moore, W. Chow, T. Singh). (See also NOR-22-142).

2. Provide advice as required for the completion of study "Determination of nutrient and biomass status of aspen ecosystems in Alberta" (P-205) and review contract report. (Scientific Authorities: L. Brace, I. Edwards).

3. Publish "executive summary" report on "Development of an integrated operation for aspen wood products and energy for aspen biomass" (P-207). (Scientific Authority: W. Ondro).

4. Publish contract report on "Impact of climatic variation on biomass accumulation in the boreal forest: selected references" (P-150). (Scientific Authority: J. Powell).

5. Publish contract report on "Impact of climatic variation on boreal forest biomass through the use of tree ring analysis" (P-149). (Scientific Authority: J. Powell).

12. Publications and Reports: (cont'd)

Kirby, C.L. and W. Chow. A mapping and resource analysis system (MARS) at the Northern Forest Research Centre. Paper presented at the Canadian Institute of Surveying Conference, Ottawa, April 1982.

Peterson, E.B., V.M. Levson, and R.D. Kabzems. Upper limits of standing crop density for woody species in the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Inf. Rept. NOR-X-243. 1982. 55 pp.

Peterson, E.B., N.M. Peterson and R.D. Kabzems. Impact of climatic variation on biomass accumulation in the boreal forest zone: selected references. Proc. 4th Bioenergy R & D Seminar, Winnipeg, March 29-31, 1982. pp. 128-137.

Peterson, E.B., N.M. Peterson and R.D. Kabzems. Impact of climatic variation on biomass accumulation in the boreal forest zone: selected references. Western Ecological Services (B.C.) Ltd., Sydney, B.C. Contract report for ENFOR Project P-150. March 1982. 650 pp.

Pollack, W.S. and J.D. Leblanc. Biomass equations, data acquisition phase, Northwest Territories 1981. Proc. 4th Bioenergy R & D Seminar, Winnipeg, March 29-31, 1982. pp. 74-78.

Systemhouse. RAMS (Resource Analysis and Mapping System) User's Guide Version I. Ottawa, Ont. Feb. 1982.

Woodland Resource Services Ltd. Development of an integrated operation for aspen wood products and energy from aspen biomass. Contract report for ENFOR Project P-207. October 1982. 355 pp.

13. Signatures:

J.M. Powell
Investigator - J.M. Powell

S.S. Malhotra, Program Manager

A.D. Kiil, Regional Director

12. Publications and Reports: (cont'd)

Kirby, C.L. and W. Chow. A mapping and resource analysis system (MARS) at the Northern Forest Research Centre. Paper presented at the Canadian Institute of Surveying Conference, Ottawa, April 1982.

Peterson, E.B., V.M. Levson, and R.D. Kabzems. Upper limits of standing crop density for woody species in the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Inf. Rept. NOR-X-243. 1982. 55 pp.

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Systemhouse. RAMS (Resource Analysis and Mapping System) User's Guide Version I. Ottawa, Ont. Feb. 1982.

Woodland Resource Services Ltd. Development of an integrated operation for aspen wood products and energy from aspen biomass. Contract report for ENFOR Project P-207. October 1982. 355 pp.

13. Signatures:

J.M. Powell
Investigator - J.M. Powell

S.S. Malhotra, Program Manager

A.D. Kiil, Regional Director

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.

Added Goals for 1982-83:

8. Prepare a report on the bimass weight tables for the prairie region for the NoFRC "Forestry Report" dealing with growth and yield.

9. Oversee a general review report on the information available in literature regarding the heat of combustion values for the major tree species of the prairie provinces.

10. Oversee a report on the synthesis and interpretation of biomass related data collected for the NoFRC studies previously completed under the ENFOR project.

10. Accomplishments in 1982-83:

1. An information report entitled "Biomass equations for ten major tree species of the prairie provinces" was prepared and published. (NOR-X-242)

2. A manuscript based on data collected through two service contracts for ENFOR P-92 field samples and entitled "Variation in specific gravity of ten prairie tree species" was prepared and is currently under review.

3. All the analyses for the various tree species and their components have been completed and the prediction equations for them have been derived. A poster paper "Biomass equations, data acquisition phase, N.W.T. 1981" was presented and published for the 4th Bioenergy R & D Seminar, Winnipeg. (see NOR-34-180)

4. Specific gravity of the N.W.T. tree species and preliminary statistical analysis have been completed and the service contract report "Determination of specific gravity on trees of N.W.T." has been received.

4. Determine specific gravity relating to the 6 tree species sampled in the N.W.T.

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11. Goals for 1983-84: (cont'd)

7. Prepare a forest management note on "Conversion of biomass volumes to biomass weights" in the prairies.

8. Undertake analysis for comparative estimates of biomass using N.W.T. and prairies prediction equations, and prepare a forest management note incorporating the results obtained and recommendation made.

9. Participate in and contribute to the national forest biomass inventory program and provide input to the pilot demonstration of biomass conversion undertaken by NoFRC on a township basis.

12. Publications and Reports:

Micko, M. Determination of Specific Gravity on Trees of N.W.T. Contract report, University of Alberta. April 26, 1982.

Pollack, W.S. and J.D. Leblanc. Biomass equations, data acquisition phase, Northwest Territories 1981. Proc. 4th Bioenergy R & D Seminar, Winnipeg, March 29-31, 1982. pp. 74-78.

Singh, T. Biomass equations for ten major tree species of the prairie provinces. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Inf. Rept. NOR-X-242. 1982. 35 pp.

Singh, T. Weight tables for important tree species in the prairie provinces. Environ. Can. Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Management Note No. 14. Aug. 1982. 4 pp.

13. Signatures:

Investigator

Program Manager

Director

11. Goals for 1983-84: (cont'd)

7. Prepare a forest management note on "Conversion of biomass volumes to biomass weights" in the prairies.

8. Undertake analysis for comparative estimates of biomass using N.W.T. and prairies prediction equations, and prepare a forest management note incorporating the results obtained and recommendation made.

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13. Signatures:

Investigator

Program Manager

Director

NOR-35 Tree Disease Research

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1982

1. Project: Tree Disease Research

2. Title: Forest tree rusts of western North America

3. New: Cont.: X 4. No.: NOR-35-026

5. Study Leader: Y. Hiratsuka

6. Key Words: *Cronartium, Pucciniastrum, Peridermium, Melampsora, Chrysomyxa,* cytology, morphology, taxonomy, Uredinales, inoculation experiment, pathogenicity.

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

8. Study Objectives:

General:

To acquire a comprehensive knowledge and to improve diagnostic capability on the forest tree rusts of western North America with particular emphasis on the Northern Region in terms of identity, host range, life history, distribution and pathogenicity.

Specific:

To study aspects of cytology, taxonomy, life history and host-parasite relationship of conifer needle rusts, pine stem rusts, and poplar-conifer rusts of the region, and related species in the world.

9. 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.

10. Accomplishments in 1982-83:

1. A research project on western gall rust studies in relation to the genetic improvement program of lodgepole pine has been initiated with a contract from the Province of Alberta (AFS) administered by University of Alberta.

2. Assisted Dr. G. B. Cummins (University of Arizona) to revise a book entitled "Illustrated Genera of Rust Fungi" as the junior author. The manuscript has been prepared and scheduled to be published in 1983.

3. Rough draft of an information report entitled "Impact of pine stem rusts of hard pines in Alberta--10-year plot study" is prepared with Drs. Van Sickle and Powell.

4. A report on herbicide control trials of the alternate hosts of comandra blister rust (second year results) was written and submitted to AFS.

11. Goals for 1983-84:

1. Continue western gall rust study in relation to genetic improvement program of lodgepole pine.

   - Publish an illustrated information report on western gall rust.

   - Coordinate research activities of cooperators (Drs. P. Blenis and M. Pickard, a possible PDF and Eric Allen).

2. Publish an information report entitled "Impact of pine stem rusts of hard pines in Alberta--10-year plot study" with Drs. Powell and Van Sickle.

3. Prepare an invited symposium presentation at the Third International Mycological Congress (Tokyo) on the taxonomy of rust fungi.

4. If approved, plan and start professional development leave to Asia from August 1983 to investigate tree rusts especially new forms of white pine blister rusts discovered in Asia in recent years.

12. Publications:

Up to 1982:

Journal publications: 38

Information reports, notes, etc.: 10

File reports: 6

1982-83:

Journal publications:

Tsuneda, A. and Y. Hiratsuka. Commensal relationship between *Scopinella gallicola* and *Cladosporium* sp. Rept. Tottari Mycol. Inst. (In press).

Powell, J. M. Rodent and Lagomorph damage to pine stem rusts, with special mention of studies in Alberta. Can. Field-Naturalist (In press).

Information reports, notes, etc.:

Allen, Eric and Y. Hiratsuka. 1982. Infection and penetration of western gall rust. Paper presented at the Phytopathological Society of Alberta meeting in Fairview (Abstract.

File reports: nil

13. Signatures:

Investigator

Program Manager

Director A. D. Kiil

CANADIAN FORESTRY SERVICE
STUDY STATEMENT
1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1982

1. Project: Tree Disease Research

2. Title: Forest diseases: Research and technical transfer services

3. New: Cont.: X 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 conduct short term investigation of tree diseases as need arises.

   2. To provide diagnostic and taxonomic service of tree diseases and other forest fungi.

   3. To maintain and improve diagnostic and taxonomic service capabilities of tree disease pathogens and other forest fungi in the region.

   4. To prepare checklists of forest fungi of important areas (e.g. national parks, provincial parks, etc.), diagnostic keys for identification, and other related publications.

9. 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.

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.

10. Accomplishments for 1982-83:

1. First draft of an information publication on major tree and shrub diseases of the Prairie Provinces is in good progress and will be ready for review in 1983-84 and for publication in 1984-85.

2. Provided diagnostic and identification service of tree and shrub diseases.

3. Maintained and upgraded Mycological Herbarium and a fungus culture collection.

4. A paper on metabolites of *Gremeniella abietina* (*Scleroderris* canker pathogen was presented to an international symposium (Mexico) by Dr. W. A. Ayer (U. of A.) with Y. Hiratsuka as co-author.

5. Two proposed papers with Dr. S. Takai (GLFRC) were combined into one and under review with Canadian Journal of Botany.

6. Started a research project with Dr. W. A. Ayer (Department of Chemistry, U. of A.) on *Armillaria* root rot with the fund made available by the Province of Alberta (Alberta Forest Development Trust Fund) through University of Alberta (Department of Forest Science). About 60 isolates of the pathogen have been obtained for comparative studies and a "trap log" plot has been established. A paper was presented at the Phytopathological Society of Alberta meeting.

Added Accomplishments:

7. Mr. Eiji Nagasawa of the Tottori Mycological Institute (Japan was a visiting scientist for four months (Aug.-Dec.) and collected about 350 specimens of macrofungi (more than 100 species) for future mycorrhizal studies. His visit was supported partly with the fund supplied by the Province of Alberta (AFDTF) through University of Alberta (Department of Forest Science).

8. Obtained a contract from the Province of Alberta (Department of Energy and Natural Resources) and compiled data for a publication on aspen-poplar decay with a subcontractor (Dr. A. A. Loman).

11. Goals for 1983-84:

1. Complete first draft of an information publication on major tree and shrub diseases and start review process for publication during 1984-85 fiscal year.

2. Provide diagnostic and identification service of the tree and shrub diseases.

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

4. Start to investigate blue stain fungi associated with mountain pine beetle with Dr. W. A. Ayer (U. of A.) with a NSERC strategic grant.

5. Publish a journal paper (Can. J. Bot.) on internal symptoms of DED induced by a toxin with Dr. S. Takai (GLFRC).

6. Continue investigation on *Armillaria* root rot with Dr. W. A. Ayer (U. of A.) and a graduate student (Ken Mallett) with a grant from the Province of Alberta (AFDTF).

7. Prepare a list of macrofungi collected and identified by Mr. E. Nagasawa, incorporate dried specimens into the herbarium, and deposit cultures into the fungus culture collection.

8. Publish a paper on a new leaf spot fungus on balsam poplar from Manitoba and Ontario.

9. Publish two pest leaflets (Western gall rust and silver leaf).

10. Publish an information report on aspen-poplar decay with Dr. A. A. Loman. The work is supported jointly by the Province of Alberta (Department of Energy and Natural Resources) and Blue Ridge Timber Co. Ltd. (Poplar Research Committee).

12. Publications:

Up to 1982:

Journal publications: 4
Information reports, notes, etc.: 9
File reports: nil

1982-83:

Journal publications:

Ayer, W. A., Y. Hoyano, I. van Altena and Y. Hiratsuka. Metabolites of plant disease causing fungi. *Gremeniella abietina*. Revista Letinoamericana de Quimica (In press).

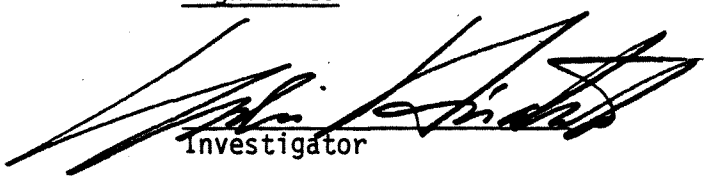
Richards, W. C., S. Takai, D. Lin, Y. Hiratsuka and S. Asina. An abnormal strain of *Ceratocystis ulmi* incapable of producing external symptoms of DED Europ. J. For. Path. (In press).

Information reports, notes, etc.

Mallett, K. and Y. Hiratsuka. 1982. *Armillaria* root rot investigation of intensively managed conifer forests. Plant Pathology Society of Alberta meeting in Fairview (Abstract).

Nagasawa, E. and Y. Hiratsuka. 1982. Macrofungi of conifer forests in Alberta. Plant Pathology Society of Alberta meeting in Fairview (Abstract).

13. Signatures:



Investigator

Program Manager

Director A. D. Kiil

NOR-35-153 Supplementary to 10 - 6.

Progress Report submitted to Alberta Forest Development Research Trust Fund, October 1983.

1) Systematic literature search was conducted and a comprehensive care index of papers on *Armillaria* root rot is established.

2) Contacts have been made with scientists working with *Armillaria* root rot problem in other parts of Canada (Dr. D. Morrison, Victoria; Dr. P. Singh, St. John's).

3) More than 60 isolates of *Armillaria mellea* have been obtained from U.K., B.C., Ontario and Newfoundland as well as various locations and hosts in Alberta. They have been obtained and accessioned in the fungus culture collection of the Northern Forest Research Centre. Initial work to compare between biological forms exist in Alberta and other parts of the world has been initiated. Colony types, biological groupings and vigor classes of rhizomorph development are found to be useful characteristics for comparison.

4) Search for a consistent and reliable method of inoculation is underway. Wood blocks or sterilized carrot sticks inoculated with the pathogen seem to be suitable inocula to be put into potted seedlings. A successful inoculation was obtained with a potted tree. Next stage will be to inoculate a number of potted trees to investigate disease progression and to test influence of predisposition to disease development.

5) A "trap log" plot has been established in Hinton area to study relationship between distribution of the organism and incidents of the disease. Aspen logs (ca 1 m long) were pounded in 1 m apart on 10 x 10 m plot containing several "pockets" of dead and dying *Armillaria* infected trees. The logs will be excavated in the spring of 1983 and will be checked for the presence of the pathogen.

6) Surveys of macrofungi associated with conifer stands of various locations in Alberta were conducted by Mr. E. Nagasawa (visiting scientist from Tottori Mycological Institute supported partially by this grant). More than 400 specimens were collected and identified. About 110 species were recognized and pure cultures of 25 species have been obtained.

7) A paper outlining the project was presented at the Phytopathological Society of Alberta in Fairview, Alberta.

8) Metabolites of several forms of *Armillaria mellea* have been extracted and some of them are identified. Crude extracts from the liquid cultures are biologically active and preliminary biological assays were performed. Selection and modification of suitable biological assay techniques for selected metabolities are underway. Method using pine germinants in the petri dish seems promising.

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983-84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1982

1. Project: Tree Disease Research

2. Title: Canker, dieback and mortality of juvenile forest trees and amenity species

3. New: X (some goals transferred from NOR-10-155)

4. No.: NOR-35-194

5. Study Leader: H. Zalasky

6. Key Words: Canker, dieback, mortality, juvenile trees, amenity species, ice nucleating agents, frost, frost damage, fungal succession, remedial measures, technical transfer

7. Location of Work: Northern Forest Research Centre, Edmonton, intensively managed forest stands, provincial nurseries and homeowners in our region.

8. Problem:

In recent years inquiries for information on cankers, dieback and mortality affecting individual amenity trees, forest trees and nursery stock have increased in an effort to protect their aesthetic value in the home gardens and provincial and national parks. Cankers and dieback affect the rejuvenating capacity and quality of nursery stock and juvenile trees in new stands and the resulting lower productive value of the new stands is generating concern among forest managers and the research community. Several information gaps are evident in the following areas:

1. Agriculture research has had 12 years gain on knowledge of ice nucleating agents (INA) by determining their effects on annual crops and their possible control to reduce losses. Time has come to provide similar service in forestry. The INA mediate in frost damage of a crop at warmer temperatures than that of a crop free of INA. The INA are minute single cell organisms adaptive to certain freezing temperatures and ice formation as moisture moves to the freezing front and forms ice crystals in

delicate cells, rupturing the highly complicated membranes and interfering with the chemical reactions inside each cell. The INA multiply readily on the surfaces of bark and foliage by mobilizing and utilizing moisture and metabolites in the host cell walls.

2. Symptoms due to dieback, defoliation and death of vital tissues of the bark are often difficult to diagnose and lead to expensive mistakes in attempting to remedy the damage. There is a need to define to managers and lay public each stage of killing, growth retardation, growth defects during rejuvenation, and instability during phenological and growth form adjustment.

3. There is a need to explain the red belt symptoms in large blocks of seedlings or thousands of hectares of trees along a certain elevation. The public pressure can take advantage of a tract of land so affected if no suitable information is available for correct cause and remedy.

9. Study Objectives:

1. To determine the effects of INA and microclimate on cold tolerance of seedlings and juvenile trees and use knowledge gained to develop more effective overwintering guidelines and to enhance field performance.

2. Investigate the use of non INA agents or competition to control populations of INA on the phylloplane of trees and nutralize their mediation in frost.

3. Assemble photos and photograph trees and parts of trees to illustrate the effects of frost damage and demonstrate how to diagnose symptoms even though they have been initiated in past years to aid in remedial measures of growth problems, undesirable multileadering or stunting.

4. To investigate red belt symptoms, winter browning, bark discoloration, and subsequent severe defoliation and changes in refoliation patterns.

10. Resources:

a. Starting date: 1982
b. Estimated year of completion: 1988
c. Estimated professional man-years required: 5
d. Essential new major equipment for 1983-84 with costs:
cold plate $1,800.00
e. Essential new major equipment beyond 1984 with costs: Nil
f. 1983-84 man-years:

Prof.	0.6
Supp.	1.0
Casual	0.3
Total	1.9

11. Progress to Date: New study - see accomplishments 1982-83.

12. Goals for 1982-83:

    1. Goal 6 transferred from NOR-10-155. Initiate a field and laboratory investigation of ice nucleating agents (INA) and their competitors.

    2. Part of goal 7 transferred from NOR-10-155. Advisory and consulting services pertaining to the health of trees and shrubs, identification and other professional tasks.

    3. Litature review, an added goal.

13. Accomplishments in 1982-83:

    1. Progress has been made with INA isolations from bark and leaf surfaces of plants and trees and from irrigation water, and with identifications of INA cultures to genus or species. Some freeze drop tests have been conducted to test INA activity of cultures as time permitted. Results may provide information for a short paper.

    2. Health of trees and shrub inquiries: most of the inquiries came from private home owners and from research people.

       Identifications and Professional:

       Have participated in a Workshop on review of pathological research in Canada.

       Have assisted Wil Holland on how to interpret frost damage on the basis of topography, area involved, severity, elevation, uniformity, frequency and time of occurrence.

       Have provided four INA cultures to Agr. Can. Scientist at Lacombe, Alberta.

       Have provided references on INA literature to consulting firm and on poplar decay to a researcher from ARC.

       Have given advice to U. of A. students on techniques in histology, disease control in experimental material and fungus identification.

       Have reviewed three research papers.

       Have identified 30 fossil specimens to species for Prof. Karrow, Waterloo University, Department of Earth Sciences.

Have identified a fossil specimen for Steve Zoltai.

Have identified hardwoods and conifers for a private collector specializing in cane making.

3. Have summarized literature on various aspects of cell biology pertaining to INA activity and techniques.

14. Goals for 1983-84:

1. Prepare a manuscript on "Bacterial ice nucleating patterns, chemical, morphological and INA changes".

2. Continue with field and laboratory investigations of ice nucleating agents (INA) on leaf and nursery irrigation water habitats.

3. Initiate exploratory field tests with seedlings treated with INA or their competitors.

4. Continue with the study of common loci for INA in bacteria and plant cells.

5. Determine the role of fungal spores as INA agents and their subsequent activity during molding, colonization of dead tissues of the bark, of dieback or of peripheral occlusion tissues.

6. Advisory and consulting services on the health of trees and shrubs, identification and professional service.

15. Publications:

a) Prior to 1982

Nil

b) 1982-83

Zalasky, H. 1982. Summary of frost types and damage to forests. File Report.

Zalasky, H. 1982. Fossil specimen identifications of wood from Sault Ste. Marie for Prof. P. F. Karrow. File Report.

16. Signatures:

Harry Zalasky
Investigator

Program Manager

Director A. D. Kiil

NOR-52 Analytical Services Laboratory

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 22, 1982

1. Project: Analytical Services Laboratory

2. Title: Analytical Services Laboratory

3. New: Cont.: X 4. No.: NOR-52-807

5. Study Leaders: G. Hogan, Y. Kalra

6. Key Words: Analysis, soils, vegetation, water

7. Location of work: Northern Forest Research Centre

8. Study Objectives:

   1. Maintain an adequate analytical laboratory to conduct analyses of soils, vegetation and water.

   2. To provide an efficient analytical service commensurate with budget-equipment allocations.

9. Goals for 1982-83:

   1. Maintain an adequate analytical laboratory to conduct analysis of soils, vegetation and water.

   2. To provide an efficient analytical service commensurate with budget and equipment allocations.

10. Accomplishments in 1982-83:

   1. An adequate laboratory was maintained, additional equipment, i.e. titration system was purchased to provide more efficient service to clients requesting this procedure.

   2. Approximately 12,000 analyses of soils, vegetation and waters have been carried out for NoFRC scientists and outside clients. At the present rate all analytical commitments will be met by the end of the budget year.

11. Goals for 1983-84:

    1. Maintain an adequate analytical laboratory to conduct analyses of soils, vegetation and water.

    2. To provide an efficient analytical service commensurate with budget and equipment allocations.

12. Publications:

    Nil

13. Signatures:

Investigator	Program Manager
Investigator	Director

NOR-53 Computer and Biometric Services

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 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 1982-83:

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

   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.

Goals for 1982-83: (cont'd

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.

Goal added:

9. Present a poster on clearcutting and nutrient export at the 12th International Congress of Soil Science to be held in New Delhi, India in February, 1982.

10. Accomplishments for 1982-83:

1. Assistance and advice was provided for the fire growth model.

2. Assistance on biometrics was provided in response to four requests from NoFRC research staff.

3. A forest management note entitled 'BIOMASS:FORTRAN subroutines for biomass computation' was prepared, reviewed, and is now with the editor.

4. All the needed programs and documentation were obtained and the optimization technique is ready for testing.

5. More familiarity with widely used statistical packages such as SPSS, MIDAS and BMDP was gained through the year by attending training courses at U of A and by application of some programs included in the packages at NoFRC.

6. Preliminary assessment on the nature of reporting needed for the previously completed work under ENFOR contract was undertaken; the review is expected to be finalized before the end of the fiscal year.

7. An information report entitled "A proposed method for preliminary assessment of erosion hazards in the forests of west-central Alberta" was reviewed and edited, and is now pending publication.

8. A paper entitled "Predicting yields of geochemical constituents in the natural waters of a subalpine system in Alberta, Canada" was finalized and is now pending publication.

9. A poster session paper entitled "Effects of progressive clearcutting on export of nutrients from forest lands in Alberta, Canada" was presented at the Twelfth International Congress of Soil Science held in New Delhi, India, during February, 1982.

11. Goals for 1983-84:

1. This study has been terminated. Active goals (#3 and #6) remaining from 1982-83 have been transferred to Project NOR-34; goal 4 will be held in abeyance for the time being; the remaining goals have been completed.

12. Publications 1982-83:

Publications

Singh, T. 1982. A proposed method for preliminary assessment of erosion hazards in the forests of west-central Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta, Inf. Rep. (In press)

Singh, T. 1982. Predicting yields of geochemical constituents in the natural waters of a subalpine system in Alberta, Canada. (In press)

Lee, C. 1982. Comparison of two correction methods for the bias due to the logarithmic transformation in the estimation of biomass. Can. J. For. Res. 12(2): 326-331.

Reports

Singh, T. 1982. Effects of progressive clearcutting on export of nutrients from forest lands in Alberta, Canada. Poster paper presented at the 12th International Congress on Soil Science held in New Delhi, India in February, 1982.

13. Signatures:

Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1983 - 84

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1982

1. Project: Computer and data processing 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 processing, programming, system analysis, graphics, mapping, statistical analysis, information retrieval, Gimms, MARS, RAMS, Data base

7. Location of work: Edmonton

8. Study Objectives:

   1. To provide an up-to-date computer service, including data processing, programming, system analysis, computer modelling, mapping and graphics to NoFRC research staff and administrative personnel.

9. Goals for 1982-83:

   1. Provide consulting in all aspects of data processing, including system analysis, statistics, programming and simulation modelling

   2. Provide in-house courses for potential users of computer services

   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

   5. Install and test HP 1000 mini-computer for image analysis and interface with PDP 11/60

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

6. Provide keypunch and data entry service, back up and restore facilities as required by various projects

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

8. Install, test, and evaluate the TEKTRONIX PLOT 10 features for possible purchase. Evaluate a multi-color pen option for our current TEKTRONIX plotter

9. Develop contour and general X-Y plotting systems for the TEKTRONIX computer

Goals added:

10. Co-author with C.L. Kirby a paper on RAMS (MARS) system and available features and present at the CIS convention in Ottawa

11. Assist NoFRC staff and outside cooperators in computer analysis of R&D programs

10. Accomplishments for 1982-83:

1 - 6 Goals accomplished

7 - Goal not achieved; will be addressed in 1983-84

8 - 10 Goals accomplished

11 - The university TEXTFORM commands were tested on the PDP 11/60 and it was found that, all commands could be entered using the PDP editors. This allows us to do the necessary editing and preparation in house, then taking the taped version to the U of A for the final run only, thus saving considerable funds on text editing.

- The climate data was again massaged and recleaned for analysis giving out results such as degree days, mean temperatures, frost free days and so on. (J. Powell)

- Plotting programs to display table output and pie charts were developed. (T. Singh)

- Some work and liaison between D. Golding at UBC was done along with special plots of data over the last 13 years with confidence intervals.

- Two meetings with J. Fisher at S.F.S. in Prince Albert took place to find out what Saskatchewan is doing in the way of mapping-they are using the sophisticated CGIS system in Ottawa, at this time, over the phone lines.

- Some Prince Albert data was rehashed and run for K. Froning and a graduate student he is counselling.

- Considerable time was spent assisting the Biometrician prepare BIOMASS equations for the ENFOR project and plotting out results for publication. (T. Singh)

- The new two-way editor for the PDP 11/60 was tested and a mini user's guide prepared.

- 3 maps were completed using the RAMS System, a township for Alberta and Saskatchewan plus a test map for the NWT. These maps are being used for demonstrations and to test the BIOMASS equations. (W. Moore)

- Data was supplied to the Resource Data Analysis Project. (P. Golec)

- A CS 2 was finally hired after a search of 9 months and "job fair" interviews in Calgary and Vancouver. (R. Griffiths)

- Programs to help analyse growth performance of containers and fertilizers were written. (J. Ball)

- Programs to compile bark beetle data were written. (B. Moody)

- A data base was set up for inquiries into bark beetle data by various keys. (B. Moody)

- Keypunching, verifying and data entry were performed as required, a huge backlog has been cleared up.

- A couple of fire growth programs were written for the Apple III computer for AFS. (Newstead)

- Manipulated data to calculate mean height by area and count by species. (W. Ives)

- Assisted with PARKS programs as required. (P. Achuff)

- Provided programming and consulting assistance to AFS. (B. Baker)

11. Goals for 1983-84:

1. Prepare yearly report on computer use by individual researcher and resulting publications.

2. Write or adapt programs and systems as required and provide documentation.

3. Assist with design and preparation of economics table retrieval system and help evaluate PFRC economic data base programs as to adaptability to NoFRC's system. (W. Ondro)

4. Continue development, testing and documentation of computer programs for statistical and numerical analysis, and plotting sub-routines to aid statistical and simulation modelling.

5. Continue to expand and refine contour and general X-Y plotting systems for the TEKTRONIX computer.

6. Assist with the ENFOR computing as required. Apply BIOMASS coefficients to RAMS maps data to produce BIOMASS output. (J. Powell)

7. Assist with RAMS mapping system so data can be used for Demos; and write programs as required to handle future requests; assist with map digitizing and error correction. (W. Moore)

8. Provide keypunch and data entry services and backup and restore facilities as required by various projects.

9. Setup and maintain data bases as required using DATATRIEVE.

10. Assist people who use U of A computer as and when needed; keep current with DEC and HP software and hardware releases and innovations.

11. Provide consulting in all aspects of data processing, including system analysis, statistics, programming, where possible.

12. Establish the GIMMS-RAMS programs so maps can be interchanged with other GIMMS users. (W. Moore)

13. Provide in-building courses for potential users of hardware and software facilities.

14. Assist with PDP 11/60 capture of data from the Nuclear Spectrometer. (M. Apps)

15. Assist with transfer of data from the PDP 11/03, used in the pollution control section, to the PDP 11/60. (G. Hogan)

16. Install updates to MINITAB as received.

17. Develop or adapt a stores inventory system to assist stores in keeping the inventory up to date.

18. Develop a text editing system so the library can prepare accession lists using the computer.

19. Assist, as required with the AFMAS Accounting System.

20. Assist with the interpretation of paper tape output for the NOR-4 project. (R. Yang)

21. Evaluate and install various DECUS programs such as RUNOFF-a forms editor; TECO-a powerful system editor.

22. Provide assistance in the development, programming and testing of computer models for various research programs.

23. Prepare a report on the state of and usage of the RAMS system at NoFRC.

24. Investigate the necessity of obtaining network facilities such as DATAPAC so the PDP 11/60 could be used by other establishments and we could use other computers as well.

12. Publications:

Publications

nil

Reports

Kirby, C.L. and W. Chow. 1982. RAMS (MARS) mapping system and available features. Paper presented at the CIS convention in Ottawa.

13. Signatures:

Investigator

Program Manager

Director