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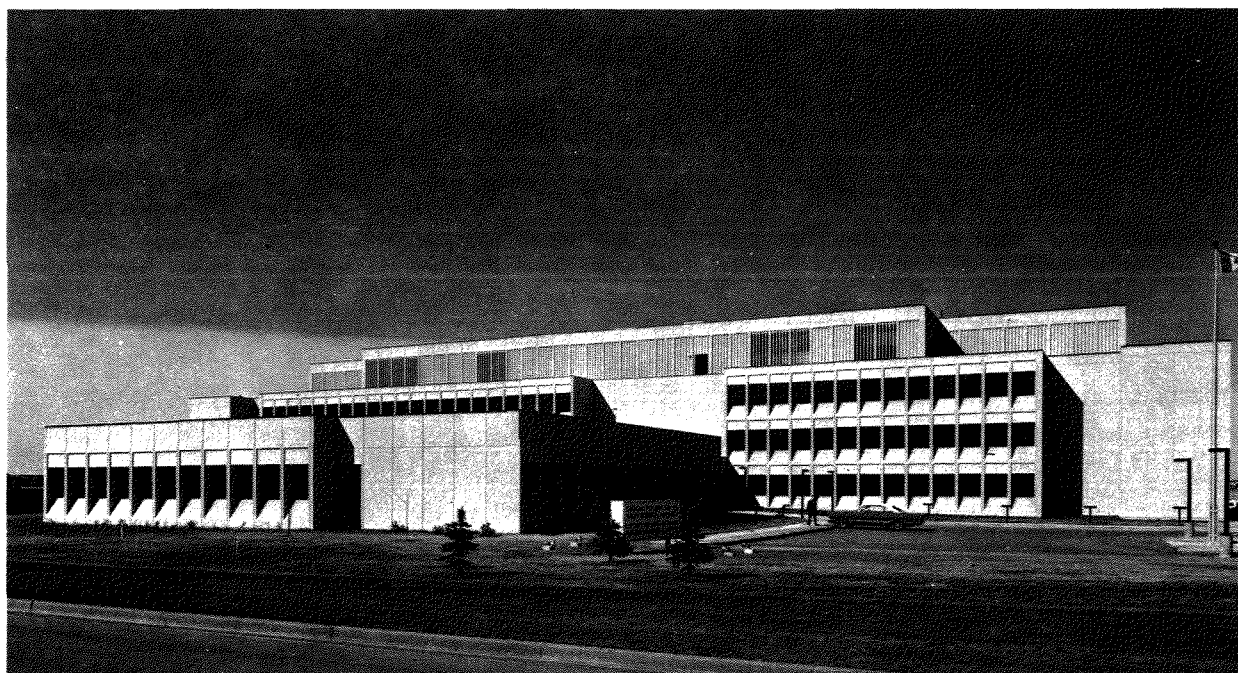
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STUDY STATEMENTS 1984-85

Northern Forest Research Centre

Canadian Forestry Service

Edmonton, Alberta



STUDY STATEMENTS

1984-85

NORTHERN FOREST RESEARCH CENTRE
CANADIAN FORESTRY SERVICE
EDMONTON, ALBERTA

MAY 1984

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 prairie provinces and the NWT.
9. Collaborate with project NOR-35 for diagnostic and taxonomic service of tree and shrub diseases and the upkeep of the Mycological Herbarium.
10. Work towards the production of the first draft of a standard survey methodology manual suitable for the region.
11. Continue dwarf mistletoe surveys and report on provincial forests surveyed.
12. Assess operational use of satellite imagery to delineate areas of severe defoliation by forest tent caterpillar and other aspen-poplar defoliators.
13. Collaborate with Bill Ives and Herb Cerezke and provide assistance with photography for the illustrated report on the "Common forest insects of the Region".

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 populations. 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 ^{Species} 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 1983. File Report.
- Gates, H. and J. Edmond. 1983. Losses from the Engelmann 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.

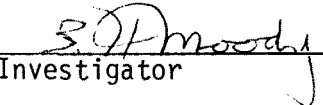
- Still, G.N. and B. Moody. 1982. Jack pine dwarf mistletoe in Saskatchewan, 1982. File Report.
- Still, G.N. 1982. Forest insect and disease conditions in Prince Albert National Park, 1982. File Report.
- Still, G.N. and B. Moody. Forest insect and disease conditions in Saskatchewan in 1982 and forecasts 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.

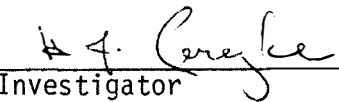
Tidsbury, C. 1983. Jack pine budworm in Manitoba, 1983 and forecasts for 1984. File Report.

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

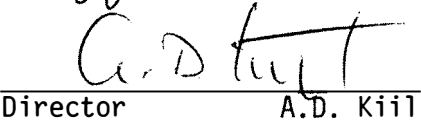
These timely File Reports are promptly distributed to provincial and regional foresters, national and provincial park superintendents and warden staffs, agricultural representatives, provincial entomologists and pathologists, city parks and recreation staffs, other national FIDS regions, FIDS Director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

13. Signatures:


Investigator


Investigator


Program Manager


Director A.D. Kii1

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.

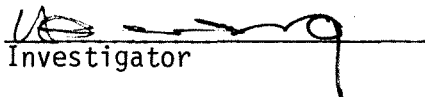
10. Accomplishments in 1983-84:

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-Wisconsinian 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.

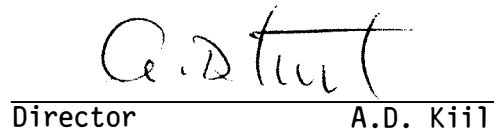
11. Goals for 1984-85:

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. Kii

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-033) 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-033).
- (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 consultary 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 1984.
 - (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.

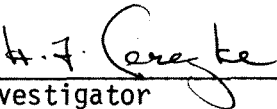
Cerezke, H.F., J. Drouin and B. Neill. 1983. Revised chapter in WCCP report on insect control in "Shelterbelts, Ornamental Trees and Shrubs", 18 p.

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

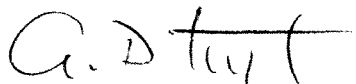
Wieser, H., E.A. Dixon and H. Cerezke. 1983. Field bioassay of *exo*-Brevicomin analogs with *Dendroctonus ponderosae* Hopk. in lodgepole pine stands in southwest Alberta, July-August 1982; Status Rep., 11 p.

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:


Investigator


Program Manager


Director A.D. Kil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1984-85

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

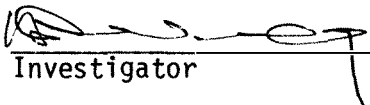
Date: December 20, 1983

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 diagnostic 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.
 8. Revision of the introduction, republication of the "Common insect and mite galls of the Canadian prairies", Information Report NOR-X-196.
10. Accomplishments in 1983-84:
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 1982 remained the same in 1983.
 - 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.

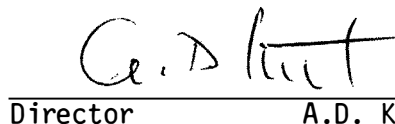
- 2) The following introduced insects present in Ontario were surveyed to determine if they have spread into Manitoba in 1983.
 - a. The mountain ash sawfly present in Kenora, Ontario in 1982 was not evident in southeastern Manitoba.
 - b. The European pine shoot moth present in Ontario and British Columbia 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 collaboration 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. 1983.
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. Kii1

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

12. Publications 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

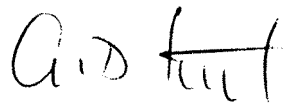
Moody, B.H. 1983. Assessment of mountain pine beetle impact on lodgepole pine plots in the Rocky Mountain National Parks to 1983. File Report.

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:


Investigator


Program Manager


Director A.D. Kii1

STUDY STATEMENT

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

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 communities

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

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 deposition on soil chemistry by measuring the movement of S and other elements using zero tension lysimeters and by measuring total and available elements in each soil horizon at monthly intervals during the frost-free period. Information will be submitted for publication in 1984-85. (Addison, Maynard)
6. Determine the factors that influence the response of mosses and vascular plants to elemental S. (Addison)
7. Determine the factors that control the mobility and form of pollutants and other elements in the soil. (Maynard)
8. Provide consulting services to Government, University and Industry staff as well as to the general public. Participate in workshops and symposia. (Addison, Maynard)

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 reviewed 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:

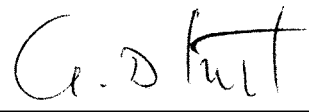
Maynard, D.G., P.A. Addison and K.A. Kennedy. 1983. Impact of elemental sulfur dust on soils and vegetation of Pinus contorta stands in west-central Alberta. International Symposium on Dynamics of Boreal Forest Ecosystems, Thunder Bay, Ontario (in press).

13. Signatures:


Investigator


Program Manager


Investigator


Director A.D. Kii1

STUDY STATEMENT

1984-85

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, 1983. (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. 1983. (Hogan)
 3. Prepare a paper on the use of the moss bag technique and resultant data. To be submitted for review by May 1983. (Hogan)

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 by Oct. 1983. (Hogan)
9. Provide consultation to regional clients and CFS staff on matters relating to air pollution impact on forests and forest soils and represent CFS on regional and national committees as required. (Hogan)

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 reviewed 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.

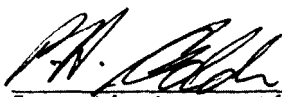
10. Accomplishments for 1983-84: (cont'd)

- 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. CO₂ 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:

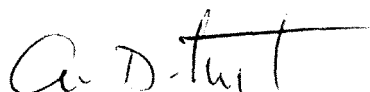
Transferred to NOR-7-182

12. Publications:13. Signatures:


Investigator
for G.D. Hogan

Deey Maynard


Program Manager


Director A.D. Kii

1984-85

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 SO₂ 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 SO₂ 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 SO₂ fumigations. (Addison)
5. Determine the influence of intermittent 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 SO₂ on the physiology of jack pine seedlings (carried over from 1983-84)

Added goals:

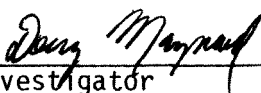
9. Complete requirements for papers submitted to journals (Hogan)
 - a) Flin Flon paper (see 83-84 goal 1)
 - b) Thompson paper (see 83-84 goal 2)
 - c) Moss bag paper (see 83-84 goal 3)
10. Complete work required for the publication of the Forestry Report. (Hogan)
11. Prepare a publication on the five-year 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. Kii

1984-85

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 quantitative ^{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 draft document: "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 -

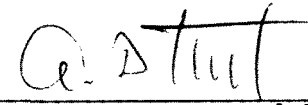
- 7) Prepare a journal manuscript for review on procedures for the determination of radionuclides in soils and vegetation (Apps)
- 8) Design field laboratory and greenhouse experiments with cooperators (NOR-7) to investigate the uptake of radionuclides and their effects upon native forest species. (Apps, Addison, Maynard)

12. Publications:13. Signatures:


Investigator


Program Manager

Investigator


Director A.D. Kill

1984-85

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, monitoring of established plots in Alberta/Manitoba, field test Velpar G on slopes, Velpar L with mist-blower and DPX6376 applications on 1/10 acre plots at Slave Lake, Grande Prairie and chemical thinning at Edson and Slave Lake with bromacil.
 - a) Conifer release, site preparation from weed/grass competition -Velpar G. 20% @ 8, 12.5 lbs/acre, Saddle Hills, G. Prairie
DPX6376 spring application @ 3, 6 g/2 L
Hyvar X-L (bromacil) chemical thinning, Edson, Slave Lake
TF1169 weed/grass control and tolerance of conifers
Garlon and Roundup - trials if cleared by Agric. Can.
Pesticide Branch.

2. Continue and complete evaluation of pheromones with NRC.
 - Continue evaluation of pheromone effectiveness, contamination rates and clarify biologies of *P. willingana*, *aesculana* and a seed feeding species.
 - Continue evaluation for *Petrova albicapitana*, *metallica* re distribution, inter-tree height, with W.G.H. Ives and low attraction baits. Obtain distribution in Alberta.
 - Continue to monitor for detection of pine shoot moth, *R. buoliana*.
 - Pest leaflet should be considered on seed/cone insects.
 - Continue with chemical controls/soil drench trials and cone study with J.A. Muldrew, w/aldicarb, bidrin, MSR, dimethoate, carbofuran.

10. Accomplishments in 1983-84:

1. Continued assessments, monitoring of established plots with large scale field tests (0.04 ha) of Velpar Granular 20%, 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 0.04 ha plot in spring 1983 at Faust @ 500 g/ha at 240 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 summaries 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.

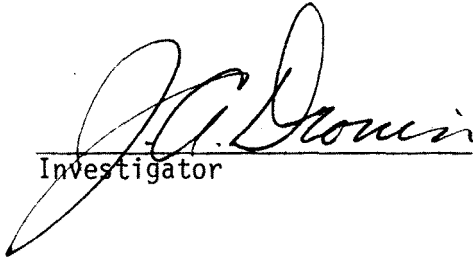
Soehngen, U. and J.A. Drouin. 1983. Annual revision of insect pests and controls on houseplants and on greenhouse woody ornamentals and crops. In WCCP Report (1983). 12 pp.

Wong, H.R., J.A. Drouin, D.L. Szlabey and D.T. Dang. 1983. 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.

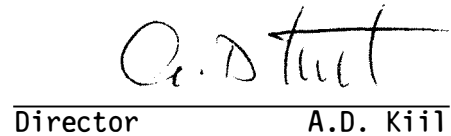
13. Signatures:



Investigator



Program Manager



Director A.D. Kii1

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.

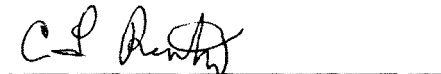
12. Publications:

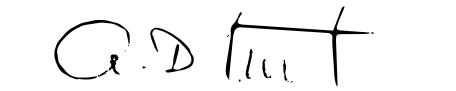
W.G.H. Ives and C.L. Rentz. 1983. Growth and survival of young lodgepole pine regeneration in west-central Alberta.
II. 1981-82 survival. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. File report. May 1983.

13. Signatures:


Investigator


Program Manager


Investigator


Director A.D. Kil

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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 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:

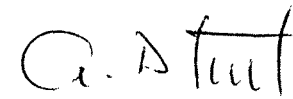
1. Nothing useful accomplished.
2. Nothing useful accomplished.
3. Nothing useful accomplished.
4. Additional data on the effectiveness of systemic insecticides were collected. Analysis of data is not yet completed. Goal will be transferred to NOR-9-132. Mr. Drouin has agreed to examine data and prepare 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. Kii1

1984-85

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:

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.

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 "Auriculariaceae 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. albon* and the influence of growth medium on inhibitor production. Can. J. Bot. 61:2147-2152.

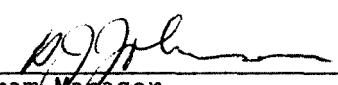
Information reports, notes, etc.

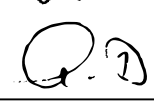
Tetu-Bernier, P. E., E. Allen, and Y. Hiratsuka. 1983. Bibliography of western gall rust. NoFRC. Information Report NOR-X-250.

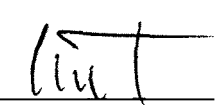
Cummins, G. B., and Y. Hiratsuka. 1983. Illustrated Genera of Rust Fungi. American Phytopath. Soc. Minneapolis. 152 p.

13. Signatures:

Investigator


Program Manager


Director


A. D. Kii

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).

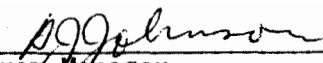

Takai, S. and Y. Hiratsuka. 1984. Scanning electron microscope observations of internal symptoms of white elm following *Ceratocystis ulmi* infection and ceratoulmin treatment. Can. J. Bot. (In press).

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. Kil

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-10-155)
4. No.: NOR-35-194
5. Study Leader: H. Zalasky
6. Key Words: Canker, dieback, mortality, juvenile trees, amenity species, ice nucleating agents, frost, frost damage, fungal succession, remedial measures, technical transfer
7. Location of Work: Northern Forest Research Centre, Edmonton, intensively managed forest stands, provincial nurseries and homeowners in our region.
8. 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 neutralize 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.

11. 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

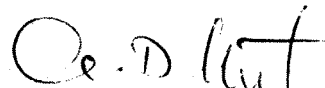
b. 1983-84

Zalasky, H. 1983. Butt and root winterkill of showy Mountain ash (*Sorbus decora*) at Stelle nursery. File Report

13. Signatures:


Investigator


Program Manager


Director A. D. Kii