STUDY STATEMENTS

1984-85

NORTHERN FOREST RESEARCH CENTRE
CANADIAN FORESTRY SERVICE
EDMONTON, ALBERTA

MAY 1984

I N D E X

NOR-1 Detection and appraisal of tree pests and vegetation disturbances

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1983

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, climate influences and pollutants on trees and shrubs and other types of vegetation.

9. Goals for 1983-84:

   1. Survey, map, and report on major forest pests of the region, i.e. mountain pine beetle, forest tent caterpillar, spruce budworm, jack pine budworm and spruce beetle.

   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 paririe provinces and the NWT.

9. Collaborate with project NDR-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 defoliatros.

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".

10. Accomplishments in 1983-84

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, spruce beetle, forest tent caterpillar, and jack pine budworm) in the three prairie provinces and the Northwest Territories. Aircraft time for surveys is largely provided by outside agencies.

   Major areas mapped and reported with moderate-to-severe defoliation are: 1) A total of 75 000 ha of spruce budworm infestation in the

region; 2) 4 850 000 ha of aspen stands defoliated primarily by the forest tent caterpillar and 3) 250 000 ha of jack pine budworm infestation in Manitoba. Mountain pine beetle infestation was mapped over 11 000 ha in southern Alberta, and the spruce beetle infestation on 1 500 ha in northern Alberta.

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 beetle in southern Alberta Cypress Hills, Saskatchewan and Alberta and several national parks in cooperation with study NOR-1-143.

   b. Conducted a Fireblight survey to measure the severity of infestation on mountain ash trees in Edmonton, jointly with Alberta Agriculture and Parks & Recreation. A report is available.

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

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

   e. Surveys to detect new or introduced pests also included baited traps for possible introduction of gypsy moth and the European pine shoot moth.

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

   g. Identified dwarf mistletoe infection of residual jack pine trees during control operations in burnt-over areas in northern Alberta, for the Alberta Forest Service. This led to the detection of small groups of beetle-killed jack pines over several thousand hectares. The bark beetle was identified as the pine engraver, *Ips pini*.

3. Compiled and published information report on the forest pest situations in the region for 1982 and made predictions for 1983. 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 30 occasions, e.g. to Parks Canada staff, courses sponsored by Alberta Agriculture, staff of tree nurseries, AFS staff, Parks and Recreation, etc.

b. T.V., radio and newspaper interviews were given on pest problems.

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 two 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)
- CANUSA and Eastern Budworm Council

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. Other Forestry Reports given priority over FIDS.

8. FIDS Forest Management Notes not included on NoFRC publications list for 1983. The Report was produced internally as a Survey Bulletin.

9. Collaborated 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 survey methodology manual continued and is 30 percent completed.

11. Systematic roadside surveys of jack pine dwarf mistletoe were continued in Saskatchewan in 1983. A file report was completed.

12. Operational use of satellite imagery to delineate areas of severe defoliation by forest tent caterpillar was assessed jointly with Study NOR-1-184 and Project NOR-22.

13. Collaborated with Bill Ives and Dick Wong and provided significant assistance with photography and insect collections (about 3,000 slides representing 600 insect species) for the illustrated report "a Practical Guide to the Forest Insects of the Prairie Provinces".

11. Goals for 1984-85:

1. Survey, map and report on major forest pests of the region, i.e. mountain pine beetle, spruce beetle, forest tent caterpillar, spruce budworm, jack pine budworm, dwarf mistletoe and needle cast or needle rust.

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 1983 and make predictions for 1984 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 if on NoFRC priority list.

8. Publish Forest Management Notes (4) 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. Continued dwarf mistletoe surveys and report on provincial forests surveyed.

12. Collaborate with Bill Ives and Dick Wong and provide assistance with photography and insect collection for the pictorial to forest and shade tree insects of the Canadian Prairies.

12. Publications 1983-84:

Information Reports, Notes etc.

Hiratsuka, Y. and J. Petty. 1982. Important forest insects and diseases. Prairie Region. 1978. In: Forest Insect and Disease Annual Report 1978 and 1979. Environ. Can., Can. For. Serv. Ottawa.

Moody, B.H. and H.F. Cerezke. 1983. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1982 and predictions for 1983. Environ. Can., Northern Forest Research Centre. Inf. Rep. NOR-X-248: 19 p.

Moody, B.H. and H.F. Cerezke. 1983. Contribution In: Forest Insect and Disease Conditions in Canada 1982. Compiled by T.E. Sterner and A.G. Davidson. Environ., Can. For. Serv. Ottawa.

Still, G.N. 1983. Forest Insect and Disease Conditions in Saskatchewan in 1983 and forecasts for 1984. Forest Management Note.

File Reports

Cerezke, H.F. and H.S. Gates. 1983. Surveys and impact estimation of mountain pine beetle damage in the Bow-Crow Forest, Alberta, during 1982. File Report NOR-143 -033; 10 p.

Cerezke, H.F. 1983. 1983 report of the Canadian Forestry Service to the Environmental Committee of the Alberta Horticultural Advisory Committee. File Report.

Cerezke, H.F. 1983. Alberta Pest Control Advisory Meeting report from the Canadian Forestry Service. File Report.

Emond, F.J. 1983. Insect and disease surveys of Saskatchewan provincial tree nurseries. File Report.

Emond, F.J. 1983. Canadian Forestry Service 1983 Report to the Saskatchewan Advisory Committee, Insect Control and the Saskatchewan Advisory Council, Crop Protection, Plant Disease Committee. File Report.

Emond, F.J. 1983. Tree pest extension report, 1983. File Report.

Emond, F.J. 1983. Summary of special surveys for AFS, 1983. File Report.

Gates, H. 1983. Insect and disease conditions in Wood Buffalo National Park and Slave River area, Northwest Territories. File Report.

Gates, H. 1983. Mountain Pine Beetle in Waterton Lakes National Park in 1983. File Report.

Gates, H. 1983. Results of Spruce Budworm Pheromone Traps in Alberta in 19B3. File Report.

Gates, H. and J. Edmond. 1983. Losses from the Engelman Spruce Beetle in Northern Alberta. File Report.

Gates, H. and H.F. Cerezke. 1983. Surveys and impact of mountain pine beetle damage in Bow-Crow Forest, Alberta during 1983. File Report.

Gates, H. and B. Moody. 1983. Deployment of spruce budworm pheromone traps in Alberta. File Report.

Grandmaison, M. 1983. The spruce budworm in Alberta, 1982. File Report.

Grandmaison, M. 1983. Forest tent caterpillar post-hatch survey for Alberta, 1983. File Report.

Grandmaison, M. 1983. List of insects photographed during the 1983 season. File Report.

Grandmaison, M. and H. Gates. 1983. Trembling aspen defoliation in Alberta during 1983 and predictions for 1984. File Report.

Moody, B.H. 1983. Report on the spruce budworms in the Prairie Provinces and the Northwest Territories 1983. Report prepared for the 11th Annual Forest Pest Control Forum, Ottawa.

Moody, B.H. 1983. Report on the status and control of other pests in the prairie provinces, 1983. Report prepared for the 11th Annual Forest Pest Control Forum, Ottawa.

Moody, B.H. 1983. Status of major forest insects and diseases in the prairie provinces and the NWT, 1982-83. Contribution to report to working group on forest insect and diseases, North American Forestry Commission, October 1983.

Moody, B.H. 1983. Highlights of forest insect and disease research in the prairie region. Contribution to the Canadian report to the North American Forestry Commission, October 1983.

Petty, J. and M. Grandmaison. 1983. Insect and disease conditions in Waterton, Banff, Jasper, Kootenay, Yoho and Elk Island National Parks, 1982. File Report.

Petty, J. 1983. Insect and Disease conditions in Waterton, Banff, Jasper, Kootenay, Yoho and Elk Island National Parks, 1983. File Report.

Still, G.N. and B. Moody. 1982. Jack pine dwarf mistletoe in Saskatchewan, 1982. File Report.

Still, G.N. 1982. Forest insect and disease conditions in Prince Albert National Park, 1982. File Report.

Still, G.N. and B. Moody. Forest insect and disease conditions in Saskatchewan in 1982 and forecasts for 1983. Forest Pest Survey Bulletin.

Still, G.N. 1983. Slide presentation and field trip in the Quirk Creek Gas Plant area on July 26, 1983. File Report.

Still, G.N. 1983. Forest insect and disease surveys in the Fort Simpson District, N.W.T. - July 19-21, 1983. File Report.

Still, G.N. 1983. Jack Pine dwarf mistletoe surveys in Saskatchewan, 1983. File Report.

Still, G.N. 1983. Spruce and jack pine budworms in Saskatchewan, 1983 and forecasts for 1984. File Report.

Still, G.N. 1983. Trembling aspen defoliation in Saskatchewan, 1983 and forecasts for 1984. File Report.

Still, G.N. 1983. Insect and disease conditions in Saskatchewan provincial tree nurseries in 1983. File Report.

Still, G.N. 1983. Forest insect and disease conditions in Prince Albert National Park in 1983. File Report.

Still, G.N. 1983. Mountain pine beetle in Saskatchewan in 1983. File Report.

Still, G.N. 1983. Summary of forest insect and disease surveys and activities in Saskatchewan in 1983. File Report.

Tidsbury, C. 1983. Jack pine budworm in Manitoba, 1982 and forecasts for 1983. File Report.

Tidsbury, C. 1983. Insect and disease conditions on shelterbelt, ornamental plantings and shrubs in Pineland Forest Nursery, Hadashville, Manitoba, 1982. File Report.

Tidsbury, C. 1983. Forest tent caterpillar infestation in Manitoba, 1983 and defoliation forecasts for 1984. File Report.

Tidsbury, C. 1983. Spruce budworm infestations in Manitoba, 1983 and forecasts for 1984. File Report.

Tidsbury, C. 1983. Insect and disease conditions in Riding Mountain National Park, 1983. File Report.

Tidsbury, C. 1983. Jack pine budworm in Manitoba, 1983 and forecasts for 1984. File Report.

Tidsbury, C. 1983. Insect and disease conditions on shelterbelt, ornamental planting and shrubs in the Pineland Forest Nursery, Hadashville, Man., 1983. File Report.

These timely File Reports are promptly distributed to provincial and regional foresters, national and provincial park superintendents and warden staffs, agricultural representatives, provincial entomologists and pathologists, city parks and recreation staffs, other national FIDS regions, FIDS Director in Ottawa, etc.

13. Signatures:

Investigator

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1983

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

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 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.

10. Accomplishments in 19B3-B4:

1. a. Identified over 1000 larval and adult sawflies for the Forest Insect and Disease Survey of the Northern Forest Research Centre; Canadian National Collection, Systematic Entomology Laboratory, U.S.D.A.; provincial agencies; regional clients and in-service personnel.

   b. Reviewed a sawfly manuscript on Panamanian sawflies submitted to the Proc. Ent. Soc. of Washington for publication.

2. A rough draft of the paper on the "Larvae of the North American genera of Diprionidae (Hymenoptera: symphyta)" has been prepared and will be submitted for typing.

3. A Forest Management Note on the introduced pine sawfly in Manitoba has been submitted for publication.

4. The information report written in collaboration with J.A. Drouin on the seasonal development and chemical control of the birch leaf miners in Alberta has been reviewed by the technical board and is in the hands of the editorial board.

5. The fossil sawfly representing a mid-Wisconsian interstadial (30,000 B.P.) was identified as *Empria* sp. for the Department of the Army, U.S. Army Cold Regions Research and Engineering Laboratory, Alaskan Project office, Fort Wainright, Alaska.

6. The male of *Pristiphora banksi* Marlatt has been discovered and the species redescribed for the study on the revision of this genus.

11. Goals for 19B4-B5:

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

2. Submit the paper on the "Larvae of the North American genera of Diprionidae (Hymenoptera: Symphyta)" for review by the technical board.

3. Identify for the Smithsonian Institute, Washington, D.C. 48 adults of *Pristiphora* Latreille.

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

5. Supervise the research of a visiting scholar from the Forest Research Institute, Chinese Academy of Forestry, Beijing, People's Republic of China.

12. Publications in 1983-84:

Wong, H.R. and R.C. Tidsbury. 1984. Introduced pine sawfly in Manitoba. Forest Management Note 26. 2 p.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1983

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

2. Title: Control and damage impact of insects injurious to trees and forests

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 forests 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 1983-84:

   1. Continue role in assessment of MPB within the region as in 1983 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".

10. Accomplishments in 1983:

1. (a) Represented NoFRC on Mountain Pine Beetle Technical Committee to review MPB infestations in western Canada. One meeting held at Fernie, B.C., with representation by AFS, BCMF, Parks Canada, B.C. Parks and PFRC.

(b) Represented NoFRC on Canada/U.S. Memorandum of Understanding Agreement on MPB; attended and reported at Action Planning Meeting, Portland, Oregon.

(c) Provided coordination with FIDS staff (NOR-D33) on MPB air and ground surveys, and monitoring for population trend and overwinter survival (data summarized in Ann. Report of FIDS (see NOR-033). A file report was prepared which gives estimates of tree and volume losses due to MPB attacks in the Bow-Crow Forest during 1982, and also gives area affected, distribution of infestations and methodology used in deriving estimates (see Cerezke and Gates, File Rep., NOR-D33).

(d) Results of aerial photography and ground surveys in Kootenay National Park in MPB infested areas, conducted in 1982, were summarized in a file report as listed under Item 12.

(e) Provided consultory service to various agencies on MPB problems within the region, including Parks Canada, Alberta Forest Service, Alberta Parks and Saskatchewan Parks and forestry staff. Information exchange on MPB was maintained between PFRC and Montana. Services provided included bark beetle identifications, information on control strategies, current literature, slide requests, ecological effects and pheromones.

(f) Provided advisory and coordination role with Saskatchewan Prov. Parks, Alberta Prov. Parks and Alberta Forest Service in establishing large-scale experimental trials of a MPB pheromone tree-baiting program. A total of 900 tree baits were placed out by provincial staff within control areas of the Cypress Hills and Bow-Crow Forest to evaluate its use in the control strategy. Data have been collected on the distribution of baited and adjacent unbaited trees and attack densities by MPB, and are being analyzed for effectiveness in detection and control. Results will be conveyed to the agencies in early 19B4.

(g) Participated as guest speaker at a Public Seminar on MPB and its ecological influences on the Waterton Lakes Biosphere Reserve, Waterton Lakes, Alta.

(h) Participated in a two-day meeting convened by Director Forestry Operations, Saskatchewan Tourism and Renewable Resources to review the current MPB control program and proposal for an accelerated logging plan for the west block of Cypress Hills, Saskatchewan.

(i) Conducted a ground survey of MPB in the area of highest potential for spread in Kootenay National Park. Data will be summarized in a file report.

2. (a) Data were analyzed and a first-draft report was prepared, summarizing results of field studies of MPB pheromones tested in the Cypress Hills, Alberta during 1982.

(b) Data obtained from a 1982 field experiment on MPB pheromone bioassay studies in the Bow-Crow Forest were analyzed and summarized in a status report, jointly with cooperating researchers, Drs. H. Wieser and E. Dixon, Dept. of Chemistry, University of Calgary.

(c) During 1983 a series of field experiments were conducted in the southern Bow-Crow Forest, in cooperation with Drs. Wieser and Dixon, to test various synthetically produced chemical analogs of the compound exo-brevicomin, a pheromone produced by the MPB. The objectives are to identify compounds that provide strong synergistic aggregative or antiaggregative behavior of MPB adults, and to explore potential field applications in MPB detection and control. The project is funded in part by Alberta Forest Development Research Trust Fund.

Five separate field experiments were conducted using different pheromone bait formulations in multiple funnel traps and as tree baits. All field data have been collected and summarized by trap or density catches. A status report was prepared summarizing data analyses completed to date.

3. All data have been collected on the MPB rearing experiment and some data were analyzed.

4. Contributions were made toward preparations of FIDS Ann. Inf. Report (see NOR-033) and for National FIDS report.

5. Some re-analyses of data on the following reports was completed but the reports could not be finalized because of other commitments:

   (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 Mountain National Park, Manitoba, during 1979-80.

   (c) Control studies of seed and cone insects in mature white spruce trees with carbofuran, near Grande Prairie, Alta.

6. Provided representation at:

   (a) Western Committee on Crop Pests and Western Forum, Penticton, B.C. Updated two chapters in report for four western provinces for 1984 control recommendations.

   (b) Attended and reported at Alberta Pest Control Advisory Meeting (reported under NOR-033).

   (c) Attended and reported at Environmental Committee, Alberta Horticultural Advisory Meeting (reported under NOR-033).

7. Useable photographs and all literature files transferred to W. Ives (Study NOR-9-181).

Other Accomplishments

8. (a) Provided a one-day training session on insects, diseases and other forest damage agents to forestry staff of Blue Ridge Timber Co.

   (b) Presented lecture to acreage owners on the subject "Trees and Acreage Living".

   (c) Provided several radio/newspaper interviews on insect problems.

9. Examined a woodborer-bark beetle problem in northwest Manitoba related to large clearcut blocks. Causal insects were identified and a report was prepared with management recommendations.

10. Provided advice and technology transfer on a variety of insect and disease related problems (e.g. root collar weavils, woodborers, shelterbelt insects, forest tent caterpillar, spruce budworm, pesticides, nursery pests).

11. Goals for 1984:

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

2. Continue representation on MPB Technical Committee and provide input into Can./U.S. MPB Action Plan as required.

3. Finalize report on 1982 MPB pheromone experiments in Cypress Hills with co-authors.

4. Complete the analyses of MPB pheromone data collected in 1983 and combine with that obtained in 1982 for joint authorship publications.

5. Finalize report on MPB rearing experiment completed in 1982.

6. Time-permitting, finalize the following three reports:

   (a) Impact studies of the jack pine budworm (*Christoneura 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.

7. Continue cooperative field studies with Drs. H. Wieser and E. Dixon and Alta. For. Service on MPB pheromone testing and application.

8. Provide consultory and information service to clientele as requested.

12. Unpublished Reports, 1983

Cerezke, H.F. 1983. Surveys and interpretation of large-scale color aerial photographs of mountain pine beetle infestations in Kootenay National Park in 1982. File Rep. 13 p.

Cerezke, H.F. 1983. Canada/United States Joint Lodgepole pine/ Mountain Pine Beetle Action Planning Meeting Report; 3 p.

Cerezke, H.F., J.H. Borden and T.N. Trott. 1983. Field tests with semiochemicals of the mountain pine beetle in the Cypress Hills, Alberta; 6 p.

Cerezke, H.F. 1983. Report on jack pine mortality surrounding recent clearcuts near Moose Lake, Manitoba; 7 p.

Cerezke, H.F., J. Drouin and B. Neill. 1983. Revised chapter in WCCP report on insect control in "Shelterbelts, Ornamental Trees and Shrubs", 18 p.

Cerezke, H.F. and J. Drouin. 1983. Revised chapter in WCCP report on insect control in "Seasoned Wood and Timber Structures". 3 p.

Wieser, H., E.A. Dixon and H. Cerezke. 1983. Field bioassay of *exo*-Brevicomin analogs with *Dendroctonus ponderosae* Hopk. in lodgepole pine stands in southwest Alberta, July-August 1982; Status Rep., 11 p.

Wieser, H., E.A. Dixon and H. Cerezke. 1983. Field bioassay studies of mountain pine beetle in southwestern Alberta, using semiochemicals combined with analogs of *exo*-Brevicomin. Project Status Report; 21 p.

13. Signatures:

H.F. Cerezke
Investigator

Program Manager

A.D. Kiil
Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1983

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 and W.G.H. Ives

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 diagnositc and biosystematic services.

9. 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.

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.

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

10. Accomplishments in 1983-B4:

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 from in-service personnel, clients, outside agencies and scientists.

2. a. Nearly ninety specimens determined by specialists in Ottawa and by myself have been incorporated into the insect reference collection.

   b. Over four hundred specimens collected by personnel of the Insect and Disease Survey were reared, in which over one hundred and fifty were overwintered to obtain biological information and specimens for the reference collections.

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

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

   Dr. H. Goulet, Biosystematic Research Institute, Ottawa, Ontario.
   Dr. P.T. Dang, Biosystematic Research Institute, Ottawa, Ontario.
   Mr. V. Hildahl, Manitoba Dept. Natural Resources, Winnipeg, Manitoba.
   Mr. A.J. Kolach, Manitoba Agriculture, Winnipeg, Manitoba.

4. Identified and returned the three hundred and fifty insects submitted by the Forest Technology School, Hinton, Alberta.

5. 1) A survey was made in 1983 for the following introduced insects, which have entered southeastern Manitoba in recent years:

   a. The status of the introduced pine sawfly, which was first collected in 19B2 remained the same in 19B3.

   b. The European spruce sawfly present since 1969 was detected across the Red River in the Lockport area in Manitoba.

   c. The larch casebearer, present since 1965, has not increased in numbers or extended its range from last year.

2) The following introduced insects present in Ontario were surveyed to determine if they have spread into Manitoba in 1983.

   a. The mountain ash sawfly present in Kenora, Ontario in 1982 was not evident in southeastern Manitoba.

   b. The European pine shoot moth present in Ontario and British Columbia is still not present in Manitoba or Alberta.

   c. The identification of adult moths caught in pheromone traps set out by Agriculture Canada, Food Production and Inspection Branch did not disclose the presence of the Gypsy moth in our area.

6. The most common insects attacking young trees in plantations and scarified areas at Hinton, Alberta were: *Petrova metallica* (Busck), *Petrova albicapitana* (Busck), *Pissodes terminalis* Hopping and *Hylobius warreni* Wood. These were mainly on trees 16-18 years old.

7. Assisted W.G.H. Ives in the preparation of the pictorial guide to forest and shade tree insects of the Canadian Prairies by identifying and rearing over 2900 specimens, preparing over 700 specimens for photographing and overwintering over 1500 specimens. At the present time over 3000 slides have been taken of insects and their damage.

8. The introduction of the Information Report NOR-X-196 entitled the "Common insects and mite galls of the Canadian Prairies" has been enlarged and revised for republication.

11. Goals for 1984-85:

1. Provide diagnostic and biosystematic services for the more difficult determinations on mature and immature insects damaging forest and shade trees.

2. Maintain and improve reference collection of insects and mites.

3. Provide information and specimens to scientists engaged in taxonomic and biological studies.

4. Determine the spread of introduced insects in the Canadian Prairies.

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

6. Collaborate with W.G.H. Ives in the preparation of the pictorial guide to the forest and shade tree insects of the Canadian Prairies.

a) identification of immature and mature insects;

b) conducting a literature review of the forest insects of this region (Transferred from NOR-9-181).

7. In colaboration with F.J. Emond to determine the major insects attacking the poplar stooling beds in tree nurseries.

8. Distinguish the damage of *Petrova metallica* (Busck) and *Petrova albicapitana* (Busck) attacking lodgepole pine in Alberta.

12. Publications in 1983-84:

Wong, H.R., J.A. Drouin, D.L. Szlabey and P.T. Dang. 19B3. Identification of three species of *Proteateras* (Lepidoptera: Tortricidae) attacking shoots of Manitoba maple in the Canadian Prairies. Can. Eng. 115: 33-339.

13. Signatures:

Investigator

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 20, 1983

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 1983-84:

   1. Re-asses 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.

10. Accomplishments for 1983-84:

1. Tree condition was re-assessed for the third year on 37 impact plots for damage caused by the mountain pine beetle in pine stands in the national parks (Yoho, Kootenay, Waterton). Volume analyses of live trees and beetle-killed trees have been completed and a report prepared.

2. Work on the first draft of a literature review of the effects of major forest pests on tree mortality and growth in the region, commenced and is about 30% completed.

3. • Spruce budworm damage in 17 impact plots established in 1981 in Manitoba, was assessed and information recorded. Defoliation in 1983 was moderate-to-severe and mortality of balsam fir high, 90% in some plots.

• Systematic surveys of dwarf mistletoe infected jack pine stands in Saskatchewan were continued with NOR-1-033. As dwarf mistletoe is a perennial problem, remeasurements of impact plots were postponed and the analysis of 1982 data completed instead.

• Ten permanent sample plots were established in a current jack pine budworm infestation in Manitoba. The objectives are to develop budworm population sampling methods and to measure impact or damage. Defoliation was estimated in 1983 and branch samples taken to develop an egg-mass sampling and forecasting technique for the jack pine budworm jointly with the Manitoba Forestry Branch.

• Cores and discs samples taken in 1982 from white spruce trees that survived the 1959-1969 spruce budworm outbreak in the Namew Lake area of Sask. and Man. were computer analysed and a report is in preparation.

4. Continued to investigate the use of remote sensing techniques as a tool to assess pest-caused damage in conjunction with study NOR-1-033 and project NOR-22. A publication by Hall et al is in Press.

5. Continued to develop effective working relationships with officials of provincial and industrial forest resource management agencies. This has been effective in redirection of harvest cuts to areas with tree mortality caused by forest pests or into areas with new infestations in an effort to prevent further damage or deterioration of dead trees.

11. Goals for 1984-85:

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. (a) Remeasure for the fourth year, 17 spruce budworm impact plots in Manitoba and assess data.

   (b) Assess for the second year damage caused by the jack pine budworm in 10 permanent plots in Manitoba.

   (c) Reassess dwarf mistletoe impact plots in Saskatchewan and establish additional plots if required.

4. Continue to investigage the use of remote sensing techniques as a tool to assess pest damage in cooperation with project NOR-22.

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

12. Publications 1983-84:

Hall, R.J., G.N. Still and P.H. Crown. 1983. Mapping the distribution of aspen defoliation using Landsat color composites. Can. J. Remote Sens. In Press.

File Reports

Moody, B.H. 1983. Assessment of mountain pine beetle impact on lodgepole pine plots in the Rocky Mountain National Parks to 1983. File Report.

Moody, B.H. 1983. The effect of the 1959-1969 spruce budworm outbreak on tree growth of white spruce in the Namew Lake area. A preliminary Report.

13. Signatures:

B.H. Moody
Investigator

Program Manager

A.D. Kiil
Director

NOR-4 Yields of managed stands

NOR-4-45

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

1. Project: Yields of managed stands.

2. Title: Growth and yield of five commercially important native species in Alberta, Saskatchewan, and Manitoba.

3. New: Cont.: X 4. No: NOR-4-045

5. Study Leader: I.E. Bella

6. Key Words: Pinus banksiana, P. contorta var. latifolia, P. resinosa, Picea glauca, Populus tremuloides, tree and stand growth, yield tables, thinning and spacing.

7. Location of Work: Various locations in Alberta, Saskatchewan, and Manitoba.

8. 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.

9. 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 (Kolabinksi) of precommercial thinning (Study 2-tA) in aspen stands near Pelly, Saskatchewan to assess growth and yield 30 years after treatment (NDR-4-45, Bella).

3. Complete the analysis and publish a Forest Management Note on the spacing study in lodgepole pine at Teepee Pole Creek, Alberta. Growth and yield 15 years following treatment will be reported (NDR-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 (NDR-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)

Added goals:

13. Prepare a talk on the implications of juvenile spacing dense 1P stands.

14. Analyse data and prepare a manuscript on biological damage in young 1P.

10. Accomplishments in 1983-84:

1. The remeasurement of a precommercial thinning (Study 2-jP) and a commercial thinning (Study 3-jP) in SE Manitoba was completed with assistance from the Winnipeg suboffice.

2. The remeasurement of a precommercial thinning (Study 2-tA) in aspen near Pelly, Sask., was completed (Kolabinski).

3. The analysis of a spacing study in lodgepole pine at Tepee Pole Creek, Alberta, is in progress; reporting postponed.

4. Contributed to the organization of the annual meeting of the Canadian Poplar Council. A study in the effect of logging practices on the development of new aspen stands at Hudson 8ay, Sask., was relocated and remeasured and the results presented in a paper at the CPC meeting in Saskatoon.

5. Rather than a Forest Management Note an ms on tree growth response to line openings in forest stands of west-central Alberta is being reviewed for publication as an Info. Report, or a Journal article.

6. Forestry Report on "Growth, Yield and ENFOR" is ready for publication.

7. A survey to determine the incidence of damage (insect, disease and small mammals) in juvenile 1P has been completed and the data analysed.

8. Suitable areas were located in the Gregg Burn to expand 1P spacing trials at age 25. Original trials were established at age 7.

9. A reconnaissance in the Edson Forest (Marlboro W.C.) with Paul Atfield, Forester, St. Regis (Alberta) Ltd., suggested that the previously reported accelerated early growth of 1P in the area is chiefly due to lower initial regeneration densities and natural variation in tree growth. Therefore, no further studies will be undertaken at this time.

10. Contributed to the organization of a symposium on 1P as a member of the organizing committee.

11. Continued to provide advise on mensurational problems including thinning, growth and yield and stand modelling.

12. Info. Report on the "Influence of stand edge on the performance of white spruce and lodgepole pine seedlings" (Johnstone and Sims) is about to be published.

Goals added:

13. Prepared and gave a talk on the implications of juvenile spacing of dense 1P stands, at the AFS Forester's Meeting, March 1983.

14. Prepared a manuscript on biological damage in young 1P stands for publication in the For. Chron.

11. Goals for 1984-85:

1. Co-operate in a problem analysis of R & D needs in stand tending, growth and yield for Manitoba, Sask., and NWT in relation to the upcoming agreements, and memorandums of understanding. (NOR-4-45, Bella)

2. Organize a field tour in the Hinton area for the international symposium on 1P management. (NOR-4-45, Bella)

3. Co-author and present a paper on fertilization at the 1P symposium. (NOR-4-45, Bella)

4. Publish a journal article and prepare and publish a note on biological damage in young 1P stands. (NOR-4-45, Bella)

5. Direct (Bella) the remeasurements (COSEP) of permanent growth plots in 1P. (NOR-4-45, Bella)

6. Publish journal article on tree growth response to line clearings in western Alberta. (NOR-4-45, Bella)

7. Establish plots (Bella); carry out prescribed spacing and tree measurements (Lux and COSEP) as in the original plan, for expanding the 1P spacing study in the Gregg Burn (south of Hinton) to obtain stand development information following spacing at age 25. (NOR-4-45, Bella and Lux)

8. Continue to provide advice on measureational problems including thinning, growth and yield and stand modelling, as well contribute to technology transfer on related problems as required to the federal-provincial agreements. (NOR-4-45, Bella)

12. Publications 1983-84:

Publications:

Bella, I.E. 1983. Natural lodgepole pine in west-central Alberta. Part I: Regeneration stocking. In "Lodgepole pine: regeneration and management." The Proceedings of a Fourth International Workshop. U.S.D.A., Forest Service, Gen. Tech. Rep. PNW-157.

Reports:

Bella, I.E. 1983. Logging practices and subsequent development of aspen stands in east-central Saskatchewan. Paper presented at the 5th Annual Meeting of the Poplar Council of Canada. Saskatoon, Sask. Sept. 7-9, 1983.

13. Signatures:

Investigator

Program Manager

Director

Study No.	Location	Soil and Site	Stand age at establishment	Date of establishment	Date of remeas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
1-lP	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. (1987 A)	16	0.1	Low selection thinning to specified Stand Density Index every 5 years, except in 1971 & later	Control, no thinning - 2 plots Thinned: to 40%,50%,60%,70% 80%,100%, & 120% of control SDI 2 plots each
3-jP	Sandi-lands, Man.	Medium sand; fresh	40	1958	1963 1968 1973 1978 1983 Spr. (1988 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. (1988 Spr.)	15	.002 - .007	Mechanical Strip-thinning	Control: 5 plots Thinned 1-way: 5 plots Thinned 2-way: 5 plots
		b. Sand, fresh	11	1967	1969 1976 1981 (1986 A)	5	.002 - .007	Mechanical Strip-thinning	Thinned 1-way: 5 plots

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1984 (continued)

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

SUMMARY OF ACTIVE THINNING, SPACING AND YIELD STUDIES IN CONIFERS
1984 (continued)

Study No.	Location	Soil and Site	Stand age at establishment	Date of	Date of remeas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
6-jP -rP	Sandi-lands, Forest Reserve	Sand, fresh	3 y.o. seedlings planted	1963	1973 1978 1983 (1988 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 (1988 A)	32	variable		as above
7-lP	a. Gregg burn	three site types	7	I964	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	I972 1977 1982 (1987 A)	3D	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 establishment	Date of remeas.*	No. of plots	Plot size (acres)	Treatment	
								Method	Intensity
1 (MS133)	Turtle Mtn. For. Res.	Non telluric mesic clay loam till	11	1948	1953 1960 1965 1971 1976 1981 (1986 A)	5	0.2	Regular spacing & alternate strips	Control, no thinning - 2 plots Thinned: 5' x 5', 7' x 7', & 2D' alternate strips - 1 plot each
2 (MS155)	Pelly, Sask.	Non telluric mesic clay loam till	14	1951	1957 1962 1967 1972 1977 1983 Spr. (1988 Spr.)	14	0.2	Thinned to fixed SDI every 5 yrs., except in 1972 & later	Control, no thinning - 2 plots Thinned: to 12D, 100, 80, 70, 60, & 5D% of SDI of control in 1951 - 2 plots each intensity
3 (MS146)	Riding Mountain National Park	Non telluric mesic clay loam till	14	1950	1960 1965 1971 1976 1981 (1986 A)	4	0.1	Regular spacing	Control, no thinning - 1 plot Thinned: 8' x 8', 10' x 10', 12' x 12' - 1 plot each
		Telluric mesic silty clay loam till	23	1950	1960 1965 1971 1976 1981 (1986 A)	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 A?)	24	0.1	Thinning to regular spacing and pruning	Control, no thinning - 12 plots Thinned and Pruned: 12' x 12' spacing with 5 pruning treatments

* Planned measurement years are in brackets.

NOR-4-75

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

1. Project: Yields of Managed Stands.

2. Title: Stand modelling of the growth and development of important forest types in the Prairie Provinces.

3. New: Cont.: X 4. No: NOR-4-075

5. Study Leader: H. Grewal
Co-operator: I. Bella

6. Key Words: Tree and stand growth, stand development, density-competition effects, yields, stocking, site, ecological systems, models, simulation, aspen, jack pine, black and white spruce, red pine, lodgepole pine

7. Location of Work: Manitoba, Saskatchewan and Alberta

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 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." (NDR-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)

Install a condensed version of the STEMS model on the PDP 11/60 computer at NoFRC.

Added goals:

4. Test a new mortality function from the Lake States for aspen and jack pine.

10. Accomplishments 1983-84:

1. Completed residence requirements at U.B.C. and passed comprehensive exam. Ph.D thesis is in progress. Thesis topic was revised as "Improved methods of modelling white spruce growth and yield".

2. A workshop on the usefulness of the STEMS model for forest industries and provincial forest departments is postponed until February 1984.

3. White spruce and lodgepole pine calibration is underway. More white spruce data was requested from provincial forest departments.

   Installed an updated condensed version of STEMS model which projects basal area growth on the PDP 11/6D computer at NoFRC.

4. A new mortality function from the Lake States was tested for aspen and jack pine. The function is superior to its predecessor but more computation is required.

11. Goals for 1984-85:

1. Gather growth and yield data from provincial and industrial forest services for calibrating STEMS model for white, black spruce and red pine. (NOR-4-75, Grewal)

2. Organise 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 and Bella)

3. Complete Ph.D thesis research and writeup by November 1984. In order to achieve goal 2. an education leave is requested for the summer of 1984 (May to August) so that thesis work may be carried out at U.B.C. with the help of research committee. (NOR-4-75, Grewal)

4. Install an improved version of STEMS incorporating management options on new computer at NoFRC. (NOR-4-75, Grewal)

12. Publications 1983-84:

Nil

13. Signatures:

Harjit S. Grewal
Investigator

Program Manager

Investigator

Director

NOR-4-102

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

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 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. (NDR-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. (NDR-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.

Added Goals

5. Co-operate in selecting a suitable area for a new study (NOR-4-195) by evaluating homogeneity of soil, and developing study plan.

6. Construct soil columns to help explain the large N-deficits in the upper 61 cm of soil in plots with high rates of applied urea.

7. Prepare report on 5-year effects of fertilization on the N-S status of two Luvisols supporting 30-yr lodgepole pine stands.

10. Accomplishments in 1983-84:

1. Laboratory analysis of soil samples was completed.

2. Laboratory analysis of soil samples report "Nitrogen shifts and content changes in the horizons of two Luvisol soils following fertilization," was completed and is being reviewed.

3. The first draft of a proposed Forest Management Note covering the soils aspect and response to fertilization has been proposed.

4. This study will be continued for another year.

5. Contributed in the selection of a suitable area for a new study. (NOR-4-195)

6. Initiated a laboratory experiment using simulated soil profiles to help explain N-deficit in upper soil profiles after urea application.

7. Prepared a report on the five year effects of fertilization on the N-S relationships in Luvisols supporting 30-yr old lodgepole pine stands.

11. Goals for 1984-85:

1. Publish journal article entitled, "Nitrogen shifts and content changes in the horizons of two Luvisol soils following fertilization" (NOR-4-102, Baker)

2. Publish a report on the five year effects of fertilization on the N-S relationships in Luvisols supporting 30-yr old lodgepole pine stands. (NOR-4-102, Baker)

3. Continue a laboratory study to test the effects of various N-carriers on soil and to observe any movement of fertilizaer - organic matter reaction products within and/or through the profile. (NOR-4-102, Baker)

12. Publications 1983-84:

Nil

13. Signatures:

Investigator

Program Manager

Director

NOR-4-122

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

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 Objectives:

To assess the effects of fertilizing 70-year-old and 30-year-old lodgepole pine stands on stand growth and yield.

9. 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)

10. Accomplishments in 1983-84:

1. Published journal article "Composite design versus factorial experiments in forest fertilization trials".

2. Manuscript on ten-year growth response of 70-year-old lodgepole pine to fertilization has been prepared and reviewed.

3. Prepared a manuscript on fertilization effects on 30-year-old lodgepole pine and is being reviewed.

4. Completed data analysis of fertilization effects on lodgepole pine specific gravity and tracheid length. Report preparation is in progress.

5. Provided advice to inside and outside agents on mensurational and statistical problems.

11. Goals for 1984-85:

1. Publish information report on ten-year growth response of 70-year-old lodgepole pine to fertilization. (NOR-4-122, Yang)

2. Publish information report on ten-year results of fertilizing 30-year-old lodgepole pine stands. (NOR-4-122, Yang)

3. Prepare a management note on fertilizing lodgepole pine in west-central Alberta. (NOR-4-122, Yang and Baker)

4. Participate and contribute lodgepole pine symposium by co-authoring an article on lp nutrition and fertilization. (NOR-4-122, Yang and Bella)

5. In cooperation with Dr. M. Micko, University of Alberta, publish report on the effect of fertilization on lp specific gravity and tracheid length. (NOR-4-122, Yang and Micko)

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

12. Publications:

Yang, R.C. Composite design versus factorial experiments in forest fertilization trials. Can. J. For. Res. 13: 438-444.

Yang, R.C. Natural lodgepole pine in west-central Alberta. Part III. Fertilization. [in] Lodgepole pine: Regeneration and management. USDA Pacif. Northwest Forest and Range Exp. Station. Gen. Tech. Rep. PNW-157.

13. Signatures:

Investigator

Program Manager

Director

NOR-4-195

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

1. Project: Yields of managed stands

2. Title: Fertilization and thinning of semi-mature lodgepole pine stands.

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

5. Study Leader: 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. Study Objectives:

To assess the effects of thinning and fertilizing semi-mature 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.

9. 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)

10. Accomplishments in 1983-84:

1. A detailed study plan including justification, study objectives, stand selection criteria, thinning and fertilizer regimes, sampling procedures and laboratory work requirements was prepared.

2. A suitable stand was located; stand characteristics (number of stems, basal area per hectare) were measured.

11. Goals for 1984-85:

Subject to final approval of the study plan:

1. Establish plots according to the study plan; thin designated blocks to a desired density; tag and tally all crop trees on plots. (NOR-4-195, Yang)

2. Sample thinned (cut) trees for biomass, foliar N concentrations, percentage proportions of tree components, i.e., needles, twigs, branches, bole etc., to estimate N content of these prior to fertilization. (NOR-4-195, Yang and Baker)

3. Sample ground vegetation as per Item 2. (NOR-4-195, Baker)

4. Sample soil profile to 120 cm (4 ft.) in 4-5 pits to describe profile and estimate background levels of nutrients N, S, P, Al, Mn, etc. (NOR-4-195, Baker)

5. Set up 2 to 3 field lysimeters in the study area to monitor both the movement of N and organic matter within the soil profile as a result of urea-organic matter interactions and reaction product synthesis. (NOR-4-195, Baker)

12. Publications:

Nil -- new study

13. Signatures:

Investigator

Program Manager

Investigator

Director

NOR-5 Fire management systems and guidelines

NOR-5-037

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

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 system, 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 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.

5. Added goal: Publish Forestry Report No. 28 Article "Short-term fire retardant effectiveness in a lowland black spruce fuel complex".

10. Accomplishments in 1983-84:

1. Provided instructional lectures to A.F.S. division boss trainees at Forest Technology School. Lectured on fire management and control to Wes Hosford Elementary School student class. Presented aerial fire control lectures to A.F.S. suppression crews at entrance and Red Deer holding camps. Advised Sask. DTRR Staff on use of water Gelling agents in retardation of dessication of bare root planting stock. Provided technical evaluation of prototype, float-equipped, thrush commander water bomber conversion. Travelled to Ontario, Stockton and Sacramento, Calif. to discuss retardant and air tanker research and development activities with Monsanto Inc., Hemet Valley Flying Service Inc. and Calif. Dept. Forestry Personnel.

2. Owing to sporadic fire occurrence and limited aerial transfer activity was unable to work towards this goal. In lieu of field work opportunities collated and computer analyzed 1982 A.F.S. aerial attack summaries and prepared format for A.F.S. continuation of this assessment procedure. Prepared report on results for A.F.S. Submitted on-site evaluation results to date for publication in Forestry Report Article.

3. Directed the testing and calibration of retardant application system with a range of retardant solutions and discharge nozzels. Combustion table calibration and output recording instrumentation was initiated. System refinements are pending. This goal transferred to NOR-5-131.

4. Conducted North America-wide search for suitable canvas material required for wetting agent testing procedures. Failure to locate suitable material precluded further testing of wetting agents by this method. Established contact with industries and government agencies

responible for development and assessment of foaming agents. Findings to date have been submitted in the form of a file report.

5. Added accomplishment: published forestry report No. 28 article "Short-term fire retardant effectiveness in a lowland black spruce fuel complex". See publications.

11. Goal for 1984-85:

Terminate Study.

12. Publications:

Newstead, R.G. and M.E. Alexander. 1983. Short-term fire retardant effectiveness in a lowland black spruce fuel complex. Can. Dep. Environ., Can. For. Serv., North. For. Res. Cent. For. Rep. No. 28 (Sept. 1983).

Newstead, R.G. and R.J. Lieskousky. 1982. Evaluation of air tankers and fire retardants on wildfires. Forestry Report. No. 28., P. 6-7. Cdn. For. Serv., North. For. Res. Centre. Edmonton.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-5-086

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

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 1983-84:

   1. Publish "Forest ecosystems and fire hazard in central Saskatchewan".

   2. Publish "Failures and successes in jack pine regeneration following postcut burning and seeding in southeastern Manitoba".

   3. Publish "Jack pine regeneration following postcut burning and seeding in central Saskatchewan".

   4. Publish "Foliar moisture variations in jack pine, black spruce, white spruce and balsam fir, central Alberta".

5. Publish "Foliar calorific variations in jack pine, black spruce, white spruce, and balsam fir, central Alberta".

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

10. Accomplishments in 1983-84:

1. Published paper on "Forest ecosystems and fire hazard in central Saskatchewan".

2. Published paper on "Jack pine regeneration following postcut burning and seeding in southeastern Manitoba".

3. Published paper on "Jack pine regeneration following postcut burning and seeding in central Saskatchewan".

4. Prepared paper on "Foliar moisture content variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" (for Can. J. For. Res.).

5. Prepared paper on "Foliar heat content variations in jack pine, black spruce, white spruce and balsam fir, central Alberta" (for Cent. J. For. Res.).

6. Progressed well in the analysis of fuel, fire behaviour and weather data for a semi-mature jack pine stand in central Alberta.

11. Goals for 1984-85:

1. Publish "Foliar moisture content variations in jack pine, black spruce, white spruce and balsam fir, central Alberta".

2. Publish "Foliar heat content variations in jack pine, black spruce, white spruce and balsam fir, central Alberta".

3. Publish "Fire behaviour and effects in a semi-mature jack pine stand, central Alberta".

12. Publications:

Chrosciewicz, Z. 1983. Forest ecosystems and fire hazard in central Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent. For. Rep. 28:10.

Chrosciewicz, Z. 1983. Jack pine regeneration following postcut burning and seeding in southeastern Manitoba. Environ. Can., Can. For. Serv., North. For. Res. Cent. Inf. Rep. NOR-X-252.

Chrosciewicz, Z. 1983. Jack pine regeneration following postcut burning and seeding in central Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent. Inf. Rep. NOR-X-253.

13. Signatures:

Investigator

Program Manager

Director A.D. Kill

NOR-5-131

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

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 wildlife 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 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.

10. Accomplishments in 1983-84:

1. FMN - An Inexpensive Portable Fire-Finder has been printed.

2. The combustion table has been set up to weigh and record weights as small as 5 grams. The retardant application system has been calibrated for water and will replicate application rates reliably.

3. Due to the extremely wet fire season no lightning fires were documented.

4. Provided individual seen area maps, composite seen area map, and suggestions as to which towers should be manned and where aerial patrols should be flown.

5. First draft of file report has been prepared.

6. The work done to date on using LLP information and lightning fire prediction methods to delineate areas for infrared searches has shown that the LLP and the prediction methods will have to be more refined before a reliable method of finding lightning caused fires with infrared can be developed.

   Sask. Forest Fire Control with technical input from NoFRC is sponsoring development of a new infrared scanner (xedas) for fire surveillance work. Some preliminary flights have been made with the xedas and it will be compared to the AGA-scan extender. Because of the work with the new scanner no further development work was done on the AGA-scan extender combination.

7. Twenty fire weather stations were inspected to establish weather data reliability factors. Fire report forms for 1977-82 were copied. Fire weather data and daily SITREP reports have been compiled. R. Smith is in process of putting the daily report information into the computer.

8. Provided liaison and technical services to client agencies as follows:
   a) located an Edmonton machine shop that will build the fire finder for the Yukon;

   b) at request of PNFI suggested modifications to Gorman Rupp pumps to secure the muffling system to the cylinder;

   c) provided advice on map scales and divisions to Saskatchewan D.T.R.R. regarding the LLP mapping system;

   d) attended Central Region Fire Weather Committee meeting in Winnipeg;

   e) toured two Sask. bomber bases to familiarize PNFI personnel with the Sask. operation;

   f) at the request of the A.F.S. went to Footner Lake to record on video a retardant line building and backfiring operation;

   g) made an evaluation flight with P.A. aviation regarding their new scanner;

   h) supplied information to AFS on wetting agents;

   i) provided information to Ontario Ministry of Natural Resources regarding the NoFRC scan-extender;

   j) conducted a sensitivity test of the xedar scanner in Sask.

11. Goals for 1984-85:

1. Re-evaluate fire detection research needs in region and recommendations to achieve same and prepare file report.

2. Develop testing and evaluation techniques to assess rheological coating and retardancy characteristics of selected fire retardants on standard fuel beds using the retardant application and combustion systems.

3. Collect lightning fire origin data to be used for supporting the lightning fire prediction model. Data, including holdover time, burning characteristics 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. Complete file report on currently available infrared systems, operational procedures, availability, sensitivity, accuracy and costs and distribute to clientele.

5. Compile fire weather and fire report data for calibration and performance of the CFWI in Saskatchewan.

6. Prepare file report on use of infrared and LLP system for improved fire detection and send to clientele.

7. Initiate assessment of procedures to map large wildfires using thermovision, pyroelectric videocon tubes and visible light video systems.

8. Provide technical services and training to client agencies.

12. Publications:

Ogilvie, C. 1982. The Scan Extender - a device to enhance the capabilities of the AGA 750 thermovision. USDA For. Serv. Fire Manage. Notes 43(3):22-24.

Ogilvie, C. and P. Bihuniak. 1983. An Inexpensive Portable Forest Firefinder. Can. Dep. Environ., Can. For. Serv., North. For. Res. Cent., For. Manage. Note 25.

Ogilvie, C. 1983. AGA Thermovision Scan Extender. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Rep. 28-7.

Lynch, G.M. 1983. Electronic markers for relocating small forest fires. Forestry Report No. 28, P. 11. Cdn. Forestry Service, Northern Forest. Res. Centre. Edmonton, Alta.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-5-168

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

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: Gilles Delisle, D.E. Dube

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 1983-84:

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

   2. Prepare a study plan by Feb. 1/83 presently entitled "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 [Dube].

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

Added Goal:

6. Publish article in Forestry Report.

7. Publish article in Joint Proceeding of Intermountain/Rocky Mountain Fire Council (1982).

10. Accomplishments in 1983-84:

1. No progress. Parks Canada has been contacted to develop strategy aimed at completing reports [Dube].

2. A study plan has been prepared titled: "Fuels in the forested stands around Jasper townsite, Jasper National Park, Alberta". The study plan also satisfies a M.Sc. project proposal at the U. of A. Botany 401 was completed as part of the required course work in the M.Sc. program [Delisle].

3. Fieldwork was conducted between June 15/83 and Sept. 15/83. Seven negotiation types were identified and thirty-seven plots were located within them. Quadratic mean diameters and specific gravity for standard size classes of four tree species was determined.

4. Advisory services with National Parks were conducted throughout the year as required including:

   a) Wardens and naturalists from Jasper National Park - discussion of fire/fuel management [G.D.].

   b) Provided advice to Elk Island National Park personnel regarding procedures for prescribed fire program [D.O/M.E.R./G.D.].

   c) Presented seminar on fire history/management to Wood Buffalo National Park personnel in Fort Smith [April/83, D.D.].

   d) Discussed fire management in National Parks with National Film Board of Canada [May/83, D.O., M.E.A.].

   e) Attended major symposium/workshop on "Fire Management Policy, Programs and Issues in Parks, Wilderness and other Natural Areas", Missoula, Montana. File report submitted [G.O.].

5. Two experimental burns were monitored in Elk Island National Park. Four additional burning plots have been established and partially sampled in anticipation of the 1984 spring burning program. [G.D.]

Added Accomplishments:

6. Published article in Forestry Report #28 entitled, "One and one-half centuries of fire in Wood Buffalo National Park". [G.D./D.D.]

7. Published article in Proceedings of Joint Fire Council Meeting - entitled "Fire Management Activities in Canadian National Parks: An Update". [D.D.]

11. Goals for 1984-85:

1. Prepare summary data reports for Nahanni/Wood Buffalo fire history studies. [Dube]

2. Publish fire history atlas for Alberta. [Transferred from study 174 - Delisle].

3. Provide advisory services to National Parks with emphasis on fire management guidelines [G.D/D.D].

4. Continue field work on forest fuels in Jasper National Park [G. Delisle].

5. Collect research data in support of prescribed burning in selected National Parks. [G.D./D.D.]

6. Publish French [co-authored with M.E. Alexander] and English version of Forestry Technical Report; "overview and annotated bibliography on the Canadian Forest Fire Danger Rating System". [G. Delisle]

7. Complete analysis and reports associated with Pukaskwa National Park fire history/ecology/managment project [M.E.A. transferred from #174].

12. Publications:

Delisle, G.P. and D.E. Dube. 1983. One and one-half centuries of fire in Wood Buffalo National Park. Forestry Report. No. 28. North. For. Res. Centre. Cdn. For. Service, Edmonton, Alta.

Dube, D.E. 1983. Fire Management Activities in Canadian National Parks: An Update. In Proceedings of Joint Fire Council Meeting - Fire - Its Field Effects, edited by Jane E. Lotan, Oct. 19-21, 1982, Jackson, Wyoming.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiit

NOR-5-174

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

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. Dube

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 1983-84:

   1. Publish Forestry Report. Terminate. (Dube)

   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 airtankers. 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. (Dube)

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.)

Added Goals:

12. Publish paper on evaluation of fire bombing aircraft. (R. Newstead)

13. Undertake update of CFS - GLFRC bibliography on fire history (Inf. Rep. O-X-304). (M.E.A.)

10. Accomplishments in 1983-84:

1. Published Forestry Report, No. 28, September, 1983.

2. Editorial drafts of two reports, "Forest Fire Environments of Pukaskwa National Park" and Forest Fire Management in Pukaskwa National Park", nearing completion.

3. Completed, reviewed and submitted for editing an Information Report on the status of all air tanker/retardant drop pattern data compiled and analyzed to date entitled, "Air tanker and fire retardant drop patterns: A status report" by R.G. Newstead and R.J. Lieskousky.

4. Intermountain Fire Council held in Banff, Alta. Oct. 25-27. Approx. 225 registrants (50% over estimate). NoFRC fire section made a major contribution to organization and conduct of meeting. All papers presented at workshop are in hand and editorial review initiated.

5. Published: 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. pp. 145-162.

6. Completed, reviewed and submitted for editing an Information Report on the development and application of the initial attack planning model entitled "Development and Application of a Forest Fire Initial Attack Planning Model" by R.C. Newstead and D. Quintilio.

7. Fire history maps for Alberta have been completed and updated to include the 1983 fire season. Publication awaiting funding approval. (Transferred to study 168).

8. Provided technology transfer, participation on committees, task forces and review boards as follows:

   a) Participated on the CCREM co-op supply task force to investigate the feasibility of a national air tanker productivity model, the basis for a comparative analysis of the relative performance of Canadian air tankers. (R.N.)

   b) Participated in the Canadian Committee on Forest Fire Control Annual Meeting and provided technical guidance to the national air tanker sub-committee technical session. (R.N.)

   c) Provided technical review of a proposed publication by W. Ondro and I.E. Bella (R.N.).

   d) Conducted on-site appraisal of fuel loading and fire risk potential within and adjacent to Waterton National Park townsite. Compiled report on findings and recommendations for W.N.P. evacuation and suppression planning purposes. (R.N.)

   e) With W. Murray, PNFI, fire research, toured air tanker bases and reviewed aerial attack programs in Alberta and Saskatchewan. (R.N.)

   f) Northwest Territories Fire Management Program Committee met in Yellowknife (Jan. 83) and Ft. Smith (June/83). The Committee endorsed the Red Knife Hills experimental burning project. (D.D.)

   g) Lab demonstration (i.e. fire whial) and program discussion to school tour (Lac La Biche) and Lakeland College students. (R.N./M.M.)

   h) Participated in a Caribou Management Workshop in Fort Smith, N.W.T. and presented a formal presentation on the Porter Lake experimental burning project. (April/83 - D.D.)

   i) A.F.S. meeting (C. Smith) to discuss opportunities for research in "mechanized line construction" (May). M. Moffey prepared first draft of annotated bibliography on subject. (D.D.)

j) Participated on A.F.S. Strategy and Tactics Task Force visit to California to review California Dept. of Forestry and U.S. Forest Service fire management organization (D.D. Oct. 2)

k) Visited all major clients in region with C. VanWagner (P.N.F.I.) including N.W.T. (Ft. Smith), Alberta (Edmonton), Saskatchewan (P.A.), Manitoba (Winnipeg) and U. Alta., NoFRC fire research staff and management, and C.I.F.F.C. to discuss long-term fire research direction. (D.D.)

l) Attended the Western Region Fire Weather Committee meeting in Edmonton (March, 83 - D.D./G.O.).

m) Interviewed by C.B.C. radio (April 14) and Capital Cable T.V. (April 29) in association with National Forestry Week. (D.D.)

9. a) Prepare and maintain annual/monthly administrative reports, (annual appraisals; monthly hi-lites; daily leave forms; monthly attendance forms; expense statements; travel authority; purchase requisitions; study statements; operational and work plans; C.O.S.E.P.).

b) Prepared three Position Analysis Schedules (270-1714/270-1672 and 270-7076).

c) Conducted interviews and prepared supporting documentation for term position and research position (F02)

d) Participated in meetings relevant to the fire project and to the lab in general. (L.M.C.C.; C.U. Committee; Gerin presentation; C.A.P. presentation; DOE/P.S.C. meeting; N. Simmon meeting; M. Feller meeting; FEDC meeting; classification boards; C.V.W. seminar; Science Advisory Committee; D. William - Human Resources; PILP - Pat Fogarty.

e) Reviewed and commented on manuscripts originating from fire study leaders and external, i.e. Kluane fire history study and Liard inventory report and Enfor report.

f) Addressed personnel issues and problems as required.

g) Attended two-day course on "Conflict Management - mediation and resolution - A management approach".

h) Attended ten-day course on "Departmental Orientation for Middle-Managers".

i) Prepared and presented project review to C. Winget - Jan. 26/83.

j) Screened over 350 applications for two proposed fire research positions.

k) Other major issues:
   1) AES/CFS policy review of forest meteorology
   2) Human Rights Commission Questionnaire
   3) Cancellation of Red Knife Hills Project.
   4) Quality of Research
   5) C.I.F.F.C.
   6) Cooperative Supply Agreement
   7) CCFFC/CREM took force on fire research

l) Major visits to lab requiring time commitments.
   a) C. Van. Wagner (March/83) - P.N.F.I.
   b) R. Wein (June/83) - U.N.B.
   c) M. Weber (July/83) - P.N.F.I.
   d) M. Feller (Aug./83) - U.B.C.
   e) B. Stocks (Sept./83) - G.L.F.R.C.
   f) R. Barney (Jan./B3) - U.S.F.S.
   g) W. Clark (Jan./83) - P.N.F.I.
   h) E. Stechishen (Oct./83) - P.N.F.I.
   i) R. Reid (frequent) - Private
   j) D. Dempster (?) - Private

10. Unable to fill operations research positions. Goal advanced to 19B4/85 pending staffing action.

11. See study 131, goal 7. Further progress pending staffing action on operation research positions.

Added Accomplishments:

12. Published: Haggerty, D., R. Newstead and E. Stechishen. 1983. Evaluation of fire bombing aircraft. Can. For. Ind., Aug. 19B3.

13. Report entitled, "Forest and Rangeland Fire History Bibliography" reproduced for Wilderness Fire Symposium by U.S.D.A. Forest Service.

11. Goals for 1984-85:

1. Prepare regional fire research strategy in anticipation of Forestry Development Agreements and Memorandums of Understanding (D.D.).

2. Publish an Information Report on the Development and Applications of the initial-attack planning model, incorporating fire-line productivity, rate-of-spread, fuels and other related information. (R.N.).

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

4. Publish Proceedings of Intermountain Fire Council Meeting (D.D.).

5. Supervise and Coordinate the regional fire research program by:

   a) Preparing and maintaining annual/monthly administrative reports.
   b) Staff two vacant research positions
   c) Write and submit for classification three Position Analysis Schedules
   d) Review manuscripts from fire research study leaders
   e) Attending relevant administrative meetings.

6. Provide technology transfer, participate on committees, task forces and review boards aimed at improving the protection and use of Canada's forests through efficient fire management by:
   a) hosting Regional Fire Research Subcommittee
   b) participation at Intermountain Fire Council
   c) participation on Northwest Territories Fire Management Program Committee.
   d) Canadian Committee on Forest Fire Control. (D.D.)

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

8. Continue development of regional fire data library including information from fire reports, daily fire weather records and fire statistics. (O.R.)

12. Publications:

Alexander, M.E.; Dube, D.E. 1983. Fire management in wilderness areas, parks and other nature reserves. Pages 273-297 (Chapter 15) SCOPE 18: The Role of Fire in Northern Circumpolar Ecosystems, R.W. Wein and D.A. MacLean (eds.). John Wiley and Sons, Chichester, England.

Dube, D.E. 1983. A perspective on fire management. Forestry Report, No. 28. Northern Forest Research Centre, Canadian Forestry Service, Edmonton, Alberta.

Haggerty, D., R. Newstead and E. Stechishen. 1983. Evaluation of fire bombing aircraft. Can. For. Indust. 103(8): 21-24 Aug. 1983.

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., pp. 145-162.

Mastroqiuseppe, R.J., M.E. Alexander and W.H. Romme. 1983. Forest and Rangeland Fire History Bibliography. File report, distributed at Wilderness Fire Symposium, Nov. 15-18, 1983, University of Montana, Missoula. Reproduced by USDA Forest Service, Intermountain Forest and Range Experiment Station, Northern Forest Fire Laboratory, Missoula, Mont.

Maffey, M.E. 1983. An improved sprinkler system. Forestry Report, No. 28. p. 2 Northern Forest Research Center, Canadian Forestry Service, Edmonton, Alberta.

13. Signatures:

Investigator

Program Manager

Director A.D. Kill

NOR-5-191

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 15, 1983

1. Project: Fire management systems and guidelines.

2. Title: Fire danger and behaviour 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 behaviour 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 behaviour in terms and by methods which are useful to fire management agencies.

9. 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 Behaviour 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 Behaviour 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.

Goals Added:

10. Serve as scientific authority for contract to revise the Texas Instruments model 59 (TI-59) calculator program for hourly calculation of forest fire danger.

11. Revise bibliography supplement to CFS-GLFRC handbook (Inf. Rep. O-X-287) on fuel and fire behavior description.

12. Attend 1983 annual meeting of the Intermountain Fire Council.

10. Accomplishments for 1983-84:

1. Inf. Rep. on Fire Behavior in the Black Spruce-Lichen Woodland Fuel Complex: the Porter Lake Project not completed in its entirety due to heavy commitments with respect to NOR-5-174 activities (i.e., Pukaskawa and GLFRC). Porter L. Project file report nearly completed. This includes an interim summary (representing 1st draft of Inf. Rep.) and 26B-page data compendium. Final illustrations for Inf. Rep. completed. Preliminary results (i.e., summary tables) of Porter Lake Project experimental fires transmitted to R.A. Lanoville, INAC Regional Fire Centre, Fort Smith, N.W.T. Two seminar presentations, entitled "Fire Behavior in the Black Spruce Lichen Woodland Fuel Complex: the Porter Lake Project", given on the preliminary research results: (i) Western Region Fire Weather Committee Seminar, Mar. 22, Edmonton (1-pg. summary in Alexander 1983 b) and (ii) CWS Western Region Lecturer Series, Apr. 14, Edmonton. Completed initial version of 60-min video tape on the Project. Representative slides selected, in cooperation with G.P. Delisle, for duplication and transmittal to other CFS fire research projects.

2. Very little progress to report on completion of Inf. Rep. "Spring Fires in a Semi-Mature Trembling Aspen Stand, Central Alberta" due to heavy commitments with respect to NOR-5-174 activities (i.e., Pukaskwa and GLFRC). Current draft on word processor disc. Spread rates, etc. have been archived in CFS Fire Danger Group's national fire behavior data base.

3. Published manuscript "Tables for Determining Spring Drought Code Starting Values in West-Central and Northern Canada" as NoFRC Forest Management Note 17 (Alexander 1983 c). Tables and TI-59 program in use region-wide, B.C., and Yukon. Summary article on the subject of overwinter adjustment to spring Drought Code starting values, including flow diagram of determination process and 1982/1983 DC starting values in prairie provinces and N.W.T., published in the Sept. 1983 FIRE issue of the NoFRC Forestry Report series (Alexander 1983 c).

4. Manuscript entitled "Prescribed Fire Behavior and Impact in an Eastern Spruce-Fir Slash Fuel Complex" submitted July 27, 1983 and accepted for publication, without request for revision, in the Jan.-Mar. 1984 issue of Canadian Forestry Service Research Notes. Spread rate, etc. has been archived in CFS Fire Danger Group's national fire behavior data base.

5. Paper entitled "Analysis of Extreme Wildfire Behavior in East-Central Alberta: a case study" presented at Seventh Conference on Fire and Forest Meteorology. Co-authored manuscript with B. Janz (AFS Weather Section) and D. Quintilio (FTS Hinton), published in conference transactions (Alexander et al. 1983). Conference paper in use as training material in B.C. (Assoc. of B.C. Professional Foresters Advanced Fire Management Course), at the Alta. Forest Technology School (FTS) and with the Alta. Forest Service. A slide show (60 transparencies) prepared from conference paper and distributed to PRFC, AFS-HQ, FTS Hinton, and AES-HQ. Spread rate, etc. has been archived in CFS Fire Danger Group's national fire behavior data base.

6. Preparation of Forestry Technical Report manuscripts (French and English versions) "An Annotated Bibliography on the Canadian Forest Fire Danger Rating System" not completed in its entirety due to heavy commitments with respect to NDR-5-174 activities (i.e., Pukaskwa and GLFRC). Current draft on word processor disc. A total of 186 references adapted, or written for 33% of bibliography references. Rough draft of introduction written, indexes formulated, and cover design completed. French translation of titles and abstracts completed to date by G.P. Delisle.

7. INAC Minister's decision forced cancellation of the experimental burning project in the lowland black spruce fuel type, N.W.T. (scheduled for July 1983). Efforts expended coordinating CFS involvement will be of assistance in potential northern Alberta project (see Goals for 1984-85, item 4.). Contributed to article published in the Sept. 1983 FIRE issue of the NoFRC Forestry Report series with

respect to fuel description, fire danger ratings, and fire behavior analysis of two experimental fires in the lowland black spruce type of central Alberta (Newstead and Alexander 1983).

8. Attended CFS National Fire Danger Working Group meetings at PFRC Victoria (Feb. 8-1D) and 8anff (Oct. 27) with respect to the Spread Phase of the CFFDRS extension concept. Submitted comments on May 1983 version ISI/fire spread rate equations and national fire behavior data base (correspondence on file). Solicited W & N Region user agency reviews of CFFDRS extension proposal prepared by Group members. Completed comprehensive review of existing Canadian Forest Fire Weather Index Tables in light of 4th Edition being prepared for distribution in the spring of 1984 (correspondence on file). CFFWI analysis of a major wildfire contributed to the Group's national fire behavior data base published as an article in the Sept. 1983 FIRE issue of the NoFRC Forestry Report series.

9. (i) Acted as external reviewer on three unsolicited manuscripts: (a) An Electronic Timer for Measuring the Rate of Spread of Wildland Fires (USDA For. Serv. NC Res. Note) by R.W. Blank and A.J. Simard; (b) Verifying Fire Behavior Models with Prescribed Fires (J. For.) by J. van Wagtendonk and S.J. Botti; and (c) The Effect of Fire Intensity Level on the Re-establishment of Hazel and Raspberry in East-central Alberta (Can. J. Bot.) by M. Johnston and P. Woodard.

(ii) Reviewed book "Forest Fire Prevention and Control" for the Forestry Chronicle at request of Book Review Editor. Review to be published in Dec. 1983 issue.

(iii) At the request of AES Western Region, made presentations on "Forest Fire Danger and Behavior Rating in the Northwest Territories" at two half-day (Apr. 18 and 19) fire weather awareness seminars held in Edmonton for Arctic Weather Centre forecasters in preparation for the 1983 N.W.T. fire weather forecasting program.

(iv) At the request of P.J. Murphy, U of A Dept. of Forest Science, participated in fire growth modelling session with other regional fire behavior specialists as part of Professor Murphy's Ph.D. thesis project at UBC (Sept. 27).

(v) Reviewed drafts of policy document AES/CFS Review of Meteorological Services to Forestry prepared by CFS-HQ and AES.

(vi) As chairman of the Western Region Fire Weather Committee, organized and compiled/edited proceedings (Alexander 19B3 b) of technical seminar and 5th business meeting held at AES Western Regional Office in Edmonton (Mar. 22). Copies distributed to all interested groups east of Ontario. Attended 9th annual meeting of the Central Region Fire Weather Committee held at AES Central Regional Office in Winnipeg (Dec. 9).

(vii) Technical advice on G.P. Delisle's research in Elk Island and Jasper National Parks (see NOR-5-168).

10. Contract to revise the TI-59 calculator program to compute Fine Fuel Moisture Code, Initial Spread Index, and Fire Weather Index on an hourly basis. First draft of an internal report (for limited distribution to interested parties in the Region) completed with contractor.[1]

11. Revision of bibliography supplement to CFS Inf. Rep. O-X-287 "Measurement and Description of Fuels and Fire Behavior on Prescribed Burns: a handbook" co-authored with D.J. McRae (GLFRC) and published as OMNR Fire Management Bulletin 88 (copies distributed to Canadian fire management agencies by Canadian Committee on Forest Fire Control).

I2. Attended Intermountain Fire Council's 1983 Fire Management Workshop on Suppression Options and Alternatives held in Banff (Oct. 25-27.

II. Goals for 1984-85:

I. Publish Information Report entitled "Fire Behavior in the Black Spruce-Lichen Woodland Fuel Complex: the Porter Project, Caribou Range, N.W.T.", co-authored with C.E. VanWagner (PNFI), B.J. Stocks (GLFRC), and B.D. Lawson (PFRC).

2. Publish Information Report entitled "Spring Fires in a Semi-Mature Trembling Aspen Stand, central Alberta", co-authored with D. Quintilio and R.L. Ponto.

3. Submit final drafts of French (co-authored with G.P. Delisle) and English versions of a manuscript entitled "An Overview and Annotated Bibliography on the Canadian Forest Fire Danger Rating System (CFFDRS)" for publication as a Forestry Technical Report by CFS-HQ.

4. Coordinate national CFS inter-establishment documentation team effort associated with an experimental burning project in the lowland black spruce fuel type, northern Alberta (July), pending cooperation of Alberta Forest Service.

5. Continue data compilation and analyses associated with the publication of case histories/studies of selected wildfires (e.g., 19BO Rolling River Fire-Riding Mtn. NP).

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

[1] Alexander, M.E.; Lee, C.Y. Hourly computation of forest fire danger with a programmable hand-held calculator (Mk. II - April 1983). 16 p.

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

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

12. Publications/Reports:

Alexander, M.E. 1983a. Tables for determining spring Drought Code starting values in west-central and northern Canada. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Manage. Note 19. 8 p.

Alexander, M.E. (compiler & editor). 1983b. Western Region Fire Weather Committee (WRFWC): Minutes of the fifth business meeting and seminar proceedings (Mar. 22, Edmonton, Alta.). Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Study NOR-5-191 File Rep. No. 5. 20 p.

Alexander, M.E. 1983c. Overwinter adjustment to spring starting values of the Drought Code. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Rep. 28:5.

Alexander, M.E. 1983d. Analysis of the Canadian Forest Fire Weather Index for the 1968 Lesser Slave Lake Fire. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Rep. 2B:8-1D.

Alexander, M.E.; Janz, B.; Quintilio, D. 1983. Analysis of extreme wildfire behavior in east-central Alberta: a case study. Pages 38-46 in Preprint Vol. Seventh Conf. Fire and For. Meteorol. (Apr. 25-29, Fort Collins, Colo.). Amer. Meteorol. Soc., Boston, Mass.

Alexander, M.E.; McRae, D.J. 1983. Bibliography supplement to CFS prescribed burn handbook. Ont. Minist. Nat. Resour., Aviation and Fire Manage. Cent., Sault Ste. Marie, Ont. Fire Manage. Bull. 88 (revised). 5 p.

Newstead, R.G.; Alexander, M.E. 1983. Short-term fire retardant effectiveness in a lowland black spruce fuel complex. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. For. Rep. 28:3-4.

13. Signatures:

Martin E. Alexander
Investigator

Program Manager

A.D. Kiil
Director

NOR-7 Reduction of damage from pollutants in the atmosphere

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 30, 1983

1. Project: Reduction of damage from pollutants in the atmosphere.

2. Title: Impact of air-borne pollutants on forests.

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 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 communties
      c. Submit for review a journal article on the deposition of pollutants from sour gas processing as measured by lichen and moss element content.

9. Goals for 1983-84: (Cont'd)

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 depostion 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)

Additional goals:

9. Prepare and submit for review a journal article on extraction and determination of elemental sulfur in forest litter.

10. Present a seminar on the influence of elemental sulfur on forested systems to the Air Pollution Control Association.

11. Prepare and submit a review article on sulfur cycling in grassland and parkland soils.

10. Accomplishments in 1983-84:

1. An article entitled "Quantification of branch dwelling lichens for the detection of air pollution impact" was submitted and is currently being reviewed externally in England.

2. An information report entitled "Biomonitoring the effects of sour gas processing on the forested ecosystem in west-central Alberta" has been reviewed internally and by representatives of both Canterra Energy Ltd. and Gulf Canada Resources Inc. It is currently being revised.

3. A forestry report on air pollution and forests has been submitted and is with the editorial staff of NoFRC.

10. Accomplishments in 1983-84: (Cont'd)

4. a. About 20 replicate photographs of a lodgepole pine canopy were taken at each of two sites in an attempt to quantify the density of the forest canopy. Owing to difficulty in repositioning the camera in the exact spot and levelling accurately, this technique for monitoring of canopy changes has been abandoned. b. An article entitled "Effect of particulate elemental sulfur on bryophytes" has been submitted and is currently out for external review in England. c. The data from the lichen and moss survey have been analysed by principal component canonical correlation and multiple regression techniques without success. The limited extent of the pollution impact in the vicinity of the sour gas plants has made it impossible to use the data set as a whole to describe the pattern. Currently, the data are being truncated and statistics are being run to determine at what distance the pattern of S content in lichen and mosses no longer is influenced by the gas plant sources.

5. a. Deposition has been measured with the use of our deposition collectors for the past two years. The collector has been tested against a moss substrate and was found to be about 85% efficient. b. Monthly soil sampling and biweekly measurements of lysimeters were carried out through the summer of 1983 (April to October). 1983 was an exceptionally dry year in the Rocky Mountain House area and dramatic differences in the lysimeters were noted as compared with 1982. It appears that the lysimeter network will need to remain in place in 1984 in order to separate the influence of environment from that of the acidification.

6. A study which examined the change of the plant community (understory) over time at Strachan has been completed and it is now possible to describe how the plant community and its component species have been degraded as soils have been acidified by the elemental S dust. The journal paper outlined in 4b presents the influence of elemental S on mosses.

7. Cooperative work in association with Dr. Jim Germida of University of Saskatchewan has lead to an understanding of how the population of the bacteria Thiobacillus (S oxidizer) both influence and are influenced by soil pH. Currently, 1983 samples are being analysed which should complete the work required to produce a journal paper.

8. A substantial amount of consulting has been carried out by both Maynard and Addison in 1983. Consultive services provided ranged from those requiring up to a month to complete (Monenco's report on the Lodgepole Blowout) to those requiring only a couple of hours. The following list of categories gives an idea of the scope of involvement. Details will be provided if required.

10. Accomplishments in 1983-84: (Cont'd)

Papers reviewed for journals	6
Papers reviewd for NoFRC	6
Issues dealt with for DOE	4
Advisory for Industry/Public	12
Advisory for Provincial Government	4

Additional Achievements:

9. A journal paper entitled "Extraction and colorimetric determination of elemental sulfur in forest litter" has been submitted for review and is currently in final preparation for submission to Water, Air and Soil Pollution.

10. A presentation on the influence of elemental S on forested ecosystems was presented to the Air Pollution Control Association meeting in Calgary in June.

11. A review paper entitled "Sulfur cycling in grassland and parkland soils" was presented to the American Institute of Biological Sciences symposium on "sulfur and the ecosystem" and has been submitted to the Journal of Biogeochemistry for publication.

11. Goals for 1984-85:

1. Prepare and submit to Canterra Energy Limited and Gulf Canada Resources Inc., an annual report describing the research accomplishments in 1983. (Addison, Maynard)

2. Prepare and submit for review a journal article on the influence of elemental S dust on the vascular plant communities in the foothills of Alberta. (Addison)

3. Prepare and submit for review a journal article on the spatial, temporal and vertical variability of total element content and pH in forest soils. (Maynard)

4. Prepare and submit a journal article on the population dynamics of Thiobacillus as they relate to changes in soil chemistry caused by elemental S. (Maynard)

5. Continue to measure elemental S deposition and the movement and change of elements in forest soils as a result of elemental S. (for preparation and submission of report in 1985-86) (Maynard, Addison)

6. Continue studying the factors that control the mobility and form of pollutants and other elements in the soil. (Maynard)

11. Goals for 1984-85: (Cont'd)

7. Initiate a study to determine the influence of elemental S dust and liming on the growth and elemental content of the upper crown of lodgepole pine. (Addison)

8. Submit for review a journal article on the deposition of pollutants from sour gas processing as measured by lichen and moss element content. (carried over from 1983; Addison).

9. Complete and publish the following papers (carried over from 1983-84):
   a. Quantification of branch dwelling lichens for the detection of air pollution impact
   b. Biomonitoring of the effects of sour gas processing on the forested ecosystem in west-central Alberta.
   c. Forestry Report - Air Pollution and Forests.
   d. Effect of particulate elemental sulfur on bryophytes.

12. Publications 1983-84:

Maynard, D.G., P.A. Addison and K.A. Kennedy. 1983. Impact of elemental sulfur dust on soils and vegetation of Pinus contorta stands in west-central Alberta. International Symposium on Dynamics of Boreal Forest Ecosystems, Thunder Bay, Ontario (in press).

13. Signatures:

Investigator

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 24, 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-7-178

5. Study Leader: 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 and 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 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, 19B3. (Hogan)

   2. Prepare and publish a report on the soil, lichen and higher vegetation, work that forms a prt of the Thompson study. To be submitted for review by Feb. 19B3. (Hogan)

   3. Prepare a paper on the use of the moss bag technique and resultant data. To be submitted for review by May 19B3. (Hogan)

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

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)

8. Prepare a file report on acid rain and acid rain monitoring within the region particularly as it relates to forest growth. To be submitted b y 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)

Added Goal:

10. Present a poster at the "Acid Rain and Forest Resources" conference on work carried out at Thompson, Man.

10. Accomplishments for 1983-84:

1) This paper has completed the internal review process and has been submitted to the Journal of Environmental quality.

2) This paper has been written and reviewd by two internal and one external reviewers. It requires minor revision and should be ready for submission to the journal by mid-December.

3) This paper is almost complete and should be submitted for review by the end of November.

4) Two articles on acid rain and heavy metals were prepared for the Forestry Report and were submitted to the editor on Oct. 1, 1983.

10. Accomplishments for 1983-84: (cont'd)

5) The report is in preparation and should be submitted for review by the end of December.

6) Initial experiments are being carried out but have been hampered by the late arrival of the LI-6000 photosynthetic system. If the system is not operational by the end of November, the experiments will go ahead using more conventional measurements of growth.

7) Experiments on the effects of metals on soil enzymatic activity (acid phosphatase, urease) were carried out during the summer. Some methods development was carried out which led to preliminary experiments. The results obtained are by no means conclusive but they suggest that in situ these enzymes are not as sensitive as was previously thought. CO_2 evolution studies could not be carried out.

8) Some research has been done with respect to this goal but writing has not been initiated.

9) Consultation with regional clients has been in three areas.
   a) Lodgepole blowout - 3 weeks
      The consultants reports were reviewed at the request of the ERCB.
   b) Pine point Mines-Water license Renewal - 1 week
      These hearings will take place in mid-December.

10. Presented a poster presentation at the Acid Rain and Forest Resources conference on the work carried out in Thompson, Manitoba.

11. Goals for 1984-85:

Transferred to NOR-7-182

12. Publications:

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 30, 1983

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 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)

9. 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.

10. Accomplishments in 1983-84:

   1. A report that described research activities in 1982-83 was submitted and accepted by the Research Management Division of Alberta Environment.

   2. Data that described the influence of SO_2 concentration and duration of exposure on the capability of the lichen *Evernia mesomorpha* to fix ^{14}C was analysed and was determined to be inadequate to describe the interaction between these two factors. The variability in both the controls and treatments was so great that the main responses could not be quantified. A new cuvette for the exposure of lichens has been constructed and an IRGA has been modified to allow for the measurement of photosynthesis in lichens. A duplicate experiment is currently being carried out.

   3. Data from both Rocky Mountain House and Ft. McMurray on the distribution of SO_2 in forest canopies as measured by sulfation candles has been combined and is currently being analysed.

   4. A study which examined the influence of SO_2 concentration and the duration of exposure on several biophysical and biochemical processes in jack pine has been completed. A journal article entitled "The effect of SO_2 on the physiology of jack pine seedlings" has been submitted and is currently in its first review.

   5. The analyses for the total element content of 4 soil horizons from the most heavily contaminated site in the Oil Sands area have been completed. Analysis of the extractable element content awaits both the installation and testing of the Ion Chromatograph and the evaluation of various extractants for use in forest soils. (Information to be published under NOR-7-114) in 1984-85.

   6. The publications which were to be initiated by A.A. Khan have not been forthcoming.

11. Goals for 1984-85:

1. Prepare and submit to the Research Management Division of Alberta Environment an annual report on research accomplishments in 1983. (Addison, Maynard)

2. Complete the study on the influence of SO_2 concentration and duration of exposure on net photosynthesis of *Evernia mesomorpha*. Prepare and submit a journal article. (carried over from 1983; Addison)

3. Complete and publish a journal article on the distribution of SO_2 in forest canopies. (carried over from 1983-84; Addison)

4. Determine the influence of environmental history on the response (net photosynthesis) of jack pine to SO_2 fumigations. (Addison)

5. Determine the influence of intermittant fumigation on photosynthesis and biomass of jack pine and aspen. (Addison)

6. Determine the effectiveness of various extracting solutions in determining available cation and anion concentrations in forest soil litter and mineral horizons. (Maynard)

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

8. Complete and publish a paper on the effect of SO_2 on the physiology of jack pine seedlings (carried over from 1983-84)

Added goals:

9. Complete requirements for papers submitted to journals (Hogan)
   a) Flin Flon paper (see 83-84 goal 1)
   b) Thompson paper (see 83-84 goal 2)
   c) Moss bag paper (see 83-84 goal 3)

10. Complete work required for the publication of the Forestry Report. (Hogan)

11. Prepare a publication on the five-year comparisons from the Thompson study. Carried over 1983-84 to be completed by Jan. 31, 1984) (Hogan)

12. Prepare a file report on acid rain and acid rain monitoring within the region. Carried over 1983-84. (Hogan)

13. Present paper on "Sulfur determination Environmental Materials by ICAP-AES to Sulfur 84, Conference, sponsored by Sulfur Development Institute of Canada". (Hogan, Maynard)

12. Publications 1983-84:

Addison, P.A., S.S. Malhotra and A.A. Khan. 1984. Sulfur dioxide sensitivity of woody boreal forest species grown on native soils and tailings (accepted for publication - Journal of Environmental Quality)

13. Signatures:

Investigator

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 24, 1983

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-7 -186 (formerly NOR-32-186)

5. Study Leader: M.J. Apps

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, and 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 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)

10. Accomplishments in 1983-84: (to Nov. 83)

1. A batch digestive and radiochemical analysis scheme for U, ^{226}Ra, ^{210}Po and ^{210}Pb has been developed and tested for lichen samples. The EDA radon emanation system was modified, calibration/precision/accuracy tests performed, and is now used for quantative ^{226}Ra analysis. Delayed neutron activation at the U of A is employed for U analysis but higher sensitivity may be required for low level vegetation samples. An alpha spectroscopy system has been assembled and tested for ^{210}Po and ^{226}Ra measurements. Gamma measurement capability has been established and used for ^{133}Ba recovery determination. Routine analysis and final testing of ^{210}Pb procedures have been delayed pending installation of a gas proportional alpha-beta system in December.

2. (a) Field work continued with a field camp at the abandoned Gunnar site. Vegetation and gamma exposure surveys were performed on the major tailings areas. Replicate vegetation and substrate samples for 16 indigenous species which have invaded the tailings were collected. Tailings material from both Gunnar and Lorado were obtained for planned laboratory growth and uptake studies.

(b) A preliminary set of Lorado lichen samples were analysed for ^{226}Ra and U. Early results indicate that Ra/U activity ratios may be used to differentiate between particulates of tailings and other (soil) origin. Further analysis awaits ^{210}Pb capability to ascertain radon gas contribution.

3. Available literature, including EIS and Board of Inquiry reports, for the region has been researched and a summary of the uranium industry's effects on the terrestrial environment is being prepared. Data for the report includes: a review of uranium activities in the region - past, present, and expected future; a compilation of potential source terms - mine operations, tailings, waste rock; a summary of terrestrial pathways; an evaluation of available baseline information; weaknesses in current knowledge; recommendation for continued research.

4. A report on the goals and activities of NOR-32-186 was submitted for Forestry Reports on 4 Oct.

5. The Wollaston Lake area was chosen as the most likely area for renewed uranium development. A field camp was established in cooperation with an EPS team and a reconnaissance survey made of the area. Lichen samples were obtained from a series of locations in the general area with emphasis put on the Midwest Lake property where the next major development is expected. These samples are being prepared for analysis.

6. a. Alternate member of Regional Mining Committee of RSCC
   - critical review of Cluff Lake Phase II E.P.S.

   b. Member of Analytical Subcommittee of Canadian Uranium Producers Metallurgical Committee
   - two meetings Toronto, (May) and Pinawa (Oct.)

   c. Critical review and comments on draftdocument: "Present and Possible Future DOE Activities in the Nuclear Area"

   d. Member of Graduate Thesis committee at U. of A
   - Mr. John Duke, Geology, MSc (U & Th distribution)

   e. Workshop on Analytical Chemistry Related to Canada's Nuclear Industry, Oct.
   - gave 50 minute presentation

   f. Represent CFS at Public Consultation Meeting, Regina

11. Goals for 1984-85:

1) Complete preparation and submit for review an information report on Uranium mining and milling and radionuclides in the terrestrial environment. (Carried over from 1983-84) (deadline June 1984) (Apps)

2) Continue investigation of extent and mechanisms of radionuclide transport into the terrestrial environment in the Beaverlodge area. Prepare and submit for review a journal article on transport via dust and radon daughters. (deadline Dec. 1984) (Apps)

3) Complete analysis of 1983 Wollaston Lake reconnaissance survey samples. Prepare a progress report on the findings. (Apps)

4) Further improve and modify procedures for the determination of radionuclides in soils and vegetation. (Apps)

5) Undertake baseline studies in proposed development areas as needs and opportunities arise. (Apps)

11. Goals for 1984-85: (Cont'd)

6) Provide consultation to regional clients and CFS staff on matters relating to nuclear activities in the region. Represent CFS on regional and national committees as required.

If time permits -

7) Prepare a journal manuscript for review on procedures for the determination of radionuclides in soils and vegetation (Apps)

8) Design field laboratory and greenhouse experiments with cooperators (NOR-7) to investigate the uptake of radionuclides and their effects upon native forest species. (Apps, Addison, Maynard)

12. Publications:

13. Signatures:

Investigator

Program Manager

Investigator

Director A.D. Kiil

NOR-9 Chemical controls of pests and vegetation in managed forests

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 21, 1983

1. Project: Insect and vegetation management systems

2. Title: Chemical controls of pests and vegetation in managed forests

3. New: Cont.: X 4. 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 trails 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 1983-84:

   1. Continue assessment, monotiring 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, carbofuran.

10. Accomplishments in 1983-84:

1. Continued assessments, monitoring of established plots with large scale field tests (0.04 ha) of Velpar Granular 2D%, DPX T.6376 and fluazifop-butyl - all spring applications - at Faust, Slave Lake. Velpar G. 20%, summer applied on slopes at Grande Prairie at 14 kg, 19.5 kg/ha.

   a) Conifer release, white spruce, weed/grass competition on slope trials with Velpar G. 20% @ 14 kg, 19.5 kg, and 28 kg/ha, spring applied at Faust, Slave L. and summer at Grande Prairie.

      Results of controls on heavy clay soils at Faust were good to excellent on control, release, and canopy opening. Minimal lateral leaching occurred in low areas and no streaking on slopes. Velpar Liquid tests with mistblower were cancelled due to chlorosis on w. spruce using this technique. Chemical thinning at Edson/Slave Lake were also omitted due to "flash back" in sandy soils.

      Spring, summer, fall 1982 spray treatments applied on split plot design at 3 dosages of 70, 250 and 500 g/ha (see abstracts) of DPX T.6376.

      Proposed tests with Velpar G. at Saddle Hills was deferred for another year until seedlings become better established. Roundup and Garlon remained on the questionable list.

      DPX T.6376 was again applied on 0.D4 ha plot in spring 1983 at Faust @ 500 g/ha at 24D kPa hydraulic pressure. Crop tolerance at end of 1st year was rated 2, control 8.5. Spring applied fluazifop-butyl 25% @ 1 kg/ha w/1% sol'n wetting agent Agral. Crop tolerance 9 and control only 2.5. Dosage too light.

2. Continued with evaluation of pheromones with the National Research Council at Saskatoon, Dr. E. W. Underhill, and Dr. H.R. Wong, W.G.H. Ives, C. Rentz, D. Szlabey and Survey personnel;

   a) field testing of 42 baited Zoecon® traps at Pibroch, St. Albert and Lacombe for *P. aesculana* and *P. willingana* as well as biologies, populations, damage and distribution. (see report attached).

   b) Six traps were set out in each of Manitoba, Saskatchewan and Alberta to monitor spread or distribution for the pine shoot moth (R. buoliana). No moths were recovered in 1983.

   c) field testing of Petrova spp. baited traps at Nojack (8), Whitecourt (8), Slave L. (8), Gr. Prairie (8), Porcupine Hills (8), Cypress Hills (8) and in Hinton area with W.G.H.Ives and Cam Rentz (100) to test bait specificity and attraction for the Pitch Twig Moths, *P. albicapitana* and *P. metallica* to obtain biology, population ratios, damage and distribution patterns. Baits were efficient during the time span, specificity was only fair to good in 8 of the best baits. A definite division of populations exists at about 3500' altitude - *P. metallica* does not occur below 3000'. Flight periods and peaks are dissimilar - *P. m.* first.

3. Participated with J. Muldrew in chemical controls on Seed and Cone Insects, field tests with Dimethoate, Aldicarb, 10G, Carbofuran 10G, dicrotophos and metasystox were used in June.

4. Reviewed the EG-ESS classification standards as part of a 3-man committee to recommend a new rating system and classification criteria.

5. CFS representation, reporting, extension requests/displays, radio interviews, surveys, consultations, talks, and papers and summarises were provided for;
   Western Committee on Crop Use (ECPUA)
   Expert Committee on Weeds (ECW) (ECPUA)
   National Research Council (Saskatoon)
   Brooks Hort. Center
   Forest Service, Industry and general public.

11. Goals for 1984-85:

1. Continue assessment, monitoring of established plots in Alberta/ Manitoba on the established 1, 2, 3-5 year measurements, continue field tests of Velpar Liquid "over the top" hydraulic sprays; DPX T6376 applications at lower dosage of 70 g/ha and with Garlon at 1 L/ha at Slave Lake and Grande Prairie.

2. Assist Alberta Forest Service in proposed 2,4-D glyphosate and hexazinone aerial spray program in Peace River block.

3. Continue evaluations of pheromones with National Research Council:

   - for the boxelder twig borer complex, to clarify biology and taxonomy of *P. aesculana*.

   - for evaluating distribution of pitch twig moths *P. albicapitana* and *P. metallica* with further large scale trapping at Hinton with W.G.H. Ives and Cam Rentz. Study start mid-May to end of July.

   - Monitor pine shoot moth *R. buoliana* baits and effectiveness - baits (6+1 check) will be set up at Sault Ste. Marie and Wasa L., B.C.

4. Review and terminate Seed/Cone Insect trials, phenology and life history.

5. Continue with FPMI, ECW, ECPUA, herbicidal pesticide impacts and as summarizer for ECW (western).

6. Prepare Information Report on pheromones/effectiveness on *Proteoteras* spp.

12. Publications:

1983-84

Drouin, J.A. 1983. Expert Committee on Weeds Research Report Vol. 3 Western Canada Section, Regina, pp. 283-286.

Drouin, J.A. 1983. Annual revision of Insect Pests and controls on Berry Crop. In WCCP Report (1983). 4 pp.

Cerezke, H.F., J.A. Drouin, and B. Neill. 1983. Annual revision of insect pests and controls on shelterbelts, ornamentals and shrubs. In WCCP Report (1983). 13 pp.

Cerezke, H.F., J.A. Drouin. 1983. Insect pests and controls in seasoned wood and timber structures. In WCCP Report (1983). 3 pp.

Soehngen, U. and J.A. Drouin. 1983. Annual revision of insect pests and controls on houseplants and on greenhouse woody ornamentals and crops. In WCCP Report (19B3). 12 pp.

Wong, H.R., J.A. Drouin, D.L. Szlabey and D.T. Dang. 19B3. Identification of three species of Proteoteras (Lepidoptera: Tortricidae) attacking shoots of Manitoba Maple in the Canadian Prairies. Can. Ent. 115 (4) 333-339. 1983.

Drouin J.A. 1983. The Northern Pitch Twig Moth and a Pitch Twig Moth, *Petrova albicapitana* and *P. metallica* in Alberta, 1983. File Report. 4 p.

Drouin, J.A. 1983. The Boxelder Twig Borers, *Proteoteras aesculana* Riley, and *Proteoteras willingana* (Kearfott) in Alberta, 1983. File Report. 4 p.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-9-181

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 21, 1983

1. Project: 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 and C.R. Rentz

6. Key Words: Jack pine, *Pinus banksiana* Lamb., lodgepole pine, *Pinus contorta* Dougl., white spruce, *Picea glauca* (Moench) Voss, insect damage, tree diseases, stocking standards, site classes, reforestation, browsing, rodent damage.

7. Location of Work: Prairie Provinces and Edmonton

8. Study Objectives:

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

9. Goals for 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, 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.

10. Accomplishments in 1983-84:

1. Second-year mortality in lodgepole pine plots near Hinton was assessed.

2. A file report summarizing first-year mortality of lodgepole pine near Hinton was prepared. Data for second-year mortality are being coded, prior to transferring to computer, and a file report will be prepared after the data are processed.

3. Because little assistance was obtained from Dr. Cerezke, due to other assignments, his association with the study has been terminated. Dr. H.R. Wong will now be a major contributor to study. Numerous photographs (about 3000, representing some 600 species) have been obtained to fill in gaps or to replace unsatisfactory pictures already on hand. Accompanying text has been prepared for a number of the figures: by the end of the fiscal year a total of between 40 and 50 should be written. Transferred to NOR-1-154.

4. Attempts to obtain larch sawfly in Manitoba were largely unsuccessful, due to very low population levels. Populations in Alberta also declined, but enough larvae were collected to provide an estimate of the rate of parasitism.

11. Goals for 1984-85:

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

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

3. (Transferred from Study NOR-9-185). Prepare the report "Dispersal and impact of the larch sawfly parasite *Olesicampe benefactor* and the hyper-parasite *Mesochorus* dimidiatus" for publication, should any rewriting be required.

12. Publications:

W.G.H. Ives and C.L. Rentz. 1983. Growth and survival of young lodgepole pine regeneration in west-central Alberta. II. 1981-82 survival. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. File report. May 1983.

13. Signatures:

Investigator

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 21, 1983

1. Project: Insect and vegetation management systems

2. Title: Insects and diseases affecting seed production in the Prairie Region

3. New: X Cont.: 4. No.: NOR-9-185

5. Study Leader: J.A. Muldrew

6. Key Words: Seed production, seed and cone insects, seed orchards, white spruce, *Picea glauca*, Jack pine, *Pinus banksiana*, Lodgepole pine, *Pinus contorta*, *Dioryctria abietivorella* (fir coneworm), *D. reniculelloides* (spruce coneworm), *Laspeyresia youngana* (spruce seed moth), *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 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 1983-84:

   1. Cooperate with 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-damage 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.

10. Accomplishments in 1983-84:

1. Nothing useful accomplished.

2. Nothing useful accomplished.

3. Nothing useful accomplished.

4. Additional data on the effectiveness of systemic insecticides were collected. Analysis of data is not yet completed. Goal will be transferred to NOR-9-132. Mr. Drouin has agreed to examine data and prepare a report, either a file report or an information report, depending upon the amount and quality of information.

5. Nothing useful was accomplished.

6. A considerable amount of data was collected on the position of attacked seeds within insect-attacked cones, but analysis of data was not completed. The data will be filed, but no additional work will be undertaken, as it is pointless to develop a sampling technique for estimating insect damage if work on seed and cone insects is to be terminated.

7. The paper "Dispersal and impact of the larch sawfly parasite *Olesicampe benefactor* and the hyperparasite *Mesochorus dimidiatus*" has been with the editor for several months, but has not yet been published. Any additional work required to bring the report to publication will be undertaken as a goal in Study NOR-9-181.

11. Goals for 1984-85:

1. Terminate study.

12. Publications:

Nil

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-10 Silviculture investigations

NOR-10-39

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture investigations

2. Title: Nursery operations

3. New: Cont.: X 4. No: NOR-10-039

5. Study Leader: E. Harvey

6. Key Words: Root pruning, storage and packing, storage mold, disease control, seedling mortality, 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; 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; Clearwater Provincial Forest Nursery, The Pas, Manitoba; St. Regis (Alberta) Ltd., Hinton; Blue Ridge Lumber (1981) Ltd., Whitecourt.

8. Study Objectives:

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

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

   3. To advise on containerized and bareroot production of seedlings.

   4. Maintain liaison between NoFRC and regional nursery facilities.

9. Goals for 1983-84:

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

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

3. Supervise observance of production standards for bareroot and container stock for physiology, nutrient, and hardening trials and administer greenhouse and nursery facilities at NoFRC. (NOR-10-39-Harvey)

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

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

10. Accomplishments in 1983-84:

1. No research was conducted; position vacant.

2. Greenhouse and nursery production problems investigated at Pine Ridge (light intensity) and at Pineland (soil pH) nurseries. Provided advisory service. Analyses of soil and foliage for monitoring bareroot nurseries in the region were conducted. The analytical results were discussed in the context of published sufficiency levels of nutrients (Edwards NOR-10-135).

3. Containerized stock produced for physiology and nutrition trials. Managed the greenhouse and nursery facilities and supervised the installation of sodium lamps in the greenhouse (Dymock NOR-10-192).

4. Cooperated with Manitoba Department of Natural Resources, the host agency for the 1983 Federal-Provincial Nurserymen's meeting. Acted in liaison capacity by disseminating relevant information to the regional nurseries. Coordinated the summary of regional nursery statistics for the Forestry Development Program, Gt. Lakes Forest Research Centre (Edwards NOR-1D-135).

5. No OECD seed inspection work was undertaken. Two enquiries were received and both were referred to the Pacific Forest Research Centre (Dymock NOR-10-192).

11. Goals for 1984-85:

1. Gain familiarity with regional nursery production systems for bareroot and containerized stock. Provide technology transfer including advisory services on the production system, employing field trials, demonstrations and workshops as appropriate (039). (NOR-10-39, Harvey)

2. Administer NoFRC greenhouse and nursery complex and develop guidelines and a plan for its use. (NOR-10-39, Harvey)

3. Cooperate in conducting the regional nurserymen's meeting at NoFRC and prepare proceedings for publication. (NOR-10-39, Harvey)

4. Monitor soil fertility and seedling nutrition in bareroot nurseries in the region; maintain monitoring program already underway. (NOR-10-39, Harvey)

5. Participate in review of nursery problems and develop a method of approach for a research project within the priorities set. (NOR-10-39, Harvey)

6. Undertake training in seed inspection and conduct OECD seed inspection as required. (NOR-10-39, Harvey)

12. Publications in 1983-84:

Nil

13. Signatures:

Investigator

Program Manager

Director

NDR-10-135

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture investigations

2. Title: Nursery soil fertility and seedling growth

3. New: Cont.: X 4. No: NDR-1D-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; Hadashville, Manitoba

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 1983-84:

   1. To provide advisory service, investigate problems, and offer recommendations in soil fertility and tree nutrition as requested by industry and government agencies. (NDR-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. (NDR-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)

Added Goal:

6. To prepare a paper "Nutrient deficiencies and their correction in white spruce" and present it at the annual meeting of the B.C. Nursery Association in Prince George, B.C.

10. Accomplishments in 1983-84:

1. Investigated soil fertility, soil management and tree nutrition problems at Pine Ridge and Pineland nurseries and at Prince Albert Pulpwood seed orchard. Also provided quality control checks on fertilizer distribution system at Blue Ridge nursery facility.

2. a) The manuscript has been reviewed twice and has been submitted to the editor (FMN).

   b) The manuscript has been prepared for second review (Inf. Rep.).

   c) The manuscript has been prepared for second review.

3. Data have been analyzed and a file report prepared. A presentation of the report, "Effect of N, P, and K on early growth of black spruce and red pine", was made at the annual Federal-Provincial Nursery meeting at Hadashville, Manitoba. The report will appear in the Proceedings of the meeting.

4. Two fields each of jack pine and white spruce at Prince Albert nursery have been sampled prior to seeding and at the end of the first growing season. Seedlings (1-0) will be analysed to determine total nutrient uptake. Data on fertilizer application and soil amendments also have been collected.

5. Physiological hardening experiments planned for lodgepole pine in NOR-10-192 were postponed because of inadequate technical support. Newly installed sodium lamps were checked and progress was made in experiments with white spruce.

Added Goal:

6. Prepared a paper, "Nutrient deficiencies and their correction in white spruce", on invitation, and presented it at the annual meeting of the British Columbia Nursery Association at Prince George, B.C. The report will appear in the Proceedings of the meeting.

11. Goals for 1984-85:

1. Complete publication of:

   a. Fertilization guide for conifer seed production (FMN).

   b. Erodibility index for forest land (IR).

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

2. Review contractor's report on ENFOR Project P-205 and undertake added analysis as needed. (NOR-10-135, Edwards and Brace)

3. Provide advisory service, investigate problems, and offer recommendations on soil fertility and tree nutrition as requested by industry and government agencies. (NOR-10-135, Edwards)

4. Continue experiment on the effects of residual fertility on jack pine and white spruce at Prince Albert. Soil and foliage samples will be collected for analysis before and after the growing season. (NOR-10-135, Edwards and Van Dyk)

5. Initiate study on nutrient requirements for hardening of containerized bS and lP seedlings. Prepare a study plan for review, stating approach to the problem and the solution expected. (NOR-10-135, Edwards and Van Dyk)

12. Publications 1983-84:

Edwards, I.K. 1983. The effect of N, P, and K on early growth of containerized red pine and black spruce. Proceedings of the annual Federal-Provincial Nursery Meeting held at Hadashville, Manitoba, September 13-15, 1983.

Edwards, I.K. 1983. Nutrient deficiencies and their correction in white spruce. Proceedings of the annual meeting of the B.C. Nursery Association in Prince George, B.C., September 27-29, 1983.

13. Signatures:

Investigator

Program Manager

Director

NOR-10-155

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture 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, Alberta; 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 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.

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.

10. Accomplishments in 1983-84:

1. a. Forest Management Note published as indicated in 12 (below).

b. Goal terminated as noted in PM's 1983 letter.

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

d. Manuscript submitted for acceptance: "Frost hardiness of conditioned lodgepole pine and white spruce containerized seedling overwintered and field tested in a frost-prone Whitecourt forest clear-cut of Alberta".

2. A draft journal paper "Colorimeter detection of the effects of early onset of frost damage affecting surface color components of containerized lodgepole pine and white spruce seedlings" was submitted for approval.

3. Have been consulted in 17 nursery problems by private and government agencies.

4. Goal transferred to Project NOR-35.

5. Study terminated.

11. Goals for 1984-85:

Nil Terminated

12. Publications 1982-83:

Zalasky, H. 1983. Field storage of containerized conifer seedlings. Canadian Forestry Service. Environ. Can. Forest Manage. Note. Note No. 20.

Zalasky, H. 1983. Optimizing containerized conifer seedling production in the prairie region. Canadian Forestry Service. Envir. Canada Forest Manage. Note. Note. No. 21.

13. Signatures:

Harry Zalasky
Investigator

Program Manager

Director

NOR-10-176

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture 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, Edmonton, Alberta

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 regional and national programs, including the Canadian Forest Resource Data Program, and the Mechanization of Silviculture Program.

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

9. Goals for 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-coordinate 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. (NDR-10-17 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)

10. Accomplishments in 1983-84:

1. Carried out routine co-ordination work. Completed restaffing of NOR-10-039 portion - upgraded to FO-2 level.

2. Organized and co-ordinated meeting of RRTC in Prince Albert, Saskatchewan on Sept. 27, 28, 29, 1983. Reported to RSAC Dec. 1, 1983. Carried out related technology transfer and research communication within RRTC activity.

3. This goal was pursued to stage of initial management plan review, then held in abeyance until Parks Canada completed legal aspects of agreement with CANFOR, which was not accomplished until late 1983.

4. Not published. Draft completed and circulated to RRTC members for comment.

5. Mechanization inventory complete. Data bank still under development. GLFRC has data retrieval capability but incomplete information. Workshop plans are at the stage of having received agreement by participants to present paper. Data is set and tentative agenda prepared. Meeting will probably be tied into NACMEC annual meeting. Equipment evaluation was undertaken with GLFRC on Moss Sylvaplanter, and Saskatchewan equipment trials, and color-video was recorded for a wide variety of machines. Display and video presentation made at RRTC meeting in Prince Albert (Gorman). NACMEC meeting in Sault Ste. Marie attended by L. Brace.

6. FMN planned to update National Silviculture Report once all questionnaires are returned. CIF silviculture data committee contacted and liaison established. They will not duplicate our efforts.

7. Continued on Scientific Advisor on ENFOR-P-205. Contract report now delayed to early 1984.

8. Contributed to MPB paper and returned to PFRC.

11. Goals for 1984-85:

1. Participate in problem analysis on research priorities in MOUs for Manitoba and Saskatchewan. (NOR-10-176, Brace)

2. Continue as project leader and co-ordinator of NOR-10 and as chairman of Regional Reforestation Technical Committee, Coordinator of Wood Buffalo IEE review, and regional representative on NACMEC. (NOR-10-176, Brace)

3. Continue inventory and data bank for mechanization of silviculture study. Cooperate with GLFRC and provinces in equipment evaluations. Conduct mechanization of silviculture workshop and report proceedings. (Inf. Report) (NOR-10-176, Brace and Gorman)

4. Co-operate with Regional Resource Data Specialist in updating the CFRDP National Silviculture Report. Publish FMN on 1981-83 data. (NOR-10-176, Brace and Kuhnke)

5. Publish information report on Regional hare damage. (NOR-10-176, Brace)

6. Continue to contribute comments and review on documents for Canada/USA LP/MPB committee. (NOR-10-176, Brace)

12. Publications 1983-84:

Nil

13. Signatures:

L. H. Grace
Investigator

Program Manager

C. D. Tait
Director

NOR-1D-19D

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture investigations

2. Title: Field performance of planted stock

3. New: Cont.: X 4. No: NOR-1D-19D

5. Study Leader: N. Walker

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 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 19B3 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)

10. Accomplishments in 1983-84

1. Co-operative study with AFS continued as scheduled for items (a), (b), (c) and (d).

e. FMN on 3 sizes of containes at FRFN in preparation (Ball)

2. a. Remeasurement of Alberta plots completed and FMN drafted

b. 10-year remeasurement of styroplug and bareroot seedlings in Central Saskatchewan completed and provided to Ball (NOR-10-196).

3. Available plot data assembled to illustrate hare damage on research plots in Alberta and Saskatchewan. Observations in draft FMN in 2(a) above also relevant.

4. Draft report prepared on 5-year data from prepared burns in Saskatchewan (see following under NOR-10-196).

11. Goals for 1984-85

1. Co-operate in preparation of FMN on 3 sizes of container stock reared at P.R.F.N. (NOR-10-190, Walker and Ball)

2. Complete remeasurement and analysis of 10 to 15 container seedling plantations and 1974 plantings of Hillson containers at Hinton and prepare draft FMN. (NOR-10-190, Walker)

3. Continue performance measurements of co-op seedling performance study with AFS at Grande Prairie. Prepare annual status report for file. (NOR-10-190, Walker)

4. Remeasure CFS aspen conversion plots in Alberta and provide data to Ball (NOR-10-190, Walker and Ball)

5. Complete and publish information report on jack pine regeneration (NOR-10-190, Walker and Sims).

12. Publication 1983-84

File Report: Walker, N.R. and W.J. Ball. 1983. Establishment and progress report on factors affecting field performance of containerized and bareroot stock in Alberta. AFS-CFS Co-op. Project.

13. Signatures:

N R Walker
Investigator

Program Manager

Director

NOR-10-192

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture investigations

2. Title: Forest tree seedling and seed physiology

3. New: Cont.: X 4. No: NOR-1D-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 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. Complete sampling 1982 wS and lP container stock and initiate sampling of 1983 container 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 cellular metabolites of interest 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 lP data (with Edwards).

2. Cone and seed physiological research. (NDR-10-I92 Dymock)

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

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

3. Perform D.E.C.D. seed analyst duties as required. (NDR-10-192 Dymock)

4. Continue preparation, review, and submission of the following growth regulator papers from Ph.D. thesis. (NDR-1D-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. (NDR-10-192 Dymock)

Goals Added:

6. Perform duties of acting/greenhouse and nursery manager until 83-12-31, after which those duties will be assumed by the Nursery Research Officer, Eileen Harvey in January 1984.

7. Initiate a study on the promotion of early flowering in conifer seedlings through the use of extended photoperiod, differing light regimes, and/or growth regulator applications.

8. Initiate a study with Elizabeth Powell to evaluate early growth and development of wS and lP seedlings (to 14 weeks from germination) during the shortening autumn (natural) photoperiod, and the effectiveness of providing supplemental light using either fluorescent or high pressure sodium lamps.

10. Accomplishments in 1983-84:

1. Seedling physiological research. (NDR-10-192 Dymock)

a. Production of seedling stock for research needs under NOR-10-192.

- Grew 420 trays each of lP and bS in Spencer-Lemaire Ferdinands (6's) for cold hardiness, dormancy, and root growth capacity (RGC) testing, and for subsequent analysis of selected endogenous cellular metabolites beginning in 1984-85.

- Grew 36 trays of wS in Spencer-Lemaire Ferdinando (6's) for dormancy testing and future analysis of selected endogenous cellular metabolites.

- Grew 12 species of conifers in Spencer-Lemaire Super 45's to evaluate growth response to different light regimes and/or extended photoperiod during first half year of growth from seeding, under greenhouse conditions.

- Grew 216 wS and 216 lP in four different container/pot sizes (Spencer-Lemaire Super 45's, 0.7 litre capacity; 4.5 litre round pot, 5.4 litre square pot; and 9.0 litre round pot) under two different light regiments and/or extended photoperiod for the first half year of growth from seeding, in order to determine the optimum container/pot size for studies on the promotion of early flowering in wS and lP through the use of extended photoperiod, different light regimes, and/or the use of growth regulator applications.

- Supervised the growing of approximately 12,000 cS for promotional purposes during the summer of 1983.

- Supervised and assisted Elizabeth Powell in growing 18 trays each of wS and 1P seedlings for Biology 30 study to evaluate early growth and development during shortening autumn photoperiod with or without different types of supplemental light.

- Maintained wS and 1P bareroot seedling beds (seeded during 19B2) in the nursery at NoFRC.

b. Continue sampling container stock for phenological, physiological and biochemical testing during cold hardening, dormancy, and dormancy breaking.

- Completed sampling 1982 wS and 1P container stock for dormancy testing and stored root tip and bud samples for further microscopic analysis. Freeze-dried and powdered root, needle, stem, and bud samples. Performed initial pigment analyses (with one student assistant - Thomson).

- Initiated weekly dormancy (oscilloscope/SWD) testing, measurement of growth parameters (height, RCD, shoot/root FW and DW), monitoring of phenological condition of shoot and root, and stored samples of root tips and buds of 1983 bS, wS, and 1P for further microscopic analysis.

- Initiated weekly replicate sampling (3 replicates of 36 seedlings each) of 1983 bS and 1P and single replicate sampling of 1983 wS seedlings. Material was rapidly frozen and stored at -25°C prior to freeze drying. Materials catalogued and ready for analysis of endogenous cellular metabolites of interest to begin during 1984-85.

- Initiated weekly cold hardiness testing of 1983 bS and 1P container stock at three freezing regimes (-5°C, -10°C, and -15°C) and three intervals of exposure (6.0 hours, 24.0 hours and 168.0 hours). Performed oscilloscope/SWD testing on one-half treated seedlings 48 hours following return to greenhouse conditions. Scored survival and degree of shoot/root damage after three weeks on remainder.

- Initiated root growth capacity testing of 1983 bS and 1P at one, two, and three week intervals following each weekly sampling.

- Initiated weekly sampling of 1983 wS, bS, and 1P to determine the time to bud break and flushing under greenhouse conditions following outdoor storage in cold frames.

- Initiated hourly monitoring of root, shoot, ground, and air (at 1.5 metres) temperatures of 1983 wS, bS and 1P container stock in outdoor cold frames.

- Attended the 25th Annual Silver Anniversary Meeting of the Canadian Society of Plant Physiologists at the University of Waterloo, June 21-23, 1983 and presented a research paper entitled, "Changes in the physiology of lodgepole pine seedlings during overwintering."

- Attended the annual Federal-Provincial Nurseryman's Meeting September 13 and 14, 1983 at Hadashville, Manitoba and presented a report entitled, "A review of physiological investigations on cold hardening and dormancy processes in container grown nursery stock at NoFRC."

c. Methods/bioassays development for investigating role(s) of endogenous cellular metabolites of interest during cold hardening, dormancy, and overwintering in seedlings (with one student assistant - Thomson)

- Investigated spectrophotometric analyses and various purification methods for investigating conifer pigment changes during overwintering.

- Obtained 2.0 kg dwarf rice seed from Dr. R.P. Pharis for gibberellin bioassay tests.

- Purchased computer assisted gradient HPLC system with automated fraction collection and UV/VIS and fluorescence detection capabilities for purification, separation, and analysis of endogenous cellular metabolites of interest. Delivery and system installation were completed 83-12-06. Methods development using HPLC will commence in mid-January 1984.

- Continued literature review of current methods of analysis of endogenous cellular metabolites of interest, particularly endogenous growth promoters and inhibitors.

d. Study nutrient requirements for hardening containerized bS.

- Re-designed experimental parameters to better fulfill goal of study after examining results of 1982 study on 1P. Concluded 1P study should not only be repeated, but expanded. Lack of manpower to carry out bulk of study work resulted in termination as of 83-08-31. Recommend transferring responsibilities for studying nutrient requirements for hardening to NOR-10-135 (Edwards).

2. Cone and seed physiological research. (NDR-10-192 Dymock).

   - Both goals under this section have been amalgamated under a proposed PRUF study to be carried out by Dr. A.K. Hellum, Forest Science Dept., U. of Alberta in cooperation with Dymock (NOR-10-192). Initiation of this study on lodgepole pine cone and seed maturation processes is subject entirely to funding through PRUF.

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

   - One inspection/analysis requested by Reid, Collins Nursery Limited, Aldergrove, B.C. for collection of whitebark pine near Nordegg, Alberta. No seed inspector on staff at NoFRC. Both inspection and subsequent analysis referred to P.F.R.C. in Victoria.

   - One request for collection of Engelmann Spruce, Alpine Larch, and Whitebark Pine received from Iceland. As NoFRC does not maintain a collection service, matter was referred to Reid, Collins Nursery Limited, Aldergrove, B.C. Volume of seed required not known. Matter will likely be pursued by contractor with client (Iceland) and collections and inspection/analyses required during 1984 seed crop period.

4. Manuscript preparation from Ph.D thesis (NOR-10-192 Dymock).

   - Both papers expected to be completed and sent to journal for review by March 31, 1984 (Physiologia Plantarum or C.J.B.).

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.

   c. Attended the 1983 Federal/Provincial Nurserymen's Meeting, hosted by MNR in Hadashville, Manitoba, Sept. 13-14, 1983.

   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, AFDRTF and PRUF proposals.

Goals Added:

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 (Mills) and one student assistant (Haley).

   b. Coordinated greenhouse space allocation requests for 1984. Assigned space allocations for 1984 to NoFRC researchers and as an alternate for AFS Research Branch (Spruce Grove) if their facilities for 1984 are not completed at Smoky Lake (PRFN).

   c. Coordinated the purchase, installation and assessment of high pressure sodium lights in greenhouses #2 and #3, in cooperation with Hogan (LRTAP) and Schoendube (Chief Engineer). Modifications to greenhouse compartments and benches carried out to most effectively utilize new lights for all sizes of stock.

7. Initiated study on the promotion of early flowering in conifer seedlings through the use of extended photoperiod and/or growth regulator applications.

   a. Initiated and completed a study on the influence of light quality and extended photoperiod on the growth and development of 12 conifer species during the first half year of growth in the greenhouse. This was carried out and completed in cooperation with Sherry Wilson, a 1981 graduate in Forest Science at U. of A. who is currently enrolled in the Botany Dept., U.of A.as a special student completing physiology and biochemistry course work prior to enrolling in an M.Sc. program in tree physiology. Analysis and reporting of results will be complete in February 1984 and will satisfy requirements of an independent study carried out under the supervision of Dr. John Hoddinott, Botany Dept., U.of A. in cooperation with Dymock (NOR-10-192).

   b. Initiated and completed a study to determine the optimum container/pot size to be used for early promotion of flowering in wS and lP through the use of extended photoperiod, different light regimes, and/or growth regulator applications. This study was also carried out in cooperation with Sherry Wilson to satisfy requirements outlined under 7a. Data analysis and report preparation are in progress, and will be completed in early February 1984.

8. Initiated and completed a study of early growth and development in wS and 1P seedlings during shortening natural photoperiod and using different light regimes to supplement the daylength, with Elizabeth Powell as part of her requirements for completing Biology 30. Report to be prepared.

11. Goals for 1984-85:

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

a. Produce 1984 stock in sufficient numbers for all study requirements under NOR-10-192.

b. Complete cold hardiness tests on 1983 bS and 1P.

c. Complete dormancy tests on 1983 bS, wS, and 1P.

d. Evaluate 1983-84 data and prepare draft journal report on cold hardening and dormancy testing of bS and 1P during overwintering.

e. Initiate cold hardiness and dormancy testing of wS and rP and collect, preserve, and store replicates of wS and rP material for analysis of selected endogenous cellular metabolites during 1985-86.

f. Continue methods/bioassays development for studying the role of endogenous cellular metabolites of interest in tree seedling physiology.

g. Initiate study of the role(s) of selected endogenous cellular metabolites in cold hardening, dormancy, and overwintering of 1983 1P and bS seedlings.

h. Present a report on: "The influence of light quality and extended photoperiod during the first half year of growth of 12 conifer species grown under greenhouse conditions," at the 1984 Federal/ Provincial Nurseryman's Meeting to be hosted by the C.F.S. at the NoFRC during September 1984. The report will be subsequently published in the proceedings of the meeting.

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

a. Promotion of early flowering in conifers.

Initiate main study on promoting early flowering in 1P through use of extended photoperiod, differing light regimes, and growth regulator applications. Treatments to begin during February 1984, one month after seeding in 5.4 litre square BCFS pots. Material to be outplanted in NoFRC nursery in August 1984. Assessment of male and female flowering and subsequent cone/seed production to commence at yearly intervals during spring 1985.

b. Perform lecture and laboratory instructor duties in Forest Science 417 - Tree Seed Biology from February 14 to March 15, 1984 during absence of Dr. A.K. Hellum from the University of Alberta.

c. Begin cooperative research project with Dr. A.K. Hellum on lodgepole pine cone and seed maturation during June 1984. Initiation of this study is subject to approval of funds through PRUF.

3. Provide consultative services to NoFRC staff and CFS regional clients concerning tree physiology and cone and seed production. (NOR-10-192, Dymock)

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

5. Complete publication of the following 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.

12. Publications 1982-83:

Dymock, I.J. 19B3. Changes in the physiology of lodgepole pine seedlings during overwintering. Presented as an oral paper at the 25th Annual (Silver Anniversary) Meeting of the Canadian Society of Plant Physiologists, June 21-23, 1983 at the University of Waterloo, Waterloo, Ontario.

Dymock, I.J. 1983. A review of physiological investigations on cold hardening and dormancy processes in container grown nursery stock at the Northern Forest Research Centre. Presented as a report at the annual Federal/Provincial Nurserymen's Meeting hosted by the MNR, at Hadashville, Manitoba, September 13-14, 1983. To be published in proceedings during early 1984.

13. Signatures:

Investigator

Program Manager

Director

NOR-10-193

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture 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, Alberta; 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 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. 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) Subjects of interest include compaction and erosion effects upon tree stem and root growth, and length of time required to naturally ameliorate compacted sites.

Goals added:

6. Present paper to High Latitude Silviculture meeting at Fairbanks, Alaska on "Ecological classification of Alberta forests and its application for forest management."

7. Act as scientific authority on contract for design format of forest ecosystem field guide.

8. Write PAS descriptions for the following:

   a. Forest ecology research officer (term position now complete).

   b. Site productivity and ecology technician.

9. Prepare seminar for NoFRC audience, "Application of forest ecological classification for forest management."

10. Accomplishments in 1983-84:

1. Draft copies of information to be included in the forest ecosystem field guide were prepared and sent to government and industrial foresters for their review and comment. The field guide should be ready for publication by Mar. 31. A draft of a detailed report describing forest ecosystem types of western Alberta, should also be ready at this time.

2. Publications status:

   a. Vegetational indicators as independent variables in forest growth prediction in west-central Albera (NOR-10-193 Corns, Pluth) has been revised and accepted for publication by Forest Ecology and Management after rejection by Can. J. For. Res.

   b. Distribution of plant community types of west-central Alberta, in relation to selected environmental factors. (NOR-1D-193 Corns) has been published by Can. J. For. Res.

   c. Plants new to Alberta from Banff and Jasper National Parks (NOR-10-193 Achoff, Corns) has completed internal review and has been submitted to Canadian Field-Naturalist.

3. Draft report prepared on forest succession 24 years after clearcutting (Edson forest). (NOR-10-193 Corns).

4. Analysis and characterization of highly productive forest sites in our area has been initiated. Soil samples from several such sites sampled during the Biogeoclimatic inventory were analyzed for several micronutrients. (NOR-10-193 Corns)

5. Much of the available literature dealing with site modification during logging and site preparation has been reviewed. (NOR-10-193 Corns)

6. Presented paper, "Ecological classification of Alberta forests and its application for forest management," to the High Latitude Silviculture meeting in Fairbanks, Alaska. The paper was co-authored with R. Annas of the AFS Research Branch. Proceedings will be published by the USPA Forest Service, PNW Forest and Range Experiment Station.

7. Field guide design and format work was satisfactorily completed under contract supervised by IGWC.

8. PAS descriptions were written for the following:

   a. Forest ecology research officer (term position now completed).

   b. Site productivity and ecology technician to serve in NOR-10-193 project. Preliminary rating (EG-ESS6) is now completed by Personnel Branch.

9. Seminar presented to NoFRC audience, Sept. 22, 1983, "Application of forest ecological classification for forest management."

11. Goals for 1984-85:

1. Publish Information Reports on synthesis of ecological classification (including biogeoclimatic) data for field guide on western Alberta forest ecosystems and their management. (NOR-10-193, Corns and Annas)

2. Publish following reports:

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

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

3. Prepare draft report for review on forest succession 24 years after clearcutting (Edson forest). (NOR-10-193, Corns)

4. Continue data evaluation and plot selection for analysis and characterization of highly productive forest sites in the Region, with objective of determining potentially manageable chemical and physical factors (including several micronutrients). Existing data plus new plot data are required. Work plan to be provided. (NOR-10-193, Corns)

5. Continue literature review of effects of soil modification during logging and site preparation upon subsequent site productivity and inititate field study of same (possible contributions from study 135, 176, 190, 192 or cooperation with CWS). Work to be undertaken within an ecological classification framework. Work plan to be provided.

12. Publications 1983-84:

Corns, I.G.W. 1983. Forest Community types of west-central Alberta in relation to selected environmental factors. Can. J. For. Res. 13: 995-1010.

Annas, R.M., I.G.W. Corns, G. Barth and H. Habgood 1983. Common forest plants of west-central Alberta. File report. (To be included in field guide).

Corns, I.G.W. and R.M. Annas in press. Ecological classification of Alberta forests and its application for forest management. Proc. High Latitude Silviculture Comm. Meet., Fairbanks, Alaska, Aug. 14-17, 1983.

13. Signatures:

Investigator

Program Manager

Director

NOR-10-196

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 12, 1983

1. Project: Silviculture investigations

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

3. New: Cont.: X 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 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 south-eastern Manitoba. (NOR-10-196 Dyck).

   3. To initiate remeasurement of projects MS 226, 227, and 190 (at Pine Falls, Fish Road, Mantago 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". (NDR-10-196 Dyck and Froning)

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

10. Accomplishments in 1983-84:

1. Grafting of jack pine was carried out in March.

2. - Bella's plots of jP, rP, wS at 4X4, 6X6, 8X8, 10X10 spacings at Moody were measured (height, diameter, crown width and tree rating) (4 man weeks).

   - Thinning trials near Piney, Vassar and Hadashville were assessed for height and diameter (4 man weeks).

   - Hudson Bay poplar plot remeasurements (1 man week).

3. MS 226 field measurements at Pine Falls completed. MS 226 and 227 field measurements at West Hawk Lake completed. Results are being compiled on these two areas.

4. A reconnaissance of MS-226, 227, 190, 238 projects at Pine Falls, Fish Road, Mantago Ridge and other projects was carried out in early spring and late summer.

5. - Forestry Week at Hudson Bay; Dyck and Still looked after display, provided information, etc.

   - Gave a 30-minute presentation to the Alberta Foresters Annual Meeting at Whitecourt on optimization of container seedling sizes.

   - Attended Regional Reforestation Technical Committee meeting at Prince Albert.

   - Gave a slide presentation on Forestry for Careers Day at Kinuso.

   - Attended National CIF meeting at Sault Ste. Marie.

- Attended prairie nurseryman's meeting at Hadashville.
- Attended two Manitoba Forestry Association meetings.
- Attended one Manitoba CIF meeting.

Some herbicide work was carried out at Pine Falls and at the Agassiz involving liaison between Dupont, Abitibi, Dept. of Natural Resources and CFS.

Plot maintenance of Ives' mortality plots was carried out. Assistance was provided to Moody and Ives with jack pine budworm sampling and insect collection.

6. The Forest Management Note "Fertilization improves red pine seed production" which has been reviewed is being expanded to include data on 1983 seed production.

7. Terminate (incomplete).

11. Goals for 1984-85:

1. (a) Publish Information Report "Five-year performance of jack pine and white spruce container and bare-root stock on prepared burns in central Saskatchewan."

   (b) Compile, analyze and prepare a draft Forest Management Note on ten-year results of the above. (NOR-10-196, Ball)

2. Continue remeasurement of projects MS 226, 227 and 190 for analysis and preparation of case histories (Fish Road, Montago Ridge, Beaver Creek, etc.). (NOR-10-196, Ball and Dyck)

3. Perform silviculture liaison and technology transfer function with Manitoba and Saskatchewan clientele via Winnipeg sub-office. (NOR-10-196, Ball)

4. Continue to assess existing silvicultural research projects in Manitoba and Saskatchewan to determine suitability for remeasurement and reporting. Transfer files to Manitoba. (NOR-10-196, Ball)

5. Remeasure 20-year-old white spruce spacing trials at Riding Mountain for Bella. (Jamieson's study) (NOR-10-196, Dyck)

6. Remeasure MS238 "Regenerating cut-over X2B and V2 sites by planting and seeding on scalped strips, Manitoba Paper Company Limits" and prepare a Forest Management Note on 1965 establishment (area 2). (NOR-10-196, Ball and Dyck)

7. Publish Forest Management Note "Fertilization improves red pine seed production." (NOR-10-196, Dyck)

8. Remeasure MS-69 (one plot); co-operate with the National Park in regenerating the triploid clone and prepare a file report -- contingent upon National Park's co-operation. (NOR-10-196, Ball and Dyck)

9. Co-operate with Pidwirny's master's thesis on black spurce fertilization at Wabowden and Wanless; CFS will measure and analyze thinning plus fertilizer response, also, and prepare a file report. (NOR-10-196, Ball, Dyck and Pidwirny)

10. Prepare a FMN note on 3 sizes of container stock reared at P.R.F.N. as part of contract work with AFS at Grande Prairie (NOR-10-196, Ball and Walker).

12. Publications 1982-83:

Nil

13. Signatures:

Investigator

Program Manager

Director

NOR-12 Tree improvement

NOR-12-50

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

1. Project: Tree improvement

2. Title: Provenance tests for coniferous species.
   - Experiment a. (Formerly MS187) Provenance experiments with the white spruce of Manitoba and Saskatchewan.
   - Experiment b. (Formerly MS089) Red pine (Pinus resinosa) provenance experiment.
   - Experiment c. (Formerly MS088) Scots pine (Pinus sylvestris) provenance experiment.
   - Experiment d. (Formerly MS234) A test of twelve Norway spruce provenances from northern Europe and Siberia -- Riding Mountain Research Area.
   - Experiment e. (Formerly MS019) All-range jack pine provenance experiment, Manitoba-Saskatchewan sub-experiment.
   - Experiment f. (new) Geographic variation in black spruce, Northern Region component.

3. New: Cont.: X 4. No: NOR-12-050

5. Study Leader: J.I. Klein

6. Key Words: Geographic variation, seed sources, seed zones, Alberta, Manitoba, Saskatchewan, exotic species, Picea abies, Picea glauca, Picea mariana, Pinus banksiana, Pinus resinosa, Pinus sylvestris.

7. Location of Work: Wasagaming, Vassar, Piney, Mafeking, Sundown and Carberry, Manitoba; Holbein, Indian Head, and P.A. Pulp Camp 6, Saskatchewan; Reno, Alberta.

8. Study Objectives:

   1. To screen populations of conifer species for possible usefulness for planting in various areas within the Northern Region.

   2. To obtain an indication of the probable usefulness of further provenance testing or similar research with the species under trial and to guide the planning of such research.

3. To obtain information on patterns of geographic variation in the species under trial.

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

9. Goals for 1983-84:

Nil

10. Accomplishments in 1983-84:

Nil

11. Goals for 1984-85:

Scots pine:

1. Measure the test plantations following the 25th growing season after planting. (NOR-12-050, Klein)

Black spruce:

1. Measure the test plantations following the 10th growing season after planting. (NOR-12-050, Klein).

12. Publications 1983-84:

Nil

13. Signatures:

J D Klein
Investigator

Program Manager

Director

NOR-12-51

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 16, 1983

1. Project: Tree improvement

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

3. New: Cont.: X 4. No: NOR-12-051

5. Study Leader: J.I. Klein

6. Key Words: Pinus banksiana, progeny test, family test, seed orchard, forest genetics, tree breeding, artificial selection, grafting, clone bank, Saskatchewan; Manitoba, Alberta.

7. Location of Work: Sundown, Marchand, Stead, Oakbank, Boggy Creek, and Birch River, Manitoba; Smeaton, Meadow Lake, and Hudson Bay, Saskatchewan; Whitecourt and Wildwood, Alberta.

8. Study Objectives:

   1. To identify wild jack pine genotypes that are genetically superior in terms of economic yield for areas of major jack pine planting activity in the Northern Region.

   2. To produce scions or control-pollinated seed of the superior genotypes for propagation of seed orchard trees.

   3. To identify genetically superior source areas for seed collection.

9. Goals for 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 transparancies 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)

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)

10. Accomplishments in 1983-84:

1. There were no adverse comments on the first draft of the plan for cooperative development of Province of Manitoba seed orchards, and no final action on authority to implement the plan; hence there was no reason to revise the original draft.

2. The Information Report entitled "Establishment and First Results of a Jack Pine Breeding Program for Manitoba and Saskatchewan" was published.

3. The Forest Management Note entitled "Selection for Eastern Manitoba Seed Orchards Based on 10-Year Family-Test Results" was published.

4. Photo transparencies of breeding program materials were culled, labeled, and classified, and a subject index was compiled.

5. An illustrated talk on the jack pine breeding program, emphasizing plans for seed orchard development in Manitoba, was presented to the Manitoba Section of the Canadian Institute of Forestry in February.

6. The special report of maps and source lists for the breeding program was not completed. The time allotted for this goal was pre-empted by the unanticipated need to arrange fireguard installation around test plantations.

7. About 500 scions of selected eastern district families were grafted in February-March with a success rate of about 90%. Another 400 scions were grafted in May with less than 10% success.

B. The western breeding district family test was measured at 10 years from planting.

9. A manuscript on design and selection thinning of the seedling seed orchard at Birds Hill nursery, intended for publication in The Forestry Chronicle, is under review.

10. Additions to the graft inventory from successes among the 139 grafts made exceeded losses, mainly among 1982 grafts overwintered in pots, by 17, and the inventory of grafts required for clone bank completion increased only to 3100 of 3185 required, 50 grafts short of the goal.

11. About 1150 seed orchard grafts were made of central and western breeding district parent clones selected for superior five-year progeny height, with a success rate of better than 80%.

12. Advice was provided to cooperators and others on tree improvement techniques as required.

13. There were no contacts required on behalf of the national tree improvement program. Promotion of tree improvement in the region included a press contact under goal 5, and discussions with provincial officials.

11. Goals for 1984-85:

1. Prepare a regional tree improvement research strategy in anticipation of forestry development agreements and memorandums of understanding.

2. Publish a Forest Management Note on the 10-year results of the western breeding district family test.

3. Publish the manuscript entitled "Establishment of a jack pine seed orchard by dense planting and selection thinning" in the Forestry Chronicle.

4. Publish a journal paper on the 10-year results of the eastern breeding district family test.

5. Produce a special report of maps and source lists for the breeding program.

6. Revise and publish in a journal the voluntary paper submitted to the 1982 IUFRO genetics meeting.

7. Propagate trees for Province of Manitoba seed orchards by grafting and by controlled pollination of eastern breeding district families selected at 10 years.

8. Graft scions for a Province of Manitoba seed orchard of central breeding district parent clones selected at 5 years.

9. Graft about 150 scions, plant 175 grafts, and tend more than 3000 clone bank grafts to increase the inventory of grafts required for clone bank completion to 3130 of 3185 required, and to increase clone bank stocking to 2250 grafts. Likelihood of successful grafting for about 55 positions is poor or nil according to previous results or due to scion supply deficiencies.

10. Promote, coordinate, and enhance greater use of tree improvement technology in this region.

11. Act as regional contact for the national tree improvement program.

12. Implement moving of trees in Birds Hill 1972 seed orchard to adjacent new site at 5 m x 5 m spacing, and obtain seed pollinated after final thinning.

12. Publications 1983-84:

Publications:

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.

Klein, J.I. 1983. Selection for eastern Manitoba seed orchards based on 10-year family-test results. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. For. Manage. Note 24.

Reports:

Nil

13. Signatures:

J I Klein
Investigator

Program Manager

C. D Flynt
Director

NOR-13 Forest hydrology and microclimate research

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 7, 1983

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 1983-84: (Swanson unless otherwise noted).

   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/B3).

   4. Continue evaluation of Marmot Creek treatment.

   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.

   Goals added during year

   11. Provide climate and snow data to provincial officials and private consultants with respect to Mt. Allan (Marmot Experimental Watershed) selection as 1988 winter Olympic site.

   12. Prepare file report on climate, geology, soils and vegetation of Marmot Experimental Watershed (Hillman).

10. Accomplishments 1983-84:

   1. All data has been received and compiled for analyses. The provision of up-to-date data to various "olympic" consultants has taken an inordinate amount of time during 19B3. However, most of the data are now in easily accessible form. Therefore this report should be completed early in 1984.

   2. Carried over to 1984.

   3. Carried over to 1984.

   4. All climate data sites now equipped with digital data loggers, complete climatic instrumentation. The water survey of Canada has given us permission to try two pressure transducers to measure stream flow. Data collected by the Atmospheric Environment Service during 1981 and 82 needs to be obtained, abstracted from strip charts and compiled to maintain the integrity of the Marmot data records for treatment evaluation.

5. The model WATBAL was applied to the whole of Marmot basin in an effort to detect slow changes resulting from the Cabin sub-basin clearcutting (less than 5% of total Marmot area). The modeling was successful but the flow change was too small to be detected using this technique. The program that was written and the experience gained will be used in preparing an "Alberta WRENSS" at some future date. (Bernier)

6. Final analysis of the existing Streeter basin treatment indicated that a second treatment would be difficult to evaluate. Therefore plans for the 2nd phase treatment were cancelled.

7. A FORTRAN program for WRENSS was written for the University of Alberta computer and made available as a public file under USAS: WRENSS, (Bernier). A users guide and/or simplified procedure is planned for next year. (Bernier, Swanson).

8. Continued as CFS member NRC Associate Committee on Hydrology. Attended executive meeting 27 January, Ottawa and Annual Meeting 27, 28 June at Portage la Prairie. Appointed member of Research Priorities subcommittee. Prepared presentations on evaporation measurements in forest-clearing situations.

9. Thirteen formal meetings of the ad hoc provincial committee were attended to plan the pilot watershed management project. In addition, 20 days were spent either preparing material or reviewing - discussing submissions by other committee members. The first draft of the first report was completed on 17 October. The final FIRST PHASE report should be ready for submission to the ADM's for Forestry and Water Resources by 15 December.

10. a. Five meetings were held with AFS personnel in an effort to salvage the Tri Creeks project.

    b. Four meetings were held with lawyers and consultants regarding the effect of cutting in the Gladstone Valley area on water yield.

    c. Gave five lectures on watershed management and snow hydrology to University of Alberta classes in Forest Hydrology.

11. a. Organized and transferred data on cassette tapes from digital loggers to disk store on micro computer furnished by Alberta Watershed Research Program.

    b. Prepared computer programs to print out monthly and daily summaries of data stored on disk files.

    c. Provided summaries of Marmot snow and climatic data to Provincial and private consultants as requested. Also assisted with access to our archives.

12. File report was completed (Hillman).

11. Goals for 1984-85:

1. Publications: Complete and publish:

a. Forestry report on Marmot snow, Marmot Cabin Creek results, Streeter Basin results and Marmot Twin treatment description.

b. Range-Watershed Management Implications of the Streeter Basin Project. Information report coauthored by Swanson, Golding, Hillman, Singh and Telfer.

c. The Management of Lodgepole Pine Forests for Water. Symposium proceedings, Lodgepole Pine Symposium, May 8 to 16, 1984, Spokane and Vancouver.

2. Interaction with Provincial clients:

a. Convene Steering Committee, Alberta Watershed Research Program. (February 1984, tentative).

b. Provide assistance to the Watershed Management Section, Alberta Forest Service, regarding application of research findings to management problems, and the operation of the Tri Creeks watershed project.

c. Provide CFS input to ad hoc committee formed to evaluate the potential of watershed management in water supply via a pilot watershed management project.

3. Interaction with project scientists:

Complete installation and testing of instrumentation to measure evaporation from soil and vegetation in summer, evaporation and/or melt of snow in spring at the James River forest microclimate site.

4. Provision of data:

Assist in use of the Mount Allan snow data. Advise as requested in formation of master plan for the Mt. Allan-Marmot basin Olympic and recreational ski development.

5. Interaction with outside agencies and other NoFRC staff:

a. Attend meeting of Associate Committee on Hydrology subcommittee on Research Priorities, Ottawa, January 25, 1984.

b. Participate in review of existing and future role of NoFRC in hydrological research by Ottawa CFS staff and local client agencies.

c. Attend annual meeting of the Associate Committee on Hydrology as CFS member, Quebec City, June 13-15, 1984 (dates tentative).

d. Assist with 'problems' course for graduate student John Berry, University of Alberta. (John is conducting soil and snow measurements in conjunction with our studies at James River.)

12. Publications: Nil

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 7, 1983

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 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, PRDSPER, and SUBFEM models in conjunction with studies NOR-D84, 177 (Hillman, Bernier, Swanson).

Goals Added:

5. Install groundwater table observation wells on Cabin Creek subbasin to determine locations of phreatic divide (NOR-017).

6. Transfer future activities to NOR-13-177 and terminate study.

10. Accomplishments in 1983-84:

1. Report is in review.

2. First draft completed.

3. Completed March, 1983.

4. Six soil water transects were established in the openings and the forest on the James River snow study plots.

Added Accomplishments:

5. Eleven groundwater table observation wells were installed by Alberta Environment along two transects on Cabin Creek subbasin (NOR-017).

6. All future activities transferred to NOR-13-177 and Study terminated.

11. Goals for 1984-85:

Study terminated.

12. Publications: See NOR-13-177

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 7, 1983

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 micro-climatic 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 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.

Added Goal:

4. Transfer future activities to NOR-13-177 and terminate study.

10. Accomplishments 1983-84:

1. Four plots were established to sample a range of clearing sizes at the James River microclimate study site. N-S, E-W transects of soil moisture, soil temperature, wind speed, solar radiation, air temperature and relative humidity sensors were established across 3 and 5 H diameter clearings. All transects were wired but not instrumented in 1983.

2. Thirty trees were instrumented with heat-pulse sensors over the period 26 April to 29 August. Thermal diffusivity data were obtained for a 24-hour period and each tree was then sectioned, the sensors excised and actual wood moisture content determined by oven drying. One hour's thermal diffusivity data for each sensor was analysed. Preliminary results indicate that theoretically derived moisture content underestimates actual by a constant amount, indicating that some empirical calibration may be necessary.

3. All Ph.D requirements were completed. Degree conferred at January 2, 1983 convocation ceremony.

Added Accomplishment:

4. All future activities transferred to NOR-13-177 and study terminated.

11. Goals for 1984-85:

Study terminated.

12. Publications: See NOR-13-177

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 7, 1983

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 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.

   Added Goal:

   3. Transfer future activities to NOR-13-177 and terminate study.

10. Accomplishments 1983-84:

   1. A study was designed to utilize energy and water budgeting techniques to establish the amount of evaporation occurring from snow. Four sites, i.e., forested, 1-H clearing, 3-H and 5-H clearings were selected and soil moisture-temperature sensors were installed. Instrument tower transects were installed and prewired for later installation at wind, radiation, temperature and relative humidity sensors.

   2. The passive microwave method for measuring snow accumulation was reviewed and a draft report prepared.

   Added Accomplishment:

   3. All future activities transferred to NOR-13-177 and study terminated.

11. Goals for 1984-85:

   Study terminated.

12. Publications: Nil

13. Signatures:

R. H. Swanson
Investigator

Program Manager

P.Y. Bernier
Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 7, 1983

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, transpiration

7. Location of Work: Alberta

8. Study Objectives:

   1. To develop vegetation manipulation-hydrologic models applicable to the Saskatchewan River headwaters.

   2. To conduct studies as needed to elucidate energy exchange and utilization in the processes of snow accumulation, snowmelt, evaporation and transpiration in the various microclimates created by partial and/or complete forest harvest.

   3. To conduct studies as needed to elucidate soil water movement, content and withdrawal processes in the situations created by partial and/or complete forest harvest.

   4. Incorporate the results of studies dealing with individual components of the hydrologic cycle into watershed models.

   5. Communicate the models to forest-water resources managers in provincial and federal governments.

9. 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)

Added Goal

6. Develop a FORTRAN version of the WRENS procedure for use on the University of Alberta computer system.

10. Accomplishments for 1983-84:

1. Discussed possibilities of joint soil water-fiber production research with investigators (NOR-10). A statement of these discussions and possibilities was prepared.

2. WATBAL was successfully applied to Marmot data for the 1971 to 1981 data. A statement to this effect was prepared.

3. The WRENS routing procedure was studied in detail and judged nontransferable to local Alberta conditions. A statement to this effect was prepared.

4. Analysis of stormflow on the Marmot basin is not completed. Preliminary results indicate no change in stormflow due to Cabin treatment

5. The article was submitted to the Journal (Water Resources Research) for review in December.

Added Accomplishment

6. The procedure for all regions pertinent to Canadian conditions was successfully programmed on the University of Alberta computer system.

11. Goals for 1984-85:

1. Publications:

a. Submit for review:

1) Information report on Mount Allan snow conditions and winter climate. (Bernier - Swanson)

2) Management note or brief information report as a users guide to the use of WRENSS. (Bernier - Swanson)

3) Conduct literature review on fibre production and soil water related problems. (as information report - Hillman)

b. Submit for publication:

1) Journal article on use of the variable source area simulator in small forested basins (Water Resources Research: Bernier)

2) Journal article on the effects of Streeter basin treatment on soil water, in the Journal of Range Management. (Carried over from 1983-B4). (Hillman)

3) Journal article on simulation of the effects of forest cover removal on subsurface flow, in the Journal of Hydrology. (Carried over from 1983-84). (Hillman)

4) Journal article on the passive microwave method for measuring snow accumulation. (Atmosphere-Ocean or Canadian Water Resources Journal - Bernier).

2. Research activities:

a. Complete instrumentation of soil moisture, snow ablation and transpiration plots at James River study site. Conduct preliminary runs to establish adequacy of instrumentation and data prior to 1985 snowmelt and growing season. (Swanson, Hillman, Bernier, Hurdle and Robson).

b. Determine the location of the phreatic divide on Marmot-Cabin subbasin using water table information. (Hillman)

c. Test subsurface flow model (SUBFEM) on data from James River soil water transects (Hillman).

d. Initiate the development at a WRENSS-Like procedure for the forested portions of Alberta. (Bernier)

e. Continue analysis of Marmot stormflow data for possible use in routing technique. (Bernier)

12. Publications:

Hillman, G.R. 1983. SUBFEM: A subsurface flow model for a forest environment. Ph.D. Thesis. The University of Alberta, Edmonton. 276 pp.

Swanson, R.H. 1983. Numerical and experimental analyses of implanted-probe heat pulse velocity theory. Ph.D. Thesis. The University of Alberta, Edmonton. 298 pp.

13. Signatures:

P Y Bermis
Investigator

Program Manager

C. R. Hillman
Investigator

C. D. Kiil
Director A.D. Kiil

R. C. Simonson
Investigator

NOR-22 Remote sensing applications

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 28, 1983

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: W. Chow, R. Hall, & S. Price

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 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)

10. Accomplishments in 1983-84:

(1) Presentation made at Sixth International Symposium on Automated cartography, Hull, 18 October, "Computer Mapping for Biomass Inventories", with W. Chow as co-author. The Saskatchewan example for that database analysis presentation is included with examples from three other regional jurisdictions in a first-draft Information Report. Current MARS operating procedures are included as an Appendix. In addition, initial, informal proposals to update and expand MARS to meet projected regional requirements

10. Accomplishments in 1983-84: (Cont'd)

were made, and P/Y and technical support solicited, to Indian Affairs and Northern Development (DIAND), Regional Economic Development Program, and Forestry Statistics and Systems Branch.

(2) Landsat imagery, 1:250 000 scale topographic maps and theme separations, and selected survey photos have been acquired for six regional test areas. These areas are: Southwest Alberta Foothills (4 mapsheets), Pine Falls (1 mapsheet), Lesser Slave to Lac la Biche (4 mapsheets), Lower Liaird River (3 mapsheets, Wood Buffalo National Park (10 mapsheets), and Prince Albert to Duck Mountain (6 mapsheets). Unfortunately, the thematic mapper on Landsat-4 stopped operating, but a replacement satellite is scheduled to be launched in March 1984. In addition, agreement has been reached with the Alberta Ministry of Energy and Natural Resources for a joint examination of multi-level interpretation technique for the next phase of Alberta's forest inventory in one of those test areas (i.e. southwest Alberta).

(3) Procom-2 imagery mapping equipment has been acquired, and interest in it expressed by both Alberta and Northern Affairs, for updating forest maps for recently burned and clearcut lands in remote areas with satellite imagery. Possibilities for broad examinations of caribou ranges are also being considered.

(4) A completed manuscript for publication, "Operational mapping of all burned forest land in the Northwest Territories with satellite imagery", and related recommendations have been forwarded to the Forestry Statistics and Systems Branch.

(5) A visit to PFRC provided a review of their ecological mapping activities in the Yukon, and consultations with DIAND provided an indication of the appropriatness of such mapping in the Northwest Territories. A visit with DIAND in Hull has indicated that the most fruitful forest inventory support in the Territories for NoFRC would be the provision of large-scale photo sampling development expertise and the development of an updated and expanded computer assisted mapping database, analysis, and information management capability.

(6) Participated as an active member of the Alberta Advisory Committee on Remote Sensing with reviews and suggestions. Supported DIAND personnel with Landsat imagery reviews for large areas, and made Procom-2 equipment at NoFRC available for their use in mapping burned land. Also, assumed Scientific Authority responsibilities for a biomass contract extension following the departure of P. Golec. The assessments of burned forest land for salvage decisions goal was not accomplished because it ceased to be a priority in Saskatchewan. In addition, the Canada Centre for Remote sensing did not get funding for their Geographic Information Project in FY 1983-84, but funding is expected in FY 1984-85. This latter goal will be repeated.

(11) Goals for 1984-85:

(1) Publish Information Report on computer mapping for biomass inventories, and develop detailed specifications for a digital image analysis system that can be interfaced with a computer mapping system in collaboration with colleagues, clients, and possibly an outside contractor. (W. Moore and W. Chow).

(2) Prepare and submit a Forest Management Note for review on use of Procom-2 Image Transfer equipment for change mapping with Landsat imagery. (W. Moore)

(3) Prepare and submit an Information Report for review on environmental assessments with development of multi-level remote sensing interpretation for change and trend predictions. (W. Moore & R. Hall)

(4) Initiate acquisition of a state-of-the-art computer mapping system; for three-phase capabilities (i.e., inventory databases, database image analysis system; in conjunction with regional economic development agreements, forest insect and disease survey, and northern development programs; and in cooperation with a Forestry Statistics and Systems Branch lead - if funds become available. (W. Moore, W. Chow, and S. Price)

(5) Initiate acquisition of a state-of-the-art digital image analysis system for interface with a new computer mapping system - if funds become available. (W. Moore & W. Chow)

(6) Provide advisory services in remote sensing, and subsequent computer mapping, applications to NoFRC clients and colleagues as required, and particularly as follows: (W. Moore)

(a) act as scientific authority for biomass contract;

(b) initiate cooperation with the Remote Sensing Geographic Information Project of the Canada Centre for Remote Sensing, possibly as a member of a Working Group;

(c) continue technology-transfer assistance to DIAND for annual mapping of burned land with satellite imagery;

(d) continue coordination with, and promotion of, large-scale photo sampling development and technology transfer;

(e) continue as a member of the Alberta Advisory Committee on Remote Sensing.

12. Publications:

W.C. Moore. 1983. Operational mapping of all burned forest land in the Northwest Territories with satellite imagery. Technical Report Forestry Statistics and Systems Branch, Canadian Forestry Service, Environment Canada. Chalk River (In press)

W.C. Moore and W. Chow. 1983. Computer mapping for biomass inventories. Proceedings of Sixth International Symposium on automated Cartography. 16-21 October. Hull. Vol. 2, pp. 355-364.

W.C. Moore and W. Chow. 1983. Evaluation of the development and testing of MARS. Information Report. Northern Forest Research Centre, Canadian Forestry Service, Environment Canada. Edmonton. (in draft)

13. Signatures:

Investigator

Program Director

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 28, 1983

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 cooperative 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 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)

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. Complet 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 (CACRS) 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)

Added goals:

9. Participate in cooperative study in Alberta with REAP and AFS on applications of large-scale photography to resource inventories. Phase 1 includes an analysis of paired plots for forest inventory, range and wildlife habitats.

10. Determine specifications and supervise contracts for preparing the Alberta Forest Fire History Atlas for publication.

10. Accomplishments in 1983-84: (ref. goals 1983)

1. Modifications for larger access doors on the pod was completed, a new battery charger was built, remote aperture on camera 1 was re-installed, and film magazines were modified. Contract specifications with flowcharts for the new computer intervalometer was produced. DSS unfortunately delayed the contract and the work could not be completed within the 1983-84 fiscal year. Requisition is to be resubmitted in 1984.

   Approximately 100 line miles of photography at various scales were acquired for DIAND operational trials and is to be analysed in Whitehorse with NoFRC to advise as necessary. Technical and financial status of DIAND-Forest Resources indicate that they are currently not capable of handling their own camera system.

2. Modifications were made to produce operational programs utilizing Altek peripherals (x,y,z encoder and digitizer) and their HP 9826 micro. Computer programs include: LSP #1 for forest inventory, survey traverse, area digitizer #1, flight planning #1 and 2, sun angle #1 and 2, and various statistical programs. DIAND are now able to utilize much of their computer hardware acquired two years ago.

3. All courses, much image analysis work, and statistical data analysis were completed but the thesis work is not yet finished. A poster paper presentation was given at the 8th Canadian Symposium in Montreal held May 2-5, 1983, and a file report was written and reviewed.

4. Travelled to Toronto to visit Contractor's work, and to Newfoundland. Presentations and meetings were held with the Newfoundland Dept. of Forest Resources and Lands, Abitibi-Price Inc., and Geodata Inc. A brief trip to the field was made. Views were exchanged on collaborative efforts with a joint national user's manual considered to be difficult at the present time. Much work is needed.

10. Accomplishments in 1983-84: (cont'd)

5. Advice and assistance were provided to clients and colleagues on remote sensing including camera systems and flight planning, statistics, and on use of in-house HP 9825. Major presentations were given including AFS/REAP, and a CFS committee on forest damage appraisal. Attended meeting and conducted survey on natural resources related remote sensing activities since 1978 in the Prairie region, Yukon and NWT for the Forestry working group of CACRS. File report was completed and a portion will be published in the 1982 Annual CACRS report.

6. Submitted paper entitled, "Mapping the distribution of aspen defoliation using LANDSAT color composites" to the Canadian Journal of Remote Sensing.

7. Completed 2nd draft, "Considerations for use of large-scale aerial photographs in regeneration assessment".

8. LSP sampling developments in the Yukon are to be transferred to the Northwest Territories. DIAND appears to be undecided as to whether a local capability in NWT should be developed, or whether to contract all forest inventory and appraisal work.

9. Acquired 1:500 and 1:1000 color and CIR sampling photography in the C3 management unit. Provided guidance for photo preparation and field work. Analysis of photography and data analysis is in progress.

10. Supervised contract to produce Alberta base negatives and defined specifications for scribing.

11. Goals for 1984-85:

1. Supervise contract for computer intervalometer, and conduct operational trials in Alberta (REAP) and in the Yukon (DIAND) in the 1984 field season for several resource inventory applications. Collaborate with field work and advise on analysis and interpretation of LSP. Analyze data for reports. (R. Hall)

2. Publish information report "Considerations for use of large-scale aerial photographs in regeneration assessment, " and continue development of methodology for regeneration assessments with NeFRC and Alberta Energy and Natural Resources, and initiate preparation of User's Guide. (R. Hall)

3. Complete M.Sc. thesis on the analysis of simulated thematic Mapper data for forest and land cover classification in the NWT. (R. Hall)

11. Goals for 1984-85: (cont'd)

4. Provide advisory services and presentations in remote sensing for NoFRC clients and colleagues as required, particularly as follows:
   (1) To continue as member of the Forestry Working Group of the Canadian Advisory Committee on Remote Sensing. (R. Hall)

   (2) To be a member of the scientific and technical committee for the 9th Canadian Remote Sensing Symposium to be held in St. Johns during August, 1984. (R. Hall)

   (3) Supervise contracts to publish the Alberta Forest Fire History Atlas depending on available funds. (R. Hall and G. Delisle)

5. Write, update, and modify microcomputer programs for more efficient operations and additional applications. (R. Hall)

6. Supervise contract for a market survey on the camera system. (R. Hall and W. Moore)

12. Publications: 1983-84.

Hall, R.J., G.N. Still and P.H. Crown. 1983. Mapping the distribution of aspen defoliation using Landsat color composites. Cdn. J. Remote Sensing. in press

Hall, R.J. and P.H. Crown. 1983. Methodology and preliminary results of a thematic mapper simulation for forest and land cover classification in the Northwest Territories. File Report NOR-22-188.

Hall, R.J. and J. Hickey. 1983. Prairie region, Yukon and NWT survey on status of remote sensing applications since 1978. File Report submitted to the chairman of the Forestry Working Group CACRS report.

13. Signatures:

Ron Hall
Investigator

Program Manager

Director

NOR-23 Ecological land classification of National Parks

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 29, 1983

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 managment within the Parks.

9. 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)

Added goal:

5. To conduct final workshops to assist wardens in becoming familiar with the Banff-Jasper report and how to use it.

10. Accomplishments in 1983-84:

    1. Vols. I and II of the Banff-Jasper report were published. Vol. II was reprinted. Distribution is still continuing.

    2. A journal manuscript reporting rare and unusual vascular plants in Banff and Jasper was submitted to the Canadian Field-Naturalist.

    3. The brochure entitled "Using Biophysical Resource Inventory" is written. It is partially typed and rough layout is completed.

    4. Data collection for Cryosolic, Brunisolic, and Chernozemic soil climate study in Banff National Park was continued. Data analysis is currently underway. Data collection will continue until March 1984.

    Added Accomplishment:

    5. A workshop was held in Jasper N.P. to assist wardens in becoming familiar with the Banff-Jasper report and how to use it. Wardens from the B.C. parks were also in attendance.

11. Goals for 1984-85:

    1. Present final seminar to Banff-Jasper wardens on using the reports and inventory data.

    2. Publish journal manuscript entitled "Plants new to Alberta from Banff and Jasper National Parks". (Submitted to the Canadian Field-Naturalist.)

    3. Publish the brochure "Using Biophysical Resource Inventory".

    4. Prepare and submit for review and publish journal article on soil climate study in Banff N.P.

12. Publications:

    1. Holland, W.D. and G.M. Coen, General Editors. 1983. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks. Vol. I: Summary. AIP Pub. No. SS-82-42. Northern Forest Research Centre, Edmonton. 193 pp.

    2. Holland, W.D. and G.M. Coen, General Editors. 1982. Ecological (Biophysical) Land Classification of Banff and Jasper National Parks. Vol. II: Soil and Vegetation Resources. AIP Pub. No. SS-82-44. Northern Forest Research Centre, Edmonton. 540 pp.

12. Publications: (Cont'd)

3. Achuff, P.L. and I.G.W. Corns. Plants new to Alberta from Banff and Jasper National Parks. Submitted to Canadian Field-Naturalist.

4. Holland, W.D. Using biophysical resource inventory. (In preparation).

13. Signatures:

W.D. Holland
Investigator March 26/84

Program Manager

Investigator

Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 29, 1983

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, vegetaion inventory, land use interpretation guides, wildlife resources, aquatic resources

7. Location of work: Kootenay, Mount Revelstoke, and Glacier National Parks and Northern Forest Research Centre, Edmonton

8. 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, wildlife, and aquatic resource components.

9. 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*".

9. Goals for 1983-84: (Cont'd)

   4. Continue consultative advice, workshops, research, committees, etc. to client agencies and CFS staff, as required. (Holland)

10. Accomplishments in 1983-84:

   1. Field work was finalized in Mt. Revelstoke National Park and in Glacier N.P. Manuscript maps have been submitted to Ottawa for drafting and printing (October 1983). Final report writing is in progress, with a completion date of March 31, 1984.

   2. Discussions of integration of ELC with other projects were initiated.

   3. The thesis by Helen Dudynsky "Ecophysiology of Arctostaphylos uva-ursi" was completed in 1983.

   4. Consultive advice was provided to Parks Canada and to the Technical Committee for the biosphere reserve at Waterton Lakes N.P.

      Contributions were made to the Forestry Working Group subcommittee (CECSS; Canada Expert Committee on Soil Survey) on "Soil interpretations for forestry". Three papers were presented to the subcommittee in November.

      Consultive advice was provided to Vermilion College on course content and structure for training of technicians.

      A tour was made into the Castle River area with S.S. Malhotra and R.H. Swanson to examine the impact of harvesting lodgepole pine that had been killed by mountain pine beetle infestation.

      A trip was made with D. Pluth (U. of A) and J.D. Lindsay to the Carson Lake area north of Whitecourt to select sites for deep ploughing experiments after forest harvesting.

11. Goals for 1984-85:

   1. Provide camera-ready reports for the B.C. parks by March 31, 1984. Publication of reports will be as follows:

      1) Ecological (Biophysical) Land Classification of Kootenay National Park.

      2) Ecological (Biophysical) Land Classification of Mount Revelstoke and Glacier National Parks.

   2. Present final seminars in the above parks to assist wardens in becoming familiar with the final reports and how to use them.

11. Goals for 1984-85: (Cont'd)

3. Publish 3 papers for the Forestry Working Group subcommittee to CECSS (Canada Expert Committee on Soil Survey). Subject matter is on soil interpretations for forestry, with inclusion of the following publications in the CECSS' proposed Handbook of National Guidelines for Soil Interpretations for Forestry.

    1) Holland, W.D. Windthrow hazard. Discussion paper for the Forestry Working Group, CECSS, Dttawa, Nov. 14, 1983. In prep.

    2) Holland, W.D. Flooding hazard. Discussion paper for the Forestry Working Group, CECSS, Ottawa, Nov. 14, 1983. In prep.

    3) Holland, W.D. Frost hazard. Discussion paper for the Forestry Working Group, CECSS, Ottawa, Nov. 14, 1983. In prep.

4. Continuation of consultative advice to Parks Canada.

12. Publications:

Dudynsky, H.A. 1983. Photosynthesis and water relations in Arctostaphylos uva-ursi (L.) Spreng. M. Sc. Thesis, University of Alberta, Edmonton.

13. Signatures:

W.D. Holland
Investigator March 26/84

Program Manager

A.D. Kiil
Director A.D. Kiil

NOR-28 Environmental impact assessments and peatland ecology

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 10, 1983

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 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 P/Y], Addison [0.1 P/Y] Apps, Hogan [0.1 P/Y]; Brace in Wood Buffalo National Park)

   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)

10. Accomplishments 1983-84:

1. Report prepared and published on the natural resources of Bylot Island and adjacent Baffin Island (Zoltai)

2. Participated in assessment of development proposals: logging in Wood Buffalo National Park (Brace); Slave River Hydro Development (Zoltai); Beaufort Sea Hydrocarbon Development (Zoltai); Cruise missile testing (Zoltai)

3. Examined biotic and abiotic conditions on abandoned tailings of a uranium mine (Apps, Johnson)

4. Served as chairman of the Regional Transportation Committee (Zoltai)

5. Represented CFS on the Regional Screening and Coordinating Committee (Zoltai, Addison alternate)

6. Continued work on ecoclimatic regions of Canada as chairman of national working group (Zoltai)

11. Goals for 1984-85:

1. Conduct field work in the Wager Bay area, in preparation of a National Park development (Zoltai)

2. Participate in assessment processes of development proposals as required (Zoltai, Addison, Apps)

3. Develop and maintain expertise in assessing impacts of development proposals in the terrestrial environment in various parts of the region as opportunities arise (Johnson, Apps, Addison)

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 ecoclimatic region determination, as chairman the national working group (Zoltai)

12. Publications:

Zoltai, S.C., K,J. McCormick and G.W. Scotter. 1983. A natural resource survey of Bylot Island and adjacent Baffin Island, Northwest Territories. 176 pp.

13. Signatures:

S.C. Zoltai
Investigator

Program Manager

Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 10, 1983

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 1983-84:

   1. Prepare progress 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 progress report on field work performed in the peatlands of north-central Manitoba.

Added goal:

9. Attend field symposium on the classification of mires in Oulu, Finland.

10. Accomplishments in 1983-84:

1. Prepared progress report and presented symposium on peatland dynamics studies in Alberta.

2. Conducted field work in southern Manitoba, examining and sampling 59 different peatlands.

3. Collected, identified and curated 300 different species of vascular plants, 90 species of mosses, 20 species of liverworts, and 40 species of lichens.

4. Plant macrofossils collected in northern Manitoba were identified in 1400 samples.

5. Total elemental analysis for 13 elements were made on 2300 peat samples.

6. Radiocarbon date of 20 samples was determined.

7. Outline of three chapters for the book "Wetlands in Canada" was prepared.

8. Progress report on field work performed in north-central Manitoba was prepared.

Added accomplishments:

9. Attended field symposium on the classification of mires in Finland.

11. Goals for 1984-85:

1. Prepare progress report on field work in southeastern Manitoba (Zoltai & Johnson).

2. Conduct field work by examining and sampling in detail the vegetation, peat deposits, and surface water in at least 40 different peatlands in north-central Saskatchewan (Zoltai & Johnson).

3. Identify and curate collected plant samples (Johnson).

4. Identify plant remains in collected peat samples (Zoltai).

5. Determine the chemical properties of peat samples collected in 1983 (Zoltai).

11. Goals for 1984-85: (cont'd)

    6. Obtain radiocarbon dates for 16 peat samples from southeastern Manitoba (Zoltai).

    7. Conclude the preparation of three chapters for the book "Wetlands of Canada" (Zoltai).

    8. Prepare progress report on field work performed in the peatlands of central Saskatchewan (Zoltai & Johnson).

    9. Prepare and submit journal paper, entitled "Development of a wooded island in a fen" (Zoltai & Johnson).

12. Publications:

    Wells, E.D. and S.C. Zoltai. 1983. The Canadian system of wetland classification: Structure and application. Symposium on mire classification, Oulu, Finland.

13. Signatures:

S.C. Zoltai
Investigator

S. D. Johnson

Program Manager

A. Stelfox
Director

NOR-29 Forest resource data

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 9, 1984

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: formerly P.J. Golec, now vacant

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 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.

9. Goals for 1983-84: (Cont'd)

   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)

   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.

10. Accomplishments in 1983-84:

   1. a) Acted as Scientific Authority for 2 ENFOR contracts related to the biomass program. Both are completed.

      b) Four meetings were attended (2 CFIC and 2 CFS RC)

   2. Silviculture questionnaires have been prepared and sent out. The FMN will not be published in 83/84 as all questionnaires have not returned. Spring/summer of 84/85 seen as publishing time.

   3. Work on the PSP file continued in the summer of 83/84. Most of this work was directed at converting the records to a common format. The format is determiend by FSSB's COSMADS program.

   4. FSSB was supplied with federal land harvest data. No other inventory updates required this year.

11. Goals for 1984-85:

   1. Participate with the Forest 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. Responding to United States Forest Service (USFS) information requests is included.

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CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 9, 1984

1. Project: Forest resource data

2. Title: Forest resource and operations statistics in Prairie Provinces and N.W.T.

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8. Study Objectives:

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   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 1983-84:

   1. Participate with the Forestry Statistics and Systems Branch (CFS, PNFI) in the develpment and implementation of the Canadian Forest Resources Data Program (CFRDP) as required. Work involves commenting on conceptual planning, attending committee meetings and reviewing manuscripts.

9. Goals for 1983-84: (Cont'd)

   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)

   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.

10. Accomplishments in 1983-84:

   1. a) Acted as Scientific Authority for 2 ENFOR contracts related to the biomass program. Both are completed.

      b) Four meetings were attended (2 CFIC and 2 CFS RC)

   2. Silviculture questionnaires have been prepared and sent out. The FMN will not be published in 83/84 as all questionnaires have not returned. Spring/summer of 84/85 seen as publishing time.

   3. Work on the PSP file continued in the summer of 83/84. Most of this work was directed at converting the records to a common format. The format is determiend by FSSB's COSMADS program.

   4. FSSB was supplied with federal land harvest data. No other inventory updates required this year.

11. Goals for 1984-85:

   1. Participate with the Forest 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. Responding to United States Forest Service (USFS) information requests is included.

11. Goals for 1984-85: (Cont'd)

    2. Assist with the drafting of a Forest Management Note on national silvicultural data (with L. Brace - NOR-10). Also, make any necessary changes to questionnaires and distribute for 82/83 and 83/84 data.

    3. Complete cataloguing of NoFRC's PSP's and put with common format.

    4. Supply CFRDP with updated inventory information for the region as it becomes available. Much of this information will pertain to the 1986 national inventory.

    5. Coordinate updating and expansion of regional data bases (e.g. mechanization of silviculture, economics).

    6. Cooperate with FSSB in the collection of forest depletion (harvesting, fire, insect, and diseas, etc.) and accrual (growth, afforestation, regeneration, etc.) statistics for the region.

12. Publications 1982-83:

    No publications for 1982/83.

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-31 Climatic studies

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1983

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 1983-84: (Some of goals have been transferred form 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 AES) 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).

Added Goals:

11. Act as Scientific authority for a service contract to undertake X-ray densitometric analysis of tree rings from Imperial Mills, Alberta, and of a PRUF contract for X-ray densitometric analysis of Douglas fir tree rings from Banff. (J. Powell).

12. Prepare and publish an invited contribution on the role of Richmond Longley in the study of climate variation in Canada. (J. Powell).

13. Attend workshop on linear and nonlinear model fitting and other statistical treatments organized by the Professional Institute of Education. (T. Singh).

10. Accomplishments in 1983-84:

1. The review of the two ENFOR Contract reports was completed; one is published and the other is at the final preparation stage for publication as an information report. A brief summary of both studies was submitted for the Directory of the Bioenergy Council (Washington, D.C.). (J. Powell)

2. The paper on the "History and Development of the Canadian Climate Program" was accepted for publication in "The Dperational Geographer". (J. Powell)

3. Analysis of climatic variation in the boreal forest subregions and the long-term variation based on the instrumented records in the region was completed. Monthly temperature and precipitation data were obtained from the AES for the period of record for all stations in our region. A manuscript entitled "Climatic variation in the boreal forest zone of the prairies and Northwest Territories" has been prepared and has received first review. Further analyses of the temperature and precipitation long-term records are underway to extend the study to other aspects. (T. Singh, J. Powell)

4. Further soil temperature and near ground air temperature data was extracted for two areas for one year to make the data more amenable for analysis. The digitized data are now awaiting completion of data punching pending statistical analysis. The needed computer programs were written for HP and PDP computing systems. Report preparation awaits completion of the data punching and further analysis. (J. Powell, T. Singh)

5. Table of temperature, precipitation and radiation data according to the years 1971 to 1977 were prepared showing totals for each month and a seasonal average (May to September) for each location grouped by lease working circles. Tables were also prepared for wind direction, and others showing plot location aspects, number of degree days above 0° and -22°C, first and last frost, growing days and degree days. Information was provided to the Climate Inventory Program of Alberta Energy and Natural Resources, for stations with three years of summer data, for use in their normalization program and as information for the Hinton lease area. (J. Powell)

6. Discussions were held with Forintek on preparing a note on the use of black spruce in dendrochronology but input time was not available. Recent discussions indicate that preparation of a note should be attempted in 1984. (J. Powell)

7. Data to establish climatic effects on tree growth has been obtained from Forintek along with a listing of programs used

so far, including work undertaken with Engelmann Spruce near the Columbia Icefields. The analyses require use of statistical packages through a AJ 510 terminal connected to U.of A. Familiarity was gained on the use of available computer programs and their modification to meet our requirements through a visit to Forintek and through receipt of a data tape package from them. (T. Singh, J. Powell)

8. A brief note on use of tree rings in providing biomass productivity values was prepared jointly with Forintek for the "Forestry Report" on "Growth, Yield and ENFOR". Preparation of a more expansive paper was delayed pending completion of analysis of the current Forintek project, funded through the CFS core funding, which included the collection of four further tree-ring sites of approximately 100 years old in Alberta. Assistance was provided in the collection of these samples for this extension of the original ENFOR P-149 project which mainly collected 200-year old samples in Alberta which were not directly comparable with the 100-year old material collected from Manitoba. (See also goal 13, and NOR-34-180, goal 11.5) (J. Powell)

9. The organization and running of the 17th Congress of the Canadian Meteorological and Oceanographic Society, held at Banff in May was successfully completed, through acting as Chairman of the Local Arrangements Committee and as a member of the Scientific Program Committee. A 40 page report on the Congress, which was attended by 221 registered delegates who gave 145 paper presentations, was prepared for the National Executive and submitted in August. (J. Powell)

10. Contact was maintained with the Canadian Climate Centre and the Canadian Climate Program. Attended one meeting of the national Climate Advisory Committee (CAC) as CFS representative, and one meeting of the Canadian Committee on Climatic Fluctuations and Man (CCCFM), a subcommittee of the CAC. At the latter meeting I was elected as the new Chairman of the CCCFM one of whose immediate tasks at the request of the Climate Planning Board (CPB) through the CAC was to strike a Task Force on Proxy Data. This Task Force met in May and will again meet in January at time of annual meeting of CCCFM to develop a climate scenario using proxy data. Represented the CFS on the Canada Department of Agriculture Expert Committee on Agrometeorology and presented a report while the 1982 report was published. For this Committee I served on a subcommittee to review the recommendations of the Agriculture-Climate CCP 1979 Workshop to indicate status of action on the recommendations. Also provided a report and attended the Alberta Agrometeorology Advisory Committee and represented them at the national meeting. Attended the CFS/AES Working Group meeting on Forest Meteorology at PNFI, and acted

as Technical Advisor for the AES/CFS Review of Meteorological Services to Forestry. Compiled the CFS report for the Meteorology and Atmospheric Sciences section of the 1983 volume of the Canadian Geophysical Bulletin, while the 1982 report 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 1983, while the 1982 report was published. Represented the NoFRC at the Alberta Climatological Association meeting presenting a report which will be published in the Proceedings. Represented the CFS at a Drought Seminar in Regina sponsored by the CPB. Again served on the Western Research Program of Forintek Canada Corporation Subcommittee on "Characterization of Wood" which reviews and recommends research programs for the Wood Science Dept. of Forintek. Served on the Biological Sciences Advisory Committee of NAIT, on the Alberta Fish and Wildlife Advisory Council, since March as Councillor for the Rocky Mountain Section of the Canadian Institute of Forestry, and attended Western Region Fire Weather Committee. Attended the International Meeting on Critical Periods in the Quatenary Climate History of Northern North America sponsored by the NMNS Climatic Change in Canada Project. Represented the NoFRC at a forest/wildlife workshop on research and management within the St. Regis (Alberta) Ltd. lease area, and since have compiled a listing of all studies carried out by NoFRC for a directory of resource research studies (past and present) undertaken on the lease area. Further 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.". (J. Powell)

Added Accomplishments:

11. A service contract with report entitled "X-ray densitometric analysis of tree rings from Imperial Mills, Alberta" was completed by Forintek. The material from this 100 year site had been collected under ENFOR P-149 but had not been analysed under that contract as there were insufficient funds. The annual biomass accumulated at this site was 4.3 g for 100 years for a 1-cm-thick breast height disk, which is significantly higher than for the older (200+ years) Alberta-NWT sites, but very similar to the 100 year old Manitoba sites analysed under ENFOR P-149.

    A PRUF contract was awarded to the University of Alberta who in cooperation with Forintek plan to undertake X-ray densitometric analysis of 600 year old Douglas fir tree rings obtained from Banff in 1979. Recently short increment cores were obtained by NoFRC from the earlier sampled trees to extend the record to 1983. The analysis is currently 40 percent completed. (J. Powell)

12. A contribution entitled "Richmond Longley and Climatic Variability in Canada" was recently published in "Climatic Change in Canada 3" by the National Museum of Canada. A photo of Longley was also

provided to the Museum, and used as a frontispiece as the volume is dedicated to his memory. (J. Powell)

13. A course in "Linear and Nonlinear Model Fitting" was attended which provided an insight and knowledge of advanced statistical packages (SAS, BMDP) which incorporate applications for explanatory, variable selection, and estimation or prediction which will be used in our climatology and other studies. (T. Singh)

11. Goals for 1984-85:

1. Publish paper on "Climatic variation in the boreal forest zone of the prairies and NWT". (Carried over from 1983-84). (T. Singh, J. Powell)

2. Prepare and submit for review a report on the growing season climate of four clearcut areas associated with a seedling growth study (NOR-4-045). (Carried over from 1983-84.) (J. Powell, T. Singh)

3. Prepare a report to summarize the temperature climate of clearcut forested areas in the Hinton region (J. Powell, T. Singh)

4. Continue to provide climatic and statistical advice and information to colleagues. Represent CFS and NoFRC on various advisory committees or working groups. (J. Powell, T. Singh)

5. Serve as chairman of the Canadian Committee on Climate Fluctuations and Man and the CCP Task Force on Proxy Data, including organizing a workshop and developing an action plan on proxy data for the CPB; and member of other CCP committees. (J. Powell)

6. Act as Scientific Authority for a PRUF contract for X-ray densitometric analysis of Douglas fir tree rings for Banff. (J. Powell). Act as scientific authorities for other contracts as required (J. Powell, T. Singh)

7. Undertake analysis of short-term climatic data for 150 stations in the central Canadian boreal forest zone. (T. Singh, J. Powell)

8. In cooperation with Forintek prepare a short contribution on the use of black spruce in dendrochronology (J. Powell). (Carried over from 1983-84.)

9. Assist Forintek in preparing a paper on tree-ring analysis and biomass estimates based on samples collected under P-149 and in 1983 under a Forintek Core funded program in Alberta. (Carried over from 1983-84). (J. Powell, T. Singh)

10. Continue statistical analysis to better establish climate-growth relationships in the north-south tree-ring transect data and possibly initiate preparation of a report. (T. Singh)

11. Initiate analysis of soil temperatures after clearcutting. (J. Powell, T. Singh)

12. Initiate analysis of information on paired climate stations (open and in forest). (J. Powell, T. Singh)

12. Publications:

[Powell, J.M.] 1982. Canadian Forestry Service. pp. 99-100. In Canadian Geophysical Bulletin, Vol. 35. Energy, Mines and Resources Canada, Earth Physics Branch, Ottawa. 196 pp.

Powell, J.M. 1982. Canadian Forestry Service. pp. 1B-19, Appendix III. Report of the 24th Annual Meeting of the Expert Committee in Agrometeorology. November 4-5, 19B2. Agric. Can., Ottawa. 37 pp. + Appendices.

[Powell, J.M.] 19B2. Canada/Environment Canada, Canadian Forestry Service, Northern Forest Research Centre. pp. 166-169. In Barr, B.M. (compiler and editor). The Canadian Association of Geographers Directory 19B2. 233 pp.

Powell, J.M. 1983. Richmond Longley and climatic variability in Canada. pp. 337-343. In Climatic Change in Canada 3. C.R. Harington (Ed.). National Museum of Canada, National Museum of Natural Sciences, Syllogeus No. 49.

Jozsa, L.A., S.G. Johnson and P.A. Bramhall. 1983. X-ray densitometric analysis of tree rings from Imperial Mills, Alberta. Forintek Canada Corp., Vancouver, B.C. Contract No. 02-B0-68-593. 10 p.

Singh, T. 1983. A proposed method for preliminary assessment of erosion hazards in west-central Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-251.

13 Signatures:

J.M. Powell
Investigator

Program Manager

T. Singh
Investigator

Director A.D. Kiil

NOR-33 Scientific and technical information

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1983

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 G.B. Turtle

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 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)

Goal added:

11. Participate on a committee to review NoFRC's word processing requirements, survey available equipment, and recommend to management a suitable system to replace the existing Xerox 850s and possible additional equipment. (Samoil)

9. Accomplishments in 1983-84:

1. Assisted staff in the publication of 10 Information Reports (762 printed pages) and 52 journal articles and miscellaneous publications (520 printed pages). A list of 1983 publications (total of 74) appears in Section 11. The two special technical reports -- insects of the prairie provinces and diseases of the prairie provinces -- were not written.

2. Assisted in the preparation of 9 Forest Management Notes (42 printed pages) and 1 Forestry Report (12 printed pages).

3. The Program Review 1982-83 was prepared and printed (56 printed pages).

4. Wrote specifications for and monitored the printing and reprinting of locally produced scientific and technical publications. Rewrote the specifications for and implemented another standing offer agreement for printing.

5. The NoFRC Forestry Newsletter was prepared and printed monthly throughout the year.

6. 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.

7. Continued to respond to requests from the public by mailing out publications or handing them out in person to those who visited NoFRC.

8. Continued responsibility for lobby displays, display equipment, and tending of NoFRC displays in shopping malls, at meetings, and at fairs.

9. Costs for printing self-cover Information Reports are now included in the standing offer agreement for printing.

10. The integration of word processing equipment with other typesetting and information systems was investigated. An attempt will be made in the coming year to establish an internal network using the building's white telephone system. A phototypesetter is being acquired and will be connected directly to the word processor system.

11. As a result of the committee's investigation, recommendations were made for the purchase of AES word processing equipment and an AM Varityper phototypesetter. Requisitions and specifications were prepared and sent to CFS headquarters for approval and action.

10. Goals for 1984-85:

1. Assist the research staff, through the provision of editing and publishing services, in the preparation and publication of approximately

   a) 20 Information Reports
   b) 7-10 Forest Management Notes
   c) 3 Forestry Reports
   d) 2 Pest Leaflets, and
   e) 40 journal articles and miscellaneous publications. (Samoil, Turtle)

2. Assist in the preparation of two special technical reports (possibly as Information Reports) on Insects of the prairie provinces and Diseases of the prairie provinces. (Samoil, Turtle)

3. Prepare and publish the Program Review 1983-84 of the Northern Forest Research Centre. (Samoil, Turtle)

4. Prepare NoFRC post cards to be used as reprint request cards and general message cards. (Samoil)

5. Oversee the revision and reprinting of 22 pest leaflets. (Samoil)

6. Oversee printing and reprinting of locally published scientific and technical information. (Samoil)

7. Continue responsibility for the production and printing of the monthly NoFRC Forestry Newsletter. (Samoil, Turtle)

8. Continue responsibility for the distriubtion of NoFRC publications, maintaining the mailing list, responding to requests for scientific and technical information, and carrying out the necessary correspondence. (Samoil, Turtle)

9. Continue to respond to requests from the public for general information and specific publications. (Samoil, Turtle)

10. Continue responsibility for display equipment. (Samoil, Turtle)

11. Publications:

See attached list.

12. Signatures:

Investigator

Program Manager

Investigator

Director

LIST OF PUBLICATIONS, 1983

INFORMATION REPORTS

Brace, L.G., et P.J. Golec. 1983. Statistiques sylvicoles canadiennes 1975-80. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-245F.

Carlson, L.W. 1983. Guidelines for rearing containerized conifer seedlings in the prairie provinces. Rev. ed. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-214E.

Chrosciewicz, Z. 1983. Jack pine regeneration following postcut burning and seeding in southeastern Manitoba. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-252.

Chrosciewicz, Z. 1983. Jack pine regeneration following postcut burning and seeding in central Saskatchewan. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-253.

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Moody, B.H., and H.F. Cerezke. 1983. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1982 and predictions for 1983. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-248.

Peterson, E.B., N.M. Peterson, and R.D. Kabzems. 1983. Impact of climatic variation on biomass accumulation in the boreal forest zone: Selected references. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-254.

Singh, T. 1983. A proposed method for preliminary assessment of erosion hazards in west-central Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-251.

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Klein, J.I. 1983. Selection for eastern Manitoba jack pine seed orchards. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 24.

Ogilvie, C.J., and P. Bihuniak. 1983. An inexpensive, portable forest fire-finder. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 25.

Ondro, W.J., and H.M. Stewart. 1983. Harvesting forest biomass with a Dika side cutter. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 23.

Singh, T. 1983. FORTRAN subroutines for biomass computation. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 22.

Singh, T. 1983. Weight tables for important tree species in the Northwest Territories. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 27.

Wong, H.R., and R.C. Tidsbury. 1983. Introduced pine sawfly in Manitoba. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 26.

Zalasky, H. 1983. Field storage of containerized conifer seedlings. Environ. Can., Can. For. Serv., North For. Res. Cent., Edmonton, Alberta. For. Manage. Note 20.

Zalasky, H. 1983. Optimizing containerized conifer seedling production in the prairie region. Environ. Can., Can.For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note 21.

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Samoil, J.K., and G.B. Turtle (eds.). 1983. Fire. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Rep. 28.

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Alexander, M.E., and D.E. Dubé. 1983. Fire management in wilderness areas, parks, and other nature reserves. Pages 273-297 in R.W. Wein and D.A. MacLean, eds. SCOPE 18: the role of fire in northern circumpolar ecosystems. John Wiley and Sons, Chichester, England.

Alexander, M.E., B. Janz, and D. Quintilio. 1983. Analysis of extreme wildfire behavior in east-central Alberta: a case study. Pages 38-46 in Seventh conference on fire and forest meteorology, April 25-28, 1983, Ft. Collins, Colo. American Meteorological Society, Boston, Mass.

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Bella, I.E. 1983. Natural lodgepole pine in west-central Alberta. Part I: Regeneration stocking. In Lodgepole pine: regeneration and management. Proceedings of the fourth international workshop. U.S. For. Serv., Pac. Northwest For. Range Exp. Stn. Gen. Tech. Rep. PNW-157.

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Dubé, D.E. 1983. Fire management activities in Canadian national parks: an update. In Fire -- its field effects. Proceedings of a joint Fire Council meeting, October 19-21, 1982, in Jackson, Wyoming.

Delisle, G.P., and D.E. Dubé. 1983. One and one-half centuries of fire in Wood Buffalo National Park. Page 12 in Fire. Environ. Can., Can. For. Serv., Edmonton, Alberta For. Rep. 28.

Edwards, I.K. 1983. The effect of N, P, and K on early growth of containerized red pine and black spruce. In Proceedings of the annual federal-provincial nursery meeting held at Hadashville, Manitoba, September 13-15, 1983.

Edwards, I.K. 1983. Nutrient deficiencies and their correction in white spruce. In Proceedings of the annual meeting of the B.C. Nursery Association in Prince George, B.C., September 27-29, 1983.

Haggerty, D., R. Newstead, and E. Stechison. 1983. Evaluation of fire bombing aircraft. Can. For. Ind. 103(8):21-24.

Hall, R.J., G.N. Still, and P.H. Crown. 1983. Mapping the distribution of aspen defoliation using LANDSAT color composites. Can. J. Remote Sensing 9(2):86-91.

Hiratsuka, Y., H.F. Cerezke, and J. Petty. 1982. Important forest insects and diseases. Prairie region 1979. In Forest insect and disease annual report 1978 and 1979. Environ. Can., Can. For. Serv., Ottawa, Ontario.

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Newstead, R.G., and M.E. Alexander. 1983. Short-term fire retardant effectiveness in a lowland black spruce fuel complex. Pages 3-4 in Fire. Environ. Can., Can. For. Serv., Edmonton, Alberta. For. Rep. 28.

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NOR-34 Forest biomass as an energy source

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: 2 December 1983

1. Project: Forest biomass as an energy source

2. Title: An assessment of the energy potential of forest biomass in the Prairie Provinces and the Northwest Territories

3. New: Cont.: X 4. No.: NOR-34-180

5. Study Leader: J.M. Powell

   Co-operators: I. Bella, L. Brace, W. Chow, I. Edwards, W. Moore, W. Ondro, T. Singh

6. Key Words: Biomass, energy, fuels, climate, productivity, availability, harvesting, simulation models, resource data, impacts.

7. Location of work: Western and Northern Region

8. Study Objectives:

   1. To develop and test biomass prediction equations for regional tree species and lesser vegetation and demonstrate their integration with resource inventory programs.

   2. To investigate the impact of biomass removal on site quality, nutrient status, silvicultural option and long-term site productivity on selected sites in the prairie provinces.

   3. To determine production and delivery costs of biomass under various operation conditions and to provide a basis for evaluating the feasibility of using various forms of biomass for energy.

   4. To develop and operate a computerized biomass data bank and information retrieval system to provide for more effective use of information and technology transfer.

9. Goals for 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). (NOR-31-179)

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). (NOR-31-179).

6. Publish a FMN on "Harvesting forest biomass with a Dika Side Cutter". (P-163) (W. Ondro). (See also NOR-3-123)

7. Complete and publish report on "Downed-dead wood estimates in central Alberta forest cover types" (P-23) (T. Singh).

8. Publish a journal article or information report on "A stand growth model for trembling aspen in the Prairie Provinces" (P-102) (Scientific Authority: I. Bella).

9. Provide contributions on ENFOR studies for the "Forestry Report" on Growth/Yield and ENFOR (I. Bella, I. Edwards, W. Moore, W. Ondro, J. Powell, T. Singh).

10. Continue coordination of NoFRC ENFOR projects insuring their completion and publication, and to act as establishment representative on national and regional committees. Submit reports to Bioenergy Council and NRC Bioenergy Program as required. (J. Powell).

Added Goals:

11. Initiate a contract to "Integrate utilization for wood products and energy in Manitoba" (P-254). (J. Powell, K. Froning).

12. Undertake a contract to provide "Green and dry wood densities of tree species in the region" (P-255) (Scientific Authority: T. Singh).

13. Initiate a contract for the national program for a "Compilation of forest biomass inventories for Manitoba" (P-270). Scientific Authority: T. Singh).

14. Complete a contract for the national program of "Non-destructive sampling of non-inventoried areas and nonsampled cover types in the prairie provinces and Northwest Territories" (P-273) (Scientific Authority: P. Golec). This project was later extended to "Determine the quantitative areas of each stratum of non-inventoried and non-sampled cover types in the prairie provinces". (Scientific Authority: W. Moore).

10. Accomplishments in 1983-84:

1. Presentation of "Computer Mapping for Biomass Inventories" was made to the Sixth International Symposium on Automated Cartography, Hull, 18 October, with joint authorship with W. Chow. The Saskatchewan example map for that database analysis demonstration is included with the three other regional examples (i.e., from Manitoba, Alberta and Northwest Territories) in a first draft Information Report. Copies of the "Computer Mapping for Biomass Inventories" paper were circulated to regional clients as a demonstration of the NoFRC system, and negotiations with Alberta about sharing data with their newer generation system are progressing. (P-14B and expansion; see NOR-22-142). The needed biomass equations, developed under other ENFOR projects, and how these could be used were provided at different stages of the above demonstration for converting conventional forest inventories to biomass estimates for the prairie provinces.

2. Checked analytical data for vegetation and soils as they were submitted by the contractor. To date, all vegetation and soil samples have been analysed for total N, P, K. Ca, Mg and S (approximately 5600 vegetation samples and 600 soils). Repeat analyses were requested on 71 samples, the results for which seemed anomalous. Analysis of soils for plant-available nutrients is complete except for N. (P-207)

3. A summary report on "Analysis of integrated utilization of aspen for wood products and energy" was prepared, and is currently being reviewed and edited. (P-207)

4. The information report on "Impact of climatic variation on biomass accumulation in the boreal forest: selected references" was reviewed, edited and has now been published. (P-150)

5. The information report on "Impact of climatic variation on boreal forest biomass through the use of tree ring analysis" was further reviewed, edited and is now in final preparation for publishing. (P-149)

6. A FMN "Harvesting forest biomass with a Dika Side Cutter" was published. (P-163)

7. The draft report on "Downed-dead wood estimates in central Alberta forest cover types" was reviewed. It was decided to rework the data; the original contractor tapes were obtained and a new draft of the report is in preparation. (P-23)

8. A ms. on the stand growth model for trembling aspen prepared by the contractors was rejected by a journal. A draft information report on the contract work with further analysis is now being prepared by the contractors for submission to the scientific authority by the end of the year. (P-102)

9. The following contributions from the ENFOR program are currently being edited for a "Forestry Report" on "Growth, Yield and ENFOR".
   - ENFOR studies in the western and northern region (J. Powell)
   - Biomass weight tables for the prairie region (T. Singh)
   - Determination of annual stem-wood biomass productivity (J. Powell, L. Jozsa)
   - Harvesting aspen for energy may be economic (W. Ondro)
   - Integrated utilization makes aspen an economic resource (W. Ondro, I. Bella)
   - Aspen as an energy source - problems ahead? (I. Edwards, I. Bella)

10. Coordination of the NoFRC ENFOR projects continued; regular contacts were maintained with HQ's and FSSB to ensure national goals are obtained. Five project submissions were prepared for the Bioenergy Council for publishing in their Directory.

11. Discussions were held on several occasions with MANFDR in an effort to initiate this project but they eventually were not fruitful and the assigned funding was returned to the ENFDR Secretariat.

12. Approximately 775 samples for green volume specific gravity analysis were collected under contract P-273, at 56D plots in Manitoba, 100 in Saskatchewan, 70 in Alberta and 20 in NWT. Of the total 1238 samples collected, 25 samples largely from Alberta and NWT were unuseable. The Manitoba samples are now being analysed under contract P-255 with a report due by March 31, 1984.

13. Work is underway on the contract. The needed biomass equations were supplied to Manitoba Data Service according to the requirements and specifications of Manitoba and FSSB for development of the biomass inventories from Manitoba for the national inventory.

14. Sampling was completed under contract and a report has been received entitled "Non-destructive sampling of non-inventoried areas and non-sampled cover types in the prairie provinces and Northwest Territories". The report has been forwarded to FSSB for use in developing the national biomass inventory. The

contract has recently been expanded to include a determination of quantitative areas of this forested land, by stratum, for the prairie provinces, so that realistic inventory values can be established.

11. Goals for 1984-85:

1. Publish information report "Impact of climatic variation on boreal forest biomass through the use of tree ring analysis" (P-149), (Scientific Authority: J. Powell). (Carried over from 1983-84).

2. Complete review, edit and publish summary report on "Analysis of integrated utilization of aspen for wood and energy" (P-207, (Scientific Authority: W. Ondro). (Carried over from 83-84).

3. Review contract report on "Determination of nutrient and biomass status of aspen ecosystems in north-central Alberta" and prepare for publishing (P-205), (Scientific Authorities: L. Brace, I. Edwards). (See also NOR-10-135).

4. Provide advice as required for the completion of the second phase of national project (P-273) to determine quantitative areas of non-inventoried forested land, by stratum, for the prairie provinces (Scientific Authority: W. Moore).

5. Complete and publish information report on computer mapping system for biomass using four regional maps as examples (W. Moore) (extension of P-148, see also NOR-22-142). (Carried over from 83-84).

6. Prepare and submit for review a report on "Fuel loadings in Central Alberta forest cover types" (P-23) (T. Singh) (Carried over from 1983-84).

7. Prepare, review, edit and publish information report if warranted, on "A stand growth model for trembling aspen in the prairie provinces" (P-102) (I. Bella) (Carried over from 1983-84).

8. Continue coordination of NoFRC ENFOR projects ensuring their completion and publication; act as establishment representative on national committees; and assist FSSB in completing biomass inventory information as required. Attend Bioenergy Seminars, FORCYTE short courses, and submit reports to Bioenergy Council, NRC Bioenergy Program, etc., as required (J. Powell; also L. Brace, I. Edwards, T. Singh and S. Malhotra).

12. Publications:

Chow, W. 1983. Status report and user's reference guide for RAMS at NoFRC". File Rept.

Moore, W. and W. Chow. 1983. Computer mapping for biomass inventories. Proceedings 6th Int. Symp. on Automated Cartography, Oct. 16-21, 1983. Ottawa. Vol. 2. pp. 355-364.

Ondro, W.J. and H.M. Stewart. 1983. Harvesting forest biomass with a Dika Side Cutter. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton. For Manage. Note No. 23. 2 p.

Peterson, E.B., M.M. Peterson and R.D. Kabzems. 1983. Impact of climatic variation on biomass accumulation in the boreal forest zone: selected references. Environ. Can. Can. For. Serv., North. For. Res. Cent., Edmonton, Alta. Inf. Rep. NOR-X-254. 355 p.

Woodland Resource Services Ltd. 1983. Non-destructive sampling of non-inventoried areas and non-sampled covertypes in the prairie provinces and Northwest Territories. Contract Rept. for ENFDR Project P-273. October. 37 p. + 40 p. of Appendices.

13. Signatures:

J. M. Powell
Investigator

Program Manager

A. D. Kiil
Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 2, 1983

1. Project: Forest biomass as an energy source

2. Title: Development of integrated biomass prediction equations for Western & Northern Region

3. New: Cont.: X 4. No.: NOR-34-183

5. Study Leader: T. Singh

6. Key Words: Biomass, regional and national forest statistics, energy, inventory, simulation, Prairies Region, prediction equations, mathematical models.

7. Location of Work: Western and Northern Region

8. Study Objectives:

   1. To synthesize the available biomass data for the regionally important tree species for predicting biomass.

   2. To develop and test regional biomass equations, for their accuracy and bias, in a pilot-scale demonstration for converting a conventional forest inventory to a biomass inventory.

9. Goals for 1983-84:

   1. Publish a forest management note on "BIOMASS:FORTRAN subroutines for biomass computation".

   2. Publish a journal paper on "Specific gravity of ten prairie tree species".

   3. Prepare and publish an Information Report on biomass prediction equations for six major tree species of NWT.

   4. Prepare and publish a forest management note on "Weight tables for six major tree species of NWT.

   5. Prepare and initiate review of an Information Report on "Specific gravity of major tree species of NWT" based on material from a completed service report.

6. Prepare a paper on "Forestry biomass for heating and other purposes in the prairie provinces of Canada" for the Bioenergy World Conference and Exhibition to be held in Sweden, June, 1984.

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 NWT 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.

10. Accomplishments in 1983-84:

1. A FMN on "FORTRAN subroutines for biomass computation" has been published.

2. The paper entitled "Ovendry wood density of ten prairie tree species" has received review from Forestry Chronicle and is back for suggested revision.

3. An Information Report entitled "Biomass equations for six major tree species of the Northwest Territories" was prepared, reviewed, and is with the editor for final preparation for publishing.

4. A FMN entitled "Weight tables for important tree species in the Northwest Territories" was prepared, reviewed, and is with the editor for final preparation for publication.

5. A report entitled "Wood density of six major tree species in the Northwest Territories" was prepared and has received first review.

6. A paper entitled "Energy potential of aspen and other hardwoods in the prairie provinces of Canada" has been prepared and reviewed. Paper will be submitted in mid-December for the conference Proceedings of the international meeting to be held in Regina.

7. A FMN entitled "Conversion of tree volume to biomass in the prairie provinces" was prepared, reviewed, and is presently with editor.

8. A FMN showing the results of comparative estimates was prepared and reviewed. It was suggested that the contents and text be expanded for publication as an Information Report.

9. Participated in and contributed to the national biomass inventory program by providing needed biomass equations according to their specific requirements, including for ENFOR projects P-270 and P-273 (NOR-34-180). Needed input was also provided to the pilot biomass mapping demonstration project (NOR-22-142) by deriving biomass prediction equations required for this purpose. Also participated in the Canadian Forest Inventory Committee Meeting in Manitoba, including meeting with the forest inventory section of the Manitoba Department of Natural Resources in this connection.

11. Goals for 1984-85:

1. Publish journal paper on the ovendry wood density of ten prairie tree species. (Carried over from 1983-84).

2. Publish Information Report on the biomass prediction equations of the major tree species of NWT. (Carried over from 1983-84).

3. Publish FMN on the weight tables for the major tree species of NWT. (Carried over from 1983-84).

4. Complete and publish journal paper on the wood density of the major tree specied of NWT.

5. Present paper on the energy potential of aspen and other hardwoods in the prairie provinces accepted for ENERGEX an International Energy Conference in Regina in May, 1984.

6. Publish FMN on conversion of biomass volume to biomass weight. (Carried over from 1984-84).

7. Prepare and complete review for the information report on comparative predictibility of biomass equations derived from the prairies and NWT field data. (Carried over from 1983-84).

8. Analyse field data and prepare a note on fine fuel weights of three coniferous tree species of NWT.

9. Prepare for review a report on wood density of tree species in the non-inventoried areas of Manitoba (extension from P-255).

10. Complete analysis of specific gravity samples of tree species collected from non-inventoried areas of Saskatchewan, Alberta and NWT, and consider incorporating with Manitoba data (goal 9) for reporting.

11. Prepare note on "wood and energy".

12. Publications:

Micko, M.M. and I.C. Wang. 1983. Wood for energy. Literature review on the heat of combustion of prairie tree species. University of Alberta. Contract report OSG8200071. Jan. 28 p.

Singh, T. and D. Campbell. 1983. FORTRAN subroutines for biomass computation. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. For. Manage. Note No. 22. 7 p.

13. Signatures:

T Singh
Investigator

Program Manager

Director A.D. Kiil

NOR-35 Tree disease research

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 21, 1984

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, Urendinales 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 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 pilot 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.

10. Accomplishments for 1983-84:

1. Continued western gall rust study in relation to genetic improvement program of lodgepole pine with Dr. P. Blenis (U of A). This project is supported partly by the Alberta Forest Service.

   - A comprehensive bibliography on the western gall rust has been published as an information report.

   - Mr. Eric Allen's M.Sc. thesis entitled "Infection of juvenile lodgepole pine by *Endocronartium harknessii*" was completed and accepted. His work was supported by the fund made available by AFS to U of A and supervised by Y. Hiratsuka.

   - A poster session presentation was made at the American Phytopathological Society, Ames, Iowa, as follows:

     Hiratsuka, Y. and Maruyama, P.J. 1983. Resistant reactions of two Asian pines to western gall rust.

2. Rough draft of an information report entitled "Impact of pine stem rusts of hard pines in Alberta and the Northwest Territories" with Drs. J. M. Powell (NoFRC) and A. Van Sickle (PFRC) is prepared and circulated among authors for improvements.

3. Presented an invited paper at the Third International Mycological Congress in Tokyo, Japan, entitled "Auriculariaceous rusts". In addition, two other papers were presented at the same congress as follows:

   Cummins, G. B. and Hiratsuka, Y. 1983. Families of Uredinales.

   Takai, S. and Hiratsuka, Y. 1983. Scanning electron microscope observations of elm xylem vessel alterations following cerato-ulmin treatment and *Ceratocystis ulmi* infection.

4. Started professional development leave in Japan from August 1983 to investigate tree rusts, especially new forms of pine stem rusts discovered in Asia in recent years.

11. Goals for 1984-85:

1. Continue western gall rust study in relation to genetic improvement program of lodgepole pine supported partly with the fund supplied by the Province of Alberta through University of Alberta. Act as a scientific authority for contract work with The University of Manitoba (PRUF).

2. Continue professional development leave in Japan and study pine stem rusts and other forest tree rusts until August 1984.

3. Publish a journal paper on juvenile seedling infection of lodgepole pine with E. Allen and an information report on western gall rust.

4. Complete and submit manuscript of an information report entitled "Impact of pine stem rusts of hard pines in Alberta and the Northwest Territories" with Drs. Powell and Van Sickle.

12. Publications:

Up to 1983

Journal publications: 40
Information reports, notes, etc.: 11
File reports: 6

1983-84

Journal publications:

Fairbairn, N., M. A. Pickard, and Y. Hiratsuka. 1983. Inhibition of *Endocronartium harknessii* spore germination by metabolites of *Scytalidium uredinicola* and *S. album* and the influence of growth medium on inhibitor production. Can. J. Bot. 61:2147-2152.

Information reports, notes, etc.

Tetu-Bernier, P. E., E. Allen, and Y. Hiratsuka. 1983. Bibliography of western gall rust. NoFRC. Information Report NOR-X-250.

Cummins, G. B., and Y. Hiratsuka. 1983. Illustrated Genera of Rust Fungi. American Phytopath. Soc. Minneapolis. 152 p.

13. Signatures:

Investigator

Program Manager

Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 21, 1984

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 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).

10. Accomplishments for 1983-84:

1. The first draft of an information publication on major tree and shrub diseases has been under preparation and will be ready for review in late 1984.

2. Provided diagnostic and identification service of the tree and shrub diseases.

3. Added significant number of cultures of *Armillaria mellea* complex and forest macrofungi into the fungus culture collection. Published a list of cultures deposited in the collection.

4. Cooperative project with Drs. Ayer and Browne (Dept. of Chemistry, U of A) on fungi associated with mountain pine beetle has been started with a NSERC grant. Dr. A. Tsuneda from Japan worked on the project for four months isolating and identifying blue stain fungi and other fungi associated with mountain pine beetle infestation.

5. A journal paper (Can. J. Bot.) on internal symptoms of DED induced by a toxin with Dr. S. Takai (GLFRC) is in press.

6. Continued investigation on *Armillaria* root rot with Dr. W. A. Ayer and a graduate student (Mr. Ken Mallett) with a grant from the Province of Alberta (AFRDTF).

7. A list of macrofungi (370 samples representing 154 species) has been prepared and is ready to be reviewed for an information report. Dried specimens were deposited in the Mycological Herbarium and cultures were deposited in the fungus culture collection.

8. A journal paper (Mycotaxon) on a new leaf spot fungus on balsam poplar is accepted for publication.

9. Two pest leaflets (Western gall rust and silver leaf) are in the final stage of review.

10. An information report on aspen-poplar decay with Dr. A. A. Loman, prepared for the Poplar Research Committee, is under review. Final comments were back from the committee members and will be submitted for publication.

Added Accomplishments:

11. Following papers were presented at various scientific meetings.

Takai, S. and Y. Hiratsuka. 1983. Scanning electron microscope observations of elm xylem-vessel alterations following cerato-ulmin treatment and *Ceratocystis ulmi* infection. Third International Mycological Congress, Tokyo, Japan.

Nagasawa, E. and Y. Hiratsuka. 1983. Tricholomas allied to *I. matsutake* in Alberta and British Columbia. Annual Meeting, Mycological Society of Japan, Tokyo, Japan.

Ayer, W. A. and Y. Hiratsuka. 1983. Metabolites of *Gremmeniella abietina*. International Scleroderris Symposium, Syracuse, N. Y.

12. A journal paper on a new host and distribution record of a larch needle blight has been prepared and submitted to Plant Disease Survey. Presented a paper entitled "Needle blight of alpine larch caused by *Meria laricis* Vuill. in Western Canada". Annual Meeting Alberta Phytopath. Society, Brooks, Alberta.

11. Goals for 1984-85:

1. Start review process of the first draft of an information publication on major tree and shrub diseases of the prairie provinces in early 1985.

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. Continue investigation of blue stain fungi and other fungi associated with mountain pine beetle infestation with Drs. Ayer and Browne of the University of Alberta.

   - Publish a journal paper on fungi isolated from mountain pine beetle with Dr. A. Tsuneda

5. Continue investigation of *Armillaria* root rot with Dr. Ayer (U of A) and a graduate student (Mr. K. Mallett) with a grant from the Province of Alberta (AFRDTA).

6. Publish the following reports and pest leaflets:

   - Aspen-poplar decay (Information Report)

   - Western gall rust (Pest Leaflet)

   - Silver leaf (Pest Leaflet)

12. Publications:

Up to 1983

Journal publications: 6
Information reports, notes, etc.: 11
File reports: nil

1983-84

Journal publications

Hiratsuka, Y. 1984. New leaf spot fungus, *Marssonina balsamiferae*, on *Populus balsamifera* in Manitoba and Ontario. Mycotaxon (In press).

Takai, S. and Y. Hiratsuka. 1984. Scanning electron microscope observations of internal symptoms of white elm following *Ceratocystis ulmi* infection and cerato-ulmin treatment. Can. J. Bot. (In press).

Information reports, notes, etc.

Ayer, W. A. and Y. Hiratsuka. 1983. Metabolites of *Gremmeriella abietina*. Proc. International Symposium of Scleroderris canker of conifers, Syracuse, N. Y.

Têtu-Bernier, P., P. J. Maruyama, and Y. Hiratsuka. 1983. List of fungal cultures deposited at the Northern Forest Research Centre. NoFRC Information Report NOR-X-249.

13. Signatures:

Investigator

Program Manager

Director A. D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 21, 1984

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-1D-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. 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.

9. 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 bark, or dieback or of peripheral occlusion tissues.

6. Advisory and consulting services on the health of trees and shrubs, identification and professional service.

Added goal:

7. Begin sorting illustrative material for a frost damage diagnostic report.

10. Accomplishments in 1983-84:

1. "Bacterial ice nucleating patterns, chemical, morphological and INA changes" is in rough manuscript stage.

2. Isolated 485 resident bacteria and yeast strains from lodgepole pine and white spruce samples collected at Hinton.

Prepared gram stain slides and identified the bacteria and yeasts.

Tested 150 of the 1982 and 1983 isolates in the laboratory for INA activity on lodgepole pine and white spruce germinants.

3. Field tested at Hinton most of the bacterial and yeast strains on lodgepole pine and white spruce containerized seedlings in 3 exploratory experiments, 2 in the spring and 1 in autumn.

Determined that 100% of the yeast strains and 50-68% of some of the species of bacterial strains were INA active at -5°C or warmer temperatures.

Resident and nonresident microorganisms were capable of ice nucleation in conifer seedlings.

Reared 12,000 containerized seedlings for 1983 experiments and 2,100 seedlings for an experiment in 1984. Additional seed was germinated for continuing the tests.

4. Obtained considerable information on INA loci published in biological and nonbiological journals dealing with cloning for INA strains, high ice nucleating ability in plant leaves, the study of fundamental mechanism of ice nucleation, and cloud seeding research.

   Carried out limited exploratory work in the laboratory concerning interaction of factors influencing INA processes.

   Bacterial cells sustain no apparent damage during a gradual or rapid freeze-thaw.

   Plant cells on the other hand may sustain damage during a gradual or rapid freeze-thaw.

   Supernatants of bacterial and plant cells have similar drop freezing patterns. Goal terminated.

5. Freeze-drop tested spore suspensions of Botrytis and species of Fusarium for INA activity in freeze drops but most cultures were not consistent spore producers for use on seedlings.

6. Processed 45 calls for advisory and consulting services to home owners, and to business and government agencies. Provided eight contributions to the research of others.

7. Organized the table of contents and took a few photographs of crown damage responses.

8. Prepared a file report on Stella Nursery.

II. Goals for 1984-85:

1. Prepare first draft of manuscript on "Bacterial ice nucleating patterns, chemical, morphological and INA changes" for approval and review.

2. Prepare illustrative and text material for a frost damage diagnostic report.

3. Prepare a Forest Management Note on INA work and its implications.

4. Determine the photoperiod and storage treatments required to substantially reduce freeze damage in conifer seedlings as a result of INA mediation.

5. Continue with the role of fungal spores as INA agents and their subsequent activity during molding.

6. Advisory and consulting services on the health of trees and shrubs, identification and professional service.

12. Publications:

a. Prior to 1983

2 file reports

b. 1983-84

Zalasky, H. 19B3. Butt and root winterkill of showy Mountain ash (Sorbus decora) at Stelle nursery. File Report

13. Signatures:

Harry Zalasky
Investigator

Program Manager

A. D. Kiil
Director A. D. Kiil

NOR-36 Forestry development agreements
(Program planning)

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 19, 1984

1. Project: Forestry Development Agreement (Winnipeg Sub-Office)

2. Title:

3. New: X Cont.: 4. No.: NOR-36-198

5. Study Leader: Klem Froning

6. Key Words: Canada/Manitoba Forest Resource Development Agreement, Job Creation, forest relations, economic development, liaison.

7. Location of work: Northern Forest Research Centre, Edmonton, Manitoba

8. Study Objectives:

   1. To provide regional liaison for all Canadian Forestry Service activities related to the Canada/Manitoba Forest Renewal Agreement.

   2. To supervise the delivery of federal government initiatives associated with the Canada/Manitoba Forest Renewal Agreement.

   3. To coordinate and manage the implementation of forestry employment stimulation programs in Manitoba as required.

   4. To stimulate and facilitate the maximization of funding available to the forestry sector in Manitoba from other federal agencies.

9. Goals for 1983-84:

   N/A

10. Accomplishments in 1983-84:

   1) Projects funded under the Forestry Employment Stimulation and NEED Programs were implemented (Terminate)

10. Accomplishments in 1983-84: (cont'd)

2) Assistance was provided toward improved federal forestry relations in Manitoba (NOR-54)

3.) Environment 2000 was discussed with prospective participants and preparations made for implementation.

11. Goals for 1984-85:

1. Supervise and coordinate federal direct delivery programs under the Canada/Manitoba FRA.

2. Coordinate and supervise the implementation of projects under the Environment 2000 program.

3. Initiate the expansion of the Winnipeg sub-office.

4. Assist in the development of work plans related to the Canada/ Manitoba Agreement.

5. Initiate the staffing process required under the expanded Winnipeg sub-office.

6. Provide assistance and input from Manitoba regarding forestry relations activities.

12. Publications:

Nil

13. Signatures:

Investigator

Program Manager

Director A.D. Kiil

NOR-52 Analytical services laboratory

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: December 19, 1983

1. Project: Analytical Services Laboratory

2. Title: Analytical Services Laboratory

3. New: Cont.: X 4. No.: NOR-52-807

5. Study Leader: 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 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.

Added Goals for 1983-84:

   3. Maintain an active role in the activities of WEALA to review and recommend analytical techniques (Kalra, Chairman of WEALA for 1983-84)

   4. Prepare a file report of the work performed in the laboratory in 1982-83.

   5. Prepare a paper entitled "Predicting solute yields in the natural waters of a sub-alpine system in Alberta" and submit it to Arctic and Alpine Research.

10. Accomplishments in 1983-84:

    1. Performed analysis of soil, vegetation, water and fertilizer samples for several projects.

    2. Provided facilities and helped the staff from other sections who analyzed their own samples.

Added Accomplishments 1983-84:

    3. Maintained an active role in the activities of WEALA to review and recommend analytical techniques (Kalra, Chairman of WEALA for 1983-84).

    4. Prepared a file report of the work performed in the laboratory in 1982-83 (Kalra).

    5. A paper entitled "Predicting solute yields in the natural waters of a subalpine system in Alberta" was submitted to the journal of Arctic and Alpine Research. It has been accepted and will be published in the May 1984 issue.

11. Goals for 1984-85:

    1. Provide analytical services to research scientists, cooperators,

    2. Provide assistance to other technical staff using the facilities of the Analytical Services Laboratory.

    3. Prepare a file report of the work performed in the laboratory during 1983-84 (Kalra).

12. Publications:

    Y. Kalra. 1982-83 Annual Report on Analysis performed by Analytical Services Laboratory. (File Report)

13. Signatures:

Y. P. Kalra
Investigator

Program manager

Investigator

Director

NOR-53 Computing and data processing services

NOR-53-4804

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: November 25, 1983

1. Project: Computing 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, database, PDP, VAX, word processors, telecommunications, personal computers, office automation.

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, information retrieval, personal computer evaluation, word processing evaluation and telecommunications evaluation, and to provide assistance with office automation.

9. Goals for 1983-84:

   1. Prepare yearly report on computer usage by individual researcher and any resulting publications.

   2. Write and adapt programs and systems as required and provide documentation.

   3. Assist with the design and preparation of economics table retrieval system and help evaluate PFRC economic data base programs as to adaptability to NoFRC's system.

4. Continue development, testing and documentation of computer programs for statistical and numerical analysis, and plotting subroutines 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 ENFOR computing as required. Apply biomass coefficients to RAMS map data to produce biomass output.

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; provide training and assistance as required by students and others in order to use the mapping system.

8. Provide keypunch and data entry services and backup and restore services as required by various projects.

9. Setup and help maintain databases as required using DATATRIEVE.

10. Assist people who use the 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 and programming.

12. Establish the GIMMS-RAMS programs so maps can be interchanged with other establishments.

13. Provide in-house courses for potential users of hardware and software.

14. Assist with PDP 11/60 capture of data from the nuclear spectrometer.

15. Assist with the transfer of data from the PDP 11/03 used in the pollution control section to the PDP 11/60.

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.

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.

10. Accomplishments for 1983-84:

1. All goals were accomplished during the fiscal year with the exception of goal number 20 which was cancelled as a different method was used.

2. A jointly authored paper (W. Moore and W. Chow 'Computer Mapping of Biomass Inventories' - Proceedings of the Sixth International Symposium on Automated Cartography, Hull. October, Vol. 2, pp 355-364) was prepared on the usage of biomass prediction equations on a Manitoba test inventory map.

3. A jointly authored paper (W. Moore and W. Chow 'Evaluation of the Development and Testing of Mapping and Analysis Resource System' - Information Report NoFRC, CFS, DOE, Edmonton - in draft) was prepared on the MARS mapping system including a revised user's guide.

4. Several days were spent attending demonstrations and evaluating the major word processing systems available as well as a personal computer system. Recommendations were made and the formal proposal was presented in Ottawa.

5. Evaluations of different methods of local area networks were made and a couple were selected and invited to set up a test system in the lab using the in-house phone system as feeder lines.

6. Many days have been spent evaluating various personal computers. Much advice has been given and recommendations made for potential buyers of personal computers. A paper was prepared and presented to the local Professional Institute Chapter on what to look for in personal computers.

7. A formal presentation was prepared for Treasury Board asking for approval in principle to upgrade our present PDP computer system to a VAX system. A preamble was written and translated into French and the document was then passed on for approval.

8. The stores system was developed and expanded to include expendables as well as locations of all signed-out equipment.

9. Evaluations and recommendations as to the upgrading of the RAMS mapping system were made for the ENFOR project.

10. Several demonstrations of the RAMS mapping system were done for visitors.

11. Advice and assistance was provided for the Resource Data Analysis Project.

12. The four test maps for the MARS project were completed and the biomass equations were applied in each case and results were printed. This finishes the initial phase of demonstrating biomass using the mapping system - which was the justification for the purchase of the system.

13. New versions of the operating system (RSX), MINITAB, DATATRIEVE and FORTRAN were installed. A calculator program was developed and a sorting program was written.

14. A laser printer was purchased and installed and is being tested and brought on line.

15. Two personal computers have been purchased - a NEC-APC and a Professional. These machines are to be used by the Fire and FIDS section respectively.

11. Goals for 1984-85:

1. Prepare yearly report on computer usage by individual researcher and resulting publications.

2. Write or adapt programs and systems as required and provide documentation.

3. Maintain and expand as necessary the stores system.

4. Continue to develop, expand and maintain programs and systems as needed.

5. Provide training and assistance as required with in-house courses.

6. Provide keypunch and data entry services and backup and restore services as required by various projects.

7. Install, expand and maintain a local area network using the in-house telephone system if possible.

8. Install and assist as required with the personal computers; set up the personal computers in the local network when not being used by the owners.

9. Assist with the setup and networking of the word processors as required; investigate the requirements for hooking up the laser printer to them.

10. Install the VAX computer when received; attend training courses on the operation and management of the VAX, give in-house courses to potential users of the new system; prepare basic users' manuals for them and provide assistance as required.

11. Investigate the word processing needs of the regional sub-offices and assist with the necessary networking so the lab, sub-offices and headquarters can all communicate with each other.

12. Attempt to keep current with all aspects of computing, word processors, personal computers and telecommunications by attending workshops, trade shows and reading trade magazines and literature and by attending meetings of the local computer groups (CIPS, DECUS, ACM).

13. Assist with the upgrading of the MARS mapping system; write programs as required for report generation; assist with the evaluation of proposals regarding usage of the mapping system by outside users; evaluate proposals for obtaining other mapping or image analysis systems.

14. Assist with the ENFOR project when required; assist with the purchase and modification of a visual editing terminal; install the terminal in the local network with an auto-dial modem; provide assistance and training in the use of the modem and terminal as required.

15. Install DATAPAC - a network for computing communications - and test.

16. Assist users with DATATRIEVE, MINITAB and RUNOFF as required for data bases, statistics and document editing respectively.

17. Attempt to increase the speed of data transfer from the PDP 11/03 to 9600 baud from 300 baud.

12. Publications 1983-84:

Publications:

Moore, W. and W. Chow. 1983. Computer mapping at biomass inventories. In Proceedings of the Sixth International Symposium on Automated Cartography. Hull, Quebec. Vol. 2. p. 355-364.

Reports:

Moore, W. and W. Chow. 1983. Evaluation of the development and testing of mapping and analysis resource system. Proposed NoFRC Information Report.

13. Signatures:

Investigator

Program Manager

Director