

STUDY STATEMENTS

1981-82

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NORTHERN FOREST RESEARCH CENTRE

CANADIAN FORESTRY SERVICE

APRIL 1981

1981 - 82

Our knowledge of western forest tree rusts has been inadequate to solve present and future problems which are and will be caused by this group of fungi and studies of this group of fungi on identity, life history, host range, cytology, morphology, distribution and pathogenicity are necessary.

9. Study Objectives:

General:

To acquire a comprehensive knowledge and to improve diagnostic capability on the forest tree rusts of western North America with particular emphasis on the Northern Region in terms of identity, host range, life history, distribution and pathogenicity.

Specific:

To study aspects of cytology, taxonomy, life history and host-parasite relationship of conifer needle rusts, pine stem rusts, and poplar-conifer rusts of the region, and related species in the world.

10. Resources:

- a. Starting date: 1968 Projects A-232 and A-254 (1965) were combined and redesigned in 1968.
- b. Estimated year of completion: Continuing
- c. Estimated total Prof. man-years required:
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years

Prof.	0.2	(Y. Hiratsuka)
Supp.	0.3	(P. J. Maruyama)
Casual	-	
Total	0.5	

11. Progress to Date:

1. Distribution, damage, and life cycle of pine stem rusts of the region were investigated and reported in three journal publications.
2. Comprehensive studies of cytology and morphology of pine stem rusts in the region resulted in new method of determining the type of life cycles of pine stem rusts by simple germination technique. This new method has been successfully applied not only in North America but also in Europe and Asia. Thirteen journal publications have been prepared on the related subjects.
3. White spored variety of *Cronartium coleosporioides* was discovered in 1960 in a small area in Banff National Park and annual observations were commenced in 1963. Occurrence of this form and results of the annual observations of canker growth and tree mortality were published in two journal publications.
4. Morphology and life cycle of several conifer needle rusts including *Pucciniastrum sparsum*, *P. goeppertianum* and *P. epilobii* have been studied and results have been reported in six journal publications.

5. Significant amount of information on hyperparasitic fungi and insects on pine stem rusts have been obtained. Five journal publications have been published on the subject.
 6. A major publication entitled "Pine stem rusts of Canada" was published. This fully illustrated publication discusses aspects of identification, hosts, distribution, morphology, life cycle, cytology, damage, epidemiology, and control of all pine stem rusts which occur in Canada.
 7. Based on the studies of forest tree rusts of the region, terminology of spore states of rust fungi were discussed in two journal publications.
 8. Reporting of further results from a terminated study (NOR-8-094 Aecrobiology of Comandra blister rust - J.M. Powell) from 1974 has been assigned to this study.
 9. Mycoparasites of pine stem rusts were studied and reported in five journal publications.
12. Goals for 1980-81:
1. A journal paper "Morphology of spermogonia and taxonomy of rust fungi" will be published as a part of the proceedings mentioned in 2. below.
 2. Edit and coordinate the publication of symposium papers on taxonomy of rust fungi. The proceedings will be published from the Tottori Mycological Institute (Japan).
 3. If time permits, complete analysis of data and the first draft of a paper on pine stem rusts plot study with Dr. A. Van Sickle (PFRC) and Dr. J.M. Powell (NFRF).
 4. Three journal papers will be published with Dr. A. Tsuneda (NRC Visiting Fellow) on hyperparasites of pine stem rusts.
 5. Cooperate with Professor W. Ayer (Dept. of Chemistry, University of Alberta) on fungal metabolites and publish a paper.
 6. Co-author a chapter in a book entitled "The Rust Fungi" with Dr. S. Sato. The book will be published by Academic Press.
 7. Help revise a book entitled "Illustrated Genera of Rust Fungi" with Dr. G.B. Cummins (University of Arizona).

Goals Added:

8. Supervise two small contract projects on the pine stem rusts at the Pine Ridge Nursery with the fund made available by the Alberta Forest Service and submit reports to AFS.

13. Accomplishments in 1980-81:

1. A journal paper entitled "Morphology of spermogonia and taxonomy of rust fungi" was published.
2. Edited and published a group of symposium papers presented at the Second International Mycological Congress from the Tottori Mycological Institute.
3. No progress has been made to publish the results of pine stem rusts plot study with Drs. Powell (NFRS) and Van Sickle (PFRC). Part of the information has been used in a paper on rodent damage on pine stem rusts prepared by Dr. Powell and pertinent data have been used to answer several important inquiries from B.C. Forest Service.
4. Two journal papers were published with Dr. A. Tsuneda (NRC Visiting Fellow) and another paper under review.
5. Cooperated with Dr. W. Ayer (Dept. of Chemistry, University of Alberta) on fungal metabolites and published a paper in Canadian journal of Microbiology.
6. A chapter of a book entitled "The Rust Fungi" was prepared and sent to the editor.
7. Cooperated with Dr. G.B. Cummins (University of Arizona) to revise a book entitled "Illustrated Genera of Rust Fungi".
8. Supervised two small contract projects on the pine stem rusts at the Pine Ridge Tree Nursery with the funds made available by Alberta Forest Service. Two reports were submitted to AFS.

14. Goals for 1981-82:

1. Publish a paper on a new species of fungi isolated from a pine stem rust with Dr. A. Tsuneda.
2. Help revise a book entitled "Illustrated Genera of Rust Fungi" with Dr. G.B. Cummins (University of Arizona).
3. Complete analysis of data and the first draft of a paper on pine stem rusts plot study with Dr. A. Van Sickle (PFRC) and Dr. J.M. Powell (NFRS).

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

15. Publications:

Up to 1980

Journal articles: 31

Information reports, notes etc.: 6

File reports: 0

1980-81:

Journal articles:

Hiratsuka, Y. and N. Hiratsuka, 1980. Morphology of spermogonia and taxonomy of rust fungi. Rep. Tottori Mycol. Inst. 18:257-268.

Ayer, W.A., S.D. Lee, A. Tsuneda and Y. Hiratsuka. 1980. The isolation, identification, and bioassay of the antifungal metabolites produced by *Monocillium nordinii* Can. J. Microbiol. 26: 766-773.

Tsuneda, A. and Y. Hiratsuka. 1980. Parasitization of pine stem rust fungi by *Monocillium nordinii*. Phytopathology 70: 1101-1103.

Tsuneda, A., Y. Hiratsuka and P.J. Maruyama 1980. Hyperparasitism of *Scytalidium uredinicola* on western gall rust, *Endocronartium harknessii*. Can. J. Bot. 58: 1154-1159.

Information reports, notes etc.:

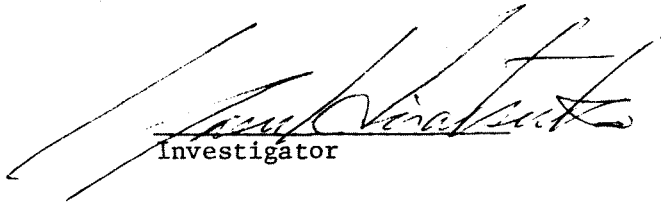
Traquair, J.A. and Y. Hiratsuka. 1979. Tropical, rust on imported plants. Proc. Can. Phytopathol. Soc. 46:72.

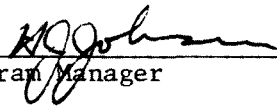
File reports:

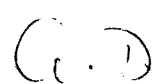
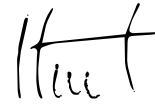
Hiratsuka, Y. and E. Allen. 1980. Pine stem rusts survey at the Pine Ridge Tree Nursery, Smoky Lake, Alberta. File report prepared for the Alberta Forest Service.

Hiratsuka, Y. and T. Evans. 1980. A survey of pine stem rusts on nursery stock at Pine Ridge Tree Nursery, Smoky Lake, Alberta 1979. File report prepared for the Alberta Forest Service.

16. Signatures:


Investigator


Program Manager

 
A/Director A.D. Kiil

STUDY STATEMENT

1981 - 82

Date: January 27 , 1981

1. Project: Detection and appraisal of tree pests and vegetative disturbances.
2. Title: Forest insect and disease survey.
3. New: Cont.: X 4. No. NOR-1-033
5. Study Leader: Y. Hiratsuka, H. Cerezke and B. Moody
6. Key Words: Detection, appraisal, distribution, parasites, hosts, damage, predators, biological control, hazard, susceptibility, stability, management, parks, recreation, symptoms, damage, effluents, easement atmosphere.
7. Location of Work: Throughout region.
8. Problem:

Forest insects and diseases annually destroy or degrade large quantities of otherwise usable wood fibre. They cause important damage to nursery plantations, shelterbelts and park plantings which have high aesthetic or shelter values. The relations between insects, diseases and their hosts are complex and often obscure. Many of the problems confronting resource managers have their origin in insect or disease activities, but in other instances unsuspected factors may be responsible for the damage, and the insects or diseases are of secondary importance. Correct diagnoses therefore require a highly trained technical and professional staff.

The data collected by the Survey provide essential information on life cycles, ecology, natural control agents, distribution and general abundance, which is of value to research entomologists, pathologists and other biologists. Many of the species reported by the Survey have a wide distribution, and the regional data are part of a larger body of data collected by this and other regions.

The gathering of background information on the distribution and abundance of insect and disease pests in the Prairies Region has largely been completed. We know which pests are important, and where they are most likely to occur. The need for routine detection

surveys has therefore decreased and, since management agencies are much closer to the problem than we are, they are often able to report any suspected damage. Although we will continue to monitor outbreaks of important pests, we dropped routine detection surveys and now concentrate our efforts on extension entomology and pathology, emphasizing impact and appraisal aspects. To facilitate this work we have established and strengthened contacts with provincial and federal agencies, and have initiated a number of training programs in the form of field trips, lectures or seminars, that are aimed at improving the capability of personnel in these agencies to diagnose the more common problems themselves. We will investigate any reported problems, provide identification service and give advice on control options and procedures. This approach, we believe, will make best use of available limited resources and should improve the service that we are able to provide to management agencies concerned with problems involving shade and forest trees.

9. Study Objectives:

1. To gain an improved knowledge of forest insects and diseases in the region for the purpose of minimizing damage to trees and shrubs attributable to these organisms and to provide an advisory service to management agencies and the public, and to contribute to FIDS national overview of important pest conditions.
2. Provide management agencies with diagnostic impact and appraisal services relating to effects of insects, diseases, climatic influences and pollutants on trees and shrubs and other types of vegetation.

10. Resources:

- a. Starting date: 1941 - Winnipeg and Indian Head, 1952 - Calgary
1970 - Edmonton
- b. Estimated year of completion: Continuous
- c. Estimated total Prof. man-years required:
- d. Essential new major equipment items for 1981-82 with cost: Nil
- e. Essential new major equipment items beyond 1982 with cost: Nil
- f. 1981-82 man-years

Prof.	0.4	(Y. Hiratsuka)
	0.2	(H. Cerezke)
	0.5	(B. Moody)
Supp.	1.0	(J. Petty)
	1.0	(F. J. Emond)
	1.0	(G. N. Still)
	1.0	(R. C. Tidsbury)
	1.0	(M. Grandmaison)
	0.2	(H. Gates)
Total	6.3	

11. Progress to Date:

Infestations of major forest insects and disease outbreaks have been monitored and reported on, including the forest tent caterpillar, large aspen tortrix, spruce budworm, jack pine budworm, mountain pine beetle and dwarf mistletoe. Special surveys have been conducted on a variety of problem insects and diseases throughout the three Prairie Provinces such as regeneration and nursery pests, Scleroderris canker, western gall rust, Hypoxylon canker, and elm bark beetles. The tree pest extension unit has responded to about 2,000 requests annually. Lectures and talks have been presented to many client agencies on insect and disease problems and representation has been provided on various provincial, regional and national pest advisory committees.

12. Goals for 1980-81:

1. Aerial and ground surveys to monitor major pests will be conducted in the three Prairie Provinces (Petty, Still, Tidsbury, Ranger-vacant).
2. Provide pest extension service to various client agencies (Emond).
3. Special surveys for particular pests or of designated areas will be conducted. Some examples of special surveys which will probably be carried out in 1980 are:
 - a. Conduct reconnaissance surveys in selected areas, especially western Alberta to assess and identify present and potential insect and disease problems in man-made and man-assisted forests (Hiratsuka, Cerezke).
 - b. Mountain pine beetle surveys in southern Alberta including Cypress Hills (Petty, Cerezke).
 - c. Scleroderris canker--Detection surveys will be conducted in Banff and Jasper National Parks and in red pine plantations in Manitoba (Hiratsuka).
 - d. Pine stem rusts--A follow-up survey of pine stem rusts at Pine Ridge Tree Nursery will be conducted (Hiratsuka).
 - e. Spruce budworm impact survey--Assessment of damage and impact will be conducted in western Manitoba (Cerezke).

4. Prepare a report on the mountain pine beetle in southern Alberta summarizing information on distribution, aerial and ground surveys--1979, biological observations, and a prediction for 1980 (Cerezke, Petty).
5. Information collected during 1980 field season will be collated into an information report (Hiratsuka, Petty, Cerezke).
6. Initiate an information series "Pest Report". This is a simple timely reporting format to inform CFS headquarters, other regional establishments, client agencies, and news media about important and interesting pest problems as they occur.
7. Follow-up on "FIDS Task Force Implementation Plan", as follows:
 - a. Contribute to "Working Groups" as designated (deadline April, 1980):

Western bark beetles, dwarf mistletoe (Cerezke, Hiratsuka)
Rots, Scleroderris, DED (Hiratsuka)
 - b. Prepare two "file monographs" on the two most important regional pests, bringing together existing information on incidence, distribution, damage, etc. (deadline April 1, 1981) (Cerezke, Hiratsuka).
 - c. Make effort to establish and fill two positions, FO (damage appraisal) and a ranger.
 - d. In collaboration with provincial agencies, apply best available depletion factors to provide general estimates of losses caused by major forest pests of economic and/or social importance.
 - e. Assign one ranger during the field season in Manitoba.
8. Prepare and present lectures and talks on forest insects and diseases to various client agencies as requested.

Added Goal:

9. Participate in the NFRC open house.

13. Accomplishments for 1980-81:

1. Aerial and ground surveys to monitor three major forest pests (jack pine budworm, forest tent caterpillar, and spruce budworm) were conducted in the three Prairie provinces and a spruce budworm survey was conducted in the Northwest Territories. Extent and intensity of outbreaks were recorded and predictions for the 1980 season were made (Petty, Still, Grandmaison, Gates, Tidsbury).
2. Provided pest extension service to various client agencies (provincial forest services, provincial agricultural representatives, forest industries, and municipalities) and to the general public. More than 2,000 samples and inquiries were handled including many on-site inspections (Emond, a student assistant).
3. The following special surveys were conducted:
 - a. A scleroderris canker survey in Jasper National Park revealed two new localities for the disease in the park. (Hiratsuka, Maruyama, Szlabey, Allen).
 - b. Elm bark beetle detection surveys were conducted with trap logs and sticky pheromone traps but no beetles were detected in southern Alberta. Surveys were conducted with the staff of Alberta Agriculture (Emond).
 - c. An intensively managed Christmas tree farm west of Sundre was examined. Root weevil, Armillaria root rot, terminal weevil and stem rusts were identified as main pest problems (Cerezke).
 - d. Eighteen regeneration plots in mechanically thinned stand near Edson were surveyed (Cerezke, Gates).
 - e. Conducted various surveys of mountain pine beetle independently or with personnel from Alberta Forest Service, Alberta Parks and Parks Canada in southern Alberta and southern Saskatchewan including Cypress Hills and Rocky Mountain National Parks (Petty, Gates Still, Cerezke, Grandmaison).
 - f. True color aerial photography of mountain pine beetle infested areas of Cypress Hills Provincial Park was taken (36 line miles) to be used as a base for locating beetle-killed trees. (Petty, Hall).

4. A report on mountain pine beetle with data to 1979 has been compiled and ready to be published adding the 1980 data (Cerezke, Petty).
5. An information report summarizing pest conditions of the region for 1980 and predictions for 1981 is under preparation and will be published before April 1981. Draft copy will be sent to Ottawa FIDS coordinator before 31 January, 1981, for national compilation (Hiratsuka, Petty, Cerezke, Still).
6. An information series "Pest Report" was not initiated in view of the new publication series "Forest Management Note". An article on jack pine budworm was published in the new series.
7. Following are accomplished according to "FIDS Task Force Implementation Plan"
 - a. Contributed to "Working Groups"

Western bark beetle and dwarf mistletoe (Cerezke, Hiratsuka)
 - b. No input was required for file monographs.
 - c. Two new positions (a damage appraisal officer and a ranger) were established and filled.
 - d. No pest damage and depletion figures were requested.
 - e. One ranger (Tidsbury) was sent to Manitoba for the field season.
 - f. FIDS contact persons were designated for each province and "Federal Provincial Pest Survey Review and Planning Meeting" was successfully conducted.
8. Following lectures and talks were given to various client agencies as requested:
 - a. Presented an evening lecture on important shelterbelt and shade tree pests to acreage owners (Cerezke, Emond).
 - b. Gave two lectures on Dutch elm disease at the University of Alberta as a part of a forest pathology course (Hiratsuka).
 - c. Gave a lecture and conducted a field tour to a group of Junior Forest Rangers in Whitecourt area (Cerezke).
 - d. One and a half day seminar on important forest insects and diseases with field tour was conducted for wardens and naturalists at the Prince Albert National Park (Hiratsuka, Cerezke).

- e. Gave talks on tree and shrub pests at Alberta Agriculture Tree Pruning Course (Olver, Brooks, Fairview, Ponoka) (Emond, Still, Petty).
- f. Presented a seminar at the Botany Department of the University of Alberta on pine stem rusts (Hiratsuka).
- g. Gave a talk at Forest Training School at Lac La Biche on forest pests (Emond, Grandmaison).

Added Accomplishments:

- 9. Participated actively in the open house at NFRC. Five rooms of display were organized and attended by FIDS staff including: Insect Reference Collection, Disease Reference Collection, Pest Extension, Major Forest Insects and Forest Mycology Research.

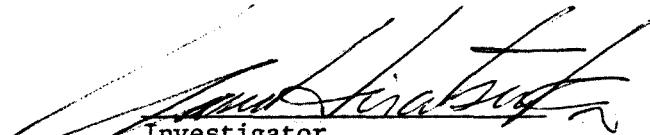
14. Goals for 1981-82:

- 1. Aerial and ground surveys to monitor major forest pests will be conducted in the three prairie provinces and the Northwest Territories (Petty, Still, Grandmaison, Tidsbury, Gates).
- 2. Provide pest extension service to various client agencies (Emond).
- 3. Special surveys for particular pests or of designated areas will be conducted. Some examples of special surveys which will be carried out in 1981 are:
 - a. Mountain pine beetle surveys in southern Alberta and southern Saskatchewan including Cypress Hills and Rocky Mountain National Parks (Petty, Still, Grandmaison).
 - b. Repeat true color aerial photography in Cypress Hills Provincial Park (likely joint cost-shared with Alberta Parks) and cover additional areas not covered in 1980-81 (Hall, Petty).
 - c. Schleroderris canker detection surveys will be conducted in Banff and Jasper National Parks and in red pine plantations in eastern Manitoba (Hiratsuka).
 - d. Data on insect and disease incidence and tree mortality in mechanically thinned plots near Edson will be summarized into a report (Cerezke).
 - e. Elm bark beetle surveys will be conducted in Alberta with personnel from Alberta Agriculture (Emond).
- 4. Compile and publish an information report on the forest pest situations in the region for 1981 and make predictions for 1982. Draft copy of the report will be sent to the FIDS coordinator (Ottawa) by the end of January, 1982.

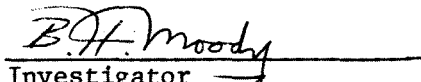
5. Organize annual Federal - Provincial forest pest review and planning meeting in March of 1981 with representatives from provincial forest services and Parks Canada.
 6. Prepare and present lectures and talks on forest insects and diseases to various client agencies as requested.
 7. Contribute several articles to "Forest Management Notes" as required.
 8. Review and evaluate survey methods used elsewhere for major forest insects and diseases, and work towards the production of a standard survey methodology manual suitable for the region (Moody).
 9. A report on mountain pine beetle incorporating data up to 1980 will be prepared and published possibly as an information report (Cerezke, Petty).
 10. Pest depletion estimates by major forest pests for 1976-81 will be made and will be incorporated in the National Forest Resource Data Program (Moody).
15. Publications:
- Up to 1980 (from 1970)
- Journal articles: 10
Information reports, notes etc.: 30
File reports: Numerous
- 1980-81:
- Journal articles: Nil
Information reports, notes etc.:
- Hiratsuka, Y., H. Cerezke and J. Petty. 1980. Forest Insect and Disease conditions of Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1979 and predictions for 1980. Northern Forest Research Centre. Information Report NOR-X-225.
- Still, G. 1980. Jack pine budworm outbreaks in Saskatchewan collapses. Forest Management Note. No. 3. Northern Forest Research Centre, Canadian Forestry Service.
- File Reports:
- Still, G.N. 1980. Jack pine budworm in Saskatchewan, 1980. File Report.

- Van Sickle, G.A., H. Cerezke, Y. Hiratsuka, L. Safranyik, and W. Wai.
1980. Survey procedures for western bark beetles and dwarf
mistletoes: Report by FIDS Working Group #2.
- Petty, J. 1980. Mountain pine beetle in Cypress Hills Provincial
Park, Alberta. File Report.
- Petty, J. 1980. Mountain pine beetle in Banff, Yoho and Kootenay
National Parks, May 1980. File Report.
- Still, G.N. 1980. Jack pine mistletoe, *Arceuthobium americanum*,
and wildfire in the Athabasca Forest, 1980. File Report.
- Emond, J. 1980. Detection survey of native elm bark beetle in
Alberta. File Report.
- Tidsbury, C. 1980. Other noteworthy insects and diseases in
Manitoba 1980. File Report.
- Still, G.N., M. Grandmaison, H. Gates, J. Petty and C. Tidsbury,
1980. Forest tent caterpillar defoliation forecasts for
1981, Central Alberta. File Report.
- Still, G.N. 1980. Forest tent caterpillar defoliation forecasts
for 1981, Saskatchewan. File Report.
- Still, G.N. 1980. Trembling aspen defoliation in Saskatchewan,
1980.
- Tidsbury, R.C. 1980. Forest tent caterpillar infestations in
Manitoba, 1980. File Report.
- Still, G.N. 1980. A post hatch survey of the forest tent
caterpillar. File Report.
- Still, G.N., H. Gates and J. Petty. 1980. Forest tent caterpillar
defoliation forecasts for 1980, Alberta. File Report.
- Tidsbury, R.C. 1980. Spruce budworm infestations in Manitoba,
1980 and forecasts for 1981. File Report.
- Petty, J. and G. Still. 1980. Spruce budworm survey, Slave River
area, Northwest Territories, July 1980. File Report.
- Emond, F.J. 1981. Tree pest extension report - 1980. File
Report.
- Emond, F.J. 1981. Insect and disease survey Saskatchewan Provincial
Tree Nurseries. File Report.

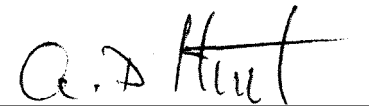
16. Signatures:


Investigator


Investigator


Investigator


Program Manager


A/Director A.D. Kiil

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 27, 1981

1. Project: Detection and appraisal of tree pests.
2. Title: Sawfly systematics.
3. New: Cont.:
4. No.: NOR-1-058
5. Study Leader: H. R. Wong
6. Key Words: Tenthredinoidea, Nearctic Region, distribution, hosts,
keys, life history, morphology, new genera, new species,
biogeography, revision, Symphyta, evolution, phylogeny.
7. Location of Work: Edmonton, Alberta.
8. Problem:

Sawflies cause serious damage to forest and shade trees in Canada. Until sawflies are identified, they cannot be discussed or treated in a scientific way. Accurate identification of pest species can determine their area of spread and assist in confining their damage to a restricted area. Systematic studies can provide the means of making predictions and generalizations about probable habits, distribution, future importance of newly discovered species, and clues on possible methods of control. It is the means by which an orderly system is provided for storing information about sawflies and is an important retrieval device.

Success in this study is excellent provided time, funds and technician assistance are available. Since I am the most experienced of two people in Canada at the present time, actively engaged in the systemic study of sawflies, any results obtained would add to the knowledge of this group of insects in Canada, and their role in our environment. Such knowledge would also aid certain biological and ecological studies in North America.

The material is made available by a number of agencies requesting identification services, in particular the Forest Insect and Disease Surveys across Canada. Species identification is generally based on the microscopic examination of the extracted genitalia, which are mounted on slides. After comparison with available types, any new species are described and illustrated together with other pertinent

information on host, life history, distribution, immature stages, phylogeny, etc. Keys are constructed to assist in future identification.

9. 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.

10. Resources:

- a. Starting date: 1950
- b. Estimated year of completion: A continuing project revised
- c. Estimated total Prof. man-years required: Indefinite
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years

Prof.	0.5
Supp.	0.0
Casual	<u>0.0</u>
Total	0.5

11. Progress to Date:

Over thirty scientific papers have been published in this study. The subject matter and the species or genera treated are indicated in previous study statements.

12. Goals for 1980-81:

1. Identify sawflies for research personnel, institutions and laboratories.
2. Obtain additional information on the life history of *Nematus fulvicrus* Provancher, if populations are available.
3. Determine the species of *Pristophora* that are new to science in North America and determine their phylogenetic relationship.

13. Accomplishments in 1980-81:

1. (a) Identified over 400 larval and adult sawflies for the Forest Insect and Disease Survey of the Northern Forest Research Centre, Canadian National Collection, regional clients and in-service personnel.
- (b) Reviewer. Sawflies from George Lake, Alberta. Questiones Entomological.
- (c) Reviewer. Symphyta of Sri Lanka. Proc. Ent. Soc. Washington.
2. Population of *Nematus fulvicrus* continued to decline and no larvae were available for study in 1980. Recent taxonomic studies in Washington has disclosed *Nematus calais* Kirby is the name for *Nematus fulvicrus* Prov.
3. Twenty seven new species of *Pristiphora* have been discovered. Several from Alaska, Yukon and Northwest Territories. The phylogenetic relationship of these species has been deduced.

14. Goals for 1981-82:

1. Identify sawflies for research personnel, institutions and laboratories.
2. Prepare descriptions of the 27 new species of *Pristiphora* for a monograph on the Evolution, Classification and Biogeography of the genus *Pristiphora* Latreille with a catalogue of the world species (Nymenoptera: Tenthredinidea).
3. Find morphological characters in larvae of the coniferous feeding sawfly of the family Diprionidae to separate the different genera in North America.

15. Publications:

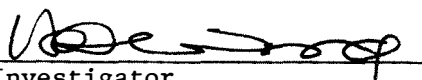
Up to 1980-81

Journal articles	27
Information Reports etc.	8
File Reports	0

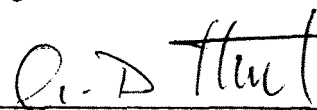
1980-81

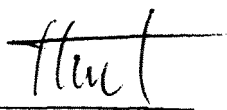
Nil

16. Singnatures:


Investigator


Program Manager


A/Director


A.D. Kill

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 27, 1981

1. Project: Detection and appraisal of tree pests and vegetation disturbances.
2. Title: Forest diseases: Diagnostic and taxonomic services.
3. New: Cont.: X 4. No.: NOR-1-153
5. Study Leader: Y. Hiratsuka
6. Key words: Mycology, herbarium, culture collection, nomenclature, identification.
7. Location of work:
8. Problem:

Accurate and prompt diagnosis of tree diseases and identification of causal organisms are essential to the pest extension services, damage appraisal studies, environmental assessment studies, and consideration of possible control measures of tree diseases. Besides, non pathogenic fungi in forest ecosystems also play important roles in nature. Proper identifications of mycorrhizal fungi, decomposing fungi and hyperparasitic fungi in the forest are important to many research studies and provide better understanding of forest ecosystems.

Taxonomy and nomenclature of fungi are constantly being revised. Changes in the concepts and limits of species and application of new or different names for the same organisms often cause confusion. Proper applications of up-to-date information of taxonomy and nomenclature are necessary whenever names of the organisms are used in reports or publications. To provide satisfactory taxonomic and nomenclatural service, a highly trained technical and professional staff is required.

To maintain and improve diagnostic and taxonomic service capabilities, it is necessary to maintain a high quality disease reference collection, a fungus culture collection and a reference literature collection. The disease reference collection of the centre contains more than 20,000 catalogued specimens of forest fungi and it is the biggest collection of forest fungi in the Prairie Provinces. The

fungus culture collection includes more than 500 live cultures of major forest fungi. The centre maintains all major taxonomic literatures of the fungi.

9. Study Objectives:

1. To provide diagnostic and taxonomic service of tree diseases and other forest fungi.
2. To maintain and improve diagnostic and taxonomic service capabilities of tree disease pathogens and other forest fungi in the region.
3. To prepare check lists of forest fungi of important areas (e.g. national parks, provincial parks, etc.), diagnostic keys for identification, and other related publications.

10. Resources:

- a. Study date: 1976 (included as a part of NOR-1-033 until 1975-76)
- b. Estimated year of completion: Continuous
- c. Estimated total Prof. man-years required:
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years
Prof. 0.4 (Y. Hiratsuka)
Supp. 0.7 (P. J. Maruyama)
Casual -
Total 1.1

11. Progress to Date:

Diagnostic and identification service of forest tree diseases has been provided for CFS personnel, outside agencies and the general public. The identification service has been closely coordinated with the pest extension service (NOR-1-033) and supported by an extensive disease reference collection and a fungus culture collection. The two collections have become the best and the most extensive depository of forest disease specimens and cultures in the Prairie Provinces. An annotated checklist of tree and shrub diseases in the Prairie Provinces and several minor mycological papers were published. Several papers on DED with the cooperation of Dr. Takai (GLFRC) have been published.

12. Goals for 1981-82:

1. Provide diagnostic and identification service of tree and shrub diseases.
2. Maintain and upgrade the Mycological Herbarium and a fungus culture collection.
3. Publish a journal publication on a new leaf spot fungus on poplar.

4. Complete the first draft of an information publication on major tree diseases of the Prairie Provinces.
 5. Cooperate with Dr. S. Takai (GLFRC) on the study of DED especially on the aspect of SEM examinations.
 6. Two pest leaflets (western gall rust and silver leaf) will be published.
13. Accomplishments for 1980-81:
1. Provided diagnostic and identification service of tree and shrub diseases for provincial forestry personal, district agriculturists, and general public mainly through pest extension service.
 2. About 200 new specimens were deposited in the Mycological Herbarium and several cultures were sent on request.
 3. A journal publication on a new leaf spot fungus on poplar is under review.
 4. Due to other commitments no progress has been made to complete the first draft of an information publication on major tree diseases of the Prairie Provinces.
 5. Cooperated with Dr. Takai (GLFRC) on the study of DED by taking SEM pictured.
 6. Two pest leaflets (western gall rust and silver leaf) have been written and ready for review.
14. Goals for 1981-82:
1. Complete the first draft of an information publication on major tree diseases of the Prairie Provinces by the end of 1981 to be able to be published in 1982-83 fiscal year.
 2. A journal paper on a new poplar leaf spot fungus will be published.
 3. Two pest leaflets (western gall rust and silver leaf) will be published.
 4. Provide diagnostic and identification service of tree and shrub diseases.
 5. Maintain and upgrade the Mycological Herbarium and a fungus culture collection.

6. Cooperate with Dr. S. Takai on the study of Dutch elm disease especially on the aspect of SEM examination.
7. Cooperate with Dr. W. Ayer of the University of Alberta on the study of metabolites of forest fungi.

15. Publications:

Up to 1980

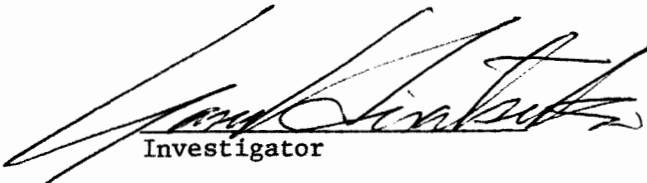
Journal articles: 3
Information reports, notes etc.: 4
File reports: Nil

1980-81:

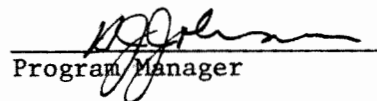
Takai, S. and Y. Hiratsuka. 1980. Toxicity of cerato-ulmi (CU) to white elm. Proc. APS-CPS Annual Meeting, Minneapolis. p. 116.

Hiratsuka, Y. 1980. "Fungi". In: A Nature Guide to Alberta. Hurtig Publ. Co.

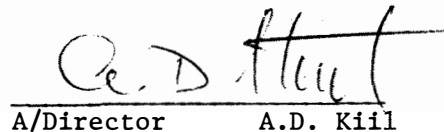
16. Signatures:



Investigator



Program Manager



A/Director

A.D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 27, 1981

1. Project: Detection and appraisal of tree pests.
2. Title: Forest Insect Diagnostic and Biosystematic Services.
3. New: Cont.: X 4. No.: NOR-1-154
5. Study Leader: H. R. Wong
6. Key Words: Insects, larvae, damage, hosts, parasites, biological control, galls, seasonal occurrence, distribution, nomenclature, taxonomy, identification, reference collection, insectary, life history.
7. Location of Work: Edmonton, Alberta.
8. Problem:

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

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

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

excellent provided experienced personnel, good insect reference collections (adults, larvae and damage) and major taxonomic literature are available. Considerable time must be devoted to keeping abreast of the latest entomological literature and changes in nomenclature. To facilitate prompt and accurate diagnosis, keys must be devised not only to the adult and immature forms, but also to insect damage in the Canadian Prairies.

The material is provided by personnel of the Forest Insect and Disease Survey and by the investigator. The immature insects are reared in the laboratory at Edmonton and in the field. The adults obtained are submitted to specialists in Ottawa or elsewhere in North America or Europe for identification and the latest nomenclature. All adults identified by specialists and larvae and damage associated with these adults are placed in the reference collection.

9. Study Objectives:

1. Provide diagnostic and biosystematic services to clients, in-service personnel, outside agencies and scientists engaged in biological and taxonomic research on insects.
2. Maintain and improve the regional collection of insects and mites.
3. When the opportunity arises, initiate biological and ethological studies to improve the diagnostic and biosystematic services.

10. Resources:

- a. Starting date: 1976
- b. Estimated year of completion: A continuing project. Revised.
- c. Estimated total Prof. man-years required: Indefinite
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years

Prof.	0.5	
Supp.	1.0	(D. Szlabey)
Casual	0.0	
Total	1.5	

11. Progress to Date:

Recorded formerly in NOR-1-033.

12. Goals for 1981-82:

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

2. Maintain and improve regional reference collection of insects and mites.
3. Provide information and specimens to scientists engaged in taxonomic and biological studies.

Goals added in 1980:

4. Make surveys in Eastern Manitoba and Western Alberta for the European pine shoot moth, larch casebearer and the European spruce sawfly.
5. Determine damage caused by an outbreak of a pill beetle in spruce and jack pine nursery beds, Big River Sask.
6. Review manuscripts submitted to scientific journals and information reports of the Northern Forest Research Centre.
7. Prepare displays and discuss the role of the Diagnostic Services for the "Open House" at the Northern Forest Research Centre in October 1980.
8. Attend and prepare a report on the meeting of the Entomological Society of America in Atlanta, Georgia.

13. Accomplishments in 1980-81:

1. Determined several thousand insect specimens in the mature and/or immature stages submitted to the Northern Forest Research Centre and handled over a thousand enquiries for in-service personnel, clients, outside agencies and scientists.
2. (a) Over one hundred specimens determined by specialists in Ottawa and by myself have been incorporated into the Insect Reference collection.

(b) Over three hundred immature insects were reared and about one hundred and fifty overwintered to obtain biological information and specimens for the reference collection.

(c) About two 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. P.T. Dang, Biosystematics Research Institute, Ottawa, Ontario.

Dr. J.A. Garland, Macdonald College, Ste-Anne-de-Bellevue, Quebec.

Dr. K. Benes, Praha, Czechoslovakia.

Additional Accomplishments 1980-81:

4. Field surveys in Eastern Manitoba and Western Alberta disclosed:
 - (a) The European pine shoot moth was not detected in the Canadian Prairies.
 - (b) The larch casebearer was not detected in Alberta and has not spread appreciably in Manitoba.
 - (c) The European spruce sawfly is not as wide spread in Manitoba as in previous years.
5. A study of an outbreak of pill beetles in beds of spruce and pine seedlings in Big River, Sask. indicate that this insect did not damage the seedlings but fed on the moss *Ceratodon purpureus* growing in the beds.
6. Reviewer. Guide to the Geometridae of Canada II.
subfamily Ennominae 3. Mem. Ent. Soc. Canada. 208 pp
- Reviewer. Dispersal of *Olsesicampe benefactor* Hinz.
Information Report. 59 pp
- Reviewer. Infestations and Interrelationships with Environmental Factors for 21 species of Forest Insects. Information Report. 264 pp
7. For the "Open House" at the Northern Forest Research Centre the following were presented.

Displays

- (a) Insects and their damage
- (b) Methods used to identify mature and immature insects
- (c) Parts of the tree attacked by various insects
- (d) Parasites of certain insects

Talks

- (a) Role of diagnostic services
 - (b) The Reference Collections
 - (c) Parasites and predators of insects
8. Prepared a file report of the Entomological Society of America Meeting, Atlanta, Georgia.

14. Goals for 1981-82:

1. Provide diagnostic and biosystematic services for the more difficult determinations on mature and ~~immature~~ insects damaging forest and shade trees.
2. Maintain and improve regional reference collection of insects and mites.
3. Provide information and specimens to scientists engaged in taxonomic and biological studies.

15. Publications

Up to 1980-81

Journal articles 37

Information Reports etc. 30

File Reports 0

Wong, H.R. 1980. Presidential Address. Proc. Ent. Soc. Alberta 27:2-3.

Wong, H.R. 1980. 1980 Conference of the Entomological Society of America, Atlanta, Georgia File Report 11 pp.

16. Signatures:


Investigator


Program Manager


A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 27, 1981

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

2. Title: Damage appraisal of major forest pests.

3. New: X Cont.: 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. Problem:

Periodic outbreaks of major insect and disease pests have caused extensive damage to trees and forests of the prairie provinces and the Northwest Territories. The impact of these pests on the forest is poorly understood and quantified, and adequate information is not available to forecast what might happen to a stand infested by a particular pest.

Both a decrease in timber production and mortality of forest stands may have drastic economic consequences. Therefore, estimates of forest losses due to pests, individually or collectively, are prerequisite to sound management and to allocation of research efforts. Losses by pests, are also a major depletion factor in the national forest data program. Provincial and industrial agencies require accurate and current records of damage to formulate their pest control, harvesting, reforestation and management plans.

9. 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 data program.

10. Resources:

- a. Starting date: 1981
- b. Estimated year of completion: Continuing
- c. Estimated total Prof. man-years required: Ongoing
- d. Essential new major equipment items for 1981-82 with cost: Nil
- e. Essential new major equipment items beyond 1982 with cost: Nil
- f. 1981-82 man-years

Prof.	0.5	(0.5 in - 033)	
Supp.	-		
Casual	-		
Total	0.5		

11. Progress to Date:

New Study

12. Goals for 1981-82:

1. Conduct preliminary surveys of established impact study plots and areas of known pest infestations to determine the current and past pest damage, and the feasibility of quantifying its effect on tree mortality and growth loss. Major pests involved would be:
 - a. Mountain pine beetle in southern Alberta and Saskatchewan.
 - b. Spruce budworm in Manitoba.
2. Review and evaluate the literature and data on the effects of major forest pests on tree growth and tree mortality in the forests of the region. If possible, apply this information to quantify pest depletion estimates for the National Forest Resource Data Program.
3. Investigate the possibility of establishing permanent plots in forests with known pests infestations (spruce budworm, jack pine budworm and dwarf mistletoes) to measure impact annually.
4. Investigate the possibility of using remote sensing techniques to assess pest damage.
5. Explore avenues of improved liaison with other forestry agencies to maximize data collection.

15. Publications:

N/A

16. Signatures:

B.H. Moody
Investigator

A. John
Program Manager

C. D. Hunt
A/Director A.D. Kill

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981-82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 2, 1981

1. Project: Reduction of damage from pollutants in the atmosphere.
2. Title: Symptomology of atmospheric effluent effects on the forest.
3. New: Cont.: X 4. No.: NOR-7-114
5. Study Leader: P. A. Addison and Vice Malhotra
6. Key Words: Sulphur gases, vegetation, lodgepole pine, white spruce.
7. Location of Work: Region-wide
8. Problem:

Industrial effluents discharged into the atmosphere in a number of locations have a real, imagined, or potentially deleterious effect on adjacent trees and other plant life. Government agencies and the general public at all levels are expressing concern. Industrial groups are apprehensive as to restrictions which may be applied. Regulatory agencies in many instances lack essential scientific information describing cause and effect relations. Provincial government agencies, industry and the public request involvement by the Canadian Forestry Service in this environmental problem in the form of cooperative research programs, detection and assessment surveys, and advisory services.

9. Study Objectives:
 1. Develop and apply methods for measurement of air-borne pollutants released from various sources as they are removed from the atmosphere by settlement, by precipitation and by assimilation.
 2. Describe vegetative symptom development resulting from known amounts of single and combined atmospheric industrial effluents, the sequence in which they are produced and develop diagnostic techniques based on these findings.
 3. Discern air pollutant injury thresholds and develop a species sensitivity index for different environmental conditions.

4. Test the Federal Air Quality objectives for air quality under defined environmental conditons.

10. Resources:

- a. Starting date: 1971
- b. Estimated year of completion: 1985
- c. Estimated total Prof. man-years required: 4.0
- d. Essential new major equipment items for 1981-82 with costs:
 1. Humidity Sensor and Electronic Control \$1,000.00
 2. Balistic Porometer for Conifer Needles \$5,000.00
 - \$6,000.00
- e. Essential new major equipment items beyond 1981 with costs:

High volume sampling system	\$55,000.00
High speed SO ₂ analyser	\$45,000.00
- f. 1981-82 man-years Prof.

	.5	(Addison)
	.3	(Vice Malhotra)
	<u>0.8</u>	Total Prof.
Supp.	.5	(Radford)
	.5	(Ridgway)
	<u>.2</u>	(Fenn)
	1.1	Total Supp.
Total	2.0	

11. Progress to Date:

Descriptive studies on the pattern and impact of pollutant deposition in the Athabasca oil sands and Flin Flon Mining and smelting areas have been completed as has the baseline study in the Cold Lake oil sands area. Both laboratory and field studies on soils, vascular plants and lichens have resulted in biomonitoring techniques, some of which show promise for future application while others need further definition. Studies on the natural environmental and biotic factors that influence pollutant uptake by or impact on Boreal Forest Plant Species have been initiated. Preliminary results indicate that further study is needed before the capability to predict pollutant impact to forest components can be reached.

12. Goals for 1980-81:

1. Write a journal article on the pattern of pollutant deposition in the Athabasca Oil Sands area as measured by lichen element content. (Addison)
2. Write a journal article on the quantification of branch dwelling lichen communities for the detection of air pollution impact. (Addison)
3. Write a final report to the Alberta Oil Sands Environmental Research Program on ecological benchmarking and biomonitoring for the detection of airborne pollutant effects on vegetation and soil. (Addison)

4. Write a final report to the Alberta Oil Sands Environmental Research Program on symptomology and threshold levels of air pollutant injury to vegetation. (Malhotra, Addison)
5. Quantify the differences in the response of lichens between aqueous and gaseous SO₂ and define the mechanisms responsible for these differences. (Addison)
6. Represent Canadian Forestry Service as a member of the Regional Hydrocarbon Committee. (Addison)
7. Participate in the planning and operation of the Sixth North American Forest Biology Workshop. (Addison)
8. Continue studies on metal phytotoxicity symptoms and physiological effects of metal on native vegetation. (Hogan)
9. Continue studies on the impact of air-borne emissions on epiphytic lichens -- goal transferred from NOR-24-159. (Malhotra)
10. Continue studies on the impact of air pollution mixtures on higher plant metabolism -- goal transferred from NOR-24-159. (Malhotra and Khan)
11. Write up and report the following: (Malhotra)
 - (a) Effects of SO₂ and other air pollutants on acid phosphatase activity in pine seedlings.
 - (b) Final AOSERP reports on NOR-24-159.
 - (c) Handbook on symptomology of air pollutants and natural stresses on forest vegetation in the Canadian Prairie region.

Additional Goals

12. Initiate a study to determine the influence of vegetation type and stand density on the concentration of SO₂ in forests. (Addison)
13. Initiate a study to explore the mechanism of Sulphur uptake and loss by plant tissue by:
 - a) Determining the impact of SO₂ on stomatal aperture;
 - b) Determining the uptake and loss of sulphur in jack pine seedlings under controlled environments. (Addison)

14. Write journal articles on:

- a) The effect of SO₂ on sugar and free amino acid content of jack pine seedlings.
- b) Determination of V in jack pine needles using neutron activation analysis.

15. Investigate the impact of Industrial Air-Borne emissions (Waterton Shell Gas Plant) on the environment around Pincher Creek and Waterton Lakes National Park. (Malhotra)

13. Accomplishments in 1980-81:

1. A paper entitled "Deposition of atmospheric pollutants as measured by lichen element content in the Athabasca Oil Sands area" by P.A. Addison and K.J. Puckett has been published in the Canadian Journal of Botany, Volume 58:2323-2334.
2. An article entitled "Quantification of branch dwelling lichen communities for the detection of air pollution impact" has been written, submitted for internal review and is currently being rewritten to incorporate changes suggested by reviewers and some added information.
3. The final report to the Alberta Oil Sands Environmental Research Program entitled "Ecological bench-marking and biomonitoring for detection of air-borne pollutant effects on vegetation and soils" has been accepted and is being published (AOSERP Report No. 111) by the Research Management Division of Alberta Environment.
4. A final report by S.S. Malhotra and P.A. Addison entitled "Symptomology and threshold levels of air pollution injury to vegetation" has been accepted and is being published (AOSERP Report No. 110) by the Research Management Division of Alberta Environment.
5. Owing to time constraints as a result of additional goals, work on the response of lichens to aqueous and gaseous SO₂ was not continued in 1980.
6. As Representative for Canadian Forestry Service on the Regional Hydrocarbon Committee, I was involved in six projects. Involvement was as follows:
 - 1) Beaufort Sea Oil and Gas
 - 2) Hudson Bay Leases
 - 3) Arctic Plot Project
 - 4) Norman Wells
 - 5) Hythe-Brainard Gas Project
 - 6) Ghost River Gas Plant

7. Involvement with the planning of the Sixth North American Forest Biology workshop (August 1980) was confined to the early stages only.
8. Studies on metal toxicities on native vegetation (*Calamagrostis neglecta*, *Agrastis gigantea*) are continuing. To date, several clones have been examined for tolerance to copper and zinc but no tolerance is evident to date.
9. & 10. These two goals were transferred to this study only as a temporary measure until the finalization of the contract with Alberta Government in April of 1980. The goals were then transferred to NOR-7-182 where they are more appropriate owing to their mixed pollutant nature. The accomplishments for these two goals are outlined in the NOR-7-182 Study Statement in their entirety.
11.
 - a) The paper by S.S. Malhotra and A.A. Khan entitled "Effects of SO₂ and other air pollutants on acid phosphatase activity in pine seedlings" has been published - Biochem. Physiol. Pflanzen 175:228-236.
 - b) The paper by S.S. Malhotra, and A.A. Khan entitled "Physiology and mechanisms of air-borne pollutant injury to vegetation 1979-80" is in press - AOSERP Report No. 109.
 - c) The handbook on symptomology of air pollutants and natural stresses entitled "Diagnosis of air pollutant and natural stress symptoms on forest vegetation in Western Canada" is in press at this time.

Additional Accomplishments

12. Huey sulphation plates were maintained at 6 heights above and within each of three plant communities (jack pine, aspen and black spruce) for a period of two months. The results indicated that plant canopies have a dramatic influence on both the distribution and absolute concentration of SO₂ in the canopy. Further work is required with much greater replication in order to accurately assess the impact of the vegetation on SO₂ deposition.
13.
 - a) The equipment required to measure the effect of SO₂ on stomatal resistance has been built and tested. Initial measurements under clean air conditions appeared to be accurate and the values obtained corresponded to those presented in the literature.

- b) Jack pine seedlings (150) were placed in an environmental growth chamber and fumigated with 0.20 ppm of SO₂. Samples of 10 plants were removed from the chamber and analysed after 0, 1, 2, 4, 8, 11 and 15 days of fumigation. The gas was then turned off. Ten plant samples were then removed after 1, 2, 4, 7, 11, 16, 23 and 30 days of clean air. Initial results indicated that both one-year- and two-year-old material take up SO₂ at similar rates but that while the young material loses S gradually in clean air, the older material does not.
-
14. Two manuscripts entitled "Effects of sulphur dioxide on sugar and free amino acid content of pine seedlings" and "Determination of vanadium in jack pine needles using Neutron Activation Analysis" have been published in *Physiol. Plant. and Env. Tech. Lett.*, respectively.
 15. Upon a request from EPS, Edmonton, conducted an extensive survey through the forested and agricultural areas both upwind and downwind from the Waterton Shell Gas Plant near Pincher Creek to investigate the impact of industrial airborne emissions on the environment. There did not appear to be any visible injury to vegetation that could be attributed to the airborne emissions. The time of investigation was, however, not the best time to examine the air pollution injury to deciduous vegetation as the fall senescence had already set in. A file report was written.
-
14. Goals for 1981-82:
 1. Revise and submit a journal article on the quantification of branch dwelling lichen communities for the detection of air pollution impact.
 2. Study the influence of type and density of plant canopies on the ground level concentration of SO₂.
 3. Examine the effect of SO₂, light and humidity on the stomatal resistance of jack pine.
 4. Initiate a paper on the gradient sites in the vicinity of the Athabasca Oil Sands area.
 5. Represent Canadian Forestry Service as a member of the regional Hydrocarbon Committee.

15. Publications:

Prior to 1980

2 Information Reports

9 File Reports

1980-81

Journals

Malhotra, S.S. and A.A. Khan. 1980. Effects of SO₂ and other air pollutants on acid phosphatase activity in pine seedlings. *Biochem. Physiol. Pflanzen* 175:228-236.

Malhotra, S.S. and S.K. Saskar. 1979. Effects of sulphur dioxide on sugar and free amino acid content of pine seedlings. *Physiol. Plant.* 47:223-228.

Hargesheimer, E.E., M.J. Apps and S.S. Malhotra. 1980. Determination of vanadium in jack pine needles using Neutron Activation Analysis. *Env. Tech. Lett.* 1:273-282.

Addison, P.A. and K.J. Puckett. 1980. Deposition of atmospheric pollutants as measured by lichen element content in the Athabasca Oil Sands area. *Can. J. Bot.* 58:

Information Reports

Malhotra, S.S. and A.A. Khan. 1980. Effects of SO₂ and heavy metals on Pinus banksiana. Proceedings of the 11th International Meeting for Specialists in Air Pollution Damage in Forests, Graz, Austria. 9 pp. In press.

Malhotra, S.A., P.A. Addison and A.A. Khan. 1980. Symptomology and threshold levels of air pollution injury to vegetation. Prep. for Alberta Oil Sands Environmental Research Program by Environment Canada. AOSERP Report No. 109 18 pp.

Malhotra, S.S. and A.A. Khan. 1980. Physiology and mechanisms of airborne pollutant injury to vegetation 1979-80. Prep. for Alberta Oil Sands Environmental Research Program by Environment Canada. AOSERP Report No. 110. 40 pp.

Baker, J. 1980. Differences in the composition of soils under open and canopy conditions at two sites close-in to the Great Canadian Oil Sands Operation, Fort McMurray, Alberta. Prep. for Alberta Oil Sands Environmental Research Program by Environment Canada AOSERP Report No. 97. 24pp.

Addison, P.A. 1980. Baseline condition of jack pine biomonitoring plots in the Athabasca Oil Sands area 1976 and 1977. Prep. for Alberta Oil Sands Environmental Research Program by Environment Canada. AOSERP Report No. 98. 43pp.

Addison, P.A. 1980. Ecological benchmarking and biomonitoring for the detection of airborne pollutant effects on vegetation and soils. Prep. for Alberta Oil Sands Environment Research Program by Environment Canada. AOSERP Report No. 111. 46pp.

Malhotra, S.S. and R.A. Blauel. 1980. Diagnosis of air pollutant and natural stress symptoms on forest vegetation in Western Canada. Hand-Book (NOR-X-228) 84 pp. In press.

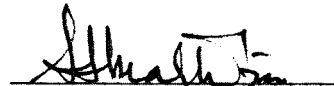
File Reports

Malhotra, S.S. 1980. The impact of airborne emissions from the Waterton Shell Gas Plant Ltd. on Waterton Lakes National Park and other areas surrounding the Plant. File Report NOR-7-114, 2 pp.

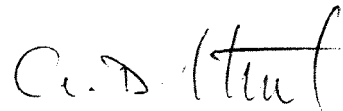
16. Signatures:



Investigator



Program Manager



A/Director

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981-82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 9, 1981

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 Leaders: Vice Malhotra, P.A. Addison and J. Baker
6. Key Words: Sulphur dioxide (SO₂), nitrogen oxides (NO_x), vanadium, nickel, synergistic, additive, antagonistic.
7. Location of Work: Oil sand areas of Alberta, Northern Forest Research Centre

8. Problem:

Industrial emissions may have actual or potentially deleterious effects upon forest vegetation and soils. A major portion of our earlier research was limited to the impact of individual air-borne pollutants on forest vegetation. Since the pollutant impact on vegetation under field conditions is a reflection of total emissions from a source, we are concerned as are other government agencies and the general public, about the potentially dangerous mixtures of emissions such as SO₂, NO_x, vanadium and nickel. The effects of these pollutants in mixtures may be additive, antagonistic or synergistic. Presently, there is a lack of scientific information on response of forest vegetation and soils to various pollutant mixtures. In order to permit regulatory agencies to assess impacts through the prediction of long-term effects and institute appropriate action, detailed research studies on the biological impact of pollutant mixtures must be undertaken. Such studies must be conducted both under controlled environment and field conditions. Information arising from such research will provide techniques for early diagnosis of air pollution injury to vegetation.

9. Study Objectives:

1. Conduct both controlled and field environmental research to describe and measure the physiological and visual impact of pollutant mixtures on forest vegetation species.

10. Resources:

11. Progress to Date:

12. Goals for 1980-81:

1. Initiate a study on the impact of air pollution mixtures on higher plant metabolism.

2. Initiate a study on the impact of air pollution mixtures on epiphytic lichens.
3. Collect soil profiles from "air pollution impingement" and "clean" areas (Athabasca Oil Sands) for air pollutant enrichment studies and determine its impact on seed germination growth and physiological processes.

13. Accomplishments in 1980-81:

1. Exposure of jack pine seedlings to vanadium, nickel and SO₂ individually as well as in mixtures increased peroxidase activity and altered its isozyme pattern. The effect on enzyme activity and its isozyme pattern was studied both after in vivo and in vitro treatment with the emission elements. The results showed that the increased activity of the enzyme was due to synthesis of new isozymes and increased synthesis of the existing ones. The analysis of peroxidase appears to be very promising in detecting air pollution injury to vegetation prior to visual symptom development.
2. In the epiphytic lichen Evernia mesomorpha, various metabolic processes appeared to be very sensitive to SO₂. Exposure of lichens to 0.34 ppm SO₂ for 2-24 h caused considerable reduction in protein and lipid biosynthesis and photosynthesis. Such a reduction in metabolic processes was studied as a function of frequency of moist period. The results showed that greater frequency of wetting produced more physiological and biochemical injury than less frequent wetting. It is suggested that under field conditions, moist microclimates will be more conducive to SO₂ lichen injury than dry ones. The pollutant mixture studies (NO₂ & SO₂) are currently underway.
3. Approximately 1000 cores of a Dystric Brunisol soil 15 cm in diameter by 20 cm deep were collected from an uncontaminated area in the Athabasca Oil Sands area. Various pollutants including V, Ni, Al, SO₄ and NO₃ were added to the core surface either singly or in combination. The amount added was based upon measured deposition in the vicinity of Suncor and represented deposition totals of soluble elements for 13, 26, 52 and 104 years. Jack pine seeds (25 per pot) were planted at a depth of 1.5 cm and over a period of several weeks, seedling establishment was recorded and the height of 4 selected seedlings was measured. Peroxidase activity was measured after 9 weeks and again at 17 weeks when visual symptoms of plant injury were noticeable.

14. Goals for 1981-82:

1. Write annual progress report on pollutant mixture effects. (Addison)
2. Continue studies on the influence of pollutant mixtures on jack pine by soil contamination by measuring plant responses such as photosynthesis, peroxidase activity, growth, visual symptom development and element content. (Addison)
3. Determine the magnitude and pattern of migration of pollutant elements and changes in soil nutrition caused by the addition of pollutant mixtures. (Baker)
4. Continue the study on the impact of air pollution mixtures on epiphytic lichens. (Addison)

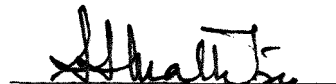
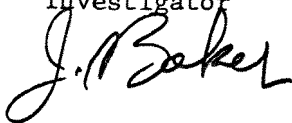
15. Publications:

Malhotra, S.S. and A.A. Khan. 1980. Physiology and mechanisms of air-borne pollutant injury to vegetation 1979-80. Prep. for Alberta Oil Sands Environmental Research Program by Canadian Forestry Service. AOSERP Report No. 110, 46 pp.

16. Signatures:



Investigator



Program Manager



A/Director

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1981

1. Project: Insect and disease management systems.
2. Title: Analysis and synthesis of Forest Insect and Disease Survey historical data and information.
3. New: Cont.: X 4. No.: NOR-9-089
5. Study Leader: W. G. H. Ives
6. Key Words: Population trends, computer mapping, data retrieval,
insects and environment.
7. Location of Work: Edmonton and Ottawa.
8. Problem:

The large body of data collected by the Forest Insect and Disease Survey since its inception has never been thoroughly examined to determine what information it contains regarding population trends and the environment.

Some of the data on general distribution and abundance and on rates of parasitism were in reports or on raw data sheets, but had not been transferred to forms suitable for computer input. Similarly, the format used by the Meteorological Branch of the Department of Transport for summarizing their weather data was not suitable for some of the analysis, and additional summaries had to be prepared.

This study has undertaken to consolidate all of the available information on common insects and weather records for Manitoba and Saskatchewan into a format suitable for computer input, and to subject these data to a thorough examination. Writing of the necessary computer programs was undertaken by staff in Ottawa.

- ### 9. Study Objectives:

To determine if the large amount of data on insect infestations collected by the Forest Insect and Disease Survey during the past years can be utilized to help explain fluctuations in populations of forest insects, and thus lead to a better understanding of the factors contributing to insect outbreaks.

10. Resources:

- a. Starting date: 1969
- b. Estimated year of completion: 1981
- c. Estimated total Prof. man-years required: Nil
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years Prof. -
 Supp. -
 Casual-
 Total -

11. Progress to Date:

The historic FIDS data for Manitoba and Saskatchewan have been summarized and plotted. Weather data have also been summarized and plotted. Twenty-one species of defoliating insects have been considered, as well as 11 weather variable, each for 7 geographical areas. SE Manitoba; Interlake area; Riding and Duck mountains, NW Manitoba; Hudson Bay area; Prince Albert area; and Meadow Lake area. Insufficient data were available for northern areas or agricultural areas. Most of the pertinent literature has been reviewed and computer manipulation of data completed and over half of the manuscript was drafted.

12. Goals for 1980-81:

Complete revision of manuscript tentatively entitled "Infestations and interrelationships of 21 species of forest insect defoliators collected in Manitoba and Saskatchewan by the Forest Insect and Disease Survey during the period 1945 to 1969".

13. Accomplishments in 1980-81:

Manuscript was completed and is now in the final editing stages. A Forest Management Note summarizing the report for forest managers was also prepared and is in final stages of editing.

14. Goals for 1981-82:

None. Study terminated.

15. Publications:

1979 - 80

Nil

1980 - 81


W.G.H. Ives. Environmental factors affecting 21 forest insect defoliators in Manitoba and Saskatchewan, 1945-1969. Information Report (In preparation).

W.H.G. Ives. Weather and Forest Insect population trends. Forest Management Note. (In preparation)

16. Signatures:


Investigator


Program Manager


A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1981

1. Project: Insect, disease and vegetation management systems
2. Title: Chemical Controls of pests and vegetation in managed forests.
3. New: Cont.: X
4. No.: NOR-9-132
5. Study Leader: J. Drouin
6. Key Words: Efficacy, spraying toxicology, pesticides, registrations, residuals, formulations, herbicides.
7. Location of Work: Prairie Region
8. Problem:

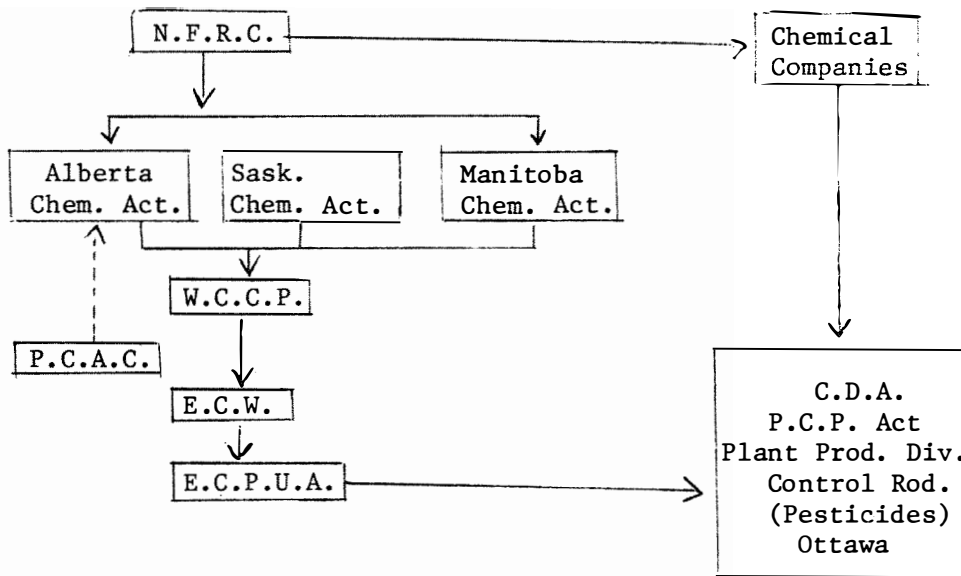
Insects and diseases cause injury and/or mortality to ornamentals shrubs and shade trees. These high cost plantings have caused much concern resulting in extensive requests for cause and/or controls to the C.F.S. In the early stages of this project, safe and efficient controls were often unknown or not registered through lack of data to support Canadian registration.

From 1972 to 1979 the data requirements were completed for the majority of priority insects for the prairie region. These field tests, with suitable recommendations were submitted to the Plant Products Div., Control Products Section, Dept. of Agriculture in Ottawa for registration. At completion of the numerous goals for insect and disease management systems and with the increasing needs for reforestation more emphasis was necessary on increasing research in herbicides, as a tool in forest management. In 1979, a study plan was determine and select equipment and techniques and finally to conduct efficacy tests in order to obtain the data requirements to submit suitable recommendations for registration in Canada.

Herbicidal screening trials were conducted to select the most promising chemicals for the control of shrubs (brush), grasses and forbs, contacts were established with chemical firms and with the Alberta Forest Service to assess their needs, support, and to select suitable sites for trials

and to ensure security. On the basis of past and current research in North America the potential herbicide candidates most suitable for forestry application were selected along with the following priority rated field testing needs; site preparation before planting; conifer release from brush competition, conifer release from weed/grass competition and chemical thinning in dense stands of conifers.

A schematic of the organizations in relation to chemical controls with herbicides is as follows:



9. Study Objectives:

1. To develop control methods and assess needs on the use of herbicides and pesticides as a tool in forest management.
2. Conduct efficacy trials for various dosages, formulations and timing and to determine percent mortality of host species.
3. Provide data to aid registration recommendations for selected chemical products.

10. Resources:

- a. Starting date: 1972
- b. Estimated year of completion: Continuing
- c. Estimated total Prof. man-years required: 0
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years

Prof.	-
Supp.	1
Casual	-
Total	1

11. Progress to Date:

Implemented a viable working unit, established contacts at the Federal and Provincial levels, and with municipal agencies and private industries involved in the use, manufacture and distribution of pesticides and related products. Determined and selected safety clothing, equipment, ground spray instruments, techniques and methods. Established a pest priority list of insect species requiring controls.

From 1972 to 1979, conducted effacy tests using mist blower, hydraulic, soil drench, bark paints and ultra low volume application methods. As part of an ongoing program at NFRFC, emphasis was on completing data requirements with the numerous insecticides to obtain registrations. These tests with suitable recommendations were submitted, on completion, to the Plant Products Division, Control Products Section of the Department of Agriculture, Ottawa. As a result of six years of trials, sufficient data has been submitted for registration review of 22 chemical products for the control of 33 insect pests attacking 22 species of trees and shrubs. These Canadian registrations are now included on several labels of insecticides.

These data were analysed and performance reports were submitted to 19 chemical companies; summary of 601 field evaluations to the Pesticide Research Report (ECPUA) Ottawa; prepared 3 File Reports, 7 Information Reports, control and/or biologies on 25 Pest Leaflets, one fungicide report and 5 manuscripts on biology and chemical control of various insect pests; illustrated 21 Pest Leaflets, illustrations for 7 front covers NOR-X series, 1 illustration for journal publication and 8 panels of illustrations for an open house presentation and a problem analysis on chemical controls and herbicidal activities for 1979.

12. Goals for 1980-81:

1. Prepare step study plan on the use of herbicides as a tool in forest management; assess needs; development of control methods; determine and select techniques and equipment; conduct efficacy tests; obtain data requirements and submit suitable recommendations with a view to registration.
2. Participate in a study to determine importance of seed and cone insects in Prairies Region for seed orchard management; investigate means of minimizing these losses through chemical and cultural controls where needed (integrate with NOR-9-181).
3. Assist W.G.H. Ives in nucleopolyhedrosis virus aerial spray application on forest tent caterpillar with heavy concentration.
4. Review, edit, illustrate pest leaflets, Information Reports and Forestry Reports.

Goals Added

5. Insecticide spray evaluations to complete efficacy data on 2 pyrethrins to complete registrations.
6. Evaluate pheremone traps for N.R.C. for *Proteoteras willingana* & *P. crescentana*.
7. Illustrating 7 front cover for NOR-X series, journals and open house.
8. C.F.S. representation, reporting, surveys, handling requests for information, controls surveys, consultations, talks, T.V. taping and papers were provided in 1980 to the following:
 - a) WCCP
 - b) Plant Products Division CDA
 - c) Plant Industry Lab Alta.
 - d) NRC Saskatoon, attractant studies
 - e) Industry, general public
 - f) Herbicide use/trials/applications, Alta. Forest Service, Manitoba Forest Serv. National Parks, Canada, Abitibi-Price Manitoba.
 - g) Alberta Hort Station Brooks.
 - h) Expert Committee on Weeds
 - i) Peace R. Small Fruit Growers Assoc.
 - j) Project Leader for Open House.

13. Accomplishments in 1980-81:

1. Prepared step study plan on use of herbicides in forestry, assessed needs, developed control methods, determined and selected techniques and equipment, contact established with chemical firms and with the Alberta Forest Service, the Manitoba Forest Service and Abitibi - Price Pulp & Paper Mills to assess needs, policies, support and to select suitable sites for field trials and to ensure security. Efficacy tests were conducted as follows:

Conifer release from brush competition (aspen, willow, birch, alder etc.) in the Forest Reforestration Project at Slave Lake on white spruce 1/10 acre replicated plots with a control plot established in a random block design. Material and dosage was Velpar Grid Balls (hexazinone) at 10, 20 and 30 lbs/acre at 3.5, 4.5 and 6 ft. spacing applied by hand. By Sept. 8, repeated examination showed the grid balls had crumbled from the rains since application but were still visible. Chlorosis and premature leaf fall was evident on birch, aspen, willows, other shrubs and grasses. Some browning of spruces were found on all plots where the grid ball had landed at base of the seedling. Evaluation will be continued in 1981. Total Velpar Grid Balls application = 14 lbs.

Conifer Release from weed and grass competition south of the Economy Tower Supplemental at Grande Prairie on replicated 1/10 acre plots/treatment on random block design. Velpar L (liquid) hexazinone), applied with a Solo pack pak sprayer at 2, 3 and 4 lbs/acre on 15 trees per plot. Spray applied in 2' circle around spruce seedling and identified with flagged spikes. Area scarified 73-74, seeded in 75. Assessment to follow in 1981.

Total Velpar L application = 42.4 oz.

Chemical Thinning in dense conifer stands of lodgepole pine in the Edson Forest on the Hudson Bay gas road 29.2 Km south of highway 16 Hyvar X-L (bromacil) applied undiluted with a metered spot gun application of 8 ml/2" stem diameter, each treated stem identified with a yellow paint spot at base. Area checked Sept. 22 but no evidence of chlorosis at that time. Evaluation to continue in 1981 and further test application at 4 ml/2" stem diameter.

Total Hyvar X-L application = 64 oz. US.

2. Participated in a Seed and Cone Workshop at P.F.R.I., Sault Ste Marie. Assessed needs, reviewed existing control methods, obtained, collected and dissected cones for 424 white spruce, 74 black spruce, 210 tamarack, and 78 balsam fir from Alberta, Manitoba and Saskatchewan to establish per cent seed destroyed, by what species and method.
3. Assisted W.G.H. Ives in nucleopolyhedrosis virus serial sprays on Forest tent Caterpillar.
4. Reviewed, edited controls and biology of 12 Pest Leaflets.

Accomplishments Added:

5. Completed insecticidal spray evaluations and efficacy data on 2 pyrethroids to complete registration data.
6. Evaluated pheromone traps from the National Research Council for *Proteoteras willingana* and *P. crescentana*.
7. Illustrated 7 front covers for NOR-X series, 1 journal and 8 panel illustrations for open house cube.
8. C.F.S. representation, reporting, handling requests, surveys, consultations, talks, T.V. taping and papers were provided to the following:
 - a) Western Committee on Crop Pesticides (ECPUA)
 - b) New and Modified Uses, Plant Product Div., CDA, submissions, registrations.
 - c) Plant Industry Lab, Alta Agric, clients and general public, industry.
 - d) National Research Centre, Saskatoon, attractant studies in forestry.

- e) Herbicide use/trials/applications, Alta Forest Serv., Manitoba Forest Service, National Parks, Canada, Abitibi-Price, Manitoba.
- f) Alberta Horticultural Station, Brooks
- g) Expert Committee on Weeds
- h) Peace River Small Fruit Growers Association
- i) Mountain Pine Beetle plots (3), carbaryl sprays for H. Cerezke

9. Project leader for Open House, preparation, organization.

14. Goals for 1981-82:

1. Continue evaluations with herbicides, selections of herbicides, selection of program and proposals for ground and aerial applications of herbicides in Alberta and Manitoba, monitor and assess existing trials, establish new test sites, and expand to spring and summer applications of herbicides as follows:
 - a) Conifer release from weeds/grass competition:
 - with new 5% grid balls @ 6' spacing
 - foliar application with glyphosate (Roundup)
 - with Velpar L (hexazinone) @ 2, 3, 4, lbs/acre applied in early spring.
 - b) Conifer release from Brush competition:
 - with Krenite (no common name) for site preparation and release
 - with glyphosate (Roundup)
 - c) Chemical Thinning in Pine:
 - with Hyvar X-L (bromacyl) @ 4 mL/2" stem diameter
2. Assist in the development of attractant (pheremone) studies with N.R.C. Saskatoon; assistance from H. Wong and Survey personnel:
 - continue field tests of pheremone traps for *P. willingana* & *P. crescentanato* distinguish damage larval differences, populations & distribution.
 - set out 6 traps in Manitoba, Alberta, Saskatchewan for *Rhyacionia buoliana* for distribution, populations.
 - set out 6 traps at Devon Nursery to collect the northern pitch twig moth *P. albicapitana* and collect 100 pupae in mid June for analysis.
3. Participate in the study of Seed and Cone insects in the prairie region by investigating means of control through chemicals.

4. Review, edit, illustrate Pest Leaflets, Information Reports and journal articles.
5. Obtain input from Tree Physiologist.

15. Publications:

1978 - 80

Nil

1980 - 81

Drouin J.A. 1980. Pesticide Field Trials on Shade and Shelterbelt Trees in Alberta, 1979. Environ. Canada, Can. For. Ser., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-227.

Drouin J.A. 1980. Summary of field tests 1980. Pesticide Research Report, Canada Griculture, Expert Committee on Pesticide Uses in Agriculture, Ottawa.

Drouin J.A. 1980. Chemical Control Trials on the Northern Pitch Twig Moth in Alberta. Tree Planters Notes, USDA,
Vol. No. pp

Drouin J.A. 1980. Annual revision of insect pests and controls on Berry Crops. In WCCP Report (1980): 5 pp

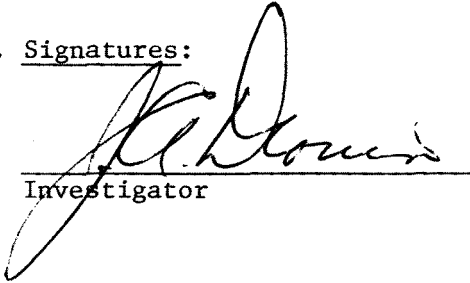
Cerezke H.F. and Drouin J.A. 1980. Annual revision of insect pests and controls an shelterbelts, ornamental and shrubs. In WCCP Report (1980): 17 pp

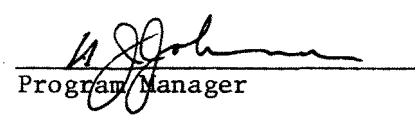
Drouin J.A. 1980. Report on the Impact of Herbicides on the Eastern Boreal Forest Ecosystem workshop. File Rep. 3 pp

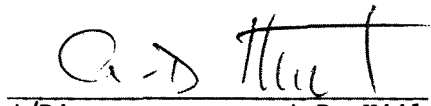
Philip H. and J.A. Drouin. 1980. Annual Revision of insect pests and controls on houseplants and on greenhouse woody ornamentals. In WCCP Report (1980) 3 pp

Drouin J.A. 1980. Report on herbicide uses/abuses and as a tool in forest management to "Maintaining our Forests" meeting A.F.S. at Slave Lake. 6 pp

16. Signatures:


Investigator


Program Manager


A/Director

A.D. Kiil

STUDY STATEMENT

1981 - 82

Date: January 28, 1981

- Since little, if any, tree mortality occurs as a result of forest tent caterpillar outbreaks, the pest is of relatively little concern to informed forest managers. Rural residents, however, are subjected to crawling masses of caterpillars and find this experience extremely

annoying. Tourist operators, in particular, are very vocal in demanding government agencies to take remedial actions. Although Malathion (and other insecticides) can provide satisfactory control, such chemical application is often difficult to justify when one considers the problem objectively.

In Canada, most outbreaks appear to be terminated by unfavorable weather conditions, high levels of dipterous parasitism (primarily *Sarcophaga aldrichi* Parker), or epizootics of virus, particularly a nuclear polyhedrosis virus. These factors may operate alone or in combinations. Unfortunately, both the dipterous parasites and the virus usually reach extremely low levels during endemic periods between outbreaks, simply because the host insect is so rare that there is little to sustain them. Consequently, both these factors usually require several years to increase in abundance before they become effective control agents.

This problem presents a unique opportunity in biological (or possibly integrated) control. If the sarcophagids and virus could be introduced into localities with incipient outbreaks, it might be possible to avert major outbreaks in these areas. This idea is not new, having been suggested by Tothill in 1918, but as far as we know has not been tried with the forest tent caterpillar, although a similar approach has been used successfully with one or two other insects. *S. aldrichi* is admirably suited to experimental manipulation of its numbers, as it can be reared successfully and easily on artificial media. Similarly, it is probable that the virus can eventually be propagated on tissue cultures. This has been done with other viruses, without loss of virulence, but has not yet (as far as we know) been done with the forest tent caterpillar, although tissue cultures of this insect have been established. It therefore seems probable that stock cultures of both the parasites and virus could eventually be maintained for use in applied biological control as needed. Before such a program is initiated, or advocated, it is essential that preliminary studies be undertaken to determine whether or not the required densities of parasites and virus can be produced and manipulated advantageously. For example, it will be necessary to determine the dispersal of released parasites under field conditions.

9. Study Objectives:

To determine whether or not localized incipient outbreaks of forest tent caterpillar can be prevented or their severity minimized by manipulation of natural biotic control factors, particularly nuclear polyhedrosis virus, augmented where necessary by chemical or bacteriological control measures.

10. Resources:

- a. Starting date: 1977
- b. Estimated year of completion: 1981
- c. Estimated total Prof. man-years required: 6.5
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years Prof. -

Supp.	-
Total	-

11. Progress to Date:

Development of techniques for rearing *Sarcophaga aldrichi* Parker on artificial media has been halted, due to lack of progress, hence any further work with the flies has been discontinued and efforts concentrated on tests with the virus.

Preliminary ground spraying of aspen stands with virus suspensions gave encouraging results, as did sprays with Dipel. Virus sprayed on larvae in 1976 gave almost complete mortality in one 1/2 acre plot and exceeded 95% in another. Dipel, when supplemented by 1 oz. or less of Sevin per 50 gals. of spray, gave 85 to 75% mortality in 1-acre plots. Various concentrations of virus were applied in 1977 before the larvae hatched. The two heaviest concentrations of polyhedra ($1 \times 10^8/\text{mL}$ and $1 \times 10^7/\text{mL}$) caused mortality approaching 100%, while a concentration of 1×10^6 polyhedra/mL caused about 75% mortality.

Aerial spraying of virus in 1978 was done under adverse conditions. Weather was unsettled, with frequent showers, some of them heavy, and synchronization between foliage and larval development was very poor. The larvae hatched early, then mined the buds. Consequently, some of the late-flushing trees were partially defoliated before the leaves flushed. In addition, the spray plots were heavily infested with forest tent caterpillar, and larval mortality due to starvation was heavy on some plots, and natural virus also caused a considerable amount of mortality. Nevertheless, the two heaviest concentrations (1×10^7 and 1.5×10^7 polyhedrol inclusion bodies per mL) increased total mortality by about 10% and 20% respectively.

Virus was applied as planned in 1979, and weather conditions were nearly ideal. Assessment of mortality showed that application to the eggs increased mortality by about 15%. Spray applied to first-instar larvae increased mortality by about 20%. Larvae sprayed during the third- and fourth-instar did not appear to suffer increased mortality, but there may have been an increase in sub-lethal mortality and a consequent increase in the carry-over of virus.

Small-scale field trials of an NPV of the Bruce spanworm were made in the Obed area. The trials indicated that this is a virulent NPV. A note has been prepared, in co-operation with Dr. J.C. Cunningham, Forest Pest Management Institute, for submission to the Canadian Entomologist.

12. Goals for 1980-81:

1. Test heavy aerial applications of forest tent caterpillar NPV to determine if the amount of additional mortality can be increased sufficiently to give satisfactory control. The actual concentrations will depend on the amount of virus on hand. Provisional values are 10^9 , 2×10^8 and 10^8 polyhedral bodies per millilitre.
2. Conduct limited follow-up sampling to determine if incidence of virus infection has increased in Partridge Hill plot, as a result of spraying in 1979.
3. Prepare an information report summarizing the results of aerial spraying conducted during 1978-80.
4. Collect late-instar larch sawfly larvae in the vicinity of the Pine Falls, Rennie, and Seddon's Corner to determine the current rates of parasitism by *Olesicampe benefactor* and

Mesochorus dimidiatus. At the same time, take note of current rate of defoliation, or make egg population estimates. If time permits, evaluate rates of larch sawfly parasitism in Obed Lake area of Alberta.

13. Accomplishments in 1980-81:

1. Two heavy concentrations of virus were applied by helicopter to forest tent caterpillar populations in the Wabamun Lake area. Control was not satisfactory, even though the concentrations were 10^9 and 5×10^8 polyhedra per millilitre.
2. Follow-up sampling in the Partridge Hill plot indicated no detectable differences in carry-over of virus in areas sprayed and not sprayed in 1979.
3. An information report summarizing the results of aerial spraying conducted in 1978-80 is in the final editing stage.
4. Larch sawfly larvae were collected in the Pine Falls and Seddon's Corner areas, and parasitism by *Olesicampe benefactor* and *Mesochorus dimidiatus* determined. There is some indication that sawfly populations in the Pine Falls area may be increasing slightly. This is to be expected, as *Olesicampe benefactor* parasitism is relatively low (about 15% 8 Km south of the plot). Defoliation at Seddon's Corner was very light, but will probably increase, as no *O. benefactor* were found among the 150 larvae collected. Defoliation at Obed had decreased, but sawfly larvae were still plentiful. Parasitism by *O. benefactor* had spread to at least 12 km east of the release site. *Mesochorus dimidiatus* was not recovered in any of the dissections, but one adult emerged before the sawfly cocoons were placed in cold storage.

5. A manuscript on *Olesicampe benefactor* dispersal is currently being edited for publication as an information report.

14. Goals for 1981-82:

None. Study terminated

15. Publications:

Up to 1979-80

Ives, W.G.H. and J.A. Muldrew. 1978. Preliminary evaluations of the effectiveness of nucleopolyhedrosis virus sprays to control the forest tent caterpillar in Alberta. Inf. Rep. NOR-X-204.

Ives, W.G.H. 1978. Evaluations of effectiveness of nucleopolyhedrosis virus sprays to control the forest tent caterpillar in Alberta - 1978 trials. File Report. 2 pp. (plus 1 table and 1 figure).

Ives, W.G.H., J.A. Muldrew and R.M. Smith. 1979. Evaluation of effectiveness of nucleopolyhedrosis virus sprays applied in 1979 to control the forest tent caterpillar in Alberta with a follow-up assessment of 1976 and 1978 applications. 3 pp. (plus 2 tables and 1 figure).

Ives, W.G.H. and J.C. Cunningham. 1980. Application of nuclear polyhedrosis virus to control Burce spanworm (Lepidoptera: Geometridae). Can. Ent. 112:741-744.

1980-81

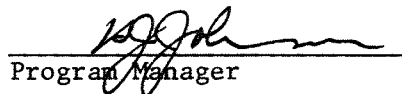
W.G.H. Ives, J.A. Muldrew and R.M. Smith. Experimental aerial application of forest tent caterpillar baculovirus in Alberta in 1978, 1979 and 1980 with assessments of areas treated in previous years. Information Report (In preparation).

J.A. Muldrew. Dispersal of *Olesicampe benefactor* Hinz, an introduced parasite of the larch sawfly. Information Report (In preparation).

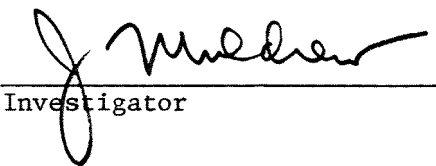
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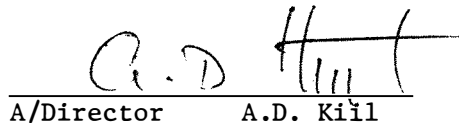
Investigator



Program Manager



Investigator



A/Director

A.D. Kill

STUDY STATEMENT

1981-82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1981

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

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

What seems to be required, then, is an assessment of tree mortality from the time of establishment until crown-closure at age 25 to 35 years. An estimate of this mortality can be obtained by establishing plots in a number of different age classes, on a variety of sites, and assessing the mortality for a relatively short period of time. This will allow a composite survival curve to be drawn up for each ecological site, possibly in about 5 years, which can be modified as more information becomes available. These curves should provide the information needed to determine what modifications, if any, of the stocking standards in relation to site class are required.

Each sampling unit will be a plot of 20 trees, and as many of these plots will be established in each area as in practical, typically 40 such plots per area. Several replicates will be established in a number of site and age classes. They will then be examined periodically to determine the amount and cause of mortality.

Insect and disease attack on jack pine and lodgepole pine are probably more important than in white spruce. Therefore, initial emphasis will therefore be concentrated on these two species.

9. Study Objectives:

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

10. Resources:

- a. Starting date: 1980
b. Estimated year of completion: 1986
c. Estimated total Prof. man-years required: 7
d. Essential new major equipment items for 1981-82 with costs: Nil
e. Essential new major equipment items beyond 1982 with costs: Nil
f. 1981-82 man-years Prof. 1.0 (W.G.H. Ives)
0.2 (K. Froning)
Supp. 1.0 (R.M. Smith)
Total 2.2

11. Progress to date:

This study was established in 1980 with a number of preliminary goals. It now seems advisable to concentrate on goal 2 in this study, and to transfer goals 1 and 3 to other studies: goal 2 has been considerably modified. Instead of widespread surveys, the study will be confined to lodgepole pine in the Hinton area and to jack pine in southeastern Manitoba. In the Hinton area, most of the data will be collected from newly established plots.

although trees in a number of old plots will be examined if time permits. In Manitoba, activities may have to be limited to a re-examination of 18 plots established by DeBoo in 1967, but new plots will be established if time and resources are available.

12. Goals for 1980-81:

1. Conduct a preliminary survey of seed production plants, by means of personal interviews and examination of cone samples, in order to determine the importance of seed and cone insects in the production of coniferous seed, particularly white spruce.
2. Conduct preliminary surveys of a number of established plantations in the Prairie Provinces to determine the amount of current pest damage and to determine the feasibility of obtaining quantitative estimates of its effect on tree mortality and growth loss.
3. Conduct a preliminary evaluation of the available data on losses attributable to insect and disease attack of trees in the region in order to determine the feasibility of incorporating this information into a Regional Data Bank on forest production.

13. Accomplishments in 1980-81:


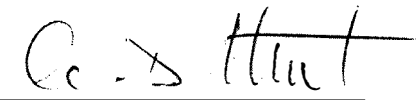
1. Limited survey of seed production plants was conducted and a number of cone samples collected. Transferred to a new study under J.A. Muldrew. (Study 9-185)
2. Limited surveys of a number of plantations were conducted, but nothing of value to the present approach was obtained.
3. No action taken. If any action is warranted it should be under Dr. Moody's direction. (Study 1-184)

14. Goals for 1981-82:

1. Select a number of sampling areas to represent several age groups and sites in lodgepole pine regeneration on scarified and planted sites in the Hinton area of Alberta.
2. Establish 40 10 m² plots in each of the above areas, recording the numbers of trees on each plot. A total of about 3000 plots are planned (Three sites, two planting methods, six age groups, two replicates, 40 plots).
3. Locate the 18 jack pine plots established by DeBoo in Manitoba in 1968 and measure height to base of current growth. Record numbers of living and dead trees and re-stake and re-tag trees as necessary.
4. If time permits, establish additional plots to give representation in additional age groupings to those represented by DeBoo's plots.

15. Publications:

Nil

16. Signatures:
Investigator
Program Manager
Investigator
A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1981

1. Project: Insect and disease management systems
2. Title: Insects and diseases affecting seed production in the Prairie Region.
3. New: X Cont.: 4. No.: NOR-9-185
5. Study Leader: J.A. Muldrew
6. Key Words: Seed production, seed and cone insects, seed orchards, white spruce, *Picea glauca*, Jack pine, *Pinus banksiana*, Lodgepole pine, *Pinus contorta*, *Dioroctria abietivorella* (fir coneworm), *D. reniculelloides* (spruce coneworm), *Laspeyresia youngana* (spruce seed moth), *Hylemia anthracina* (spruce cone maggot), *Megastigmus atedius*.
7. Location at work: Prairie Provinces
8. Problem:

The increased amount of reforestation that is taking place in the Prairie Provinces in recent years, particularly in Alberta, has focused attention on the amount and quality of seed available, particularly for white spruce. At the moment, white spruce seed is collected primarily during cutting operations and from squirrel caches. However, as reforestation progresses, and the intensity of management increases, this procedure will probably be replaced by a more selective one, either using selected stands or plantations as a source of seeds. This change will be desirable, from the point of view of tree improvement, but will also mean that the source of seed becomes more restricted.

Seed production and quality are known to fluctuate markedly from year to year. In years when the cone crop is light, insect and disease damage is often very severe with over 90% seed destruction. In years when heavy cone crops occur the percentage of seeds damaged

is usually less than 20. There is a need in the Prairie Provinces to assess the amount of seed damaged in various locations in relation to cone production and to determine which species of insects and diseases are causing the damage.

Systemic insecticides have effectively controlled some seed insect pests but in some instances the gain in seed production due to pest mortality has been offset by even greater losses in seed viability due to the toxoc effect of the insecticide on seed development. As an alternative to chemical control it may be possible to use biological control in selected cases, such as in seed orchards or other seed production areas. To assess this possibility, the current role of natural enemies of seed pests should be studied; both the species involved and the degree of mortality exerted by each.

An opportunity exists to make an assessment of the severity of the problem and to determine potential lines of study before forest management intensifies and before the use of seed orchards becomes a common practice. This would permit research to be done, and remedies to problems devised, before the seed-collection agencies encounter major problems and before forest managers encounter problems demanding immediate answers.

9. 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.

10. Resources:

- a. Starting date: 1981
- b. Estimated year of completion: 1983
- c. Estimated total Prof. man-years required: 3
- d. Essential new major equipment items for 1981-82 with cots: Nil
- e. Essential new major equipment items beyond 1982 with cots: Nil
- f. 1981-82 man-years Prof. 1.0 (J.A. Muldrew)
Total 1.0

11. Progress to Date:

(See Section 13)

12. Goals for 1980-81:

Conduct a preliminary survey of seed production plants, by means of personal interviews and examination of cone samples, in order to determine the importance of seed and cone insects in the production of coniferous seed, particularly white spruce.

13. Accomplishments in 1980-81:

Preliminary studies on seed and cone insects were carried out by J.A. Drouin in 1980. For white spruce the percentage of cones containing insect - damaged seeds ranged from 20 to 90. The percentage of total seeds examined that were destroyed by insects ranged from 3 to 63. The mean of destroyed seeds per cone ranged from 3 to 53. For larch the percentage of cones with insect - damaged seeds ranged from 15 to 94; the percentage of total seeds examined that were eaten by insects ranged from 5 to 59 and the mean of eaten seeds per cone ranged from 1 to 15. The balsam fir cones were collected too early to count the mature seeds but the percentage of cones containing insect damaged seeds was 32 and the mean of insect - damaged seeds per cone was 8.

Arrangements were made with the Pine Ridge Nursery, Alberta to receive samples of cones from collections made in 1980 and in subsequent years.

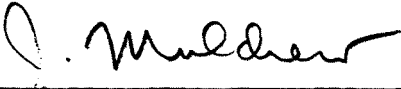
14. Goals for 1981-82:

1. To contact the seed producing agencies in each of the Prairie Provinces to arrange to obtain samples of cones from a representative series of the areas in which the cones are collected. Each sample should be between 100 and 200 cones and ideally should be removed from the collection before any seeds have come loose from the cones.
2. Cones will be collected at weekly intervals at two selected locations near Edmonton from the time of early cone formation to the time of seed fall. Some cones will be dissected and some reared to determine the insects attacking the cones and seeds and the extent of the damage caused by them.
3. Insect pests of cones will be dissected to study the natural enemies attacking them and they will be reared to obtain adult specimens of these natural enemies for identification.

15. Publications:

N/A

16. Signatures:


Investigator


Program Manager


A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: January 28, 1981

1. Project: Reduction of damage from insects.
2. Title: Control and damage impact of insects injurious to trees and shrubs.
3. New: Cont.: X
4. No.: NOR-17-143
5. Study Leader: H. F. Cerezke
6. Key Words: Forest habitats, shelterbelts, woodlots, parks and recreational areas, plantations, seed orchards, tree nurseries, pesticides, cultural control, integrated control, growth losses, population sampling.
7. Location of Work: Region wide.
8. Problem:

In the Prairie Provinces there exists the need to examine entomological problems which arise annually and seasonally, often on short notice, and cause concern in forested areas, park and recreational areas, nurseries, shelterbelts, private wood lots and ornamental plantings in urban and rural landscapes. In most cases, such problems may only require identification of the insect organism or other causal agents, and control recommendations are made according to established procedures, such as by chemical, pruning, tree removal or no controls. The nature of the recommendations are dictated by an assessment of the hazard of the insect and its potential damage, and by the wishes of the owner(s) or forest manager. Staff of the FIDS fulfill much of this need as a routine extension function provided in response to client requests throughout the Prairie Provinces.

Other entomological problems arise which are usually localized and require more comprehensive examination or short-term studies. These may include population surveys in spruce budworm-infested timber, bark beetle hazard prediction, woodborer hazard in fire-killed timber, identification of causes of mortality and tree damage in plantations and natural regeneration, development of special sampling techniques to measure insect abundance and to assist pre- and post-spray application in shelterbelts, urban and park areas, life cycle studies

to establish proper timing of controls and impact studies to measure growth losses, predict long-term effects on tree form, growth pattern and aesthetic value. Studies may also be initiated which can lead to new strategies of control or to increase effectiveness of control, such as by integration of two or more control methods, or with use of cultural techniques, biological agents, and insect pheromones. Opportunity may also exist to undertake field trial demonstrations for testing control procedure and long-term effectiveness. NOR-143 study is specifically concerned with these kinds of problems.

A prime function of this study also is to maintain up-to-date expertise and knowledge of all major forest entomological implications reflected in the wise management of forest resources by federal, provincial, and industrial agencies and the general public. Major benefits from this study will therefore be in complementing the services offered under NOR-033 and to other studies related to forest resource management such as regeneration stocking standards, forest inventory losses, seed and cone losses, and in silvicultural applications. Benefits will also extend to various federal and provincial committees which regularly review pesticide legislation, use, and application, and in the dispersal of information on insect pests of trees and shrubs generally throughout the prairies region.

9. Study Objectives:

1. To maintain up-to-date information and provide technical and advisory services on insect problems of trees and shrubs common to the region, laws related to pesticides and their usage, insect control methods and effects of pesticides on the environment.
2. To provide information on insect control, abundance, hazard, damage impact and depletion losses in areas of concern to various clients.

10. Resources:

- a. Starting date: 1973
- b. Estimated year of completion: Continuing
- c. Estimated total Prof. man-years required: Ongoing
- d. Essential new major equipment items for 1981-82 with costs: Nil
- e. Essential new major equipment items beyond 1982 with costs: Nil
- f. 1981-82 man-years

Prof.	0.8	(0.2 in -033)
Supp.	0.8	(0.2 in -033)
Casual	-	
Total	1.6	

11. Progress to Date:

Reporting and CFS representation have been provided on the various federal, regional and provincial committees listed under 12. A variety of consultancy, editorial and identification

service were provided within CFS. Various contributions were made on entomological problems within the region through T.V., radio and newspaper media, by direct consultation with clients and through lecture and workshops. Special field studies involving data collection, analyses and reporting were made on woodborers, spruce budworm, seed and cone insects, mountain pine beetle, jack-pine budworm, nursery pests and several other problems.

12. Goals for 1980-81:

1. Select and assemble photographs for the proposed publications "Common insects of trees and shrubs of the Prairies", and have these mounted onto plates with assistance of CFS photography unit. Complete first draft or text.
2. Provide CFS and NFRC representation on various federal, regional and provincial committees as follows:
 - (a) Western Committee for Crop Protection and Western Forum.
 - (b) Alberta Pest Control Advisory Committee.
 - (c) Saskatchewan Advisory Council for Insect Control.
 - (d) Shelterbelt Committee of Western Canadian Society for Horticulture.
 - (e) Maintain contact with Plant Products Division, CDA, Ottawa.
 - (f) Alberta Horticulture Advisory Committee and Environmental Sub-committee of AHAC.
 - (g) Eastern spruce budworm committee, CAN/USA program and Bt committee.
 - (h) Forest Pest Control Forum.
3. Finalize jack-pine budworm study into Information Report: "Impact studies of the jack-pine budworm (*Choristoneura pinus pinus* Free.) in the Nisbet Provincial Forest of Saskatchewan.
4. Finalize status report on spruce budworm impact in Riding Mountain National Park for Parks Canada spring planning.
5. Prepare final report summarizing my results of the joint study on control of spruce seed and cone insects for Proctor and Gamble Co. and prepare a publication, possibly for Bi-Monthly Research Notes.

6. Formalize report for seed workshop proceedings as presented earlier at NFRC. Title of report--"The effects of insects on seed and cone production".
7. Provide consultary, editorial and identification service, and workshop--seminars on forest pests to federal, provincial and industrial agencies as requested.

Goals added for 1980:

8. Prepare displays for "Open House" at NFRC, October 1980.
9. Undertake woodborer survey in Porcupine Provincial Forest, Manitoba.
10. Provide increased involvement in mountain pine beetle problem involving:
 - (i) preparation and attendance at provincially-sponsored meetings;
 - (ii) providing advisory services and field identifications;
 - (iii) conducting literature searches and preparing reports and;
 - (iv) conducting field pheromone tests.
11. Present talk at Annual Meeting of Central Forest Products Association; Winnipeg, on "Woodborers and salvage in fire-killed timber".
13. Accomplishments in 1980-81:
 1. No progress due to other committments.
 2. Provided CFS-NFRC representation at the following meetings and committees:
 - Western Committee for Crop Protection and Western Forum
 - Alta. Pest Control Advisory Committee
 - Sask. Advisory Council for Insect Control
 - Shelterbelt committee - WCSH
 - Plant Products and Quarantine Division, CDA
 - Environmental Sub-committee of Alta. Hort. Adv. Comm.
 - CANUSA - Eastern Spruce Budworm Comm.
 - Forest Pest Control Forum - Ann. Meeting.
 3. Report is incomplete; some progress made in finalizing first draft. Area revisited in 1980 to view foliage recovery, top-kill and presence of jack-pine budworm population.
 4. First draft report prepared on spruce budworm in Riding Mt. National Park, with input by National Parks personnel; summarizes budworm situation for 1979. Field surveys for budworm impact and population levels were made in 1980 and these data are being

summarized and will be combined with 1979 data under one cover.

5. First draft of seed and cone insect study was completed except for incorporation of results of a seed germinability test, undertaken to verify suspected inhibitory effects of the systemic insecticidal treatment. Germinability test conducted at NFRFC.
6. Goal not attempted, and since deleted.
7. A variety of consultory, short-term studies and lectures were provided, including editorial review of several scientific papers. Attended and participated at various meetings including:
 - joint Alta./Sask. Entomological Society Meeting
 - FPMI program review meeting, Seed and Cone Insect Workshop.
 - National FIDS meeting
 - Provided lecture on seed and cone insects to U of A students in forestry

Dispersed letters, reports, published material and slide material to over 100 client requests.

Additional Accomplishments:

8. Prepared major part of "Open House" display featuring mountain pine beetle and jack-pine budworm at NFRFC.
9. Completed a woodborer survey in Manitoba in cooperation with provincial forestry staff.
10. Provided major involvement in planning and advisory role on mountain pine beetle; activities included:
 - Attended and participated at 14 meetings with Alta. Forest Service, Alta. Parks and with interagencies (AFS, BCFS, Parks Can. and CFS - NFRFC, PFRFC)
 - Conducted small scale field trial with mountain pine beetle pheromone to demonstrate potential uses.
11. Presented illustrated talk on "Woodborers, protection and salvage in fire-killed timber" at Annual Meeting, Central Forest Products Assn., Winnipeg.

14. Goals for 1981-82:

1. Complete a first draft of text, and select and assemble photographs for the proposed publication, "Common insects of trees and shrubs of the Prairies".
2. Provide lead role at NFRC in coordination of mountain pine beetle activity within the region with client agencies (AFS, Parks Canada, Alta. Parks, Private Industry, Sask. Parks, Sask. D.T.R.R.) and with PFRC, BCMF and H.Q. as required.

Some specific goals include:

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

15. Publications:

(a) 1974 to 1980-81:

Journal Articles	- 3
Information reports, Notes, etc.	- 5
File Reports	-14

(b) 1980-1981

Journal Articles

Nil

Information Reports, Notes, etc.

Cerezke, H.F. 1980. Mountain pine beetle - a threat to pines in Western Canada. Landscape Trades: 24-25, Oct. issue.

Cerezke, H.F.: J. Drouin, B. Neill. 1980. Revision of recommended insecticides for control of insects on shelterbelts, ornamental trees and shrubs. (Chapter in WCCP report, 1980); 17 pp.

Cerezke, H.F. 1980. Spruce budworm in Riding Mountain National Park, Man. Canusa Newsletter Sep. 1980.

File Reports

Cerezke, H.F. 1980. Comments on the mountain pine beetle outbreak, Bow - Crow Forest, 4 pp.

Cerezke, H.F. 1980. Mountain pine beetle situation in Alberta and Saskatchewan, 3 pp.

Cerezke, H.F. 1980. Pheromone application to mountain pine beetle control programs - a review of the current status, 11 pp.

Cerezke, H.F. 1980. Mountain pine beetle (*Dendroctonus ponderosae*) in Alberta and Saskatchewan: an overview of the problem, 6 pp. Presented at Ent. Societies joint meeting Alta./Sask. Abstract published in Proceedings.

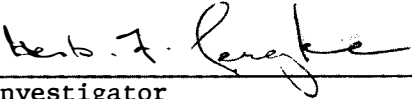
Cerezke, H.F. 1980. Woodborers and the protection and salvage of fire-killed timber, 9 pp. Presented at Ann. Meeting, Central Forest Prod. Assoc.

Edwards, I.K. and H.F. Cerezke 1980. Canadian Forestry Service Report to the Environmental Subcommittee of Alta. Horticultural Advisory Comm., 7 pp.

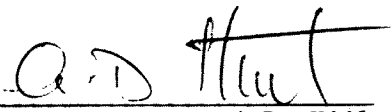
Cerezke, H.F. and B.S. Lee. 1980. Surveys of spruce budworm populations and damage impact in Riding Mt. Nat'l Park, Manitoba, 1979; 29 pp.

Cerezke, H.F.; K. Knowles, Y. Beaubien and H.S. Gates. 1980. Assessment of woodborers in fire-killed timber in the Porcupine Provincial Forest, Manitoba, 9 pp.

16. Signatures:


Investigator


Program Manager


A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 2, 1981

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: X Cont.: 4. No.: NOR- 32-178
5. Study Leader: G. Hogan.
6. Key Words: Pollutant, sulphur, metals, vegetation, soils, diagnosis, impact, restoration.
7. Location of Work: Region wide.
8. Problem:

With the increased industrialization there is concern in Canada as to the distribution, extent of transport and impact of airborne pollutants on the natural environment.

Atmospheric motions are known to cause the transport of air pollutants across provincial and international boundaries. For pollution control negotiations with the provinces and the U.S. it will be necessary to quantify the ecosystem with respect to the potential for pollutant initiated degeneration.

Major air pollution in this region originates from three sources; fossil fuel processing in Alberta, heavy metal processing in northern Manitoba, Saskatchewan and the Northwest Territories. A departmental co-ordinated program has been developed to provide information with respect to long range transport of air pollutants. The Canadian Forestry Service and the Northern Forest Research Centre specifically have agreed to cover off the forest vegetation and soils aspects.

9. Study Objectives:

1. To determine the state of representative components of terrestrial ecosystems; specifically vegetation and soils for benchmarking and baseline purposes.

2. To determine the rate and extent of deposition (wet & dry) of major pollutants from point emitters within the region.
3. To determine the extent to which local, medium and long range transport of air pollutants is degrading terrestrial forest systems.

10. Resources:

- a. Starting date: April 1, 1979
- b. Estimated date of completion: 1985
- c. Estimated total Prof. man-years required: 7.4
- d. Essential new major equipment items for 1981-82 with costs:

Block Digester and Controller	\$ 5,000.00
Drying Oven	2,500.00
Channels for ICP	8,000.00
Software Package for ICP	6,000.00
URAS (IRGA)	10,000.00
Radioisotope Scanning Attachment for GC	15,000.00
Total	<u>\$46,000.00</u>

- e. Essential new major equipment items beyond 1981 with costs: Nil
- f. 1981-82 man-years Prof. 0.9 (Hogan)

0.2 (vice Malhotra)

1.1

Supp. 0.8 (Fenn)

0.2 (Radford)

1.0

Total 2.1

11. Progress to Date:

A network of permanent biomonitoring sites has been established in the vicinity of smelters in Flin Flon and Thompson, Manitoba. Studies have been undertaken to determine the effects of smelter effluents on the quality of rainfall, on forest species and on soil processes. Four progress reports have been submitted to the Manitoba Dept. of Consumer and Corporate Affairs and Environment.

12. Goals for 1980-81:

1. Report on the baseline study carried out in Thompson. (Hogan)
2. Report on the baseline study carried out in Flin Flon. (Hogan)
3. Publish a paper on the use of the moss bag technique and resultant data in Flin Flon. (Hogan)
4. Publish an impact paper on the studies being carried out on the effects of smelter effluents on forest communities. (Hogan)

5. Investigate metal toxicity symptoms in native vegetation by studying the physiological effects of metals. (Hogan)
6. Study the germination and growth of forest species in metal contaminated soils. (Hogan)

Added Goals

7. Rephotograph lichen transplant and natural communities in the Thompson area. Bring samples to the lab for analysis of pollutants which have been accumulated during the exposure period. Physiological condition will be estimated if possible.
8. Conduct lichen surveys at Kejimikujik National Park, Nova Scotia and at Lake Superior Prov. Park, Ontario. The surveys will be used to determine if lichen monitoring can be used to detect changes in lichen growth and lichen community composition due to acid rain impact.

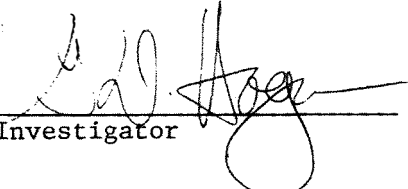
13. Accomplishments for 1980-81:

1. Progress has been made with respect to the preparation of a baseline report on the Thompson Study. Most of the vegetation and soil data synthesis has been carried out. The completion of the report however is dependent upon receiving the synthesis of the forest community description data from the Province of Manitoba staff. A semi annual report on the 1980 field season progress was submitted to the Province.
2. A report on the Flin Flon area baseline studies up to April 1980 was presented to the Manitoba Clean Environment Commission at a hearing which took place in Flin Flon in May 1980.
3. A journal paper on the use of the mossbag technique for the monitoring of the deposition of metal particulates has been delayed until the paper covered under goal 4 has been completed.
4. A journal paper entitled "Pollutant distribution and containment within a forest system as a function of distance from a smelter source" is almost complete and ready for review.
5. Studies on metal toxicities on native grasses are continuing (*Calamagrostis neglecta* *Agrostis gigantea*). To date several clones have been examined for tolerance to copper and zinc, there appears to be a potential for zinc tolerance in atleast one clone. Future studies will focus on zinc toxicity.
6. Two experiments (6 months duration) have been carried to date using Jack Pine.
 - a) The plant material from the first experiment has not been analyzed because of the volume of analytical work already in progress.
 - b) The second experiment using Flin Flon soils is underway, this experiment will not be harvested until March.


7. Study plots in Flin Flon and Thompson were maintained throughout the summer precipitation samples and mossbag particulate traps were collected on a monthly basis from May to October. The analysis of the mossbag samples has been completed and the synthesis of the data is underway. pH analysis of the rain water is completed and shows a good correlation with event sampling. Metal analysis of the precipitation is not complete.
 8. a) Six sites were established in the Cold Lake area. Vegetation was examined and a preliminary description of the stands was carried out. Sulphation plates were elected on all sites and were exposed for a 3 month period. The results from this network show that there is little current deposition of SO_2 in the area.

b) Soil sites have been described and soil and vegetation samples have been analyzed and a report on the work is currently in progress.
 9. Lichen transplant communities in the Thompson area were re-photographed. Ten replicate lichen communities at ten biomonitoring sites were examined and were brought back to the lab for analysis. The lichen specimens have been exposed for a period of 3 yrs. and should allow us to document damage to pollutant content.
 10. Lichen surveys were conducted at Kejimikujik National Park Nova Scotia and Lake Superior Prov. Pk., Ontario as part of the National LRTAP Program. Lichen species on all major trees were collected and attempts were made to document epiphytic communities. A species list for both parts is being produced from these collections by Dr. G. Robitaille, LFRG.
14. Goals for 1981-82:
1. Complete a report on the baseline study in Thompson. (Hogan)
 2. Publish a journal article on the soil and vegetation work which forms a part of the Thompson study. (Hogan)
 3. Publish a journal article on the lichen work which was part of the Thompson study. (Hogan)
 4. Publish a journal article on the use of the moss bag technique and resultant data. (Hogan)
 5. Publish a journal article entitled "Pollutant distribution and containment within a forest system as a function of distance from a smelter source. (Hogan)
 6. Continue to investigate metal toxicity symptoms and metal tolerance in native vegetation, (hydroponic studies) and examine the physiological effects of metals. (Hogan)

7. Continue to investigate the germination and growth of forest species in metal contaminated soils from field situations. (Hogan)
 8. Continue to monitor the present rates of deposition of pollutants in Flin Flon and Thompson by collection and analysis of precipitation and dryfall. (Hogan)
 9. Carry out follow up sampling in Cold Lake for sulphur in Vegetation and soils. (vice)
 - 10 a) Initiate studies to determine the impact of air pollutants, introduced by wet and dry deposition on forest soil processes. (Hogan)
 - b) Initiate studies to examine the cycling of metals and sulphur within affected and control systems. (Hogan)
15. Publications:
- To 1980
- File Reports: 4
- 1980 - 81
- File Reports
- Hogan G.D. & D. Wotton. A preliminary report on the effects of atmospheric effluents from Mining and Smelting Industries on forest vegetation and soils. Submitted to the Clen Environment Commission, May 1980.
- Hogan G.D. & S.S. Malhotra. The effect of emissions from the Hudson Bay Mining and Smelting Co. Ltd. on forest vegetation and soils around Flin Flon, Manitoba Transcript Manitoba Clean Environment Commission Hearing H-04-80 held at Flin Flon, Manitoba May 1980.
- Hogan G.D. Semi Annual Progress Report on the effects of Atmospheric Effluents from Mining and Smelting Industries on Forest Vegetation and Soils around Thompson Manitoba November, 1980.
16. Signatures:


Investigator


Program Manager


A/Director A.D. Kiil

CANADIAN FORESTRY SERVICE

STUDY STATEMENT

1981 - 82

Responsibility Centre: NORTHERN FOREST RESEARCH CENTRE

Date: February 2, 1981

1. Project: Long range transport of air pollutants
2. Title: Transport of airborne radionuclides released during uranium mining and milling operations and their effects on forest vegetation and soils.
3. New: X Cont.: 4. No.: NOR-32-186
5. Study Leaders: G. D. Hogan and vice Joshi
6. Key Words: ^{222}Rn , airborne radioactivity, uranium mining and milling, forest vegetation and soils
7. Location of Work: Uranium City - Wollaston Lake, Sask. and Northern Forest Research Centre, Edmonton, Alta.
8. Problem:

Large quantities of radioactive waste from uranium mining and milling operations in Northern Saskatchewan are present in the field study area. Gaseous ^{222}Rn radioisotope is continually being released to the surrounding environment from these mine tailings. Also, significant amounts of other radioisotopes can become airborne and can, along with ^{222}Rn and its daughters, enter the food-chain via foliar deposition or via uptake by plants from soils. Various federal and provincial agencies have expressed concern in this regard. Since very little is known about the potential effects of these isotopes. The major problem in assessing the impact of these operations on forest ecosystems is lack of data on the concentrations of various radionuclides in vegetation and soils and an unfamiliarity with their pathways within these systems. Provincial government agencies and industry request involvement by the CFS in the form of collaborative research and surveys.

9. Study Objectives:

- a. Develop methods for the measurement of various uranium - series radionuclides in plants and soils.
- b. Gather baseline data on the dispersal of ^{222}Rn and concentrations of ^{226}Ra , ^{210}Pb , and ^{210}Po in forest vegetation and soils.
- c. Study pathways of distribution and eventual fate of radionuclides deposited in the forest ecosystems.

10. Resources:

- a. Starting date: 1980
- b. Estimated year of completion: 1986
- c. Estimated total professional man-years required: 6.0
- d. Essential new major equipment items for 1981-82 with costs:
 - Low-level α/β proportional counting system: \$30,000
 - α -particle spectrometry system: \$20,000
 - Total \$50,000
- e. Essential new major equipment items beyond 1981-82 with costs:
 - Ge(Li) detector with lead Castle: \$ 25,000
 - Minicomputer-based spectral data analysis system: \$ 55,000
 - Total \$ 80,000
- f. 1981-82 man-years:

Professional:	1.0 vice Joshi
	<u>0.1</u> (G.D. Hogan)
Total	1.1

11. Progress to Date:

Nil - New Study

12. Goals for 1980-81:

1. Conduct a survey of existing literature on topics related to airborne radioactivity and plants and soils (Joshi)
2. Organize a conference of experts to discuss the environmental biogeochemistry of uranium series radionuclides. (Joshi)
3. Develop contacts with appropriate federal and provincial agencies, industry, and universities with a view to define CFS's role in radiological studies. (Joshi)
4. Initiate the setting-up of radioactivity laboratories at NFRC. (Joshi)

13. Accomplishments for 1980-81:

1. The literature survey was completed and the information gathered is being compiled for reporting in the form of a review article.
2. The conference was organized in December in Ottawa. More than 20 experts from across the country participated. The conference was very useful in developing contacts and in defining the future role of CFS in radiological matters.
3. A number of contacts were developed with the scientists and management of several organisations. In most cases the facilities were also visited in order to gain first-hand information on ongoing research. The organizations include: Atomic Energy of Canada Limited (Pinawa), Saskatchewan Environment, Saskatchewan Geological Survey, Saskatchewan Research Council, Geological Survey of Canada, University of Ottawa, Canada Centre for Mineral and Energy Technology, Eldorado Nuclear Limited, and University of Saskatchewan.
4. A ^{222}Rn counting system was selected and purchased. The duties were assumed as NFRC Radiation Safety Officer. The NFRC Radioisotope Licence was updated and submitted to AECB for renewal.

14. Goals for 1981-82:

1. Set-up laboratories and develop methods for the determination of ^{226}Ra , ^{210}Pb , and ^{210}Po in plants and soils.
2. Collect various plant and soil samples from the study area and analyze these for ^{226}Ra , ^{210}Pb and ^{210}Po .
3. Determine the soil-plant radionuclide transfer coefficients and the fluxes of ^{210}Pb soils.
4. Complete a review article on airborne radioactivity and plants.

15. Publications:

New Study

16. Signatures:

Investigator

Investigator

Program Manager

A/Director A.D. Kiil