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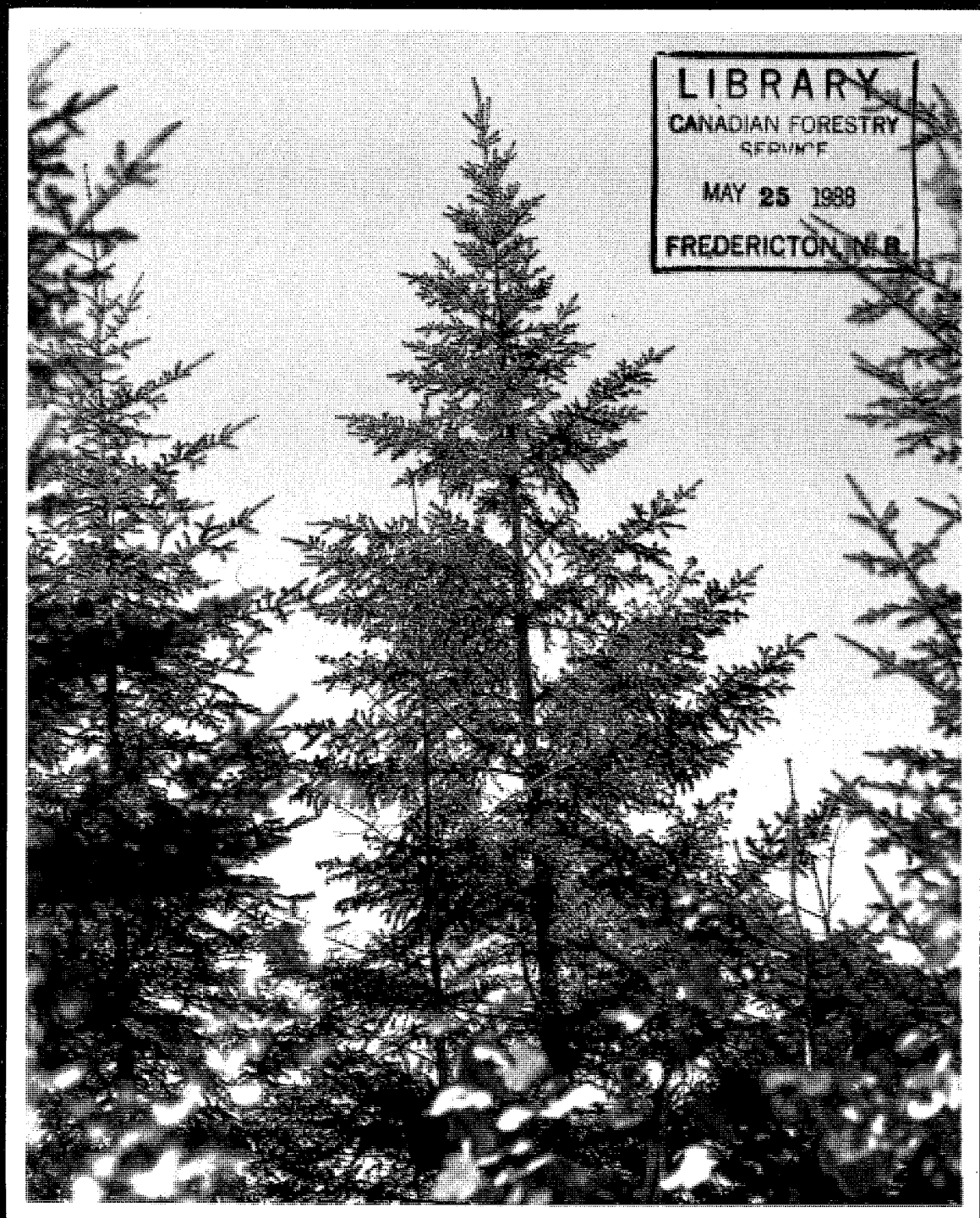
Forest pest conditions in the Maritimes 1987

Laszlo P. Magasi

Information Report M-X-166
Canadian Forestry Service — Maritimes



CANADIAN FORESTRY SERVICE-MARITIMES

The Canadian Forestry Service-Maritimes is one of six regional establishments of the Canadian Forestry Service, within Agriculture Canada. The Centre conducts a program of work directed towards the solution of major forestry problems and the development of more effective forest management techniques for use in the Maritime Provinces.

The program consists of three major elements - research and development, technical and information services, and forest resources development. Most research and development work is undertaken in direct response to the needs of forest management agencies, with the aim of improving the protection, growth, and value of the region's forest resource for a variety of consumptive and nonconsumptive uses; studies are often carried out jointly with provincial governments and industry. The Centre's technical and information services are designed to bring research results to the attention of potential users, to demonstrate new and improved forest management techniques, to assist management agencies in solving day-to-day problems, and to keep the public fully informed on the work of the Maritimes Centre.

The forest resources development branch is responsible for development, implementation, and administration of joint federal/provincial forest resources development agreements in the three Maritime provinces, for the creation of employment opportunities in the development of the forest resources, and for providing economic information to landowners and decision-makers for identifying and evaluating forest managment alternatives.

Cover: Stillwell's Syndrome - the sudden death of balsam fir trees (story in text).

FOREST PEST CONDITIONS IN THE MARITIMES IN 1987

by

LASZLO P. MAGASI

CFS-MARITIMES

Fredericton, New Brunswick

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ABSTRACT

This report reviews the status of forest insects and diseases in the Maritimes Region in 1987, and forecasts conditions for 1988, when appropriate. Economically important pests of current concern are discussed in some detail, other organisms are listed in tabular form. A separate chapter discusses the various special involvements with related activities such as the use of pheromones as survey tools, the Acid Rain National Early Warning System (ARNEWS) and others. A list of forest-pest related publications and reports is included. More detailed information is available from the Canadian Forestry Service-Maritimes.

RESUME

Ce rapport fait le bilan des insectes et maladies des arbres la région des Maritimes in 1987, et donne un aperçu des conditions prévues pour 1988, lorsqu'approprié. Les ravageurs dans d'importance courante y sont traités en détail, les autres organismes sous forme tabulaire seulement. Un chapitre en particulier explique les implications du RIMA dans des activités connexes, telles que l'usage de phéromones comme outils de relevé, le Dispostif National d'Alterte Rapide pour les Pluies Acides (DNARPA), et autres efforts. On y inclus une liste de publications et de rapports traitant de ravageurs forestiers. De plus amples renseignements sont disponsibles au Service canadien des forêts - Maritimes.

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INTRODUCTION

Some of the objectives of the Forest Insect and Disease Survey are to monitor insect and disease conditions, determine their effects on the forest, and report on the status of important and common pests. In the Maritimes, this information is disseminated to interested agencies and individuals through periodic reports such as Seasonal Highlights, Technical Notes, Information Reports, and the Annual Report of the Forest Insect and Disease Survey.

In this report, pest conditions in 1987 are described; operational control programs against the spruce budworm, gypsy moth, spruce budmoths, and seedling debarking weevil are summarized; forest pest related research programs connected with the aims of the Forest Insect and Disease Survey are briefly mentioned; and a list of reports and publications relating to forest-pest conditions is included.

The report aims to provide forest managers with information on pest conditions in the Maritime Provinces early enough to be considered in management decisions before the start of the 1988 field season. Insects and diseases that were widespread and caused considerable concern in 1987 are discussed in detail, others are presented in tabular form. More information on these and on other specific conditions will be provided upon request from CFS-Maritimes.

We have been presenting a chapter on special surveys to report on some of our projects that have implication in forest management but did not fit our previous reporting format. In 1987, this chapter includes a summary of plantation surveys carried out in cooperation with the provincial forestry services and several companies in New Brunswick and Nova Scotia; a regional surveys for the pinewood nematode, a pest of importance to international commerce and of concern to plant quarantine organizations; a summary of surveys on the condition of sugar maple and trembling aspen; a brief statement on the status of work on pheromones and other attractants used as tools for detecting the presence and monitoring the spread and fluctuation of forest insects; and a section which deals with the Acid Rain National Early Warning System (ARNEWS).

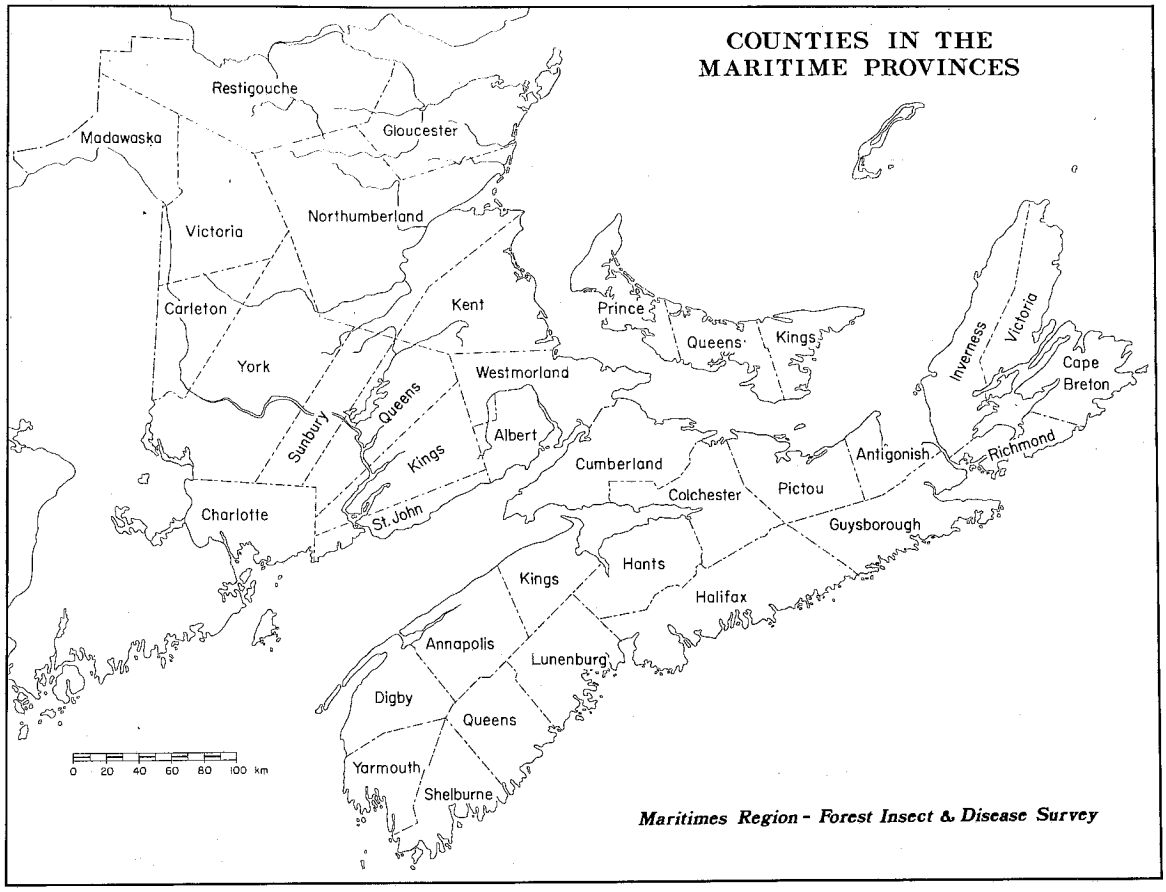
We attempt to add extra information on the pest discussed, in response to suggestions, and because requests for information indicate the need for this, now that our readership has expanded beyond our traditional clientele of the forestry community. This, we hope, will place the organism in a better perspective and provide readers with some background and a clearer understanding of the concerns we express. Comments on any part of the report for improved presentation are always welcome.

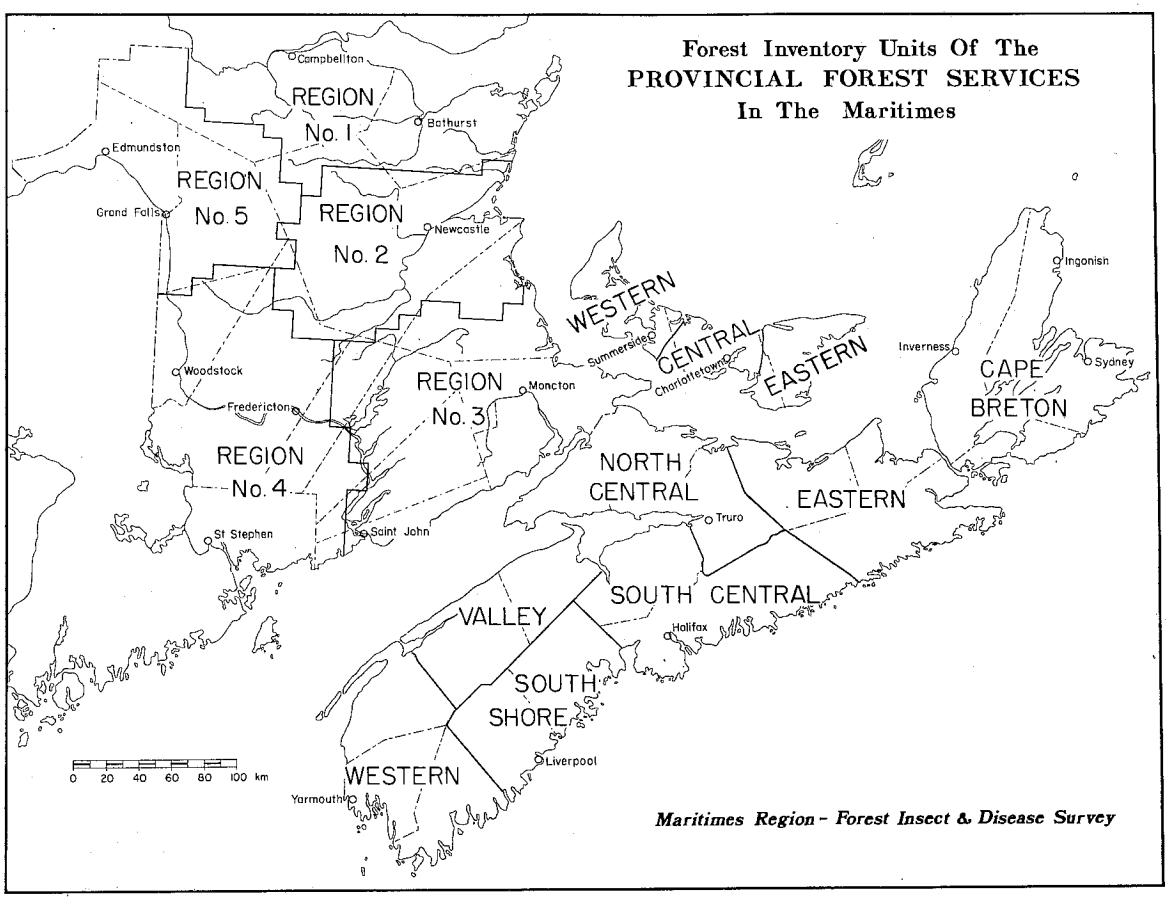
Two maps are included to help the reader locate areas mentioned. One shows the counties of the three provinces, and the other indicates the provincial forest services' forest inventory subdivisions.

In recent years, efforts towards collecting and reporting information in quantitative terms have been emphasized, but for a variety of reasons, it will never be possible to express all observations quantitatively. Throughout this report, the terms "severe, moderate, light, and trace" are used to describe the level of defoliation and, in some cases, other injury or insect population levels. Unless otherwise stated. the terms have the following ranges:

Trace	up to 5%
Light	6 - 29%
Moderate	30 - 69%
Severe	70 - 100%

In 1987 the cover of our report depicts trees that die as the result of Stillwell's Syndrome, the sudden death of balsam fir trees, a complex problem of considerable importance during the past years.


COUNTIES IN THE
MARITIME PROVINCES
Restigouche
Madawaska
Gloucester
Victoria
Northumberland
Carleton
Kent
York
Westmorland
Sunbury
Queens
Albert
Kings
Charlotte
St. John
Cumberland
Colchester
Pictou
Antigonish
Richmond
Cape Breton
Inverness
Victoria
Prince
Queens
Kings
Kings
Hants
Halifax
Annapolis
Lunenburg
Digby
Queens
Yarmouth
Shelburne
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey


Forest Inventory Units Of The
PROVINCIAL FOREST SERVICES
In The Maritimes
Campbellton
REGION No. 1
Bathurst
Edmundston
REGION No. 5
Grand Falls
REGION No. 2
Newcastle
WESTERN
Summerside
CENTRAL
Charlottetown
EASTERN
Inverness
Ingonish
Sydney
CAPE BRETON
Woodstock
Fredericton
REGION No. 3
Moncton
REGION No. 4
NORTH CENTRAL
EASTERN
St Stephen
Saint John
Truro
SOUTH CENTRAL
VALLEY
Halifax
SOUTH SHORE
Liverpool
WESTERN
Yarmouth
0 20 40 60 80 100 km
Maritimes Region - Forest Insect & Disease Survey

SUMMARY

In 1987, **spruce budworm** caused moderate and severe defoliation over 430 000 ha in New Brunswick. There was no defoliation detected during aerial surveys in either Nova Scotia or Prince Edward Island. Control operations were conducted over 584 300 ha in New Brunswick and 31 080 ha in Nova Scotia. It is predicted that infestations in 1988 will affect about 1.5 million hectares of forest in New Brunswick. In Nova Scotia defoliation, if any, is expected in small areas in the counties along the Northumberland Strait. In Prince Edward Island populations are expected to further decrease and no significant defoliation is likely to occur in the Province.

Stillwell's syndrome, the sudden death of balsam fir trees, mostly in spruce budworm affected stands, was present at levels much reduced from those observed in the last three years and was most prevalent in western New Brunswick.

Spruce beetle activity remained stable in New Brunswick and Nova Scotia but increased in Prince Edward Island. Newly attacked, dying and dead white spruce stands were observed in all three provinces.

Eastern larch beetle populations were generally low throughout the Region although newly attacked trees were found in more areas in New Brunswick than during the past few years.

European larch canker remained confined to areas already known to be affected in southeastern New Brunswick and mainland Nova Scotia.

Scleroderris canker infections increased in New Brunswick over the past few years of low activity. All new infections were of the North American race. The 10-year effort regarding the European and other non-North American races gives rise to cautious optimism as to the future of these diseases in the Provinces.

Spruce budmoths damaged an average of 10%, 9% and 15% of white spruce shoots in New Brunswick, Nova Scotia and Prince Edward Island respectively. Damage occurred throughout the Region and reached as high as 72% in a stand in western Prince Edward Island. The adulticide control program in New Brunswick appears to be successful.

Seedling debarking weevil caused considerable seedling mortality in newly established plantations in all three provinces. The most seriously affected areas were eastern mainland Nova Scotia and eastern Prince Edward Island. Damage was reduced from the levels observed during the last few years, likely the result of extremely dry weather conditions in the summer of 1987. This insect has become one of the major threats to the success of plantation establishment and efforts are continuing to minimize losses.

Armillaria root rot killed both young and old trees. The disease was common in young spruce and pine plantations and at least some tree mortality was recorded in 22% and 17% of the plantations assessed in New Brunswick and Nova Scotia, respectively.

Sirococcus shoot blight remained the most serious plantation problem of red pine in western Nova Scotia and also caused damage in Prince Edward Island and southern New Brunswick. Previously infected plantations continued to deteriorate and some of these in western Nova Scotia are virtually "wiped out". The disease was also identified on black, blue, red and white spruce in Nova Scotia.

Pine leaf adelgid infestations were severe in parts of the south shore of western Nova Scotia, after about 20 years of low populations. Shoot damage occurred on white pine and red spruce.

Balsam woolly adelgid populations appear to be on the rise as indicated by more frequent observations of stem attack, mostly in New Brunswick.

A number of **rusts** affected various coniferous and hardwood species but the only major problem encountered in 1987 was ash rust, a persistent disease of ash mostly in western Nova Scotia, which has proven to be a tree killer. The needle rust on jack pine in New Brunswick plantations, common at damaging levels in past years, was still widespread but infection levels continued to decline in 1987.

Hemlock looper defoliated balsam fir and spruce in a small area in Cumberland County, Nova Scotia. Moth activity indicates probable defoliation there again in 1988 and possibly also in western Prince Edward Island.

Whitemarked tussock moth caused trace to light defoliation in small areas of Nova Scotia and Prince Edward Island but the expected population increase in Nova Scotia did not materialize.

Gypsy moth populations have increased in some areas and the region experienced the first case of severe defoliation in a small area near Moores Mills, Charlotte County, New Brunswick. The insect appears to be firmly established in southwestern Charlotte County, New Brunswick and at a few isolated areas, mostly in communities, in western Nova Scotia. The Gypsy Moth Coordinating Committee was again in charge of overseeing all cooperative surveys.

Oak leafroller and **oak leaf shredder** caused serious defoliation of red oak in much of western Nova Scotia and in a few localized areas of New Brunswick. As the result of repeated defoliation by these insects, trees in red oak stands are deteriorating and serious crown dieback is common in the affected areas.

Other hardwood defoliators were 'quiet' in 1987 and caused no more than localized defoliation. They are included in the summary table in the report with pertinent remarks.

Birch casebearer infestations were high in western and central Prince Edward Island and in a few locations elsewhere in the region.

Birch leafminer populations were higher than observed in 1986 and, although leaf browning of wire birch and white birch was no more than light in most areas, pockets of moderate and severe foliage discoloration occurred in all three provinces.

Birch skeletonizer was more common in Nova Scotia than in the past years and caused discoloration of white birch in pockets from Cape Breton Island to the eastern end of Annapolis Valley.

Larch casebearer populations remained low after the collapse of the outbreak in western and central Nova Scotia following the 1985 season. The insect was present in many areas but caused only light defoliation.

Poplar serpentine leafminer populations were high in New Brunswick, intensified in the north and spread towards the south, generally low in Nova Scotia and very low in Prince Edward Island.

Dutch elm disease intensified within the known area of distribution but did not spread significantly in New Brunswick and Nova Scotia. In Prince Edward Island, however, a major change occurred in the status of the disease with the discovery of infected trees in several widely separated areas of Prince County. Although the incidence of the disease at most locations is low the possibility of a serious intensification is present unless control measures are continued.

Seed orchard pests were numerous but with the exception of **mites, aphids** and **Armillaria root rot** were mostly of localized importance.

Nursery and greenhouse problems were mostly abiotic in nature and were often caused by management practices.

The **Christmas tree pests** balsam gall midge and balsam twig aphid were present at generally low populations except for a few spot infestations at widely separated locations. Yellow witches' broom infections were also lower than in previous years. Drought caused some stress but no serious damage resulted.

The **Acid Rain National Early Warning System** program continued in 1987 with assessment of conditions on all 17 ARNEWS plots, completion of foliage and soil sampling, and determination of foliage retention on about 420 locations throughout the Maritimes. Red spruce plots, established in 1986, were reassessed and trees found in generally better condition than last year. No leaf browning of white birch was detected during aerial surveys along the Bay of Fundy although leaf browning was observed from the ground. White spruce exhibited foliage yellowing in a small area at Loch Katrine, Antigonish County, N.S. and this condition is being investigated as a possible "suspect".

Pinewood nematode surveys at 207 locations, involving some 450 samples were conducted in 1985-1987. The pinewood nematode ("r" form) was found at five locations in New Brunswick. Another nematode, the so called "m" form, was found at 10 locations in New Brunswick, and at 9 locations in Nova Scotia. Neither form was found in Prince Edward Island.

Cooperative **plantation surveys,** involving federal and provincial forestry services and industry, have been expanded to include more companies and were conducted in New Brunswick and Nova Scotia. There were 193 plantations and 12 thinned areas assessed, involving some 14 500 trees. About 93% of the pine, spruce and larch trees were classified as healthy.

Surveys for the **condition of sugar maple** identified some areas in western New Brunswick requiring further investigation into possible causes.

A survey to determine the **condition of trembling aspen** showed that less than one third (26%) of the trees are healthy and that more than half (53%) of the trees exhibit dieback. The situation is most serious in New Brunswick where only 3% of the trees were classified as healthy.

Pheromone surveys, were carried out for spruce budworm (an international, inter-regional research effort), forest tent caterpillar, jack pine budworm, European pine shoot moth, oak leafroller, oak leaf shredder, and gypsy moth. All except the spruce budworm and the two oak insects are in at least semi-operational use.

Other insects and diseases encountered in 1987 but not discussed in detail are presented in tabular form. Remarks explain their current status.

A list of publications dealing with forest insects and diseases, authored or co-authored by staff from CFS-Maritimes is included for reference. About 25 reports are listed.

With the retirement of still another staff member of long service, the Forest Insect and Disease Survey in the Maritimes has lost over 100 years of experience in a 16-month period.

IMPORTANT AND CONSPICUOUS FOREST PESTS

SPRUCE BUDWORM

Information presented on the spruce budworm, Choristoneura fumiferana (Clem.) is summarized from various sources: New Brunswick Department of Natural Resources and Energy, Forest Protection Limited, J.D. Irving Limited, Nova Scotia Department of Lands and Forests, Prince Edward Island Department of Energy and Forestry, and the Canadian Forestry Service-Maritimes. Both published and unpublished data were used with permission, and the cooperation of all organizations is acknowledged. More detailed information is available from the various sources.

Spruce budworm populations have shown a marked downward trend in eastern North America during the last few years and, although the insect is still the major defoliator in the fir-spruce forest, the area of defoliation is also declining. The 20-year history of severe and moderate defoliation in the three Maritime Provinces (Table 1) shows that the smallest area affected in the Region during this period occurred in 1987.

Table 1. Spruce budworm - severe and moderate defoliation in the three Maritime Provinces 1968 - 1987

Year	Severe and moderate defoliation		
	New Brunswick	Nova Scotia	Prince Edward Island
	'000 ha		
1968	389	22 (a)	0
1969	979	10	0
1970	574	n.a.	n.a.
1971	1419	182	n.a.
1972	1733	140	n.a.
1973	3151	89 (b)	73 (b)
1974	3400	353	17
1975	3500	877	243
1976	389	1220	168
1977	474	823	108
1978	669	553	112
1979	1335	527 (c)	12
1980	673	716 (d)	22
1981	1221	567	133
1982	1202	175	13
1983	2028	294	22
1984	730	59	15
1985	1070	319	54
1986	927	289	65
1987	430	0	0

a - includes light defoliation
1b - severe defoliation only
c - does not include 339 000 ha of "variable" defoliation
d - does not include 559 000 ha of "variable" defoliation
n.a. - not available

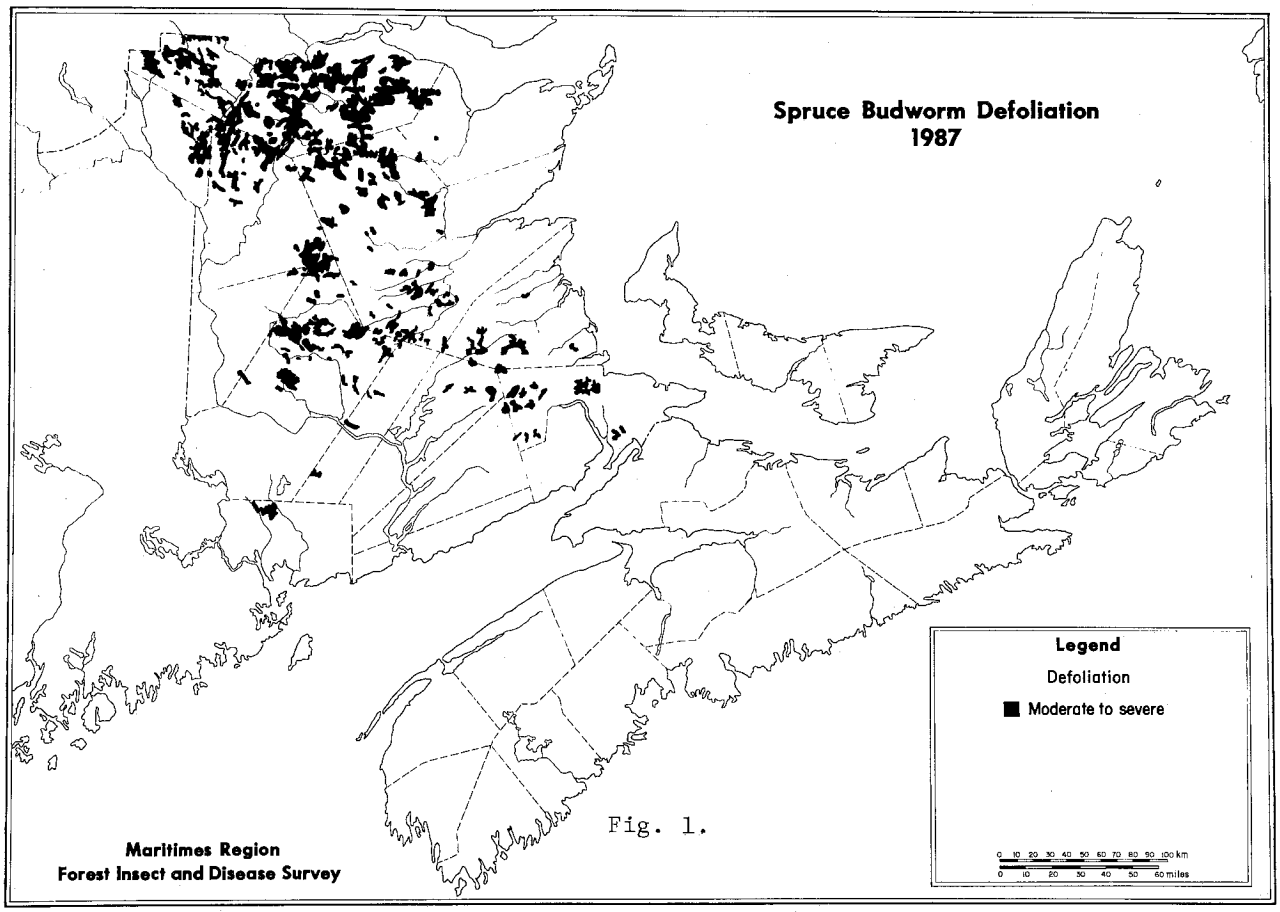


Fig. 1.

NEW BRUNSWICK

Defoliation of balsam fir and spruce stands was recorded on 518 000 ha in the Province (Fig. 1). Defoliation was severe on 241 000 ha, moderate on 189 000 ha and light on 88 000 ha. The 430 000 ha of severe and moderate defoliation was the least since 1976. Defoliation was scattered around the Province, with the largest concentrations of moderate and severe defoliation in the north-central, northwestern and central areas.

Damage - There were no specific spruce budworm damage surveys conducted by the Forest Insect and Disease Survey in New Brunswick in 1987.

Control operations - Foliage protection against the spruce budworm in New Brunswick was conducted over 584 300 ha in 1987: 478 300 ha by Forest Protection Ltd. and 106 300 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd.

Forest Protection Ltd. treated 358 700 ha with two applications of fenitrothion (Sumithion^{R}), 81 700 ha with the biological control agent *B.t.* (Dipel 132^{R} and Futura^{R}), 28 300 ha with aminocarb (Matacil 180F^{R}) followed by an application of fenithrothion and 9600 ha with fenitrothion followed by an application of *B.t.* The rates of application were 210g/ha or 140g/ha for fenitrothion, 70g/ha for aminocarb and 30 BIU/ha for *B.t.* Most of the chemical treatments were applied in water-based formulations while *B.t.* was applied undiluted.

Forest Patrol Ltd. treated 89 000 ha with aminocarb (Matacil 180F^{R}), 16 300 ha with fenitrothion (Sumithion^{R}) and 1000 ha with the biological agent B.t. (Futura S.C.^{R}). All but 2% of the 106 000 ha treated received two applications. Application rates were 90g/ha for aminocarb, 210g/ha for fenitrothion and B.t. was applied undiluted at 2.1 l/ha. All aminocarb, 84% of the fenitrothion in the first application and 40% in the second application were dispensed at UULV (ultra-ultra-low-volume) rates.

Forecast - The overwintering larval (L_2) survey was conducted by the New Brunswick Department of Natural Resources and Energy at 1572 locations. L_2 populations of spruce budworm were low at 76%, moderate at 15% and high at 9% of the areas sampled. There was a three-fold increase in the proportion of points in the high category compared to 1986 results, the intensification occurred in the north-central and northwestern part of the province. The forecast for 1988 is for 1.5 million hectares of moderate to severe defoliation. The most severe damage is expected to occur in the northern part of New Brunswick. No significant damage is expected in the southern third of the Province or throughout much of the western, eastern and northeastern areas.

NOVA SCOTIA

Defoliation - For the first time in more than two decades, there was no defoliation of balsam fir or spruce detectable during the annual spruce budworm aerial survey in Nova Scotia in 1987. Small groups of trees still supported low populations of spruce budworm at scattered locations in the Province and trace to light defoliation was detected during ground surveys. The highest level of defoliation recorded was 28% on balsam fir south of Tignish Bridge and 15% on white spruce at Wallace in Cumberland County.

Damage - There were no specific budworm damage surveys conducted by the Forest Insect and Disease Survey in Nova Scotia in 1987.

Control operations - In 1987 control operations in Nova Scotia were conducted by the Nova Scotia Department of Lands and Forests on 31 080 ha. The biological control agent B.t. (Dipel 132^{R}), at the rate of 30 BIU/ha was the only control agent used. All but 98 ha was treated aerially.

Forecast - The overwintering larval (L_2) survey was conducted by the Nova Scotia Department of Lands and Forests, with sampling assistance from Bowater-Mersey Ltd. personnel.

Information from 430 sample locations indicates that the spruce budworm population is collapsing. L_2 populations were zero at 61%, low at 33%, moderate at 4%, high at 1.5% and extreme at only 0.5% of the locations sampled. Moderate or higher populations were found only in Antigonish, Colchester, Cumberland and Pictou counties. Defoliation, if any, in 1988 is expected to be confined to small, isolated patches of fir and spruce stands in these counties.

PRINCE EDWARD ISLAND

Defoliation - For the first time since 1968, there was no defoliation of balsam fir or spruce detectable during the annual spruce budworm aerial survey in Prince Edward Island in 1987. Ground surveys detected defoliation of varying intensity in small patches of forest, on individual

trees or, in some cases, on individual branches in numerous areas throughout the Province, mostly in eastern Queens and southern Kings counties. The largest area of severe defoliation was observed in a 10 ha white spruce stand near Little Sands, Kings County.

Damage - There were no specific spruce budworm damage surveys conducted by the Forest Insect and Disease Survey in Prince Edward Island in 1987.

Control - No control measures on an operational scale were carried out against the spruce budworm in Prince Edward Island in 1987.

Forecast - The overwintering larval (L_2) survey was conducted by the Canadian Forestry Service. Information from the 38 locations indicates that spruce budworm populations in 1988 are likely to be even lower than experienced in 1987, consequently no significant defoliation of fir or spruce is expected. Populations were extreme at 5%, moderate at 21%, low at 63% and negative at 11% of the locations sampled.

STILLWELL'S SYNDROME
(Sudden death of balsam fir trees)

Stillwell's syndrome is a condition of balsam fir when trees, usually with a fair complement of foliage, despite having been exposed to varying amounts of defoliation by the spruce budworm for several years, turn bright red and die. This phenomenon has been known in balsam fir stands where considerable damage or mortality has occurred. The "dropping out" of surviving trees in spruce budworm damaged stands during the apparent recovery stage, even years after the collapse of the outbreak, was noted by the late M.A. Stillwell during his pathological studies in the Green River Watershed of New Brunswick. In his honor, we proposed to refer to this phenomenon as Stillwell's Syndrome, in 1982 when the Forest Insect and Disease Survey first drew attention to this condition.

Balsam fir trees stressed by repeated spruce budworm defoliation are susceptible to attack by numerous organisms that are normally considered to be secondary in nature. Investigations in 1982 into the possible cause of Stillwell's Syndrome found that all red trees sampled were affected by Armillaria root rot, Armillaria mellea (Vahl ex Fr.) Kummer, and at least one species of beetles. Balsam bark weevil, Pissodes dubius Rand., was present in 75% of the affected trees, balsam fir bark beetle, Pityokteines sparsus (Lec.), in 17%, and sawyer beetle, Monochamus sp. in 17%. However observations elsewhere indicate that not all Stillwell's Syndrome-killed trees are affected by Armillaria root rot, that balsam bark weevil and balsam fir bark beetle frequently occur together on the same tree; and that sawyer beetle attack of weakened living trees is not uncommon.

Sudden death of balsam fir trees was reported in 1980 and 1981, from various parts of New Brunswick. In 1982, an unusually high number of balsam fir trees died in this manner and some areas of Nova Scotia were affected. The condition was present but much reduced in 1983, increased again in 1984 and continued in 1985, especially in the northwestern part of New Brunswick. The problem further intensified in New Brunswick in 1986 and literally thousands of balsam fir trees with bright red foliage were observed during early summer aerial surveys in the western part of the Province.

In 1987, in New Brunswick, the number of balsam fir trees with red foliage was greatly reduced in much of the western part of the Province compared to 1986 levels. Exceptions were a 45 000 ha area in the Christmas Mountain Range in northwestern Northumberland County, and a 10 000 ha area of Glazier Lake, Madawaska County. Scattered red trees were present throughout the rest of western New Brunswick and a few recently dead trees were observed in the eastern half of the Province.

In Nova Scotia, balsam fir trees, dead as a result of Stillwell's Syndrome, were observed throughout the spruce budworm damaged forests of the northern mainland but the number of affected trees was low.

In Prince Edward Island, no affected trees were observed in 1987.

BARK BEETLES OF CONIFERS

Not as conspicuous as some defoliators, bark beetles nonetheless are an important group of forest insects causing tree mortality. Bark beetles usually attack trees that have been weakened by other factors but when populations are at outbreak levels, healthy trees are successfully attacked and may be killed.

Spruce Beetle, Dendroctonus rufipennis (Kby.) remained active throughout the Region in 1987 and white spruce mortality occurred in all three provinces.

In New Brunswick, spruce beetle damage was reported in 1980 after a 50-year period of inactivity. Since then the insect has been found in a number of widely separated areas, mostly in the southeastern and northwestern parts of the Province.

In 1987, infestations remained active and caused further tree mortality. On Grand Manan Island almost half (48%) of the mature and semimature white spruce trees are either infested or dead in the North Head - Castalia and the Long Eddie Point areas. Infestation levels were about the same as in 1986 along the Shepody Road in Fundy National Park, Albert County. Scattered mature and semimature white spruce trees are dead or dying in an area of 10 ha south of Lucky Lake near the Restigouche - Gloucester County line possibly from spruce beetle attack. This area needs further investigation.

In Nova Scotia, Cape Breton Island constituted the major outbreak area during the early part of the 1980s and by the end of 1983 no large areas remained without severe white spruce mortality. Beetle activity decreased between 1984 and 1986 on Cape Breton Island but there was an increase in the number of spruce beetle attacked white spruce on the mainland. In 1987, the level of insect activity was similar to that observed in 1986 with most of the tree mortality occurring on Cape Breton Island and on the northern mainland. Scattered pockets of affected trees were observed in parts of Lunenburg, Yarmouth, Digby, Annapolis and Kings counties. The

largest outbreak was recorded on the southwest shore of Big Mushamush Lake, Lunenburg County, where trees over a 10 ha area were affected. Damage in affected stands in 1987 ranged from 1 to 36% of the trees dead or dying.

In Prince Edward Island, spruce beetle killed an estimated one-third of the merchantable white spruce by 1983 when infestations peaked. Populations have decreased steadily since that time and in 1986 only a very few newly infested white spruce trees were observed in the Province. In 1987, there was an increase in infestation. Numerous newly attacked trees were observed in white spruce stands at Hermanville, St. Margarets and Victoria Cross, Kings County, at scattered locations in Queens County and at North Bedeque, Prince County. The highest level of damage was recorded in a semimature stand at Little Lands, Kings County, where 28% of the trees were dead.

Eastern Larch Beetle, Dendroctonus simplex Lec., normally attacks only weakened, damaged, or recently felled host material. However, when populations are very high, living, apparently healthy, mature or overmature trees, and even younger, small diameter trees can also become infested.

In the Maritimes, a population buildup was first noticed in Nova Scotia in 1976. This increase in beetle population followed several years of severe defoliation of larch by the larch sawfly, Pristiphora erichsonii (Htg.). Since then, the beetle has become widespread in all three provinces and has caused serious tree mortality. By the end of 1981, an estimated 24% of merchantable-size larch was dead in New Brunswick, 64% in Nova Scotia, and 13% in Prince Edward Island. The insect populations have been generally declining since 1984 and the number of trees succumbing to beetle attack has also decreased in most areas.

In 1987, newly attacked trees were observed in York, Carleton, Northumberland, Queens and Sunbury counties in New Brunswick and at Muddy Creek, Prince County, Prince Edward Island, where 20% of the larch trees were infested. No eastern larch beetle infestations were observed in Nova Scotia.

At the central New Brunswick research plot, there was a further increase in newly infested trees as 7.6% of the trees were attacked in 1987, compared to 6.7% in 1986, 2.8% in 1985, 3.8% in 1984 and 2.9% in 1983. Cumulative larch mortality due to attack by the eastern larch beetle has increased to 42% in 1987, from 6% in 1979, when the plot was established, an average of 4.7% annual tree mortality.

CANKERS OF CONIFERS

Cankers are caused by many fungi, the attacks of which are manifested in different ways, however, all are similar in one important aspect: they damage trees. Damage varies from the loss of a few small branches or minor stem infections to the deformation of the stem to such an extent that it becomes of little or no value, or the tree may die. Damage in stands is also variable. Some canker diseases eliminate only a few trees, while others may spread and infect most or all trees in a stand or plantation.

Losses are both direct, such as mortality or reduction in wood value, and indirect, such as low quality trees occupying valuable space, or affected trees serving as sources of infection either to other trees in the same stand or to areas nearby.

European Larch Canker, caused by the fungus Lachnellula willkommii (Hartig) Dennis, was first discovered in the Maritimes in 1980. Surveys since then established the distribution of the disease as widespread in southeastern New Brunswick and on mainland Nova Scotia. European larch canker has been a serious disease in many parts of Europe. The fungus is considered, by most, to be a primary pathogen (capable of infecting vigorous, healthy trees) and its presence has resulted in the exclusion of larch from plantation programs in parts of Europe. In North America, the fungus was first found in Massachusetts in the 1920's in European larch plantations. Periodic concentrated eradication attempts appeared to have been successful as the disease was not found during surveys of the area in 1965. However, it was discovered in northeastern Maine in 1981.

The fungus infects mostly young trees, therefore, future wood supplies may be affected. Tree mortality reduces stocking, branch mortality reduces growth, and cankers reduce wood quality. The extent to which the disease will cause damage in the Maritimes is not yet known but the potential for damage is there and the role of the disease will have to be considered in view of increased emphasis on forest renewal and larch tree improvement programs.

In 1987, the disease was not found outside the range of the known distribution during surveys of 87 locations (Fig. 2).

Investigation of several aspects of the behavior of the fungus under our climatic conditions has been initiated. Results will be reported as they become available. A survey to establish age and spread pattern indicates that the fungus could have been present in the Maritimes for about two decades before its discovery and may have spread from specific areas. The study also showed a rapid decrease in incidence of infected trees with increasing distance from the Bay of Fundy, possibly indicating a climatic dependence.

The disease is capable of intensifying rapidly in young stands. Incidence of infected trees in a research plot increased as follows, based on fall assessments: 1982 - 7%; 1983 - 19%; 1984 - 46%; 1985 - 88% and 1986 - 91% of trees affected. Considering the high level of incidence, no further assessments are planned.

Greenhouse-grown seedlings of 22 populations of Larix decidua, L. leptolepis, L. eurolepis, L. laricina, and L. sibirica were successfully planted in a heavily infected area in the early summer of 1983 to test differences in susceptibility to infection. Larix occidentalis seedlings were added to the test in 1985. Cankers, bearing fruiting bodies of Lachnellula willkommii, were found on three L. decidua seedlings in the fall of 1984. By the fall of 1985, 11 of the 24 living larch populations had at least one seedling infected by the disease. The species affected were L. decidua, L. leptolepis and our native tamarack, L. laricina.

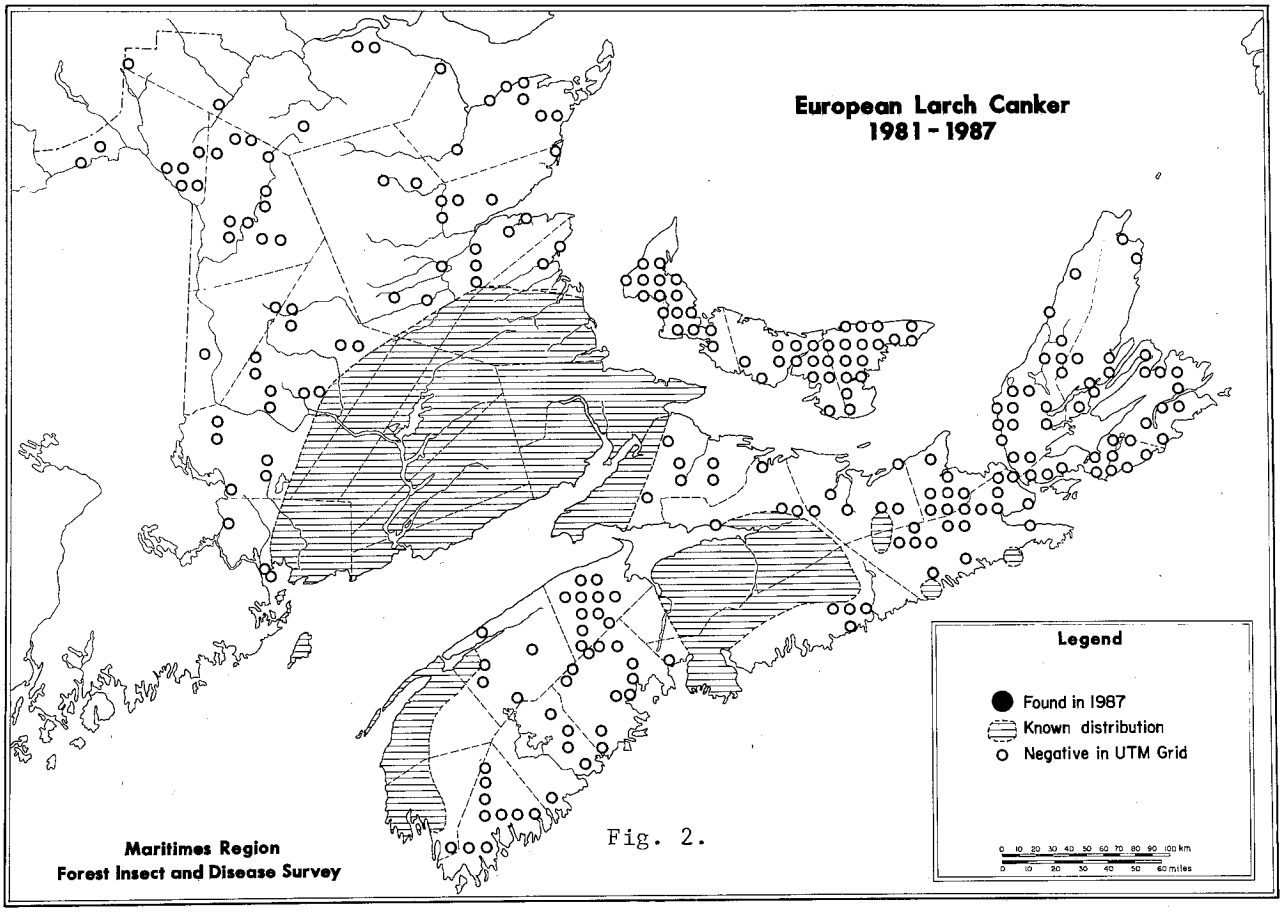


Fig. 2.

In 1987, two additional larch populations became infected. One of these represents the first infection of L. eurolepis in the study. Additional seedlings of already affected populations became infected both in 1986 and 1987.

Scleroderris Canker, caused by the fungus Gremmeniella abietina (Lagerb.) Morelet, was first found in the Maritimes Region in 1971. The disease is widespread in New Brunswick, especially in the northern half of the Province and infects mostly plantations of jack, red and Scots pine. In Nova Scotia, where the disease was first found in 1972, a few plantations of red, jack and Scots pine suffered limited lower branch mortality during the mid-1970s. The disease was last found in that Province in 1978, and appears to have died out. It has never been found in Prince Edward Island.

In 1987, after some years of minimal activity, there was an upsurge of new infections in New Brunswick. This was likely the result of the ideal weather conditions (wet and cool) during the infection period in 1986. Lower branch discoloration occurred in four jack pine plantations in Victoria County, in one at Deersdale, York County and in two plantations north of Juniper, Carleton County. In some areas the discoloration was severe, indicating heavy infection. Red pine was affected in two plantations near Deersdale and in a 100-ha plantation near Grindstone Brook, Victoria County. Scots pine was infected in a plantation at Galloway, Kent County. All isolates obtained from samples were tested and found to be of the North American race.

Table 2. Scleroderris canker - Non-North American race in New Brunswick, 1978-1987

No.	Location	UTM Grid	Host	Non-N.A. race identified	
				first	last
1	Allardville Gloucester Co.	20-31-526	jack pine	1979	1979
2	Hacheyville Gloucester Co.	20-34-527	jack pine	1979	1979
3	Big Hole Brook Tracadie Range Gloucester Co.	20-34-525	jack pine	1979	1979
4	Upper Blackville Northumberland Co.	20-28-516	Scots pine	1979	1979
5	Skin Gulch Road Black Brook Victoria Co.	19-60-526	jack pine	1979	1981
6	Sandy Point Eel River Northumberland Co.	20-34-521	red pine	1979	1981
7	Lisson Settlement Kings Co.	20-31-505	jack pine	1981	1981
8	Walton Lake Kings Co.	20-31-505	jack pine	1981	1981
9	Limekiln York Co.	19-67-512	red pine	1979	1979 (erad.)
10	Juniper York Co.	19-63-515	red pine	1978	1978 (erad.)
11	Butte D'Or Paquetville Gloucester Co.	20-33-526	red pine	1979	1979 (erad.)

Table 3. Scleroderris canker - Non-North American race in New Brunswick, 1978-1987. Results of observations, isolations and race determinations from the 11 locations where Gremmeniella abietina has been identified

Year	Location number										
	1	2	3	4	5	6	7	8	9	10	11
1978								NA		E	E
1979	E?	E?	Int	Int	E	E	NA	NA	E	*	*
1980	x	x	x	x	x	x	neg	NA	*	*	*
1981	neg	x	NA	x	E/NA	Int?	E?/NA?	E?/NA?	*	*	*
1982	neg	neg	neg	NA	NA	NA	neg	neg	*	*	*
1983	neg	neg	neg	neg	neg	neg	NA	neg	*	*	*
1984	x	neg	NA	NA	neg	neg	NA	NA	*	*	*
1985	neg	c	NA	NA	x	neg	NA	NA	*	*	*
1986	neg	c	neg	neg	x	neg	neg	neg	*	*	*
1987	neg	c	neg	neg	x	c	neg	neg	*	*	*

(Location numbers refer to information in Table 2 and in Figure 3).

Legend: NA - North-American race
E, E?, Int - non-North American races
Neg - negative, either no field symptoms or culture negative
x - not checked
c - controlled (pruning)
* - eradicated

The European race of the disease is capable of killing trees of any size (the North American race kills only small trees). This and several other "intermediate" races, have been found in New Brunswick at 11 locations since 1978 (Fig. 3). Eradication attempts at a forest nursery, in a Christmas tree plantation and in a commercial plantation appear to have been successful in eliminating the disease at these locations.

The results of 10 years of surveys by the Forest Insect and Disease Survey for the non-North American races of Scleroderris canker in New Brunswick are summarized in Table 2 and Table 3. The disease had been eradicated at 3 of the 11 locations even before the final race identifications were available (locations 9, 10, 11). At two locations "controlled" status has been achieved by the pruning of branches to 2 m from the ground (location 2 in 1985 and location 6 in 1987). The remaining six locations are "under surveillance", i.e. an annual inspection is conducted for symptoms and/or changes in symptom expression. Where present, branches with symptoms are cultured and tested to determine the appropriate race of the fungus. The

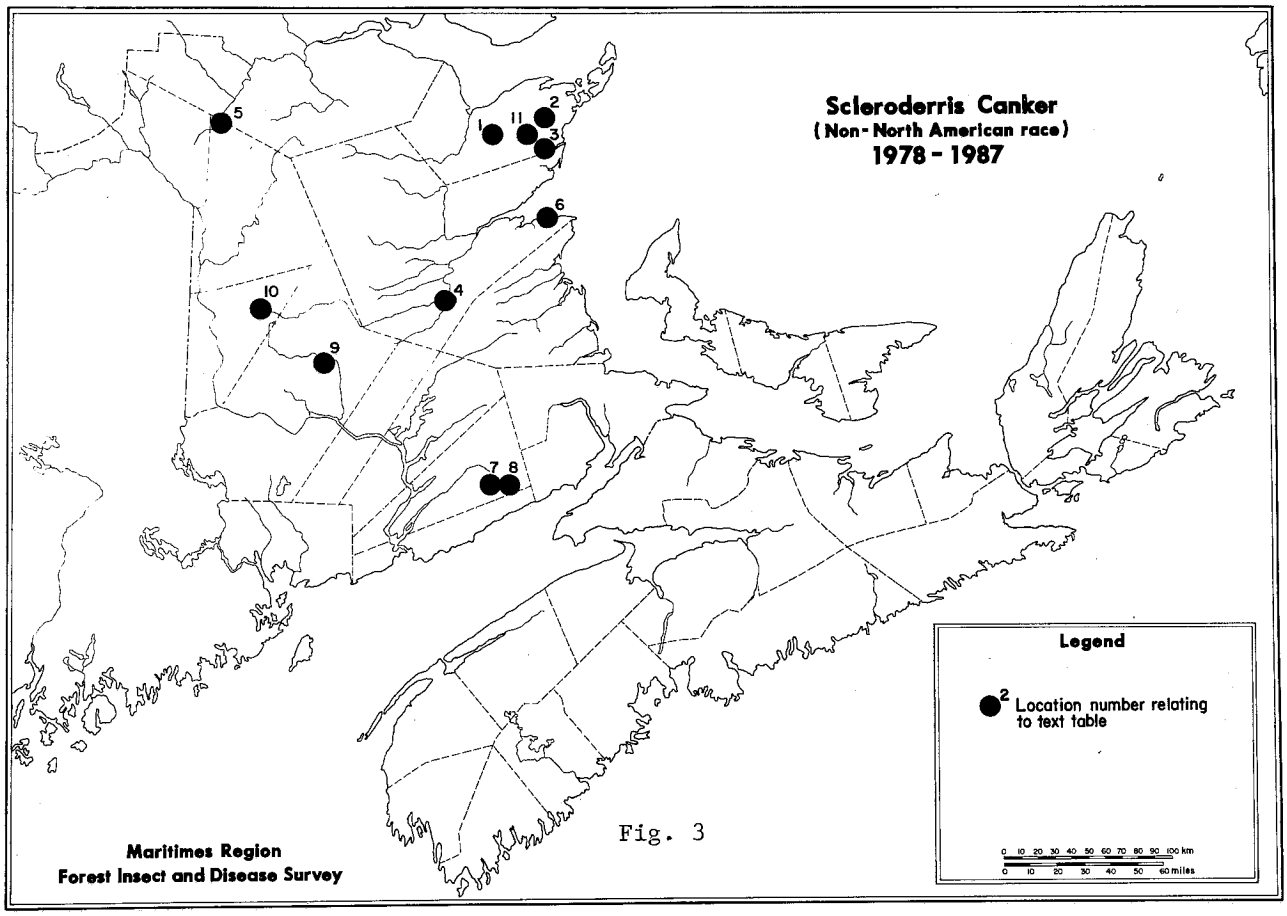


Fig. 3

non-North American race has been identified on more than one occasion at only 2 of the 8 locations under surveillance for at least five years.

The significant aspects of this effort to date are:

(1) the various non-North American races of the disease are indistinguishable in the field from the North American race,

(2) only branches less than 2 m from the ground have been affected; and

(3) no non-North American race of the fungus has been identified at any of the locations (or anywhere else in New Brunswick) since 1981.

The findings to date give rise to cautious optimism regarding the future of the non-North American races of Scleroderris canker in the Maritimes.

SPRUCE BUDMOTHS

Spruce Budmoths, Zeiraphera canadensis Mutuura & Freeman, and to a lesser degree, a closely related species Zeiraphera unfortunana Powell, have been omnipresent forest pests in the Maritimes since at least the late 1930s when the Forest Insect and Disease Survey started to keep records. Although widespread, insect populations have been generally low except for the occasional flare-up, usually on open-grown white spruce. The last recorded outbreak occurred in New Brunswick in the mid-1960s when spruce in parts of the Southwest Miramichi and the Nashwaak River drainage system sustained moderate to severe defoliation, and in Nova Scotia in the mid 1970s when similar levels of defoliation occurred in areas along the Northumberland Strait and the Fundy Coast.

Spruce budmoth, a not-too-important forest insect in mature forests, became a major pest in 1980, when, it was discovered to be causing defoliation, shoot distortion, and tree deformation in white spruce plantations over large areas in New Brunswick. In 1982, over two-thirds of the 180 locations surveyed in the Region were infested by spruce budmoth. At over 40% of these locations, in both New Brunswick and Prince Edward Island, defoliation and shoot damage were in excess of 10%. Injury was classed as moderate or severe at 10 and 20%, respectively, of the locations surveyed.

In 1987, spruce budmoths were widespread in the Region in white spruce plantations and although the general level was similar to that in 1986, damage was considerable in some areas.

In New Brunswick, an average of 10% of the shoots of white spruce trees were affected at locations scattered around the Province, however shoot damage was 43% at St. Luc, Kent County in an old field, 29% at Belledune, Restigouche County, 27% on the Laverty Trail in Fundy National Park, Albert County, 23% at Big Hole Brook, Restigouche County, 17% at Veneer, Victoria County and 17% in a seed orchard at Pokiok Settlement, York County. Spruce budmoth damage was observed in 57% of the 12 white spruce plantations assessed for pest conditions in DNR&E region 5.

In Nova Scotia, an average of 9% of the white spruce shoots were damaged. The highest level of damage was recorded at MacNabs Cove, Cape Breton County where 55% of the shoots were damaged, and 49% shoot damage was observed at Belle Cote, Inverness County. At Ben Eoin, Cape Breton County, 43% of the shoots were damaged in 1987, compared to 35% in 1986.

In Prince Edward Island, an average of 15% of the white spruce shoots were damaged at the 12 locations assessed. Damage was highest at North Enmore, Prince County, where 72% of the shoots were affected by Z. canadensis on 80% of the trees while 21% shoot damage was caused by Z. unfortunana at Foxley River, Prince County. Other above average damage levels occurred at Hermanville, Kings County (25%) and at Primrose, Kings County (16%).

Control - In the third year of a developmental program towards control of the spruce budmoths, J.D. Irving Ltd. in cooperation with the Canadian Forestry Service-Maritimes, sprayed 14 449 ha of white spruce plantations with fenitrothion (Sumithion^{R}) which was applied at 105 g/ha in a total mix of 0.73 l/ha per application (a ULV formulation). Of the area 4 714 ha

received two applications, the remainder was treated once. Treatment was timed to coincide with adult emergence and results confirmed findings in 1985 and 1986 that, when applied at a suitable timing, enough adult moths are killed to impact on egg laying - and significantly reduce damage the following year.

Pheromones were used in 1987, to time spraying operations, in monitoring the population levels and in the first year of a 3-year study of mating disruption experiments.
(Note: Zeiraphera unfortunana is also referred to as the Purplestriped shootworm.)

SEEDLING DEBARKING WEEVIL

The Seedling Debarking Weevil, Hylobius congener D.T., Sch. & Marsh., has been suspected as the causal agent in the mortality of newly planted coniferous seedlings in central Nova Scotia since the beginning of the 1980s. Its association with the problem was first reported in 1984, when seedling mortality exceeded 85% in some plantations. The insect is present on sites as early as the time of harvest. Debarking of the stems of seedlings occurs from spring through to fall resulting in progressively increasing seedling mortality. The amount of damage is related to forest management practices, such as 'hot planting' (i.e. the reforesting of cutover areas very soon after harvest), site preparation, plantation size, and the proximity of plantations to other harvested areas. The level of concern for this insect is related to increased awareness by forest managers, the recognition of the fact that past unexplained plantation failures may have been the result of weevil damage and the realization that, in the absence of practical control methods, the future of large scale plantation programs may be jeopardized.

In 1987, the weevil continued to damage and kill seedlings in recently established plantations, especially where planting has occurred within two field seasons of the harvesting operation. Damage levels were lower than in 1985 or 1986, apparently a result of the extremely dry summer conditions which restricted weevil movement and feeding. However, significant damage still occurred on many sites, resulting in both poorly and unevenly stocked plantations. Some reforestation plans on softwood sites were postponed for 1987 because of anticipated weevil problems. The most severely affected areas remained eastern mainland Nova Scotia and eastern Prince Edward Island. Reports from New Brunswick were scattered and infrequent but significant mortality levels were encountered in Sunbury County (15%) and Kent County (21%) on black spruce.

Control - Most investigations during 1987 concentrated on measures to reduce damage. Various site preparation techniques, aimed at creating a barrier of mineral soil around seedlings, seemed to reduce damage, as did treatment of seedlings with an aerosol formulation of Tree Tanglefoot . Results will be published elsewhere. Progress was also made in the search for a chemical control through the efforts of the Forest Pest Management Institute of the Canadian Forestry Service. Work by the Research and Productivity Council of New Brunswick, funded under the Canada/Nova Scotia Forest Renewal Agreement, has resulted in a trap and lure system to be used for monitoring purposes, an essential ingredient in rating potential planting sites for hazard from the seedling debarking weevil.

ARMILLARIA ROOT ROT

Armillaria Root Rot, Armillaria mellea (Vahl ex Fr.) Kummer, a disease of a wide variety of tree species of various ages, has always been a part of the forest disease complex in the Maritimes, however, its significance appears to have changed in recent years. On the one hand, the fungus is strongly implicated among the group of secondary organisms that combine to provide the final blow to trees weakened by other factors such as repeated defoliation by the spruce budworm. On the other hand, Armillaria infected or killed trees are becoming more frequent throughout the Maritimes, and are often observed in plantations. The increased frequency is doubtless a factor of the increase in the area planted. The implications of the root rot to the future of plantations under our climate are poorly understood. However, the disease is killing trees in plantations. In some areas, groups of trees are affected and there is evidence that with the spread of the fungus these patches could increase in size. In other areas, only scattered trees are infected but these could become centers of infection if the fungus spreads. Not all infected trees die, (the fungus is primarily a wood decay organism causing root and butt rot), but its action may cause understocking in both plantations and natural stands.

Armillaria root rot is also an important part of the complex of organisms associated with morality of mature trees that have been stressed by other factors such as repeated moderate or severe defoliation by the spruce budworm. The fungus is also closely associated with Stillwell's Syndrome, the sudden death of balsam fir trees.

The disease is widely distributed in the Region and mortality of trees, both young and old, was again common in 1987.

In New Brunswick, Armillaria root rot killed at least some trees in 22% of the 147 spruce and pine plantations surveyed. The 22% incidence of Armillaria infected plantations is the same as was found in 1986 during the survey of 141 plantations but is 6% higher than the 16% incidence found in 1985, based on a survey of 70 plantations. The disease is present in all areas of the Province and affects both spruce and pine. There are differences in the rate of infection among the five regions and also between the levels to which the two species are affected (Table 4). Tree mortality in the affected plantations, attributable to Armillaria root rot ranged from 2 to 16%. This figure is based only on trees definitely identified as infected by Armillaria root rot but in actuality may be higher if the cause of all dead trees were identified (i.e. trees dead from other causes).

In addition to those detected during the systematic surveys, other infected plantations were also found. In a 20 ha jack pine plantation at South Burnthill Brook, Carleton County, 24% of the trees were dead or dying in a single infection pocket, while in a 5 ha jack pine plantation at Clearwater Brook, Victoria County the affected trees were found in several widely spread infection pockets. Armillaria root rot was also found in a lodgepole pine plantation at West Branch Sabbies River, Northumberland County.

In natural stands, the following levels of infection by Armillaria root rot were noted: 44% of balsam fir affected near Pabineau Falls, Gloucester County and at Cassilis, Northumberland County; 16% of balsam fir affected at Allainville, Northumberland County and near Glazier Lake, Madawaska County and 16% of trembling aspen affected at Smiths Corner, Kent County. Other infected stands were assessed in other parts of these counties and in Restigouche County.

In Nova Scotia, Armillaria root rot killed at least some trees in 17% of 12 spruce and pine plantations surveyed during the summer. In addition, 7% of the red spruce seedlings were dead or dying in a plantation north of Upper Mount Thom, Pictou County. Sugar maple trees were found infected at a location in Guysborough County and trembling aspen in Lunenburg County.

No reports were received in 1987 from Prince Edward Island.

Plots established in plantations to study the spread of the disease on different hosts and under different conditions have been assessed annually since 1983. The plantations are of different ages and were established in areas of somewhat different cover types. Subplots, comprised of the 10 trees nearest all infected trees have also been evaluated. The summary of observations is presented in Table 5. Only the youngest plots were assessed in 1987 and some intensification was observed in all three plots. Trees in older plantations are said to acquire some resistance to fatal attack by Armillaria root rot, which they retain as long as they are in a vigorous stage without significant stress. Some of our study plantations are reaching this age. These plots will be observed annually but, unless conditions change significantly, they will be assessed only on a 5-year cycle. More plots of various species and especially of younger ages need to be established to assess the real significance of this disease in plantations.

Table 4. Armillaria root rot in spruce and pine plantations in various areas of New Brunswick in 1987

Plantations/Infection	Host	DNRE Resource Management Region				
		1	2	3	4	5
Number of plantations assessed	Spruce	11	8	16	9	69
	Pine	5	5	13	8	3
Percent of infected plantations	Spruce	9	37	0	11	29
	Pine	0	20	0	12	0

Table 5. Armillaria root rot - spread of disease in plantations 1983–1987

Species	Year planted	Year plot est.	Former cover type	Mortality, %					No. of subplots and percent mortality by year									
				1983	1984	1985	1986	1987	1983		1984		1985		1986		1987	
									No.	%	No.	%	No.	%	No.	%	No.	%
Black spruce	1976	1983	Softwood	8	10	10	10	--	4	17	5	16	5	16	5	16	-	--
Black spruce	1973	1983	Softwood-Hardwood	4	4	4	4	--	2	5	2	10	2	15	2	15	-	--
Black spruce	1978	1983	Softwood-Hardwood	8	12	20	20	--	5	2	8	6	10	6	10	10	-	--
Black spruce	1980	1983	Softwood-Hardwood	8	16	24	24	24	4	10	8	22	12	30	12	30	12	32
Jack pine	1978	1984	Softwood-Hardwood	-	2	2	2	--	-	-	0	-	1	0	1	0	-	--
Jack pine	1981	1984	Softwood-Hardwood	-	2	4	4	6	-	-	2	0	2	0	2	5	3	13
Jack pine	1978	1984	Softwood-Hardwood	-	2	2	2	--	-	-	0	-	1	10	1	10	-	--
Black spruce	1980	1985	Softwood-Hardwood	-	-	2	2	4	-	-	-	-	1	20	1	40	2	25

SIROCOCCUS SHOOT BLIGHT

Sirococcus shoot blight, caused by the fungus Sirococcus conigenus (DC) P. Cannon & Minter (previously known as Sirococcus strobilinus Preuss), has been known in the Maritimes since the early 1970's but has been present for much longer. The fungus infects and kills newly developed shoots. Fruiting bodies are produced on the twigs, needles, and cone scales from whence the spores disperse and cause new infection. Heavy attacks cause branch mortality, which result in crown dieback and tree mortality. In the Maritimes, the disease affects red pine and occasionally spruce and larch, although other species of pine, hemlock, Douglas fir, and true firs can also be affected. Trees of any size, from seedlings to 15 m in height, are damaged or killed. The initial infection in newly established plantations appears to be closely related to the proximity of older red pine stands, as 48% of young plantations less than 1 km from older red pine were found infected, compared to 8.7% which were more than 1 km away from an infection source. After the initial infection the severity of the disease increases as the trees become older.

The disease is present in all three provinces but is most widely distributed in red pine plantations in Nova Scotia, west of the Colchester-Pictou and Halifax-Guysborough county lines, and in natural regeneration in the southern half of New Brunswick.

In 1987, the disease further intensified in all three provinces. In many areas the repeated infection has resulted in serious deterioration of red pine stands and plantations, in some to the point that salvage operations were carried out.

In New Brunswick, Sirococcus shoot blight occurs mostly in the southern part of the Province, although affected plantations are known as far north as the line from southern Victoria to northern Kent counties. Infection was severe on nearly all semi-mature red pine trees in a 2 ha plantation near Mechanic Settlement, Kings County; shoot damage was common on red pine trees in Fundy National Park, both near the Headquarters area and at the intersection of Herring Cove and Point Wolfe roads; young red pine trees were affected in a plantation at Big Forks, Kent County; and light shoot mortality occurred on red pine trees of all ages along the Shin Creek road in Sunbury County.

In Nova Scotia, infected red pine stands in Cumberland, Colchester, Hants and Yarmouth counties continued to deteriorate. Some of the red pine plantations in the Rushy Lake area, Yarmouth County, are almost completely "wiped out"; infected plantations at Diligent River, and in the Chignecto Game Sanctuary in Cumberland County continue to deteriorate and some were salvage cut in 1987; newly infected plantations were found at Southampton, Cumberland County, Eastville, Colchester County, and at Indian Falls, Shelburne County. At Indian Falls, a plantation had 68% of the trees infected with an average of 17% of the shoots damaged. In addition to red pine, the disease was also identified on red spruce at East Wentworth, Cumberland County, on blue spruce at Weymouth, Digby County, on black spruce in a plantation at Mayfield, Antigonish County and on white spruce cone scales from a seed orchard at East Mines Station, Colchester County.

The deterioration of pine stands by this disease in western Nova Scotia and the spread of the disease to plantations in the eastern half of the Province, where red pine has been a major plantation species in recent years, makes Sirococcus shoot blight one of the major plantation problems in Nova Scotia.

In Prince Edward Island, Sirococcus shoot blight is now known to be present at three locations: Goose River, Kings County, Iona and Selkirk Road, Queens County. At Iona, where it was first reported on a few red pine trees in a 1 ha plantation in 1984, the number of infected shoots per tree have increased from 'light' to about 60% on some of the fringe trees in 1986. At Goose River, there was a marked increase in shoot infection in a 3 ha, 23-year old red pine plantation. First reported as light on a few trees in 1985, examination in 1986 showed that virtually all trees have some degree of damage with about 5% of fringe and open growing trees supporting close to 50% shoot damage. At Selkirk Road, where the disease was observed for the first time in 1986, about 1-2% of the red pine supported from 5 to 29% damaged shoots on lower crown branches. Infection levels in 1987 remained about the same as in 1986 at all three locations.

PINE LEAF ADELGID

Pine leaf adelgid, Pineus pinifoliae (Fitch), requires two coniferous hosts for the completion of its complicated life cycle, during which one sexual and several asexual (parthenogenetic) forms develop. The adelgid alternates between red or black spruce and pine (mostly white pine). On spruce conspicuous galls are formed, which can resemble cones. Even at high population levels little damage is caused to the tree. On white pine the adelgid attacks new shoots and causes shoot mortality. When shoot damage is serious the affected trees die. Attacks on white pine characteristically occur in odd-numbered years in the Maritimes although the full effect of infestations may not be apparent until the following spring when dead shoots became conspicuous.

Pine leaf adelgid is present throughout the Maritimes. From 1942 until the mid-1960s it often occurred at damaging levels especially in southern New Brunswick and in Shelburne, Lunenburg and Queens counties on the south shore of western Nova Scotia. Populations were generally low and damage minimal from the mid 1960s to the mid 1980s.

In 1987, there was a drastic increase of pine leaf adelgid populations in parts of western Nova Scotia, especially on white pine. In the early part of the summer there were some areas where it was difficult to find white pine needles without at least a few adult female adelgids, having just arrived from nearby spruce trees, sitting at the tip of the needles.

A summer and a fall survey were conducted in Nova Scotia in 1987, the former to assess population levels on the two hosts affected, the latter to obtain an early indication of shoot damage. The results of the infestation surveys are shown in Figure 4 for white pine and in Figure 5 for red spruce.

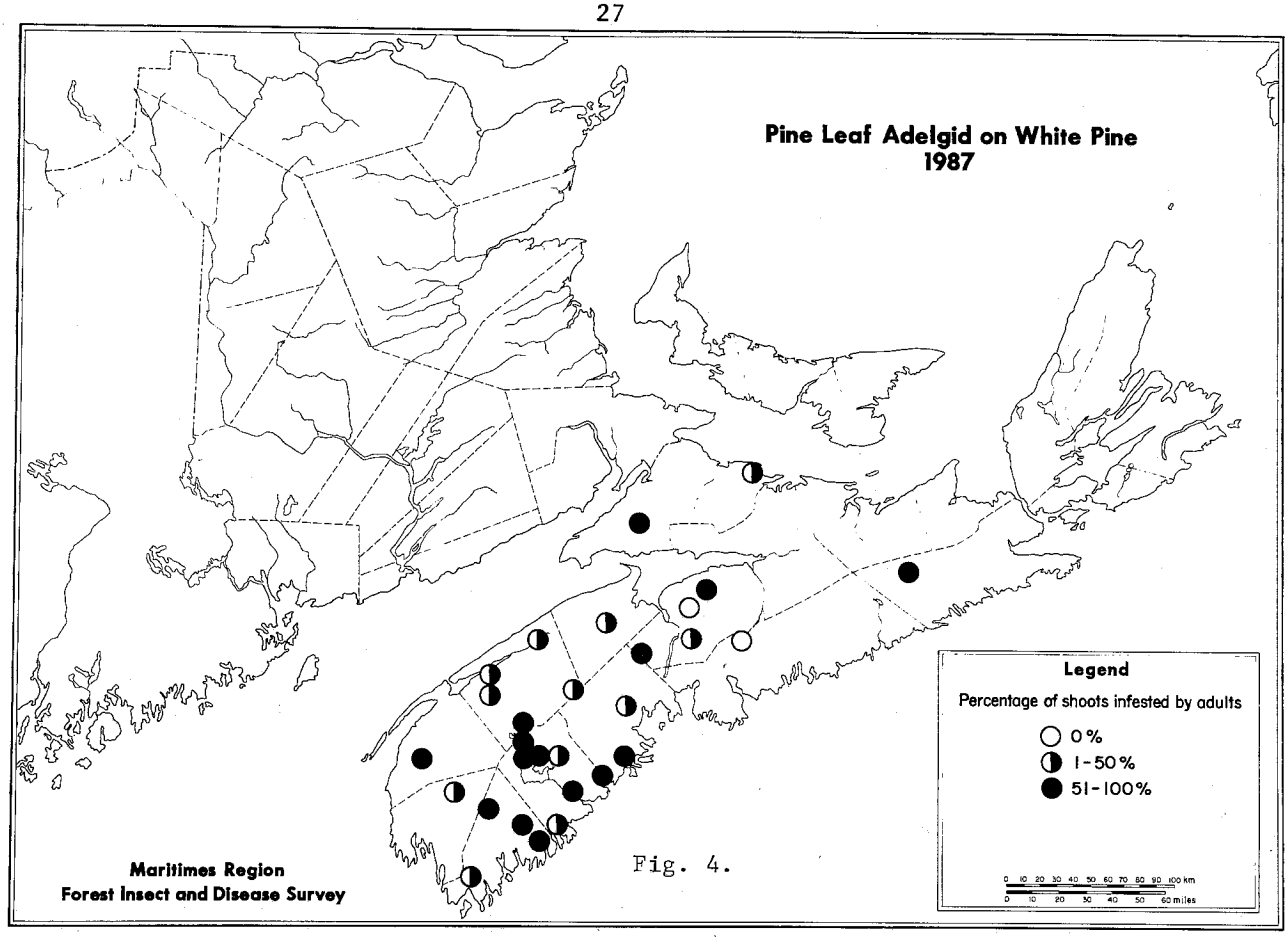

Pine Leaf Adelgid on White Pine
1987
Legend
Percentage of shoots infested by adults
0 %
1-50 %
51-100 %
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 4.

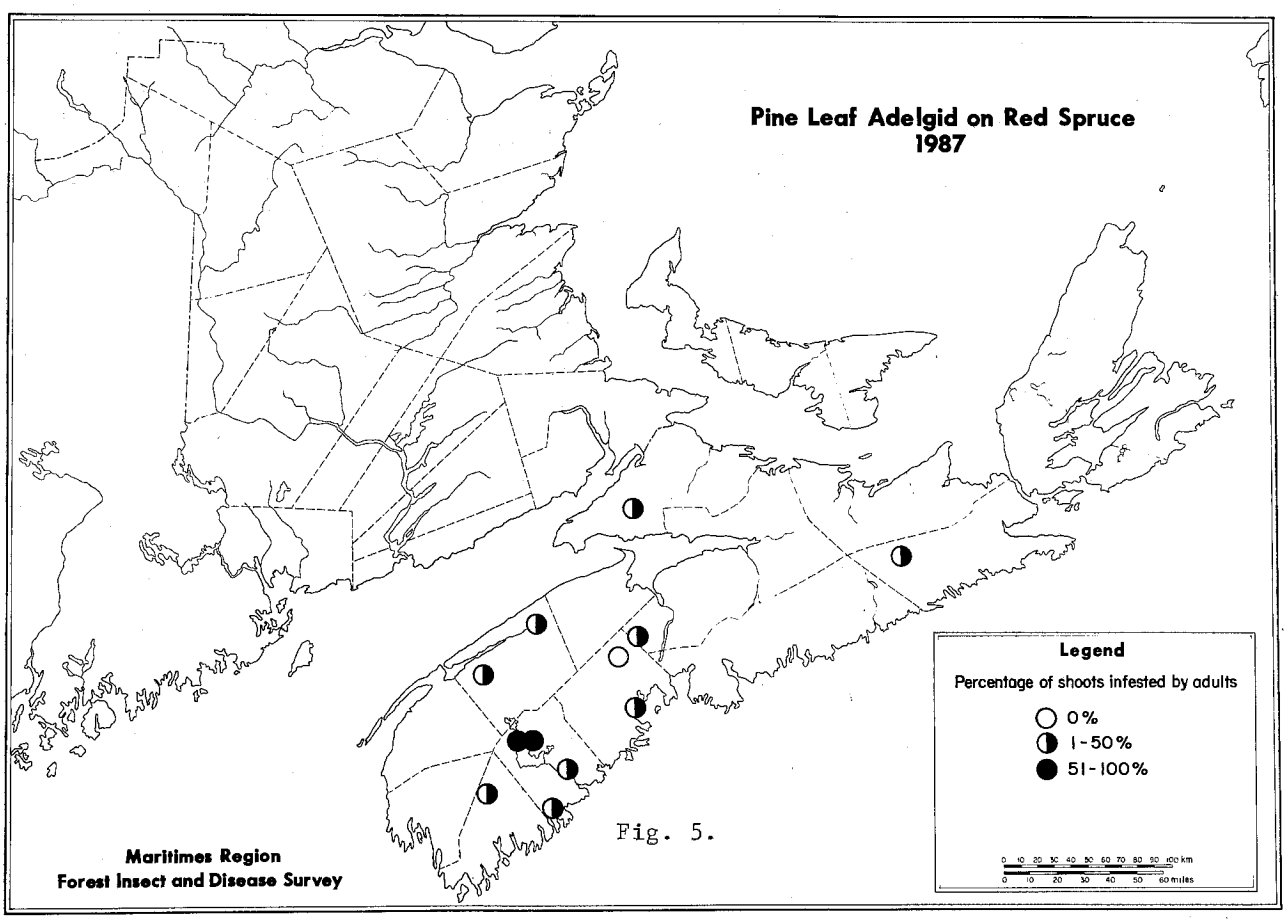

Pine Leaf Adelgid on Red Spruce
1987
Legend
Percentage of shoots infested by adults
0 %
1-50 %
51-100 %
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 5.

Infestations were generally highest in Queens, Shelburne, Lunenburg and southern Annapolis counties, roughly the same area where damage was highest during the last outbreak, decades ago. On white pine an average of 51% of the shoots were infested, with a range of 0-100% at specific locations, while on red spruce the average infestation level was 23%, and ranged from 0-92%. The most severe infestation occurred in the Lake Rossignol area, Queens County and at Northwest, Lunenburg County.

Shoot damage in the fall averaged 6.3% on white pine (range 0-47%) and 7.1% on red spruce (range 0-37%). The highest level of damage on white pine was recorded at Hemlock Hill road, Queens County, where 47% of the shoots were damaged and 40% shoot damage occurred at Northwest, Lunenburg County. The significant difference between infestation levels and shoot damage found is at least partly due to the fact that much of the damage will not become evident until the spring of 1988.

BALSAM WOOLLY ADELGID

The balsam woolly adelgid, Adelges piceae (Ratz.), previously known as the balsam woolly aphid, was introduced from Europe to North America in Nova Scotia about 1900, probably on nursery stock. It became established throughout Nova Scotia, Prince Edward Island, and the southern half of New Brunswick and at scattered locations throughout much of the remainder of the Province.

This insect attacks balsam fir and feeds on the thin-walled living cells under the bark. In feeding, it introduces a salivary substance into the tissue causing an abnormal multiplication of cells. Both twigs and stems are attacked. When twigs are attacked they become thickened and stubby, a condition called "gouting". On the trunk or stem, the sapwood beneath infested bark becomes brown and brittle. Many trees in a heavily infested stand die within one season. Infestation is indicated by the presence of a white woolly substance, secreted by the adelgid. At high populations the stems of affected trees may be completely white.

Attacks by the insect have persisted in parts of the Region for many years, with twig attack being the usual expression in coastal areas and stem attack in inland locations. Losses, in terms of tree growth, mortality, and decreased wood quality, have been substantial. Infestations, particularly in inland New Brunswick, have been much reduced since the mid-1960's as a result of low winter temperatures and death of host trees, killed by the spruce budworm. However, chronic twig attacks have persisted in parts of Nova Scotia and Prince Edward Island even though stem attacks have been rare.

In New Brunswick, there are indications that the adelgid is again becoming more common. Although populations are generally light, an increase in stem attacks have been noted in the last few years at scattered locations. In 1987, balsam fir trees at CFB Gagetown, Sunbury County and at Kingsclear, York County were found infested. Past experience shows that, given the right conditions, populations of the balsam woolly adelgid can increase rapidly. The situation will continue to be monitored throughout the Region.

RUSTS ON NEEDLES AND LEAVES

Needles of conifers are infected by a group of rust fungi. They cause the infected needles to fall off the tree prematurely and, when infection levels are high, damage occurs, such as reduced grade for Christmas trees, growth loss, or in case of repeated severe defoliation, death of young trees in plantations.

Most of the rust fungi need two different hosts to complete their life cycle. The alternate host is often a herbaceous or woody plant which occurs in close association with the coniferous host, frequently in the same plantation. The various species of rusts on the conifers are very similar in appearance but because each species needs a different alternate host, the proper identification of the fungus is important if control measures are anticipated.

On hardwoods the situation is similar to that on conifers. Heavy infection causes foliage discoloration and the leaves fall prematurely. Repeated heavy attacks result in twig and branch dieback and may eventually kill the tree. Many of the leaf rusts, such as those found on poplars and willows, are stages of the same species alternating between these trees and various conifers. Control in these situations, where both hosts are of value, becomes complicated. For example, care must be taken in species selection for uses such as in windbreaks around nurseries, seed orchards or ornamental settings.

The various rusts encountered in 1987 are discussed by host tree species below:

Coniferous hosts:

On Balsam fir - Needle rusts found on balsam fir in 1987 included Melampsora abieti-capraearum Tub. (alternate host: willow), Pucciniastrum epilobii Otth (alternate host: fireweed), Pucciniastrum goeppertianum (Kuehn.) Kleb. (alternate host: blueberry), and Uredinopsis sp. (alternate hosts: ferns). They were present throughout the Region but infections were generally low and rarely exceeded 5% of the needles affected. The most serious infection reported occurred on Deer Island, Charlotte County, New Brunswick where 17% of the needles were affected on 30% of the trees examined.

On Hemlock - Only trace infection by Pucciniastrum vaccinii (Wint.) Jorst. (alternate host: cranberry, blueberry) occurred in a few areas in Annapolis, Queens and Shelburne counties in Nova Scotia.

On Larch - Melampsora medusae Thuem. (alternate host: poplar) was found in Hants and Cumberland counties in Nova Scotia. An average of 10% of the needles were affected except at Wallace Bridge, Cumberland County where 26% of the needles on all the trees were infected. The rust was also found on the alternate host at two locations in New Brunswick.

On Pine - Coleosporium asterum (Diet.) Syd. (alternate host: goldenrod) and Coleosporium viburni Arth. (alternate host: Viburnum sp., wild raisin, hobblebush, highbush cranberry, etc.) were the two species of needle rusts

encountered on pine in 1987. While C. viburni appears mostly on jack pine, C. asterum affects both jack pine and red pine and the two species may occur together when their respective alternate hosts are present.

In New Brunswick, C. viburni has been by far the most important needle rust encountered in recent years. Repeated severe infection and the needle drop that follows resulted in young plantation trees being sustained only by their current foliage in a number of areas in the southern half of the Province. Infection levels are closely correlated to the abundance of the alternate host and the distance of trees from it. Smaller trees are most seriously affected. In 1987, the needle rust was still common in parts of the Province but the decline in infection rates, first noticed in 1986, continued. The results of surveys showed that the level of infection was lower and only 2% of the trees sustained moderate infection in 1987, compared to 8% of moderate and 1% of severe infection. Needle rust was still most common and at the highest infection level in DNR&E Region 3 but none of the plantations assessed in either region 1 or 5 were infected (Table 6). The most serious infection recorded in the Province occurred in a 50 ha jack pine plantation at Wirral, Kings County, where all susceptible needles were affected.

In Nova Scotia, infected jack pine plantations were found in Colchester, Cumberland, Guysborough, Halifax and Pictou counties but infection levels were low. The highest infection level noted was 10% of older needles affected in a plantation in Guysborough County.

In Prince Edward Island, 30% of older needles of most trees were infected in a young 5 ha jack pine plantation at Goose River, Kings County, and light infection occurred in a 2 ha plantation at North Enmore, Prince County.

Early results of research, initiated in response to concern over the effect of needle rust on the condition of jack pine plantations in New Brunswick, indicate that although the infection period in 1986 extended from mid-July to mid-September, most of the infection occurred during the Aug 7-21 period.

Table 6. Needle rust in infected jack pine plantations in New Brunswick - 1987

NBDNR&E Region	Plantat. assessed No.	Plantat. affected %	Trees infected in plantat. %	Trees in various infection categories, %				
				Negative (0)	Trace (1-5)	Light (6-29)	Moderate (30-70)	Severe (71-100)
1	3	0	-	-	-	-	-	-
2	5	80	100	6	87	7	0	0
3	13	54	56	45	40	9	5	1
4	7	57	52	41	54	4	1	0
5	2	0	-	-	-	-	-	-
N.B.	30	50	69	31	60	7	2	0

Only trace infection, not exceeding 3%, was caused by Coleosporium asterum (Diet.) Syd. (alternate host: goldenrod) in scattered red pine plantations in widely separated areas of Nova Scotia.

On Spruce - Chrysomyxa ledi (dBy.) and Chrysomyxa ledicola Lagerb. (alternate host for both: Labrador tea) were present but at very low levels on black spruce, white spruce and red spruce at scattered locations throughout the Region. The highest infection level was less than 3% of the needles infected.

Hardwood hosts:

On Ash - The ash rust, Puccinia sparganioides Ell. & Barth., (alternate host: cord grass (Spartina sp.)) has been one of the most serious foliage problems on ash in many parts of western Nova Scotia for the past decade. Infection causes foliage discoloration and premature leaf fall. Repeated attacks cause dieback and in some cases tree mortality.

In 1987, the chronic infection continued and resulted in severe foliage discoloration and premature leaf fall. At Hortonville, Kings County, all leaves of all ash trees were infected. Severe browning occurred also at Starrs Point, Kings County, and at Hantsport and Summerside, Hants County. Twig and branch mortality continued at Hantsport and was observed at Clementsport, Annapolis County. Various levels of leaf infection, with up to 40% of foliage affected, were observed in parts of Colchester, Halifax, Lunenburg, Queens and Shelburne counties. In New Brunswick, severe foliage browning and premature leaf fall occurred, accompanied by twig and branch dieback on scattered ash trees, in a 2 300 ha area between Lower Norton and Central Norton, Kings County. Infection was severe, and affected trees of all sizes, on a 0.5 ha area near Dieppe, Westmorland County, while other ash trees in nearby areas exhibited moderate discoloration. The disease was not observed in Prince Edward Island.

On Trembling aspen - Moderate foliage infection, caused by Melampsora medusae Thuem. (alternate host: larch), occurred at Kirkland, Carleton County, trace infection was noted on 10% of the trees in a seed orchard at Queensbury, York County, New Brunswick and at Cleveland, Richmond County in Nova Scotia.

HEMLOCK LOOPER

Hemlock Looper, Lambdina fiscellaria fiscellaria (Gn.), contrary to its name, is mainly a defoliator of balsam fir in the Maritimes, capable of causing serious damage when populations are high. It feeds on needles of all age classes and is a wasteful eater. Larvae chew off but do not consume all of the needles, consequently a much greater amount of foliage is removed than necessary for their development.

In the Maritimes, populations have been generally low in the past few years. The last serious outbreak occurred in central Prince Edward Island in 1977 and 1978 when the insect killed 80% of the merchantable balsam fir and over 90% of the hemlock in the affected area. A small persistent outbreak has existed in Nova Scotia since 1985.

In 1987, the hemlock looper continued to cause defoliation in the Diligent River-Yorke Settlement area of Cumberland County in Nova Scotia. Moderate and severe defoliation of balsam fir and light and moderate defoliation of red spruce occurred on about 20 ha. Great numbers of moths were observed in this area in the fall, indicating a continuation of the infestation in 1988. In other areas, larvae and moths were much more common than in previous years, an indication of a general population increase.

In Prince Edward Island, the populations were generally low and no defoliation was observed. However, a moth flight was observed in the Wellington area of Prince County in the fall and the highest catches of moths since the mid 1970's were recorded in all three light traps in the Province. This and the increase from last year's numbers - 319 from 11 in Prince County, 353 from 134 in Queens County and 174 from 0 in Kings County - indicate that hemlock looper may cause defoliation in some areas of the Province in 1988.

In New Brunswick, no defoliation occurred but larvae were collected at 11 locations in the southern part of the Province, the highest being 51 larvae in a collection from white spruce at Bloomfield Station, Kings County and 32 larvae from balsam fir at Drisdelle, Northumberland County.

WHITEMARKED TUSSOCK MOTH

Whitemarked Tussock Moth, Orgyia leucostigma (J.E. Smith), is a defoliator of considerable economic importance. Larvae feed on a variety of coniferous and deciduous hosts. Outbreaks of this insect are usually short but severe, followed by a number of years of very low populations.

The last outbreak of whitemarked tussock moth in the Maritimes occurred in the early 1970's and collapsed by 1979, due mainly to a nuclear polyhedrosis virus. Populations were very low until 1984 when the first signs of a new build-up were observed. By 1985, the insect, although still at generally low populations, was common in most of mainland Nova Scotia and in southern New Brunswick. In 1986, whitemarked tussock moth was present in many areas in the Region but caused noticeable defoliation only in eastern mainland Nova Scotia. Defoliation, at various levels of intensity, was somewhat patchy depending on forest cover type and affected white birch, red maple, apple, larch and balsam fir. However, diseased larvae were present at a number of locations indicating possible collapse of the population before the development of a full-blown outbreak.

In 1987, in New Brunswick whitemarked tussock moth populations were low throughout and no defoliation was observed. In Nova Scotia, the outbreak reported to be developing in Guysborough and Halifax counties in 1986, collapsed in 1987 and only a trace of defoliation was observed in the Sheet Harbour - Grassy Lake area of southeastern Halifax County. Elsehwere, the insect was common throughout mainland Nova Scotia but only a few larvae were found at most locations. The highest populations existed at Windham Hill and at Southampton, Cumberland County and near Havelock, Digby County. Egg masses were found but in low numbers at these locations. In Prince Edward Island, whitemarked tussock moth populations increased in northern Kings County and caused light defoliation of white birch and red maple over an area of about 1 000 ha at Hermanville. Only a few larvae were observed at scattered locations elsewhere in the Province.

GYPSY MOTH

After its reappearance in the Maritimes in 1981, the gypsy moth, Lymantria dispar (L.), gained further ground in 1987, appears to be established in both New Brunswick and Nova Scotia and caused visible defoliation in the Region for the first time in nearly half a century.

Gypsy moth has been the most destructive insect of hardwoods and to a lesser degree of conifers in the northeastern United States for decades. The status of the outbreak in Maine has been a special concern to us because of its proximity to our Region. In 1987, gypsy moth populations there were low but have shown an increasing trend over the past few years. There were 262 ha of forests defoliated by gypsy moth in the state of Maine in 1987.

In the Maritimes, the gypsy moth monitoring committee remained active in 1987, and again coordinated all surveys. This committee was formed in response to the discovery of gypsy moth in 1981, in an effort to utilize available manpower more efficiently in combatting this latest threat to the forests of the Region. Organizations involved in surveys included the Forest Insect and Disease Survey of the Canadian Forestry Service, Parks Canada of the federal Department of Environment, the Plant Health and Inspection Branch of Agriculture Canada, New Brunswick Department of Natural Resources and Energy, New Brunswick Department of Agriculture, New Brunswick Department of Tourism, Recreation and Heritage, Nova Scotia Department of Lands and Forests, Nova Scotia Department of Agriculture, Prince Edward Island Department of Energy and Forestry, and numerous municipalities. Many volunteers, campground operators, small woodlot owners, Christmas tree growers, students and other interested private citizens also assisted in the pheromone trapping program.

In 1987, early season egg-mass surveys, larval surveys, adult trapping program and late-fall egg mass surveys were conducted to determine the current status of the insect in the Region.

The adult male trapping program is aimed at defining areas where searching for egg masses should be concentrated. As a result of studies since 1980, the trap placement design was changed in 1983 to eliminate, or at least to minimize, interference from large numbers of male moths brought into the Region by weather fronts from infested areas in the United States. Information was obtained from 3565 traps, 1481 in New Brunswick, 1734 in Nova Scotia, and 350 in Prince Edward Island. Over 90% of the traps distributed were returned. This and better understanding by cooperators of the value of negative results greatly aided the planning of the fall egg mass surveys.

The status of the gypsy moth in the Maritimes in 1987 was as follows:

In New Brunswick, the first visible defoliation since the reappearance of gypsy moth after an absence of almost half a century occurred near Moores Mills, Charlotte County. Severe defoliation of hardwoods in a patch of less than 5 ha resulted from feeding by gypsy moth. Larvae also fed on foliage of fir and spruce regeneration and on ground vegetation. The larval population was extremely high at this isolated location but aerial and

ground surveys failed to detect any other areas of visible defoliation in the Province.

Many larvae were dead in early July, at about the time when pupation commenced, and counts made to obtain some indication as to the health of this population showed that:

1. about one third of the late instar larvae were dead (32% of 1562 larvae counted in cooperation with the Dept. of Natural Resources and Energy);

2. most of the larvae that died were killed by a virus disease (88%), a few by bacteria (8%) and some were parasitized (4%) - based on a small sample of only 25 dead larvae - identified by Forest Pest Management Institute; and

3. almost one third (32%) of the gypsy moth that pupated did not develop to the adult stage, 12% having been killed by disease, 2% by parasites, the rest died from undetermined causes - based on rearing of 41 pupae.

Gypsy moth egg masses and/or pupae were found during egg mass surveys at 17 locations. With the addition of 12 new locations this year, the total number of areas where gypsy moth has been found at least once since 1981 is 44. However, only 8 of these areas are outside Charlotte County and, with the exception of Fredericton, the gypsy moth has been found only once at any of these locations. In Saint John, an unemerged pupa was found in 1981 and the lack of any activity in this area since then indicates the introduction of a larvae rather than an egg mass. A similar situation is suspected in the area near Peel, Carleton County, where two years of extensive trapping and searching have failed to confirm the presence of gypsy moth.

Over 80% of the known gypsy moth locations in New Brunswick are in Charlotte County and all 17 areas where gypsy moth was found in 1987 are in the western half of the county. In view of the above, the western half of Charlotte County of New Brunswick is considered to sustain a generally low level but widespread population of gypsy moth, both in the forest and, at least in the case of St. Andrews, in the urban setting.

In Nova Scotia, gypsy moth was found at 11 locations in seven of the nine counties in the western half of the Province. All but one of the areas were either the same or adjacent to areas where the insect had been found in previous years. The exception was Canning, Kings County, which represents a minor extension in distribution. Egg masses were not numerous in most areas except at New Minas and Annapolis Royal but even there noticeable defoliation did not occur in 1987. It is worth noting that, in spite of extensive searching, gypsy moth was not found in several areas, most notably Yarmouth County, where egg masses were present in previous years.

In Prince Edward Island, the gypsy moth is not known to occur to date. There was only one male moth caught in one of over 300 pheromone traps in the Province, at Montague, in the eastern part of the Island.

Table 7. Summary of the results of detection surveys for gypsy moth in New Brunswick 1981 - 1987

County	Location	UTM Grid[1]	Gypsy moth life stages found[2]						
			1981	1982	1983	1984	1985	1986	1987
Carleton	Peel	19-61-513					●	-	-
Charlotte	Mohannes	19-62-500	●	●	●	●	●	●	●
	N.W. of Oak Hill	19-62-502			●	●	-	-	●
	Oak Hill	19-63-502		●	●	●	●	●	-
	Upper Mills	19-63-499			●	-	-	-	-
	Lynnfield	19-63-502		●	-	-	-	●	-
	St. Stephen	19-63-500			●	●	●	-	-
	Oak Bay area	19-64-501			●	-	-	-	-
	St. Andrews	19-65-499			●	●	●	●	●
	Didgequash	19-66-500		●	-	-	-	-	●
	St. George	19-67-499		●	●	●	-	-	-
	Beaver Harbour	19-67-499	●	-	●	-	-	-	-
	Pennfield	19-68-499	●	-	-	-	-	-	-
	Campobello Island	19-66-497		●	-	-	-	-	-
	Grand Manan Island	19-67-494	●	-	-	-	-	-	-
	Burnt Hill	19-63-500				●	-	-	-
	Old Ridge	19-63-500					●	-	-
	Bayside	19-64-500					●	●	-
	Little Ridge	19-62-500					●	●	-
	Grand Falls Dam	19-61-501					●	-	-
	Basswood Ridge	19-62-501					●	-	-
	Moores Mills	19-63-501						●	●
	Pleasant Ridge NW.	19-65-503						●	-
	Anderson Settlement	19-63-503						●	-
	Baillie Settlement	19-63-502						●	-
	W Moores Mills Lake	19-63-501							●
	S of Cranberry Lake	19-63-501							●
	Heathland	19-63-500							●
	SE of Scotch Ridge	19-62-501							●
	Mayfield	19-63-500							●
	Ledge Road	19-64-500							●
	S of Beaconfield	19-62-503							●
	N of Oak Hill	19-62-502							●
	NE of Scotch Ridge	19-62-501							●
	S Maxwell Crossing	19-63-500							●
	Rollingdam	19-65-501							●
	Oak Bay Prov. Park	19-64-500							●
St. John	Saint John	19-72-501		●	-	-	-	-	-
York	Forest City	19-59-505					●	-	-
	Fredericton3	19-68-509		●	●	●	●	●	-
	St. Croix	19-62-504					●	-	-
	McAdam	19-63-505						●	-
	Woukichegan Lake	19-62-505						●	-
	Beaverdam3	19-67-507						●	-

1 U.T.M. = Universal transverse Mercator System;
2 Life stages other than adults (i.e. larva, pupa, egg mass)
● = Gypsy moth found; - = gypsy moth not found;
3 Old egg mass(es) first found in the year following the first positive find indicated.

Table 8. Summary of the results of detection surveys for gypsy moth in Nova Scotia 1981 - 1987

County	Location	UTM Grid[1]	Gypsy moth life stages found[2]						
			1981	1982	1983	1984	1985	1986	1987
Yarmouth	Yarmouth	20-24-485	●	●	●	-	●	-	-
	Tusket	20-26-486			●	●	●	-	-
Digby	Grosses Coques	20-25-491		●	●	-	-	-	-
	Digby	20-28-494			●	-	-	-	-
	Smiths Cove	20-28-494		●	-	-	-	-	-
	Weymouth	20-26-492				●	●	●	●
	Weymouth Falls & Tusket Road	20-26-492				●	●	-	-
	Bear River	20-28-493					●	-	-
Annapolis	Clementsport	20-29-494		●	-	●	●	-	-
	Paradise	20-32-497		●	●	-	-	-	-
	Middleton	20-33-497				●	●	-	-
	CFS Cornwallis	20-29-494						●	-
	Annapolis Royal	20-30-495					●	●	●
	Kejimkujik Nat. Pk	20-31-492			●	-	-	-	-
Queens	Kejimkujik Nat. Pk	20-32-491						●	●
Kings	New Minas	20-38-499			●	●	●	●	●
	Port Williams	20-38-499					●	●	●
	CFB Greenwood	20-34-498						●	●
	Canning	20-38-500							●
	Kentville3	20-38-499						●	-
Halifax	Halifax	20-45-494			●	●	●	●	●
	Dartmouth	20-45-494				●	●	-	-
Shelburne	Shelburne	20-31-484			●	●	●	●	●
	CFB Shelburne	20-31-484						●	●
	Clyde River	20-30-483			●	-	-	-	-
Lunenburg	Bridgewater	20-37-491					●	●	●
Hants	Windsor	20-41-498					●	●	-

1 U.T.M. Grid = Universal Transverse Mercator System;
2 Life stages other than adults (i.e. larva, pupa, egg mass)
● = Gypsy moth found; - = gypsy moth not found;
3 Old egg mass(es) first found in the year following the first positive find indicated.

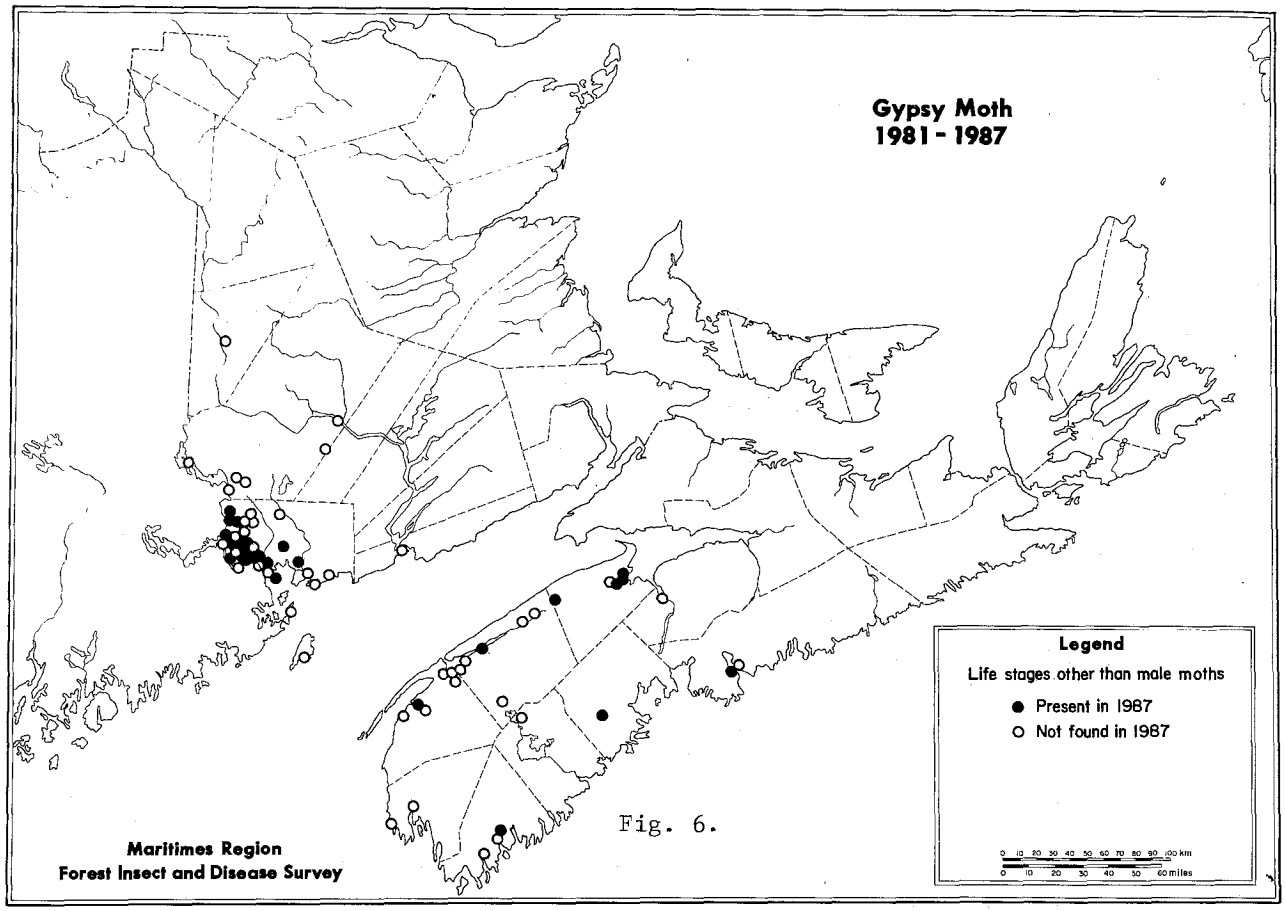


Fig. 6.

The results of gypsy moth surveys, other than adult trapping programs, conducted from 1981 to 1987 are summarized in Tables 7 and 8 and in Figure 6. In New Brunswick most of the gypsy moth locations are in forested areas, away from habitation and are concentrated in a small section of the Province adjacent to an area of the United States where the insect is known to be present. In Nova Scotia almost all of the infested spots are inhabited areas with considerable movement of people. This suggests that while in New Brunswick the presence of gypsy moth, in most places, may be the result of natural spread, in Nova Scotia the insect was likely imported by commercial traffic, visitors or residents travelling in gypsy moth infested areas.

Control operations against the gypsy moth in 1987 included:

Moores Mills, N.B. - A cooperative effort to eradicate or at least reduce the population at this isolated high intensity outbreak was complicated by the fact that at the time of its discovery pupation was already in progress and even some moth emergence had occurred. An area of 3.7 ha was root-raked and the brush piled; the area was ground sprayed with a water mixture of Permethrin (Ambush 500 EC®) at a rate of 35 g/ha; a trap-out pheromone program was conducted, involving over 350 non-saturating and 150 delta traps, was conducted; about 380 egg masses were removed during a concentrated survey; the brush piles were burned in the fall after the egg laying period had been completed.

Fredericton, N.B. - A trap-out program in a small area of the city was repeated for the second year. In 1987, a total of only 9 gypsy moth male adults were captured in the 572 traps returned of 580 traps placed and preliminary surveys failed to locate any fresh egg masses.

Shelburne, N.S. - About 500 male adults were captured in 388 traps (of 489 placed), during a trap-out program. The number of moths caught is about the same as captured in the town in 1986. At least 15 fresh egg masses were also found in Shelburne.

Other - More and more communities are becoming involved in public awareness programs emphasizing citizen participation in combatting this newly arrived pest.

OAK LEAFROLLER AND OAK LEAF SHREDDER

Oak Leafroller, Pseudexentera cressoniana (Clem.), and the Oak Leaf Shredder, Croesia semipurpurana (Kft.) have been defoliating oak since the early 1970s and have been the most serious pests of oak in the Maritimes. As a result of repeated defoliation, oak trees in many areas are suffering from various degrees of twig, branch, and crown dieback. Insect populations started declining in 1983, the decline continued in 1984 but the insects still caused various amounts of defoliation of oak in 1985 throughout the Region. In 1986 only spot infestations remained in New Brunswick and Prince Edward Island but widespread defoliation occurred in western Nova Scotia.

In 1987, the insects, predominantly the oak leafroller, were present again in western Nova Scotia. Defoliation of red oak occurred in many stands in Annapolis, Lunenburg, Queens and Shelburne counties (Fig. 7), ranged from negligible to severe and averaged 54% overall. The average defoliation of red oak on the permanent observation plots was 46% (range 30% to 65%) in Lunenburg and Queens counties in 1987, similar to the levels observed in 1986 (50%). The most severe defoliation was observed at McGill Lake, Annapolis County, Moosehorn Lake, Queens County and Upper Ohio, Shelburne County, where all foliage of all trees in the stands were damaged. In Kejimkujik National Park defoliation ranged from 25% to 87%.

Red oak stands in western Nova Scotia are in a generally deteriorating condition. A survey of tree condition in over 40 stands found that at least some crown dieback is present in all red oak stands in Queens, Annapolis and Lunenburg counties and that at least some stands are affected in the other counties in this part of the Province. More than 5% of the trees were found dead and more than 25% crown dieback was observed on more than half of the trees examined (54%).

These insects are causing serious damage in western Nova Scotia. They may also be creating an indirect problem because the widespread defoliation caused by them could conceivably delay the detection of early infestations of gypsy moth, a recently introduced insect into this part of the Province, of which oak is one of the most favored host species.

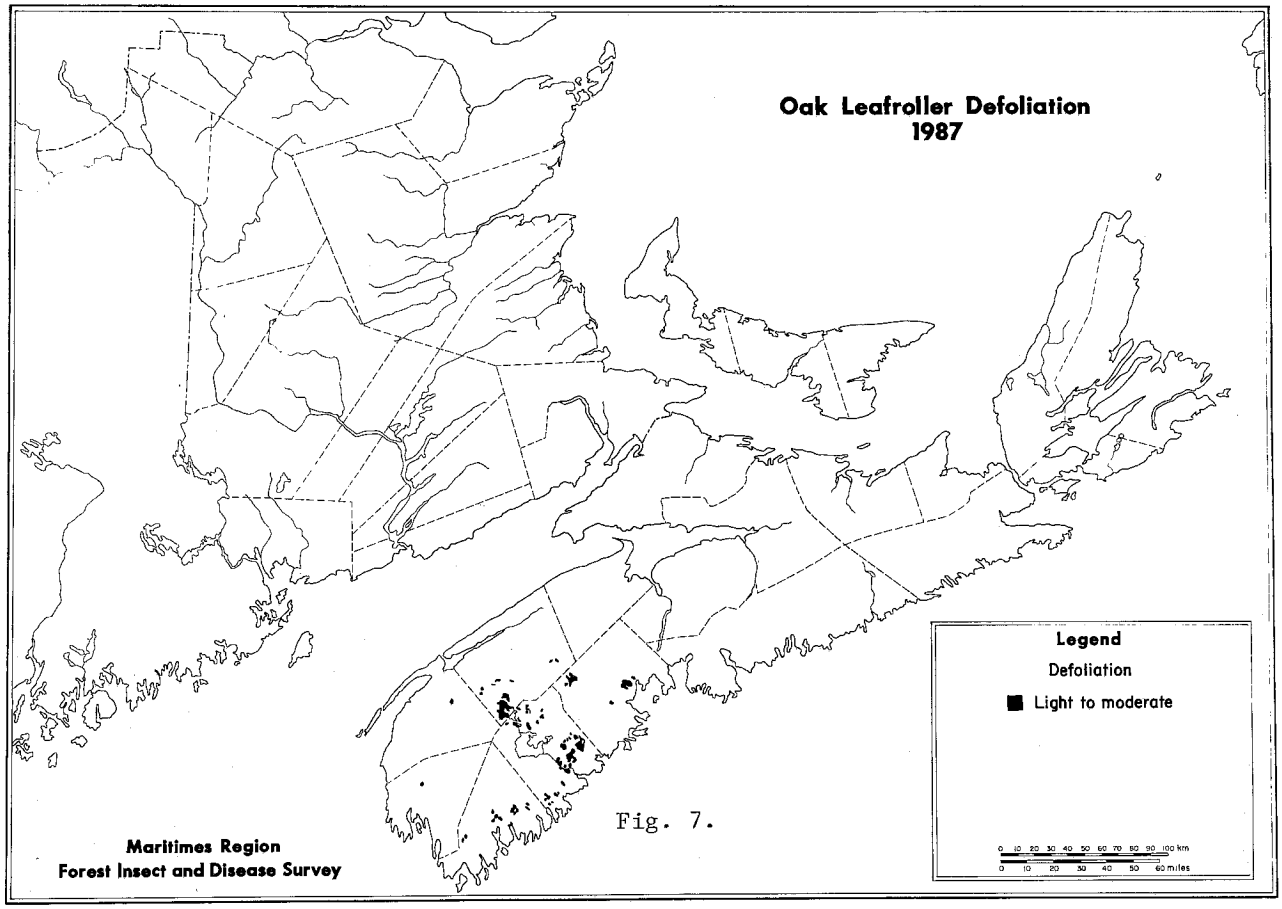


Fig. 7.

In New Brunswick, populations of the two insects were the lowest in many years in most areas, except at Cranberry Lake, Queens County, where 60% of red oak foliage was damaged in 90% of the trees in a 40 ha area, and at Upper Bear Island, York County, where light defoliation of red oak occurred. At Cranberry Lake the oak leaf shredder constituted 67% of the population mix.

Neither insect was reported from Prince Edward Island in 1987.

OTHER HARDWOOD DEFOLIATORS

Many insects of hardwoods are active in the forest each year. The majority are either of little consequence or of only local concern. These are listed in the chapter "Other insects and diseases" in this report. The few hardwood insects of major importance are discussed in separate chapters. Still others, of general distribution or for some other reason are usually discussed here in some detail to bring them to the attention of the reader.

In 1987, as in 1986, most hardwood defoliators were only of localized concern and were found at generally low populations, causing negligible defoliation. The statement made last year that these insects were noted more for their lack of damage than for having caused significant defoliation over large areas applies again in 1987. Consequently, no hardwood defoliators are included in this chapter this year.

CASEBEARERS, LEAFMINERS AND SKELETONIZERS

Some insects with specialized feeding habits, which do not consume leaves and needles in the manner typical of most defoliators are discussed in this chapter.

Casebearers spend their lives hidden in cigar-shaped cases, built of leaf or needle material, attached to the leaf surface. They reach out to feed only as far as the protection of the case allows. When the edible portion of the leaf is consumed the insect moves, house and all, to a new feeding location. Consequently, feeding by casebearers initially appears patchy but later in the season, if populations are high, the patches merge and the foliage becomes generally discolored.

Leafminers live hidden between the upper and lower protective layers of the leaf and feed on the green inner portion. In the process the leaf becomes discolored. The extent of discoloration depends on the amount of the green tissue consumed. Some species consume much of the leaf, others cut off water supply to portions of the leaf which then turn brown. Still others travel in a characteristic fashion within the leaf, in a pattern typical of the insect species.

Skeletonizers feed on the surface of leaves, usually on the underside, leaving the veins and the upper surface intact. Damaged tissue turns brown due to exposure to air and to lack of water reaching it and the leaves appear scorched. Heavily skeletonized leaves dry up and fall prematurely thus the feeding by these insects result in defoliation.

ON BIRCH

Birch Casebearer, Coleophora serratella (L.) is an introduced insect, first reported from Maine in 1927, now widely spread throughout the Maritimes. Its preferred host is white birch but other species of birch and alder are also affected. At low populations the insect causes leaf spotting and foliage discoloration and is merely an aesthetic inconvenience. However, when populations are high, the discoloration becomes serious and repeated attacks by the insect cause decline in vigor, loss of growth, and death of young trees.

In 1987, birch casebearer in New Brunswick was present throughout most of the central and eastern parts of the Province on white birch and to a lesser extent wire birch but caused only light foliage browning in those areas where discoloration was moderate in 1986 with the exception of Petit Paquetville, Gloucester County, where leaf browning was moderate on a few

white birch trees. Only trace or light foliage browning occurred in York, Sunbury, Queens and Charlotte counties in the south and in Madawaska and Restigouche counties in the north. Moderate and severe discoloration of alder occurred in the East Canaan, Magnetic Hill and Melrose areas of Westmorland County.

In Nova Scotia, moderate leaf browning of white birch, wire birch and alder occurred in northern Cumberland County while only trace or light discoloration was recorded elsewhere in the Province. The highest level of discoloration was observed at Amherst Head, Cumberland County, where 87% of white birch leaves were affected.

In Prince Edward Island, populations were high in Prince County, moderate in Queens County and low in Kings County. In Prince County 99% of white birch leaves were affected at St. Lawrence, 73% at North Enmore and 71% at Foxley River. In Queens County, 79% of the white birch leaves were affected at Rustico Island, 53% at Iona, 48% at Melville and 40% at Stanhope.

Birch Leafminer, Fenusa pusilla (Lep.) an introduced insect first observed in 1923 in Connecticut, has spread throughout Canada from Newfoundland to Alberta. The birch leafminer is a perennial pest in the Maritimes, it prefers wire birch but is also commonly found on white birch.

In 1987, birch leafminer populations were generally higher than observed in 1986 and, although leaf browning was no more than light in most areas, pockets of moderate and severe discoloration occurred in all three provinces. In New Brunswick, discoloration was severe on wire birch at DeWolfe, Charlotte County, moderate on wire birch at Basswood Ridge, Charlotte County, Berryton, Albert County and in a white birch stand near St. Quentin, Victoria County. In Nova Scotia, foliage browning was severe on wire birch at East Wentworth, Cumberland County and Glenholme, Colchester County and on white birch at Central Onslow, Colchester County, moderate on white birch at Sable River, Shelburne County. In Prince Edward Island, discoloration of wire birch was severe at Montague, Kings County and moderate in the Prince Edward Island National Park.

Birch Skeletonizer, Bucculatrix canadensisella Cham., outbreaks occur periodically in the Maritimes. The insect prefers white birch but other species of birch are also subject to attack. An outbreak, reported in 1977, covered extensive areas in Nova Scotia and eastern Prince Edward Island. Outbreaks occurred again in 1985 and resulted in moderate or severe foliage discoloration on Cape Breton Island, Nova Scotia, in parts of southeastern New Brunswick and in central Prince Edward Island. In 1986, the outbreak persisted on Cape Breton Island where the leaf browning was less severe but covered a larger area. Other outbreaks collapsed.

In 1987, the outbreak in Inverness and Victoria counties, on Cape Breton Island, Nova Scotia, has subsided significantly and only scattered patches of moderate foliage discoloration were observed. Small patches of white birch with discolored foliage were also present in Antigonish, Cumberland, Cape Breton, Kings and Pictou counties. Foliage discoloration affected an average of 58% of the leaves in the infestations areas The worst discoloration was recorded at Colwell Lake, Kings County where all white birch leaves were affected. Infestation levels were 95% at Upper North Sydney, Cape Breton County, 75% at the Chignecto Game Sanctuary, Cumberland

County and at Whycocomagh, Inverness County. The birch skeletonizer was not found in Prince Edward Island and in New Brunswick was observed only in the South Dungarvon River area, Northumberland County, where 9% of the leaves were affected.

ON LARCH

Larch Casebearer, Coleophora laricella (Hbn.), an introduced species, is considered by some to be second in importance only to the larch sawfly as a foliage feeder on larch. The insect is usually present, but widespread, persistent outbreaks have not occurred in recent years. Populations are regulated by natural control factors including the introduced parasites Chrysocharis laricinellae (Ratz.) and Agathis pumila (Ratz.), and by weather conditions. In the past, populations were high in 1943, 1952 and 1959. Widespread defoliation occurred over much of Nova Scotia in 1985 which was especially extensive and severe in the western half of the Province. In 1986, populations of the larch casebearer were much reduced and moderate and severe defoliation occurred only on individual or small groups of trees. In 1987, the larch casebearer was common in many areas of the Region but population levels remained generally low and little defoliation resulted. The highest infestation was recorded at St. Lawrence, Prince County, Prince Edward Island, where 54% of the shoots had 1 or 2 damaged needles on 90% of the trees in the area. The highest population in New Brunswick was 19% near Dufferin, Queens County, and 25% in Nova Scotia, at Glenholm, Colchester County.

ON POPLAR

Poplar Serpentine Leafminer, Phyllocnistis populiella Cham., an insect found throughout Canada, mostly on trembling aspen, has a habit of wandering inside the leaf, taking sharp turns and doubling back, hence its name. Affected leaves take on a silverish-grey hue and when populations are high the affected stand has a silvery appearance. The damage potential of this insect is uncertain but it has been reported in the literature that heavy, persistent attacks by this leafminer result in growth loss and can lead to tree mortality.

The insect, while present throughout the Maritimes, has not been a concern until 1976 when varying levels of foliage discoloration occurred in northeastern New Brunswick and in Albert and Queens counties in the southern part of the Province. By 1981 a major infestation existed throughout northern and central New Brunswick, causing trembling aspen over large areas to become silver-grey in appearance during the summer. The outbreak has persisted over much of the same area since, with expansion to the south in recent years.

In 1987, serpentine leafminer populations were high in New Brunswick, generally low in Nova Scotia and very low in Prince Edward Island. The results of assessments are summarized in Figure 8.

In New Brunswick, high populations caused a silverish-grey appearance of trembling aspen stands throughout much of the northern part of the Province. In the south, although stand discoloration is not as intense, the number of areas affected is increasing and the major infestation now includes the northern part of York County. On average 40% of the leaves on 92% of the trees were infested in the north while in the south 12% of the

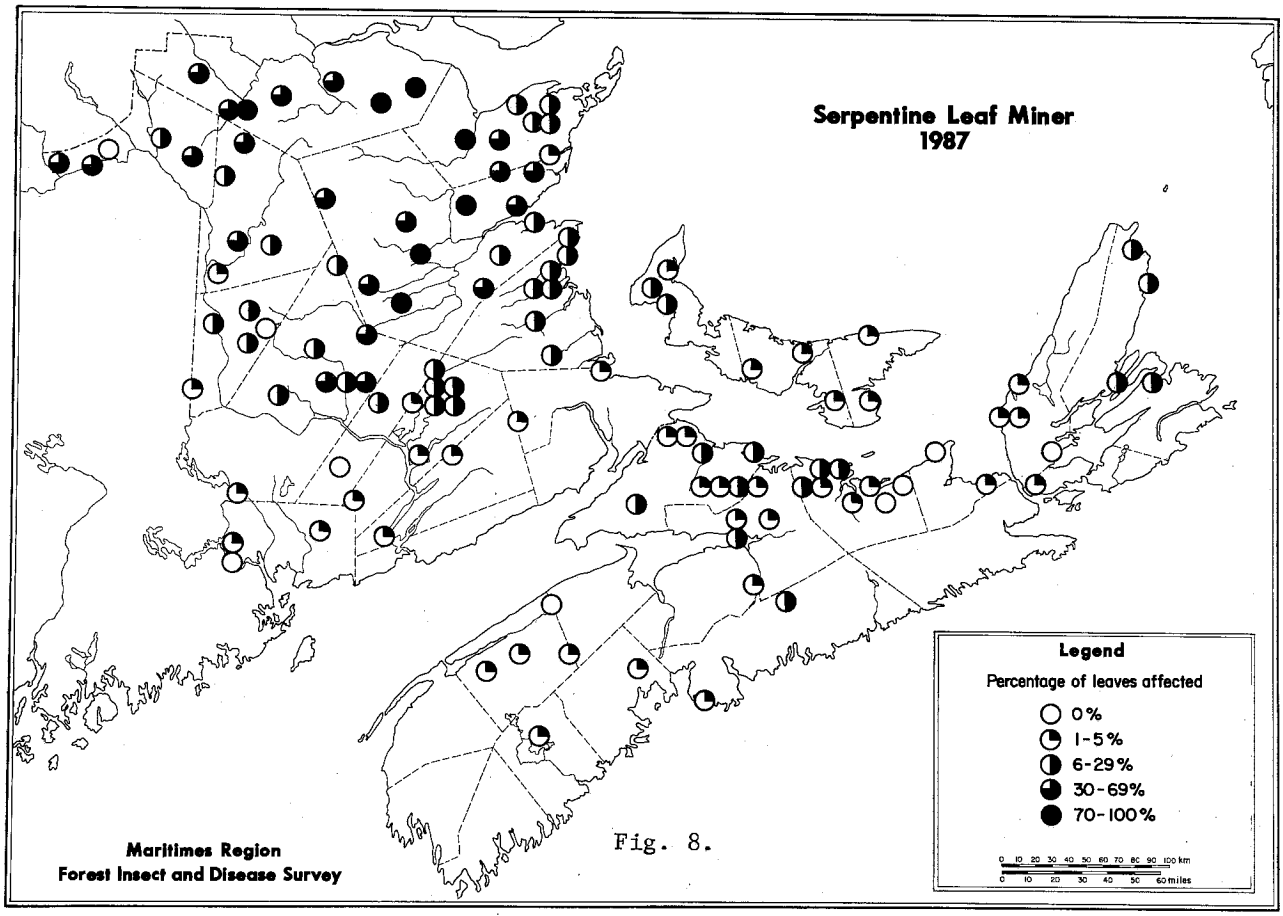


Fig. 8.

leaves were mined on 72% of the trees. Trees with all of their foliage affected were no longer restricted to northern New Brunswick.

In Nova Scotia, leaf damage was more common than in previous years but infestations were usually at the trace level with only a few areas of light foliage discoloration. An average of 7% of the leaves were affected in the areas examined in 1987. The highest level of leaf mining was 28% at Glenholme, Colchester County while 25% of the leaves were infested at Wallace, Cumberland County and at Belmont North, Cape Breton County.

In Prince Edward Island, the number of leaves mined was low, averaged only slightly more than 3% and did not exceed 7% in any area. The number of infested trees at specific locations varied and, while all trees were infested at Dalvay in the Prince Edward Island National Park, no more than one-fifth of the trees were affected in some other areas.

DUTCH ELM DISEASE

Dutch Elm Disease, caused by the fungus Ceratocystis ulmi (Buism.) C. Moreau, was a major concern in all three Maritime provinces in 1987 (Fig. 9).

In New Brunswick, the disease is present wherever elm trees are found. The resurgence of infection reported in 1984, continued, especially along river valleys. Numerous infected and dying trees, both residual old trees and young saplings, were observed throughout the Province in 1987. The disease was found in two new areas for the first time in 1987. One tree was infected at Richibucto, Kent County within the already established range of the disease and about 50 diseased trees were discovered at Murray Settlement, Northumberland County in a 5 ha area. This latter location represents a minor extension in distribution.

In Nova Scotia, the intensification of the disease, evidenced by great numbers of dead and dying elm trees, continued within outbreak areas where no sanitation is practiced. There were only minor extensions in the known range of the disease in 1987 with its discovery at Windermere, Kings County and at Melford, Inverness County.

In Prince Edward Island, a major change occurred in the status of Dutch elm disease in 1987. The disease was first discovered in 1979 in a small area of northcentral Prince County. The initial discovery was followed by an immediate and vigorous sanitation cut by the provincial government. No infected trees were found in 1980 and 1981, one infected tree was identified and removed in 1982, there were none found in 1983 and 1984, one tree was found in 1985 and two trees in 1986.

In 1987, infected trees were found at Northam (1 tree) and at Tyne Valley (1 tree) where the disease has occurred previously. In addition, infected trees were found for the first time in Alberton (1 tree), Victoria West (3 trees), Richmond (1 tree), St. Hubert (1 tree), Mount Pleasant (2 trees at the junction of Enmore Road, 1 tree on the airport detour) and at Mount Royal, where 10 dead and 25 infected trees were found. Although at present the incidence of infection is generally low, scrupulous surveillance, increased public awareness, removal of infected material and removal of beetle breeding material in communities where elm is of value as a shade tree is advised.

In Fredericton the progress of Dutch elm disease and the effects of the control program have been monitored since 1961 when the disease was first found in the City. The 31 trees killed by the disease in 1987 represented 1.0% of the current elm population within the Dutch Elm Disease Management Area. This loss is well in line with the reduction in the loss rate since 1980 when it peaked at 7.8%, followed by 5.3% in 1981, 3.0% in 1982, 2.4% in 1983, 1.1% in 1984, 1.2% in 1985 and 0.8% in 1986. Losses to date amount to 28.7% of the original urban elm stand.

No systematic survey was conducted by the Forest Insect and Disease Survey in 1987 for elm bark beetles, the carriers of Dutch elm disease, except in Fredericton, where populations of the native elm bark beetle, Hylurgopinus rufipes (Eichh.) remained low. One adult of the smaller European elm bark

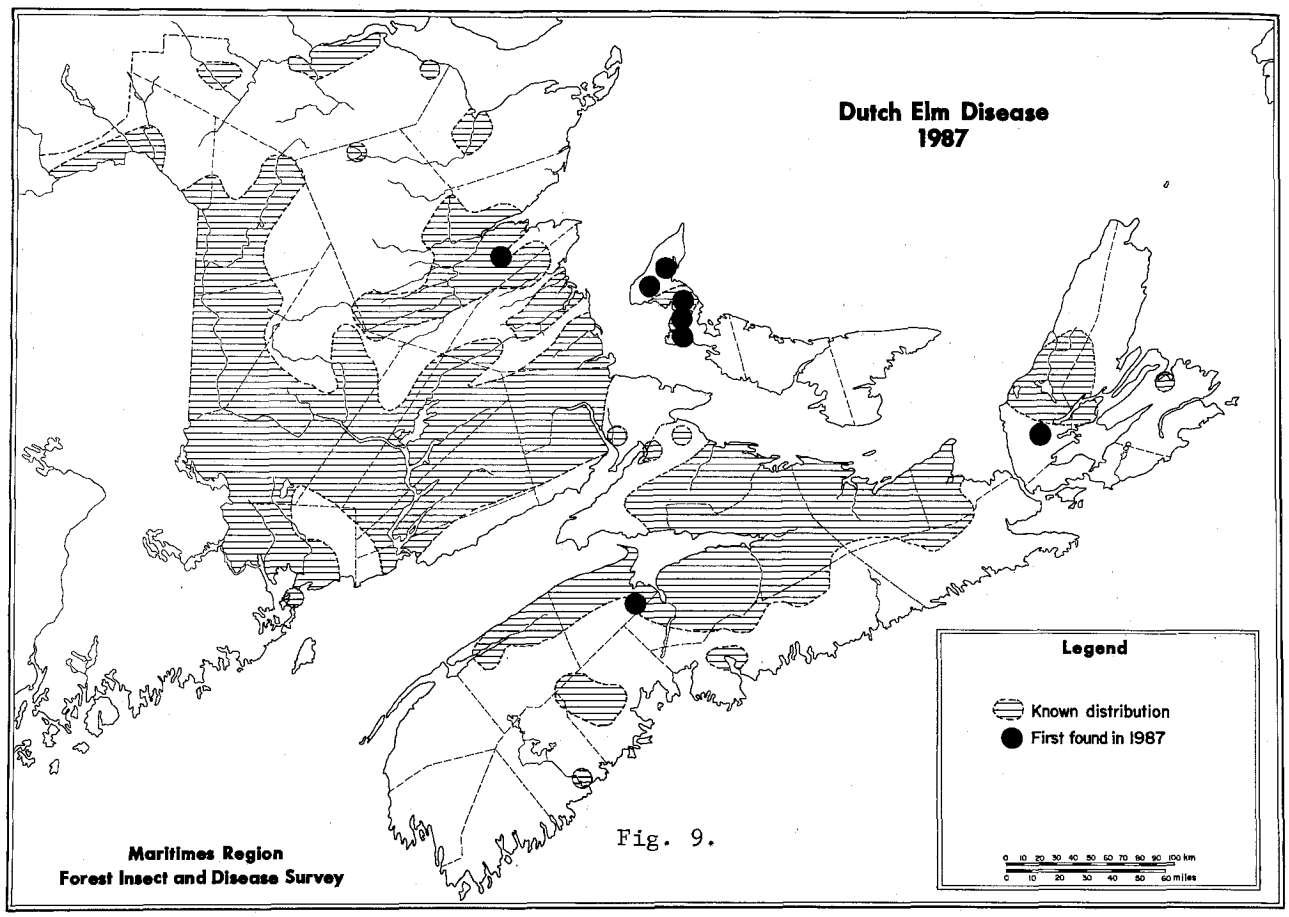


Fig. 9.

beetle, Scolytus multistriatus (Marsh.), was captured on a sticky monitoring trap. This insect, the more important vector in spreading Dutch elm disease in the United States and recently increasing in numbers in southern Ontario has not been a factor to date in Fredericton. Single adults were captured in pheromone traps in 1982 just south of the City and in 1983 at Tay Creek, some 30 km to the north and in 1986 in the City on a sticky band monitoring trap.

SEED ORCHARD PESTS

The establishment of seed orchards created a new category of high value areas in the Maritimes Region. Seed orchard and seed production are as important to nursery programs as seedling production in nurseries is to plantation programs. Consequently, anything that interferes with seed orchards also affects most other phases of forestry operations aimed at future wood production. Forest pests in seed orchards, both insects and diseases, have the potential to seriously affect seed production, either directly, by destroying seed or cones, or indirectly, by affecting the condition of trees, thus interfering with their ability to produce seed.

There has been a significant increase in the number of seed orchards in the Maritimes and the level of activity in these has also been increasing.

Tree improvement staff of all agencies are rapidly gaining experience in the detection of various problems affecting the trees. The number of samples received from seed orchards has grown proportionally, as has the level of cooperation among people sharing the same concern over the health of the trees in these orchards.

The following, which is not intended to be all inclusive, was prepared in cooperation with R.F. Smith, CFS-Maritimes, to give an overview of problems encountered in seed orchards in 1987.

Insects

The **spruce seed chalcid,** Megastigmus atedius atedius Wlk., was the major seed problem encountered and was present in high numbers in a white spruce breeding garden in New Brunswick.

Other seed/cone insects found, generally only few in number on a few scattered trees all in New Brunswick, included: the **spruce cone maggot,** Hylemya anthracina (Czerny), in seedling seed orchards of white spruce and black spruce and in a white spruce breeding garden; **fir coneworm,** Dioryctria abietivorella (Grt.), in a jack pine seedling seed orchard; another **coneworm,** Dioryctria sp. in two black spruce seedling seed orchards.

Insects, affecting trees but not directly the cones or seeds, were few and caused only minor damage included: **yellowheaded spruce sawfly,** Pikonema alaskensis (Roh.), a species of **loopers,** Caripeta sp., and a **weevil** species, Hylobius sp. **Cutworms,** Polia sp., were found in several clonal orchards with grass cover. Although the larvae were found on the tree, no damage was done to the grafts.

Aphids and Mites

Aphids and mites caused major problems in seed orchards and breeding gardens in all three Maritime provinces. Populations were very high in many areas, probably aided by the hot, dry summer, and persisted at some locations despite control programs.

Spider mites, Tetranychidae, were found at varying population levels in virtually all the tamarack seed orchards and breeding gardens in the Region. A species of Oligonychus was widespread, often in considerable numbers but generally caused only minimal damage, except in a jack pine seedling seed orchard in New Brunswick where needle discoloration was moderate to severe.

Among **aphids,** Cinara sp. were often present in conjunction with spider mites. Damage attributable to each could not always be separated but control for aphids was generally more effective than for mites. Cinara sp. were found on tamarack in New Brunswick and Prince Edward Island, on white spruce in New Brunswick and Nova Scotia and on red spruce in Nova Scotia. **Eastern spruce gall adelgid,** Adelges abietis (L.), caused moderate damage in a white spruce seedling seed orchard in New Brunswick and affected white spruce and red spruce trees in Nova Scotia. **Ragged spruce gall adelgid,** Pineus similis (Gill.), was present but caused little apparent damage on white spruce in New Brunswick and red spruce in Nova Scotia. **Pine leaf adelgid,** Pineus pinifoliae (Fitch), was an isolated find on white spruce in New Brunswick.

Diseases

Scleroderris canker, Gremmeniella abietina (Lagerb.) Morelet, caused severe infection in a jack pine seedling orchard in New Brunswick. All branches from the lower two or three whorls were pruned off and burned in an effort to control the disease.

Armillaria root rot, Armillaria mellea (Vahl ex Fr.) Kummer, is present in a number of seedling orchards in both New Brunswick and Nova Scotia and has caused some tree mortality. Monitoring plots established in several orchards will provide information on the significance of this disease.

Globose gall rust, Endocronartium harknessii (J.P. Moore) Y. Hiratsuka, was found in several jack pine seedling orchards and one clonal orchard in New Brunswick. Control operations have been initiated.

Sirococcus shoot blight, Sirococcus conigenus (DC) P. Cannon & Minter, was found on cone scales originating from a white spruce seed orchard in Nova Scotia.

Needle rusts on the various hosts were of no consequence in 1987 as infection levels have been greatly reduced from those of the past few years. Chrysomyxa sp. were present on white spruce and red spruce in Nova Scotia, Melampsora sp. on tamarack in Prince Edward Island, all at the trace level.

Abiotic causes

The **dry summer** in 1987 caused problems mostly in Nova Scotia where the drought was most severe. High tree mortality occurred in a newly established red spruce orchard without an available irrigation system.

Fertilizer burn in black spruce, red spruce and white spruce orchards in Nova Scotia may have also been an indirect effect of the lack of precipitation. It is thought that, although correct procedures were followed in applying various fertilizers, irrigation may not have been adequate to move these away from the roots and the high concentration of chemicals damaged the seedlings.

NURSERY AND GREENHOUSE PESTS

Successful seedling production is essential to avoid or at least to minimize the shortfalls in wood production predicted to occur in the future. Seedling production is as important to plantation programs as seed production is to nurseries. Pests affecting nursery production increase the cost of meeting the objectives of forestry.

Of the conditions encountered in 1987 in nurseries and greenhouses, some are mentioned here because of their importance, while others demonstrate that no facet of forestry is without problems. Although the insects and diseases mentioned may appear insignificant, they did occur in spite of

constant vigilence and continuing control measures. Good nursery practices have limited their damaging potential. Abiotic problems were widespread and severe in 1987. Considerable seedling losses occurred and many "surviving" trees were injured to some extent.

The following, which is not intended to be all inclusive, was prepared in cooperation with R.D. Hallett and T.W. Burns, CFS-Maritimes, to give an overview of problems encountered in nurseries and greenhouses in 1987.

Diseases

Sirococcus shoot blight, Sirococcus conigenus (DC.) P. Cannon & Minter affected less than 1% of a black spruce container crop in a Nova Scotia nursery and a small amount was present in one million 2-year old red pine seedlings in a New Brunswick nursery. The **gray mold** (Botrytis sp.) occurred on seedlings injured or killed by abiotic stock quality problems. A trace of gray mold was present in 2 million black spruce container seedlings with previous frost and overwintering injury and on very succulent 12-week old white spruce seedlings in a New Brunswick forest nursery.

Insects

A **root aphid, s**uspected to be Prociphilus americanus (Walker) was found on 10% of a 2-0 white spruce crop in a holding area, on a few balsam fir and on potted ornamental spruces at three separate nurseries in Nova Scotia. A **pill beetle,** Cytilus alternatus (Say), which feeds on seedling roots, was found in enormous numbers in a holding area at a New Brunswick nursery. **Spruce bud scale,** Physokermes piceae (Schr.) was present on a few white spruce grafting stock at a New Brunswick nursery. **Spider mites,** probably spruce spider mite, Oligonychus ununguis (Jac.), and associated abiotic conditions were responsible for damage ranging from moderate and severe to only trace on individual large potted white spruce in a New Brunswick nursery. Mite populations have persisted for several years on the dense lower branches.

Abiotic factors

Abiotic factors killed millions of seedlings in 1987 and were responsible for far greater losses than insects and diseases combined. Abiotic factors damaging seedlings included: **poor root development, watering problems, overwintering injury, frost damage, fertilizer burn, handling problems** and various combinations of these. The impact of non-lethal abiotic injury on subsequent plantation establishment success should not be minimized or overlooked. For example, large losses occurred when apparently healthy seedlings with poor roots failed to establish under adverse conditions, such as drought. These problems are being addressed by a multi-agency stock quality laboratory designed to detect those subtle injuries which can severely impair plantation performance before the stock is outplanted.

CHRISTMAS TREE PESTS

Among the many pests of balsam fir Christmas trees, the spruce budworm is by far the most significant in most areas of the Maritimes. Some of the others, usually of only localized importance, are mentioned elsewhere in this report. The balsam gall midge and the balsam twig aphid are discussed here because of their widespread occurrence and their effect on the quality and, consequently, on the value of Christmas trees. They are discussed not strictly from the point of Christmas tree production but, because their presence in natural stands has a spill-over effect, the statements are relevant.

The following, which is not intended to be all inclusive, was prepared in cooperation with G. Estabrooks and D. Marks, CFS-Maritimes, to give an overview of problems encountered in Christmas tree production areas in 1987.

According to the Christmas tree specialists at CFS-Maritimes, 1987 was an unusually good year for balsam fir Christmas trees. There were problems of course but some of these were the result of standard management practices (fertilizer, herbicide, etc. applications) carried to excess and 'gone wrong'.

Drought conditions in August caused some stress resulting in more than the normal amount of yellowing of needles, usually of the oldest age class on the trees. Stress symptoms also appeared on current 'internodals' (one year old terminals) of some trees. These stress symptoms, which become apparent late in the summer, are usually of consequence at the time of harvest only if needle mortality and subsequent needle drop result in thin foliage. Little of this appears to have resulted from the drought stress in 1987.

Balsam Gall Midge, Paradiplosis tumifex Gagne, populations were again low throughout the Region in 1987 except for a few isolated locations. In New Brunswick, populations were low and infestations averaged only 2% of the current needles infested affecting an average of 22% of the trees at the 36 locations assessed. The highest infestation was recorded at Mount Carleton, Northumberland County, where 25% of the needles were affected. Two Christmas tree areas, one a plantation, the other a natural managed stand had high infestations in the Fredericton, York County area. The level of infestation by the balsam gall midge was determined at 992 locations during the spruce budworm L_2 sampling conducted by the New Brunswick Department of Natural Resources and Energy. Of these, 836 were negative (90%); at 96 locations 1-10% of the needles were affected (9.7%); at 3 locations the infestation was in the 11-20% range (0.3%). No infestation in the above 20% category was recorded. Although the above represents samples from larger trees, used to determine spruce budworm populations, the figures are comparable to our results obtained from Christmas tree plantations and are a good indication of the distribution of balsam gall midge populations in the Province in 1987. In Nova Scotia, the highest level of infestation, at 60% of the needles affected, occurred at Framboise, Richmond County. It was also on Cape Breton Island where the highest infestation was reported in 1986. Populations were low elsewhere in the Province and averaged 2% of the current needles infested, the same

level recorded for New Brunswick. In Prince Edward Island, balsam gall midge affected needles were found only at 3 widely scattered locations and the infested needles averaged only 1% in these areas.

Balsam Twig Aphid, Mindarus abietinus Koch, was common throughout the Region but, with a few exceptions little shoot damaged occurred in 1987. In New Brunswick, an average of 6% of the current shoots on about one-third of balsam fir trees were affected at the 63 locations assessed during our surveys. Infestations were moderate on Christmas tree plantations at Grand Falls, Victoria County and at Millerton, Northumberland County, on roadside trees along Highway 114 in Fundy National Park, Albert County and in an area at Semiwagon Ridge, Northumberland County. Balsam twig aphid was recorded as "present" at 156 (16%) of the 992 locations assessed by the New Brunswick Department of Natural Resources and Energy during the spruce budworm L_2 surveys. In Nova Scotia, balsam twig aphid was common but the average number of shoots affected was only 8% in 1987. High infestations were observed at Big Hill, Victoria County (71%), East Earltown, Colchester County (53%) and at Wildcat Brook road, Victoria County (47%). In Prince Edward Island, 7% of current balsam fir shoots of about half of the trees were affected at St. Lawrence, Prince County.

Yellow Witches' Broom of Balsam Fir, Melampsorella caryophyllacearum Schroet., a rust fungus which needs chickweed as an alternate host to complete its life cycle, is often found in the natural forest but it has not been a serious problem in Christmas tree plantations in the Maritimes until recently. Serious damage occurred in the mid-1980s in a few plantations, especially in areas where chickweed ground cover was heavy, and affected the quality of Christmas trees. The number of new infections appeared to have been reduced in 1986 and 1987.

SPECIAL SURVEYS

SPECIAL SURVEYS

Several forest pest surveys are carried out annually that are not necessarily related to forest pests of major importance. Considering the implications this information may have in forest management, summaries and results of these special surveys have been included in our annual report.

ACID RAIN NATIONAL EARLY WARNING SYSTEM

Acid rain has been a global concern for the past few years and the effects of impurities in the air, on lakes, buildings, and the forest are becoming more apparent in many parts of the world.

Acid rain means more than just rain with lower than normal pH falling from clouds that come from elsewhere. It includes any form of acid, both wet and dry, precipitation, and air pollutants of different kinds from both near and far. These, alone or in combination, directly or indirectly affect the health of Canada's forests, by interfering with their normal development, the production of wood, or with their role in providing a healthy environment.

Concern over the future of the Canadian forests has intensified as a result of the alarming tree mortality observed in other parts of the world. The Acid Rain National Early Warning System (ARNEWS) came into being in the early part of 1984, when the Canadian Forestry Service established a national program to detect, clearly and accurately, early signs of acid rain damage to Canada's forests before damage becomes obvious.

The objectives of the program are:

1. To detect the possible damage to forest trees and soils caused by acid rain or to identify the damage sustained by Canadian forests (trees and soils) which are not attributable to natural causes or management practices;

2. Long-term monitoring of vegetation and soils to detect future changes attributable to acid deposition and other air pollutants in representative forest ecosystems.

   The Forest Insect and Disease Survey was charged with the responsibility for (1) plot establishment, (2) above-ground parameter monitoring and sampling, (3) providing assistance in obtaining foliage and soil samples for chemical analysis.

   Permanent plots are to be maintained in all Regions of Canada to monitor:

   a. the condition and changes in the condition of the forest stand,
   b. the presence and fluctuation of biotic and abiotic factors that effect the condition of the forest (insects, diseases, stand changes, temperature, etc.),

c. the changes and symptoms that indicate factors not attributable to the above that could conceivably be early signs of acid rain damage, and
d. the effect of acid rain on the condition of the various economically important tree species.

The rationale behind the above is that without close monitoring of all of the factors mentioned, the expected, initially subtle, effects of acid rain cannot be isolated and identified.

In the Maritimes Region, 15 permanent ARNEWS plots, representing the important forest species and geographical areas were established in 1984. Two additional plots have been established in northwestern New Brunswick in 1985 at the request of and in cooperation with Fraser Inc. These will be monitored jointly with the Company in future years.

In 1987, all plots were visited monthly from June to September to determine forest insect and disease conditions, detect 'acid rain' symptoms (if any) observe seed crop and premature fall discoloration, to collect ground vegetation samples, and to sample lichens and mosses found on trees. In August, detailed assessments of all plots were carried out following the procedures developed by the Maritimes FIDS unit for the national system.

Foliage and soil samples are now available for analysis from all 17 ARNEWS plots in the Maritimes. Information from increment cores collected in 1984 has been computerized in cooperation with the Petawawa National Forestry Institute.

Tree mortality on all ARNEWS plots increased to 12.1% in 1987, compared to 10.2% in 1986, 9.3% in 1985 and 8.3% in 1984.

In addition to the work on permanent plots, the results of observations for signs of possible acid rain damage were recorded for most of the 420 locations where detailed pest condition assessments were made. Special attention was directed to the number of years of needle retention on coniferous species. A summary of some of these observations is presented in Table 9. It is apparent that the percent of needles retained decreases with age of foliage and the rate of the decrease varied among tree species and between provinces. It is important to realize that the figures represent provincial averages and, more important, that at least some of the loss is definitely attributable to feeding by defoliating insects. Similar information was collected in 1985 and in 1986 in our effort to build a data base which will allow analysis of possible changes.

Forest Insect and Disease Survey personnel are always on the lookout for unusual or unexplained forest conditions, some of which are conceivably suspect for acid rain damage.

In 1985, in the southern part of New Brunswick red spruce was found in a deteriorating condition at many locations on Deer Island, Charlotte County. Although trees in many of these areas have been defoliated by the spruce budworm in the past this does not adequately explain the condition observed. In 1986, permanent observation plots, each consisting of 50 trees, were established in Charlotte and Sunbury counties in New Brunswick

Table 9. Retention of needles produced in different years by various coniferous trees in the Maritimes Region - 1987

Species	Province	No. of observations	Needles retained of the needles produced in the year indicated							
			1987	1986	1985	1984	1983	1982	1981	1980
Balsam fir	New Brunswick	113	95	80	70	59	39	29	21	13
	Nova Scotia	103	99	96	87	80	71	60	37	29
	Prince Edward Is.	6	100	93	82	80	72	63	32	12
White spruce	New Brunswick	33	98	89	83	72	56	40	23	13
	Nova Scotia	64	97	95	86	81	66	49	30	15
	Prince Edward Is.	14	87	75	76	66	61	41	25	14
Black spruce	New Brunswick	32	99	96	88	77	61	44	34	25
	Nova Scotia	20	100	97	93	83	74	52	30	14
	Prince Edward Is.	1	100	100	100	90	80	70	60	0
Red spruce	New Brunswick	43	97	93	86	77	57	44	32	17
	Nova Scotia	57	99	98	93	84	72	61	44	26
	Prince Edward Is.	3	97	93	90	73	63	30	17	17
Spruce	New Brunswick	1	100	100	90	90	80	60	70	60
Spruces (combined)	New Brunswick	109	98	93	86	76	58	43	30	19
	Nova Scotia	141	98	96	90	82	74	54	36	19
	Prince Edward Is.	18	89	79	80	68	62	41	26	14
Red pine	New Brunswick	1	100	100	100	100	100	50	0	0
	Nova Scotia	7	100	100	84	51	0	0	0	0
	Prince Edward Is.	1	100	100	60	40	40	0	0	0
White pine	New Brunswick	3	95	87	72	27	30	20	0	0
	Nova Scotia	21	98	85	57	5	0	0	0	0
Jack pine	New Brunswick	7	100	93	73	17	0	0	0	0
	Nova Scotia	5	100	96	70	24	0	0	0	0
	Prince Edward Is.	1	100	100	100	0	0	0	0	0
Pines (combined)	New Brunswick	11	99	92	75	27	17	10	0	0
	Nova Scotia	33	99	90	65	18	0	0	0	0
	Prince Edward Is.	2	100	100	80	20	20	0	0	0
Hemlock	New Brunswick	1	100	80	80	70	60	4	0	0
	Nova Scotia	7	100	95	84	70	59	37	4	0.3
Cedar	New Brunswick	2	100	95	90	80	45	35	30	25

and in Hants, Cumberland and Halifax counties in Nova Scotia to follow changes in condition of trees. The plot in Halifax County was cut in the summer of 1987. The summary of the tree conditions in 1986 and 1987 at the remaining 4 plots is presented in Table 10. The trees were generally in better condition in 1987 than the previous year on all four plots. Observations will continue to establish possible trends in condition changes.

The deterioration of white birch along the Bay of Fundy was first noticed in 1978. The condition has been under surveillance and has been reported annually in detail since 1979. In 1986, research was initiated to determine if "acid rain" is a causal factor in the annually occurring foliage browning and early leaf fall in this area. In 1987, some leaf browning occurred again but it was at such low intensity that it could not be detected during aerial surveys.

Chlorotic foliage has been observed since 1985 on white spruce trees near Loch Katrine, Antigonish County, Nova Scotia in an uneven aged stand of about 20 ha. The current foliage is green but all older needles on affected trees exhibit various levels of yellowish discoloration. Not all trees in the stand are affected but trees from all age classes show similar symptoms. Yellowing is more prominent on the upper surface of needles than on the underside. Needle retention of older foliage is less than normally found on unaffected trees. Some of the trees have thin crowns. The cause of this condition is unknown but no insects or diseases appear to be involved. Foliage, increment and soil samples collected in the fall are awaiting analysis.

Table 10. Condition of red spruce at four permanent plots in the Maritimes in 1986 and 1987

Tree Condition Class	Percent of trees in various tree condition classes							
	New Brunswick				Nova Scotia			
	Charlotte Co.		Sunbury Co.[a]		Hants Co.		Cumberland Co.	
	86	87	86	87	86	87	86	87
1 Healthy, no defoliation	4	90	0	0	14	40	0	0
2 Healthy, only current defoliation	38	10	0	56	0	0	0	0
3 More than current but less than 25% total defoliation	50	0	64	30	46	68	12	16
4 Total defoliation 26-50% no bare top	6	0	28	10	36	2	74	82
5 Total defoliation 26-50% with bare top	2	0	8	0	4	0	14	2
11 More than 90% total defoliation with bare top	0	0	0	2	0	0	0	0

[a] one tree was blown down on the plot in Sunbury County, consequently the figures given total only 98% for this plot.

CYCLICAL REVIEWS FOR SPECIFIC PESTS

Many pests, although omnipresent in the forest, are not reported annually because (1) there is little fluctuation in their distribution or in the damage they cause, (2) they normally cause so little damage that regular surveys cannot be justified, or (3) they are present in such small numbers that they are easily overlooked during routine assessment surveys. However, these organisms are a part of the pest component in the forest and, although separately each may cause little damage, their combined effects can weaken trees, reduce growth, or expose them to other problems. Forestry practices are changing and some organisms, until now obscure and unimportant in their natural habitat, are also changing in importance and the damage caused by them is becoming significant.

Several of these 'other' insects and diseases are reviewed in most years, often in connection with surveys involving a specific host species. The number depends on other activities, which determine the time available, and the time required for specific surveys. The results provide an assessment of the current status of the organism and a benchmark to which past and future assessments are compared.

Since 1982 when we first started reporting the results of cyclical reviews, the status of the following forest pests was examined: larch shoot moth and spruce gall midge in 1982; balsam shootboring sawfly, eastern dwarf mistletoe, northern pitch twig moth and larch needle casts in 1983, the latter in response to concerns over the discovery of a newly introduced species to Canada; bronze birch borer and birch ambrosia beetle, in connection with the deterioration of white birch along the Bay of Fundy in 1984.

In 1986 or in 1987 other priorities did not allow for special assessment of this type but we plan to continue with cyclical reviews in the future, especially when supporting evidence is required to explain certain forest conditions.

PINEWOOD NEMATODE

The Pinewood Nematode, Bursaphelenchus xylophilus (Steiner and Buhrer) Nickle has gained worldwide attention in recent years, mostly because of its implications to international trade of forestry products. (Reported as B. lignicolus in our 1985 report).

Nematodes are a class of "elongated, cylindrical worms, parasitic in animals or plants or free-living in soil or water" (Webster's Seventh New Collegiate Dictionary, 1970). The pinewood nematode was first identified in North America in the late 1970's and was believed to have been imported from Japan where it has been reported to have killed trees for at least 30 years. The pinewood nematode has been reported to be widely distributed in the United States and in 1982, was reported in southern Manitoba. In 1985 the nematode was found in Ontario.

The pinewood nematode is a plant-parasitic species which kills trees by rapidly multiplying in the water conducting elements after having been introduced into the trees by some wood-boring insect, such as sawyer beetles or bark beetles. The exact vector is not known but cerambycids are suspected. The affected tree, with its water supply cut off, wilts and dies within a short time. The fact that many species of nematodes may be present in trees, most not pathogenic, and that the identification of these microscopic organisms is extremely difficult has resulted in considerable confusion as to the cause of tree mortality in some areas and as to the actual distribution of the pinewood nematode itself.

In the Maritimes, the pinewood nematode (referred to earlier as the Japanese wood nematode) has been a special concern of the Forest Insect and Disease Survey since 1980. Through general observations, forest condition assessment surveys, plantation surveys, pest extension activities, provincial cooperative surveys and special surveys, staff have been on the lookout for symptomatic suspect trees. In the five years from 1980 to 1984, 15 such trees were located. These included red pine, Scots pine, white spruce and balsam fir. Nematodes were extracted from some of these and submitted for expert identification. Reports received indicated that none of the samples submitted were of the pinewood nematode. In 1984 suspect nematodes were extracted from two samples (one a balsam fir, one a white spruce). One sample contained two species of nematodes, a bacterial feeder and a mycophagous species (fungus eater). The nematode from the other samples was identified as 'definitely not pinewood nematode'. Also in 1984, a number of bark beetles from stressed balsam fir were tested as possible vectors for the pinewood nematode - with negative results.

In the fall of 1985 and the summers of 1986 and 1987 a special survey was conducted in the Maritimes as part of a national effort to establish the presence and distribution of the pinewood nematode in Canada. Recently dead, old dead, and a few living trees were sampled and from a number of locations. Insects, considered possible vectors for the nematode, were also analysed. In total, samples were obtained from 207 locations, 131 in New Brunswick, 55 in Nova Scotia and 21 in Prince Edward Island. The distribution of sampling areas and results are shown in Figure 10, the various hosts sampled in Table 11.

Although the objective was to obtain a good species mix in sampling, balsam fir received special attention, especially in the early part of the survey, because of the similarity in symptom expression between Stillwell's Syndrome and the supposedly sudden wilting of conifers when killed by the pinewood nematode. No pinewood nematode has been identified from any of the balsam fir trees that succumbed to Stillwell's Syndrome.

Pinewood nematode, the so-called '"r" form of B. xylophilus, has been identified at five of the 207 locations (2.4%), from 7 of the 397 trees (1.8%) sampled, all in New Brunswick and all from dead pine trees as follows:

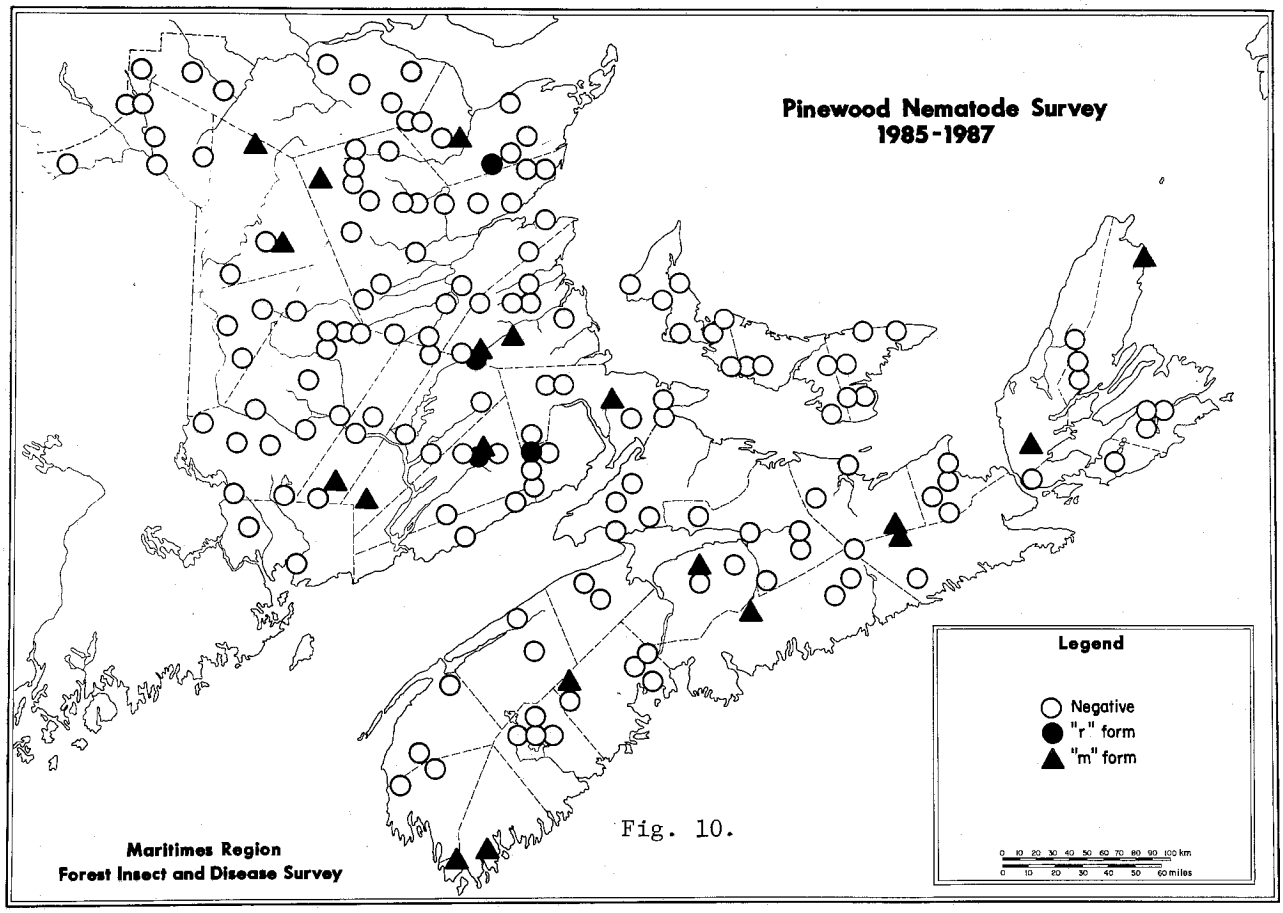


Fig. 10.

1. Nevers Brook, Kent County, N.B. (UTM: 20-30-513). Isolated from one recently dead jack pine tree from a group of trees that died in a root rot infection pocket. The number of pinewood nematodes was given as "10000+ specimens". This tree, cut and sampled in 1986 was re-sampled in 1987 when 17 specimens of pinewood nematode were found.

2. Nevers Brook, Kent County, N.B. (UTM: 20-30-513). The location is less than 1 km from the other area. Isolated from one of two old-dead and from one of five recently dead jack pine trees from a small group of porcupine killed trees. There were 17 specimens of pinewood nematode isolated from the old-dead tree and a "large population" from the recently dead tree.

3. Jeanne Mance, Gloucester County, N.B. (UTM: 20-31-524). Pinewood nematode isolated from two recently dead jack pine trees. The cause of death was not determined but there were only 20 and 6 specimens isolated from the two trees, respectively.

4. Mount Hebron, Kings County, N.B. (UTM: 20-30-507). Isolated from one windthrown jack pine tree in a 13-year old plantation. The number of pinewood nematodes was given as "100+ specimens".

5. Pleasant Mountain, Albert County, N.B. (UTM: 20-33-507). Pinewood nematode was isolated from one of two recently dead eastern white pine trees sampled. The number of specimens was given as "100+".

Another Bursaphelenchus, the so-called "m" form, which is an affiliate of uncertain connection and is considered non-pathogenic, has been identified at 19 locations, 10 in New Brunswick and 9 in Nova Scotia. Two trees were infested at two locations, in the other areas only individual trees were positive for the "m" form. Of the 21 infested trees 14 were balsam fir and one each of black spruce, red spruce, Scots pine, eastern white pine and jack pine. All but one of the trees from which the "m" form was extracted were recently dead, the exception was an old-dead eastern white pine tree from Nova Scotia. The highest number of "m" form nematode extracted from infested trees was 18 with an average of 8.3 per tree.

There is no evidence to justify the pinewood nematode in the Maritimes as an organism of biological importance (i.e. a tree killer) but the consequences of its presence may be economically significant, if it affects our ability to export some forest products, such as wood chips, because of plant quarantine related regulations in other countries.

Table 11. Summary of pinewood nematode surveys in the Maritimes Region in 1985-1987

Sampling variables	Maritimes Region	New Brunswick	Nova Scotia	Prince Edward Island
No. of locations sampled	207	131	55	21
Tree species		Number of samples		
Balsam fir	166	96	58	12
Jack pine	47	47	-	-
Red pine	13	6	6	1
Scots pine	18	12	5	1
White pine (eastern)	41	18	19	4
Black spruce	49	17	29	3
Red spruce	16	8	8	-
Sitka spruce	1	-	-	1
White spruce	45	13	6	26
Larch	1	-	-	1
Total number of trees sampled	397	217	131	49
Insects sampled				
Sawyer beetle (Monochamus sp)	26	25	1	-
Seedling debarking weevil (Hylobius sp.)	23	7	16	-
Total number of insects sampled	49	32	17	-
Total number of samples (trees and insects)	446	249	148	49

(Field work, laboratory extraction and preliminary screening was done by the Forest Insect and Disease Survey, identifications by Mrs. Joan Scott, Plant Health Laboratory, A.D.R.I., Nepean, Ont. and by Dr. Roger Anderson, Biosystematics Research Centre, Ottawa, who also confirmed all identifications. Their cooperation was instrumental in completing this project and is much appreciated).

FOREST PEST ASSESSMENT IN PLANTATIONS

The increasing importance of planted trees in forest management resulted in the initiation of an annual plantation-assessment program in 1982. The lessons learned from agriculture and from experience with large-scale forest plantings suggest that tracts of even-aged, single species forests will bring with them special pest problems. Previously insignificant pests may take on new importance and many of the well-known pests may change their habits in the new environment. Among these are the spruce bud moth, Sirococcus shoot blight, Armillaria root rot, needle rust on jack pine, and seedling debarking weevil, which are described in some detail in other chapters of this report. As our knowledge of pest outbreaks in plantations accumulates, our methods of establishing and tending them must incorporate ways to offset the effects of such pests, if we wish to avoid or minimize losses.

Our plantation surveys attempt to determine the status of all significant insects and diseases. The plan was to assess at least one host species each year in selected plantations throughout the Maritimes to obtain a general picture of pest problems. This was to indicate the need for detailed surveys of plantations in specific areas in cooperation with clients. Although plantation selection is random, new plantations were initially avoided to eliminate problems associated with site selection and establishment techniques.

Other work priorities resulted in the cancellation of specific regional surveys since 1984 although numerous observations were made in plantations. The results of these have been reported as appropriate.

The realization of the importance of forest pests to the future wood supply in New Brunswick resulted in the first large scale joint plantation survey between the provincial Department of Natural Resources and Energy and the Forest Insect and Disease Survey of the Canadian Forestry Service-Maritimes in 1985, to assess the general state of health of plantations and of silviculturally treated (thinned) areas. There were large scale joint surveys conducted in response to crisis situations, such as the Scleroderris survey in 1979, in the wake of the discovery of the European race of that disease in the Province. The survey in 1985 was conducted as a pilot project in anticipation of regular, continuing surveys in future years. In 1986, the Department of Natural Resources and Energy and the Forest Insect and Disease Survey were joined by two of New Brunswick's larger forest companies, J.D. Irving Ltd., and Fraser Inc., in carrying out

extensive pest assessment surveys in plantations. To ensure uniformity and standardization, both field and classroom instruction courses were conducted in advance of the actual field work.

In 1987, the surveys were expanded and involved the following organizations:

New Brunswick
- New Brunswick Department of Natural Resources and Energy (DNRE)
- Consolidated Bathurst Inc. (CBI)
- Fraser Inc. (Fras.)
- J.D. Irving Ltd. (JDI)
- NBIP Forest Products Inc. (NBIP)

Nova Scotia
- Nova Scotia Department of Lands and Forests (NSL&F)
- Bowater-Mersey Ltd. (B-M)
- Stora Forest Industries Ltd. (Stora)

There were 193 plantations assessed by the various organizations, 149 in New Brunswick (Table 12) and 44 in Nova Scotia (Table 13). DNRE also assessed 12 thinned areas (Table 14). Observations were made on the type and the level of forest pest-caused disturbances or damage. Field assessments were carried out by staff of the various organizations. Identification of samples and summarizing were done by the Forest Insect and Disease Survey. Analysis of data is in progress and details will be reported at a later date. Involvement in organized pest surveys of this type being a new undertaking, some companies viewed 1987 as a pilot year and limited the number of assessments accordingly.

There were 303 assessments made in the 205 areas surveyed, 32% of the plantations or thinned areas having been visited twice during the season. A total of 14 500 trees were examined in the course of the surveys.

A brief summary of some of the observations in New Brunswick is presented here. Since no analysis is yet available on almost 70% of the plantations from Nova Scotia, comparative figures for that Province cannot be given here.

1. The most remarkable - and comforting - observation drawn from the results is that, in spite of the long list of organisms encountered, plantations of both spruce and pine were found to be generally in very good condition. An average of 93% of the trees examined in New Brunswick were classified as healthy.

2. In the thinned stands 99% of the trees were considered healthy.

3. Tree mortality was 1.2% for pine and 1.0% for spruce.

4. Current defoliation occurred on spruce in New Brunswick on 10% of the trees examined in DNRE Region 1 but on close to 51% of the trees in DNRE Region 5. The intensity of defoliation was generally only trace. Moderate or severe defoliation occurred on less than 3% of the trees.

Table 12. Summary of plantation assessments by tree species and organization conducting field work in the various resource management regions in New Brunswick in 1987

Region	Tree Species	Total plantations assessed	Organization					
			DNRE	CBI	Fras.	JDI	NBIP	FIDS
1	Black spruce	5	–	5	–	–	–	–
	White spruce	1	1	–	–	–	–	–
	Spruce	5	5	–	–	–	–	–
	Jack pine	3	3	–	–	–	–	–
	Red pine	1	–	1	–	–	–	–
	Pine	1	1	–	–	–	–	–
Total for Region		16	10	6	–	–	–	–
2	Black spruce	6	5	1	–	–	–	–
	White spruce	1	1	–	–	–	–	–
	Spruce	1	1	–	–	–	–	–
	Jack pine	5	5	–	–	–	–	–
Total for Region		13	12	1	–	–	–	–
3	Black spruce	9	9	–	–	–	–	–
	Norway spruce	1	1	–	–	–	–	–
	White spruce	3	3	–	–	–	–	–
	Spruce	3	3	–	–	–	–	–
	Jack pine	13	13	–	–	–	–	–
	Mixed species	1	1	–	–	–	–	–
Total for Region		30	30	–	–	–	–	–
4	Black spruce	8	7	–	–	–	1	–
	Norway spruce	1	–	–	–	1	–	–
	Jack pine	7	5	–	–	1	–	1
	Red pine	1	1	–	–	–	–	–
Total for Region		17	13	–	–	2	1	1
5	Black spruce	47	5	–	30	12	–	–
	White spruce	21	4	–	3	14	–	–
	Spruce	1	1	–	–	–	–	–
	Jack pine	2	–	–	2	–	–	–
	Red pine	1	–	–	1	–	–	–
	Larch	1	–	–	1	–	–	–
Total for Region		73	10	–	37	26	–	–
Total for New Brunswick		149	75	7	37	28	1	1

Table 13. Summary of plantation assessment by tree species and organization conducting field work in the various forest management areas in Nova Scotia in 1987

For. Manag. Area	Tree species	Total plantations assessed	Organization NSL&F	B-M	Stora
South Central	Black spruce	1	1	-	-
	White spruce	1	1	-	-
	Red pine	2	1	1	-
Total for Region		4	3	1	-
South Shore	Red spruce	1	-	1	-
	Red pine	3	2	1	-
Total for Region		4	2	2	-
Eastern	Black spruce	5	2	-	3
	Norway spruce	2	-	-	2
	Red pine	2	-	-	2
	Scots pine	1	-	-	1
	Mixed species	3	-	-	3
	Other (unknown)	1	-	-	1
Total for Region		14	2	-	12
Cape Breton	Black spruce	14	2	-	12
	Spruce	1	-	-	1
	Red pine	1	-	-	1
	Mixed species	6	-	-	6
Total for Region		22	2	-	20
Total for Nova Scotia		44	9	3	32

Table 14. Summary of thinned areas assessed in the various Forest Management Regions by DNRE personnel in New Brunswick in 1987

Stand composition	Total assessed	Distribution by DNRE Region				
		1	2	3	4	5
Balsam fir	4	-	1	-	-	3
Black spruce	2	-	2	-	-	-
Spruce	2	2	-	-	-	-
Fir/Spruce	3	-	1	-	-	2
Jack pine	1	-	-	1	-	-
Total	12	2	4	1	-	5

5. Current defoliation on pine was the highest in DNRE Region 2 (17%). The level of defoliation on the affected trees was generally light.

6. At least some damaged buds were present on 6% of spruce and 1% of pine trees.

7. Leaders were damaged on less than 5% of pine trees. On spruce, damaged leaders were observed on 9% of the trees.

8. Multiple leadering was more common on spruce and was reported on 22% of the trees. Nine percent of the pine assessed had multiple leaders.

The various problems encountered in New Brunswick and Nova Scotia are summarized in Table 15 and Table 16, respectively.

Table 15. Problems observed during plantation pest assessment surveys in New Brunswick in 1987

Plantation problems	Number of plantations with problems in various DNRE regions									
	Pine					Spruce				
	1	2	3	4	5	1	2	3	4	5
Abiotic injuries	4	–	1	4	2	5	–	1	5	14
Animal damage	1	2	5	2	2	–	1	3	3	21
Armillaria root rot	–	1	–	1	–	1	3	–	1	20
Blister rust	–	–	3	–	–	–	–	–	–	–
Brown felt blight	–	–	–	–	–	–	–	–	–	1
Bud moth(s)	–	–	–	–	–	–	–	3	–	12
Budworm(s)	1	1	3	–	–	6	4	8	6	53
Conifer aphids	–	2	1	3	–	–	4	–	–	24
Conifer sawflies	–	–	1	1	–	–	–	–	–	–
Faulty planting	–	–	–	2	–	–	–	–	–	–
Fir coneworm	–	–	–	–	–	1	–	–	–	–
Frost damage	1	–	–	–	3	2	3	–	10	56
Frost heaving	–	–	1	–	1	–	–	3	–	9
Globose gall rust	–	2	1	–	–	–	–	–	–	–
Hardwood competition	–	–	–	4	–	1	2	3	3	1
Herbaceous competition	1	–	–	–	3	3	1	–	1	31
Herbicide injury	–	–	–	–	–	–	–	3	–	–
Mites	1	–	1	2	–	–	–	–	–	–
Needle rust	–	4	7	4	–	2	1	–	1	7
Northern pitch twig moth	–	3	4	1	–	–	–	–	–	–
Pine leaf adelgid	–	–	–	–	–	–	–	–	–	1
Root collar weevil	–	–	–	–	–	–	–	–	–	2
Snow damage	2	2	1	2	–	1	1	2	2	2
Spruce bud midge	–	–	–	–	–	–	–	–	1	9
Spruce bud scale	–	–	–	–	–	–	–	1	1	1
Spruce cone maggot	–	–	–	–	–	–	–	–	–	1
Spruce gall adelgid(s)	–	–	–	–	–	–	2	7	6	16
Spruce gall midge	–	–	–	–	–	–	–	–	–	3
Spruce spittlebug	–	–	–	–	–	1	–	–	–	6
Spruce twig aphid	–	–	–	–	–	2	–	–	1	4
Weather	–	–	1	–	–	3	2	2	2	5
Whitemarked tussock moth	–	–	–	–	–	1	–	–	–	–
White pine weevil	–	–	2	1	–	–	–	1	2	–
Winter drying	–	–	–	1	–	6	–	2	2	3
Yellowheaded spruce sawfly	–	–	–	–	–	–	–	–	–	1
Misc. problems	–	1	–	5	1	–	2	–	3	39

Table 16. Problems observed during plantation assessment surveys in Nova Scotia in 1987

Plantation problems	Number of plantations with problems in the various NSLF regions							
	Pine				Spruce			
	S.S.	S.C.	East.	C.B.	S.S.	S.C.	East.	C.B.
Abiotic injuries	1	–	–	–	1	–	2	1
Animal damage	1	2	1	–	1	–	5	2
Armillaria root rot	–	–	–	–	–	–	2	–
Bud moth(s)	–	–	–	–	–	–	1	–
Budworm(s)	–	–	–	–	–	–	1	–
Conifer aphids	2	–	1	–	1	–	–	–
Conifer sawflies	–	–	1	–	–	–	–	–
European pine shoot moth	–	2	–	–	–	–	–	–
Faulty planting	1	–	–	–	–	–	2	1
Coneworm	–	–	–	1	–	–	–	–
Frost damage	–	–	–	1	–	2	4	2
Hardwood competition	–	–	–	–	–	3	2	–
Mites	–	–	1	–	–	–	1	–
Needle cast	–	–	1	–	–	–	–	–
Needle rust	1	–	1	–	–	1	1	–
Red flagging	–	1	–	–	–	–	–	–
Root collar weevil	–	–	–	–	–	1	1	–
Sirococcus shoot blight	1	–	–	–	–	–	1	–
Snow damage	–	1	1	–	–	–	4	6
Spruce bud midge	–	–	–	–	1	–	–	–
Spruce gall adelgid(s)	–	–	–	–	–	–	1	–
Spruce needleminer(s)	–	–	–	–	–	1	–	–
Spittlebug(s)	1	–	–	–	–	–	–	–
Spruce twig aphid	–	–	–	–	–	–	1	–
White pine weevil	–	–	–	–	1	–	–	–
Winter drying	–	–	1	–	–	1	4	1
Misc. problems	1	1	–	–	–	1	6	7

Notes: - plantations with mixed tree species were not included.
- S.S.=South Shore; S.C.=South Central; East.=Eastern; C.B.=Cape Breton.

CONDITION OF SUGAR MAPLE

Much has been said and written in recent years about sugar maple decline affecting vast areas of eastern North America, especially Quebec, and on its effects on the maple syrup industry and other forestry related activities. The reasons for this decline are still not known in spite of the large, international research effort undertaken to determine the cause. Maple dieback, as it is often known, appears to be associated, at least in some instances, with the deterioration of other hardwoods.

In New Brunswick, in 1986 surveys identified some sugar maple stands in deteriorating condition but no widespread decline was found. In 1987 an aerial survey was conducted over much of the Province, covering parts of York, Carleton, Victoria and Madawaska counties, to gain a better overview of where declining stands may exist. This area was selected partly to follow up on results of the 1986 survey, and partly because of its proximity to Quebec and the northeastern United States. The survey was a cooperative effort of the Forest Insect and Disease Survey, and the New Brunswick departments of Natural Resources and Energy and Municipal Affairs and Environment.

Branch and occasionally stem mortality were found in pockets in all four counties. The largest affected area was in an uninhabited part of the Madawaska panhandle along the Quebec border. The intensity of deterioration in the affected stands was variable but in some of the smaller pockets, upper crown branch mortality was observed on more than half of the trees, notably in areas near North Branch Becaquimec Stream and Elliott Brook, Carleton County and in parts of the upper Green River and Quisbis River drainage system, Madawaska County. The cause of the deterioration was obvious during ground checks in some of the areas and included past cutting practices, insect or disease damage and current management practices. In other affected areas however, no obvious reasons were found to explain the deteriorating condition of the trees. Permanent plots will be established in stands selected from these and decline symptomology will be monitored along with pest levels, soil nutrient status and other factors possibly involved with the decline of these trees.

No unexplained decline was found in either Nova Scotia or Prince Edward Island. Deterioration in a maple syrup production area in Guysborough County, N.S. was related to previous defoliation by greenstriped mapleworm and whitemarked tussock moth and the presence of sugar maple borer (18% of the trees in the stand infested). In a stand in Cape Breton County, N.S., overthinning of the "sugar bush" exposed trees, especially near the top of the hill to the effects of strong winds and sunscald. Trees on the four sugar maple condition monitoring plots were in a generally healthy condition with only a few minor foliage pests present.

CONDITION OF TREMBLING ASPEN

In our changing world of diminishing wood supplies and impending wood shortages there is no longer justification in the forestry community for talk of unimportant forest trees or of weed species. In the Maritimes, forestry is no longer an almost entirely conifer based economy. There are companies based almost exclusively on the use of hardwood, there are others that are increasing the proportion of hardwood used and there are plans to further increase hardwood utilization. Tree species such as poplars and aspen are among the faster growing hardwoods and, due to the efforts of tree improvement programs, there are hybrid poplars with very high fiber production potential.

Trembling aspen is of consequence in the forest inventory of all three Maritime provinces and its condition should be of concern to forest managers. Trembling aspen has been exposed to a great variety of stresses in many areas of the Region in recent years. Outbreaks of insects, such as the forest tent caterpillar, casebearers, poplar serpentine leafminer, infection by diseases, such as Hypoxylon canker, twig and leaf blight, leaf spots and leaf rusts, were all factors, contributing to stress. Drought in some years was a significant added factor.

A survey in 1985 found that most trembling aspen stands exhibiting the most serious stress symptoms were in eastern New Brunswick, in the northern half of western Nova Scotia and in Prince County, Prince Edward Island; that dieback was present on 32%, 34% and 37% of the trees respectively in the three provinces; but that more than half of the trees examined were healthy in all three provinces.

In late May and early June 1987 trembling aspen, individuals or small groups of trees, displayed crowns with small, misshapen and off-colored foliage. On some of the affected trees there were only a few abnormally large leaves scattered along the branches. The condition was most prevalent in parts of York, Northumberland, Carleton and Victoria counties in central New Brunswick but was also present at scattered locations throughout the northern half of the Province. As the season progressed, the crowns of these trees became fuller and the symptoms were less pronounced. However, many trees in the more severely affected areas never attained full crown density. We have no explanation for this condition.

In the early fall of 1987 a survey was conducted similar to the one in 1985, except that selection of assessment plots was concentrated more in areas of known stress factors, such as the repeated severe defoliation by forest tent caterpillar during the recent outbreak.

The number of areas assessed in the Region was 56: 27 in New Brunswick, 23 in Nova Scotia and 6 in Prince Edward Island. Of the 1400 trees classified, 25 at each location, less than 1% were in the suppressed category. Results, summarized in Table 17 and in Figure 11, indicate that the trembling aspen resource is indeed in seriously deteriorating condition, especially in New Brunswick where at least 80% of the trees show some sign of stress in all of the areas examined. The proportion of trees affected by Hypoxylon canker was 16.4%, considerably higher than the 11% infection rate found during surveys conducted in the late 1970s.

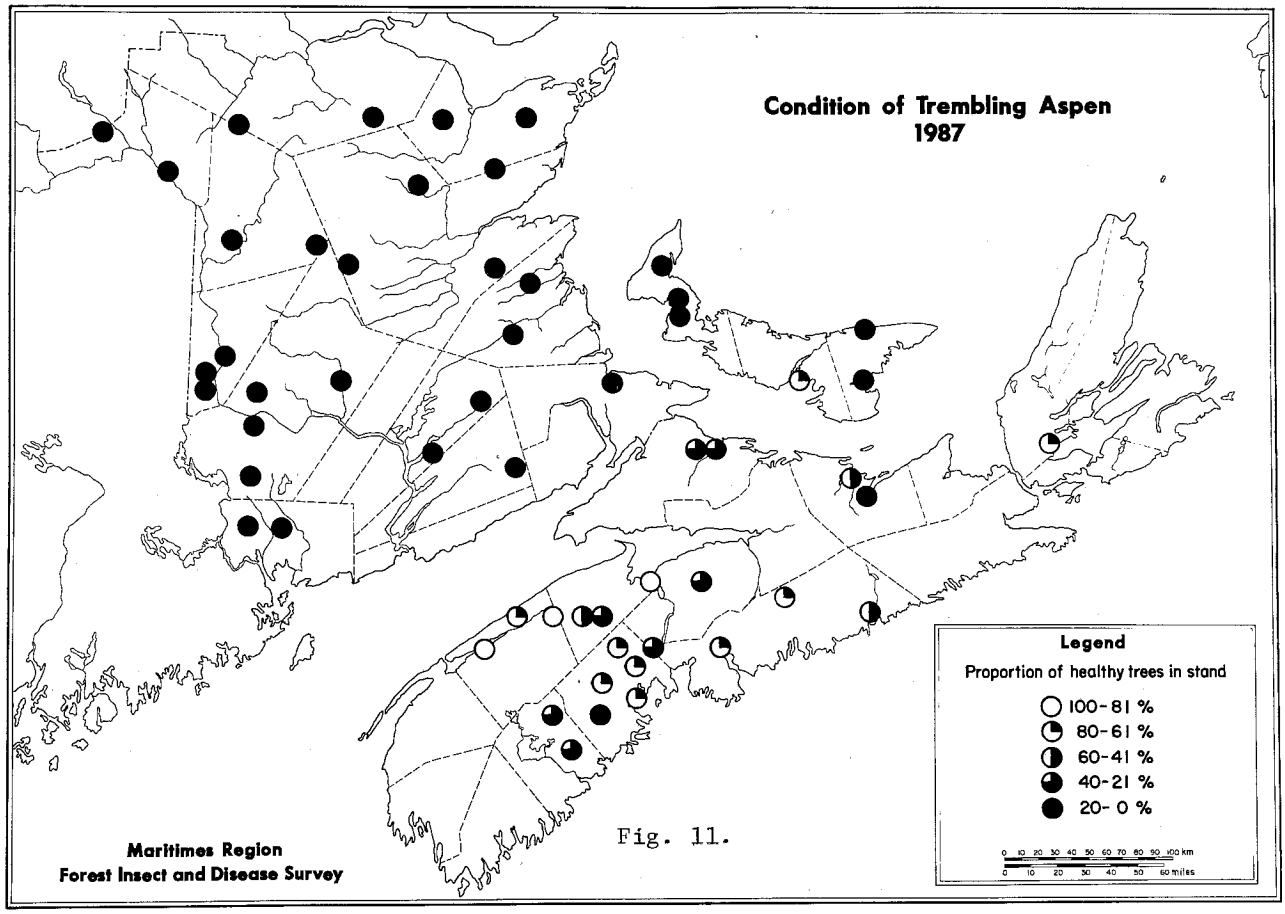


Fig. 11.

Table 17. Summary of the trembling aspen condition survey conducted in the Maritimes Region in 1987

Description	Maritimes Region	New Brunswick	Nova Scotia	Prince Edward Island
Number of locations	56	27	23	6
Number of trees	1400	675	575	150
Tree Condition (% of trees assessed)				
Healthy	26	3	53	26
Stressed - without dieback	14	25	--	16
Stressed - dieback present	53	63	40	50
Dead	7	9	7	8

PHEROMONE TRAPPING SURVEYS

Pheromones are chemical substances released by insects to communicate with another insect of the same species. In the case of sex pheromones the female attracts males for the purpose of mating. Other forms of chemical communication include host attractants, and aggregation pheromones. Collectively these are called "semiochemicals".

Researchers are rapidly developing uses for synthetic versions of semiochemicals for the detection and monitoring of insect populations, to predict infestations, and to time the application of controls.

The attractants are employed as lures and a variety of different trapping systems are used to capture the insects attracted to a specific location. Currently the most common are the 'sticky traps', however, sequential funnels, ground pits or bottles and suspended containers utilizing insecticide to trap the visiting insects are also used. The lure, trap and methods of employment must be all tailored to the particular insect and type of information required. A period of years is often necessary to verify and calibrate each system in use. Trap capture information can be confounded by population explosions, moths immigrating from long distances, unusual weather conditions etc. and all factors must be understood at least to some degree before accurate interpretation of trap captures can be made. Properly developed, these new tools can be more reliable and economical that some traditional survey techniques.

In the Maritimes, the Forest Insect and Disease Survey, often in cooperation with other organizations, has been in the "pheromone business" since 1971, when traps were first used in detection surveys for the gypsy moth, 10 years before the first egg mass was found. Since then, our efforts have gradually increased, first with opportunities to cooperate in testing various compounds for researchers, then by including testing in our program to develop pheromones as survey tools. Depending on the level of available precision, pheromones are used for:

1. detection surveys to establish the presence of an insect;

2. monitoring surveys to indicate a threshold of concern for the initiation of further action, such as more precise surveys or issuing an early warning of an impending population build-up;

3. monitoring surveys to predict the level of injury, such as defoliation, and subsequent damage, such as growth loss.

Currently, most pheromones used in the Maritimes are in the developmental stage and are used either as detection or threshold monitoring tools. However, work towards damage prediction capabilities is in progress.

In 1987, pheromones or attractants were used for a number of insects and comments on these follow:

Spruce budworm - as part of an interregional and international testing program to determine the reliability of traps and pheromones in monitoring annual population changes of the spruce budworm, the system was tested at 40

Table 18. Spruce budworm pheromone trapping in the Maritimes Region in 1987

Location	UTM Grid	Host	1986	1987							Co-Op Agency
			L_2	$L_3 - L_4$	Pheromone catch				Defol. Vis. est	L_2	
			larvae/m^2		1	2	3	Ave	%	larv/m^2	
New Brunswick											
Parkindale Seed Orchard Station #2, Albert Co.	20-34(1)-508(2)	wS	0.2	3.3	--	--	--	----	---	0.0	J.D.I.
East Branch Canaan River Westmorland Co. DNRE #10	20-33(5)-512(0)	S b/r	15.3	---	32	24	47	34.3	5.6	30.7	D.N.R.E.
Parkindale Seed Orchard Station #1, Albert Co.	20-33(9)-508(2)	bF	0.0	2.7	1	1	3	1.6	0.8	0.0	J.D.I.
Allardville East Gloucester Co. DNRE #4	20-31(4)-526(2)	bF	0.3	---	3	2	1	2.0	5.0	0.7	D.N.R.E.
Sussex Tree Nursery, Kings Co.	20-31(8)-506(8)	wS	0.0	22.7	0	12	14	8.6	10.0	---	J.D.I.
W of Despres Lake Northumberland Co.	20-30(1)-516(9)	F S	3.3 11.7	30.0	0	6	5	3.7	20.0	5.0	C.F.S.
Forks Stream Queens Co. DNRE #9	20-30(2)-510(8)	S b/r	5.3	----	11	5	8	8.0	5.0	1.6	D.N.R.E.

Table 18. Spruce budworm pheromone trapping in the Maritimes Region in 1987 (continued ...)

SE of South Lake Northumberland Co.	20-29(9)-516(9)	F S	5.3 0.3	15.0	1	1	2	1.3	5.0	2.0	C.F.S.
S of East Branch Sabbies River, Northumberland Co.	20-29(2)-515(8)	F S	6.0 1.0	25.0	3	4	2	3.0	15.0	0.0	C.F.S.
Shinnickburn Rd SE of Upper Blackville Bridge, Northumberland Co. DNRE #5	20-28(1)-516(5)	S b/r	4.3	----	1	1	2	1.3	5.0	0.0	D.N.R.E.
West Branch Sabbies River, Northumberland Co.	20-28(9)-515(5)	F S	2.0 0.0	5.0	1	0	1	0.7	<5	0.0	C.F.S.
SW of Pineville Northumberland Co.	20-27(5)-518(4)	F S	3.7	40.0	0	0	1	0.3	10.0	0.0	C.F.S.
Bartholomew Northumberland Co. DNRE #6	20-27(7)-517(7)	bF	2.0	----	9	9	3	7.0	9.0	1.6	D.N.R.E.
Bartholomew Northumberland Co.	20-27(2)-517(7)	F S	2.0 3.0	2.0	0	0	0	0.0	1.0	0.0	C.F.S.
W of Upper Blackville, Northumberland Co.	20-27(5)-516(7)	F S	20.9 12.3	120.0	5	10	11	8.6	15.0	4.0	C.F.S.
W of Shinnickburn Northumberland Co.	20-27(6)-515(9)	F	8.0	100.0	0	20	13	11.0	12.0	6.0	C.F.S.

Table 18. Spruce budworm pheromone trapping in the Maritimes Region in 1987 (continued ...)

S of Tetagouche, W of; Restigouche Co.	19-71(7)-527(4)	bF	2.7	46.7	10	15	3	9.3	13.5	7.3	F.I.D.S.
Pleasant Valley York Co. DNRE #7	19-68(7)-511(9)	S b/r	7.0	----	10	7	3	7.0	5.0	1.3	D.N.R.E.
Popelogan Lake, W of; Restigouche Co. DNRE #3	19-67(1)-529(7)	bF	11.0	----	95	193	97	128.0	75.3	18.0	D.N.R.E.
Mountain Road, Mazerolle Settlement, York Co.	19-66(4)-507(9)	bF	6.0	38.2	0	4	1	1.7	----	0.7	F.I.D.S.
Juniper Tree Nursery, Carleton Co.	19-64(2)-515(7)	bF	0.9	0.7	0	0	0	0.0	----	0.3	J.D.I.
Deersdale, York Co, DNRE #8	19-64(9)-514(8)	S b/r	---	---	3	3	2	2.7	5.0	0.3	D.N.R.E.
Gulguac River Victoria Co. DNRE #1	19-63(8)-520(2)	bF	10.0	---	9	5	4	6.0	67.8	4.3	D.N.R.E.
Plaster Rock-Renous Hwy., Little Wapske Rd, Northumberland Co.	19-63(7)-519(6)	bF	0.0	6.04	1	1	0	0.7	5.0	2.0	F.I.D.S.
Boston Brook Air-strip, Victoria Co.	19-60(4)-525(3)	F S	9.8	250.0	200	638	410	416.0	32.0	11.0	C.F.S.
Black Brook area Victoria Co.	19-60(2)-523(6)	bF	3.2	110.0	221+	258+	539+	339.3+	----	----	J.D.I.

Table 18. Spruce budworm pheromone trapping in the Maritimes Region in 1987 (continued ...)

Veneer Siding Gate, Victoria Co.	19-59(7)-524(0)	F S	15.0	380.0	732	395	672	599.0	15.0	8.0	C.F.S.
Kedgwick Forks Restigouche Co. DNRE #2	19-58(3)-530(3)	bF	8.3	-----	112	59	106	92.0	70.2	39.7	D.N.R.E.
Nova Scotia											
Mile 20, Highland Road, Victoria Co.	20-66(9)-514(0)	bF	0.0	0.0	5	4	3	4.0	1.0	0.0	F.I.D.S.
Mile 4, Highland Road, Victoria Co.	20-66(6)-511(5)	bF	0.7	0.0	0	1	0	0.3	1.0	0.0	F.I.D.S.
S Cape Breton Highlands, Inverness Co.	20-62(4)-511(1)	bF	0.0	0.0	1	1	2	1.3	1.0	0.0	F.I.D.S.
Twin Lake on Third Lake Road Guysborough Co.	20-58(1)-501(0)	bF	1.0	0.0	0	0	1	0.3	1.0	0.0	F.I.D.S.
Springhill Cumberland Co.	20-41(1)-505(4)	rS	786.0*	1.0	18	22	23	21.0	2.3	371.0*	N.S.L.F.
Southampton Cumberland Co.	20-41(1)-504(8)	rS	77.0*	1.0	1	0	0	0.3	2.0	0.0*	N.S.L.F.
Thunder Hill Cumberland Co.	20-39(5)-505(1)	rS	722.0*	1.0	2	5	2	3.0	1.0	0.0*	N.S.L.F.

Table 18. Spruce budworm pheromone trapping in the Maritimes Region in 1987

Halfway River Cumberland Co.	20-39(1)-504(1)	rS	111.0*	2.5	1	0	0	0.3	0.2	0.0*	N.S.L.F.
Diligent River Cumberland Co.	20-38(6)-502(8)	bF	265.0*	1.0	4	0	0	1.3	0.1	0.0*	N.S.L.F.
Woodville, NE of Ross Corner, Kings Co.	20-37(1)-500(0)	bF wS	0.9	0.0	2	0	0	0.7	1.0	0.0	F.I.D.S.
Sand Lake, Queens Co.	20-32(1)-490(1)	bF rS	0.0	0.0	0	0	0	0.0	1.0	1.6	F.I.D.S.
Prince Edward Island											
Valleyfield, Kings Co.	20-52(1)-510(9)	S	---	192.7	26	25	35	28.6	10.0	13.3	F.I.D.S.

1 Larvae/branch

* Larvae/10 m^2

locations in the Maritimes in 1987. Cooperating in the program were the New Brunswick Department of Natural Resources and Energy (10 locations), the Nova Scotia Department of Lands and Forests (5 locations), J.D. Irving Ltd. (5 locations), E.G. Kettela of CFS-Maritimes (10 locations), and the regional Forest Insect and Disease Survey (10 locations).

Multi-pher traps baited with PVC pellets were used in a cluster of three traps deployed at each location. Trees at these locations were sampled in the early summer to determine spruce budworm larval populations at the L3-L4 stage, adult males captured by the traps were counted at the end of the flight period, defoliation levels on the sample trees were determined and L2 counts, an indicator for next year's expected population levels, were obtained. The results of the various counts are summarized in Table 18. Where available, the L2 counts from 1986 are included for comparison.

This information becomes part of the common data base to be analyzed for relationships before the system may become an operational tool.

Forest tent caterpillar - trap capture was almost nil in 1987 (Fig. 12), a marked contrast with the first trapping year in 1984. This corresponds with the low population levels and the lack of defoliation observed.

The reduction in trap captures since 1984, expressed as the percent of trap locations where any number of forest tent caterpillar moths were caught in each year, follows:

1984	60%
1985	40%
1986	12%
1987	1%

Pheromone trapping of adult males appears to be more sensitive than the traditional egg mass surveys. The technique should aid in earlier detection, and more accurate prediction of future population fluctuations. Although the true test of the predictive ability of the forest tent caterpillar pheromone trapping program will have to wait for the next population build-up we are confident enough in the results to have cancelled the traditional, expensive and time consuming fall egg mass surveys.

With the possible exception near Berry Mills, Westmorland County, N.B. no noticeable defoliation should occur anywhere in the Maritimes.

Jack pine budworm - the numbers of jack pine budworm moths trapped were as high or higher in 1987 than last year in Kent, Northumberland and parts of Sunbury counties in east-central New Brunswick, however, to the south, the number of moths captured was even lower than the already low levels captured in 1986 with many traps negative (Fig. 13). In Nova Scotia, only one trap was positive, in Cumberland County, suggesting a reduction in populations there also.

Three years of trapping indicates an overall downward population trend with low populations being maintained in those areas where jack pine is a naturally abundant species. Positive locations in New Brunswick in 1987 were 49%, compared with 60% in 1986 and 84% in 1985.

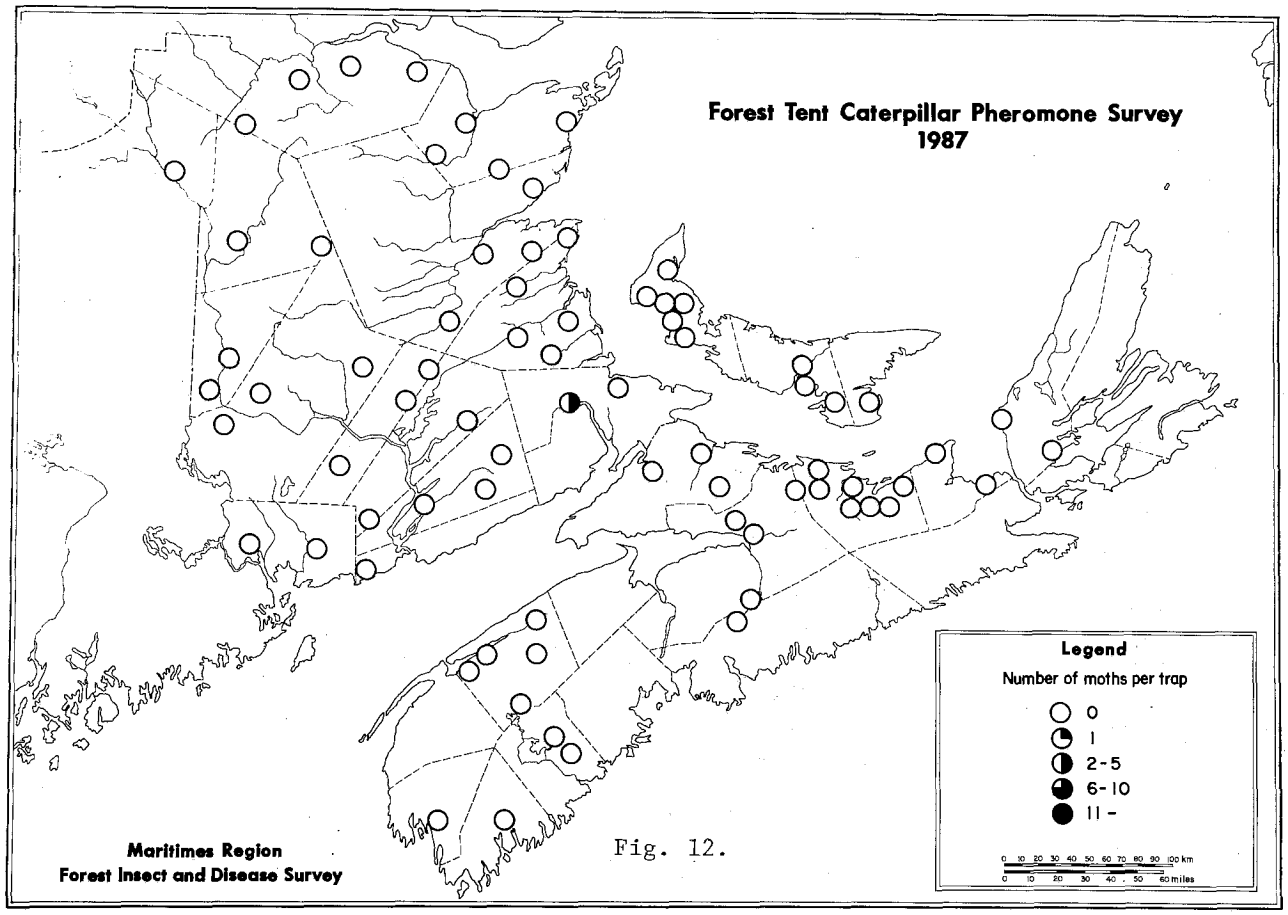

Forest Tent Caterpillar Pheromone Survey
1987
Legend
Number of moths per trap
0
1
2-5
6-10
11 -
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 12.

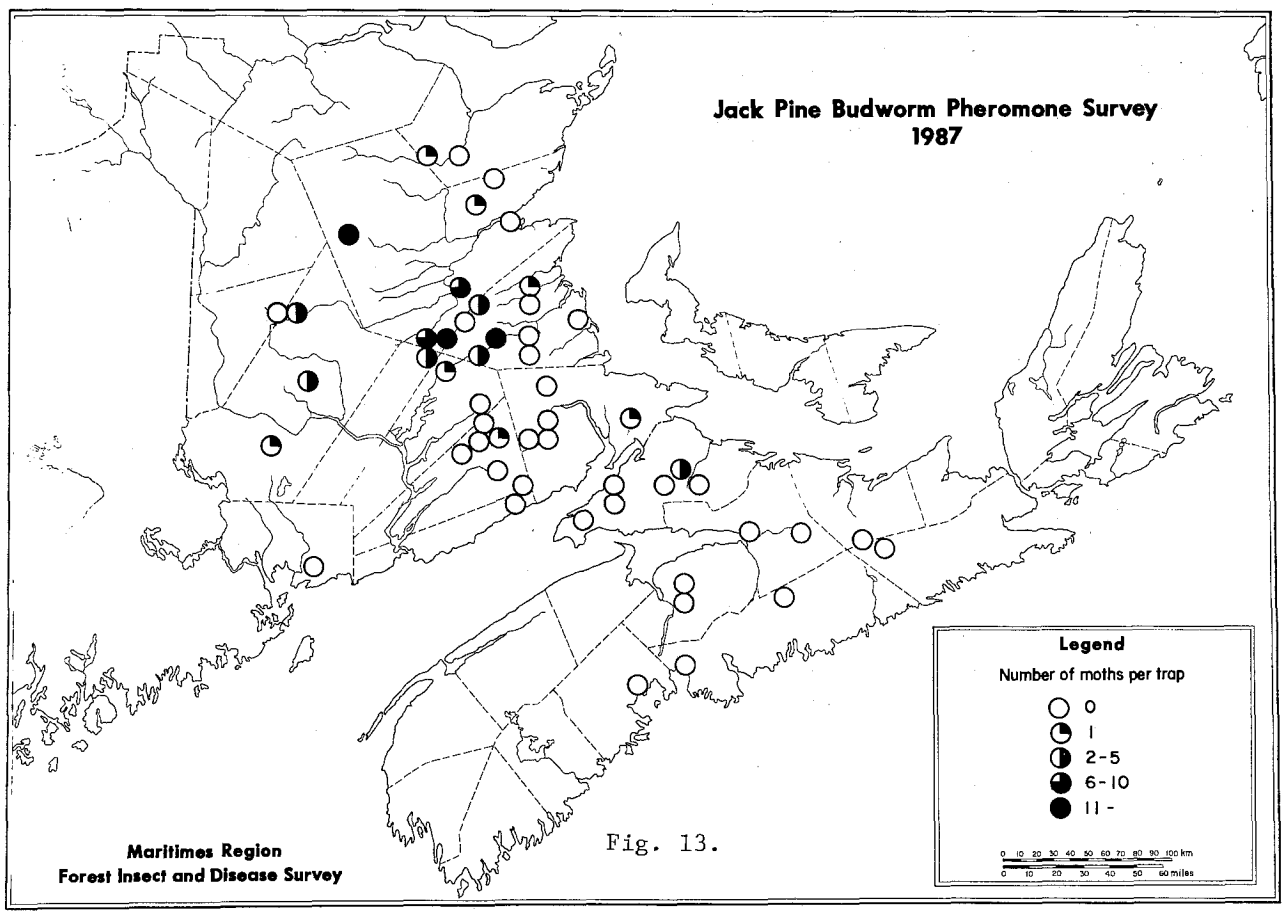

Jack Pine Budworm Pheromone Survey
1987
Legend
Number of moths per trap
0
1
2-5
6-10
11 -
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 13.

European pine shoot moth - the number of trapping locations in 1987 was kept low in response to the low levels of European pine shoot moth detected in recent years. Plans are to increase the number of trapping locations when population increases are apparent. Only one moth was caught in the 15 traps returned and due to its poor condition in the trap, even this identification is doubtful (Fig. 14).

Oak leaf shredder and oak leafroller - Both of these insects specialize in feeding on oak. Chronic feeding, especially by the leafroller in western Nova Scotia, is damaging and killing trees. In 1987, a new pheromone lure for the oak leafroller, developed by the Forest Pest Management Institute of the Canadian Forestry Serice, was successfully tested after years of development. Calibration trials will begin in 1988.

Trapping for the oak leaf shredder has been underway in the Maritimes since 1984.

In Nova Scotia, oak leaf shredder is often not encountered during egg and larval surveys, the oak leafroller being the dominant member of the complex. Consequently, few oak leaf shredder moths were captured in the 9 traps in 1987 (Fig. 15). In New Brunswick, populations have been generally low with the exception of three persistent "hot spots", at Picadilly Mountain, Kings County, Cranberry Lake, Queens County and at Fredericton, York County. Of the six locations trapped, one was negative however at Fredericton and at Cranberry Lake, catches were 11 and 17 times higher respectively, than the highest catch in Nova Scotia.

It is hoped that the further development of a pheromone trapping system for both of these pests will aid in understanding the interactions between these pests and their combined effects on the Maritimes red oak resource.

Gypsy moth - the pheromone trapping detection survey has been used in the Maritimes since 1971. The program is a multi-agency effort and is discussed in detail elsewhere in this report.

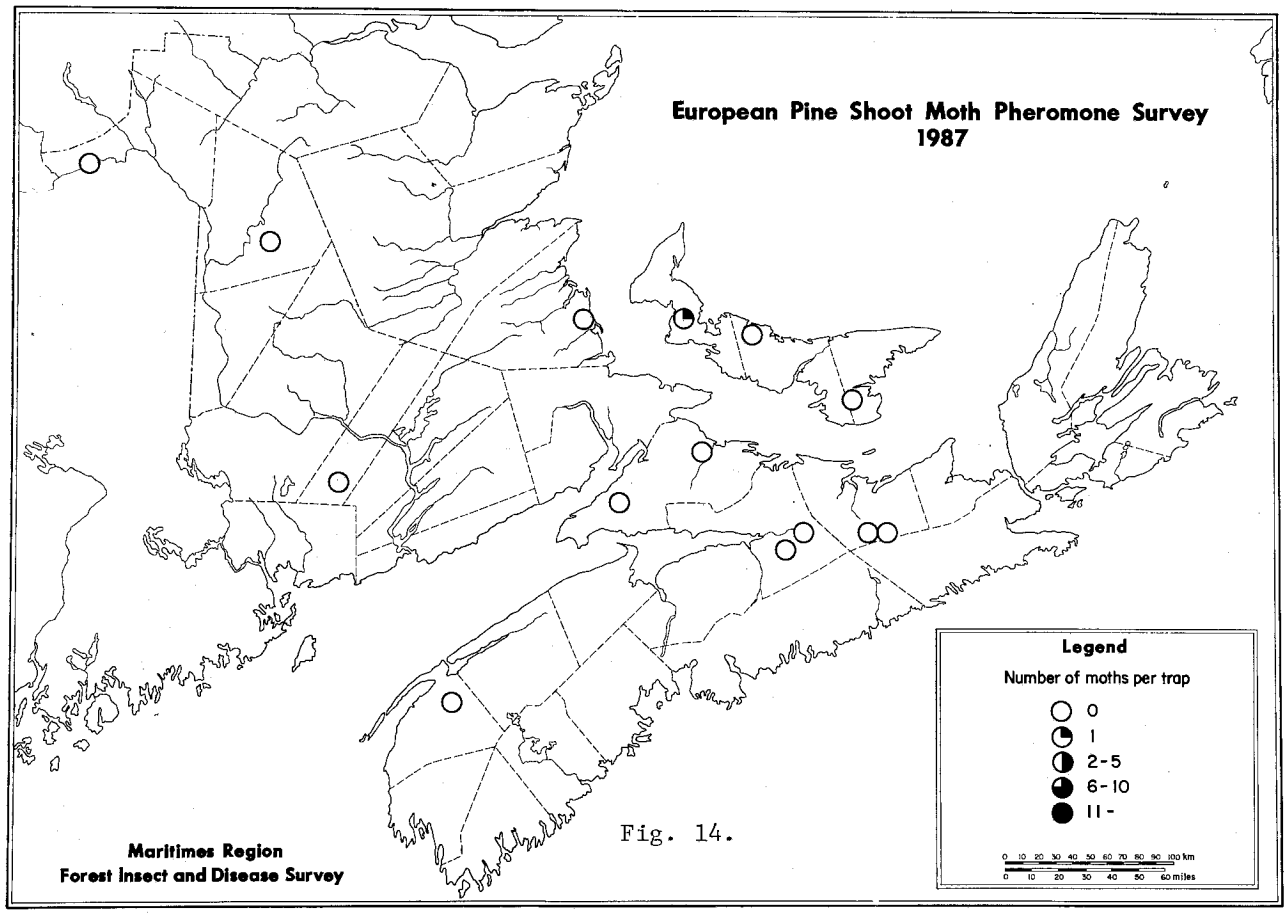

European Pine Shoot Moth Pheromone Survey
1987
Legend
Number of moths per trap
0
1
2-5
6-10
11-
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 14.

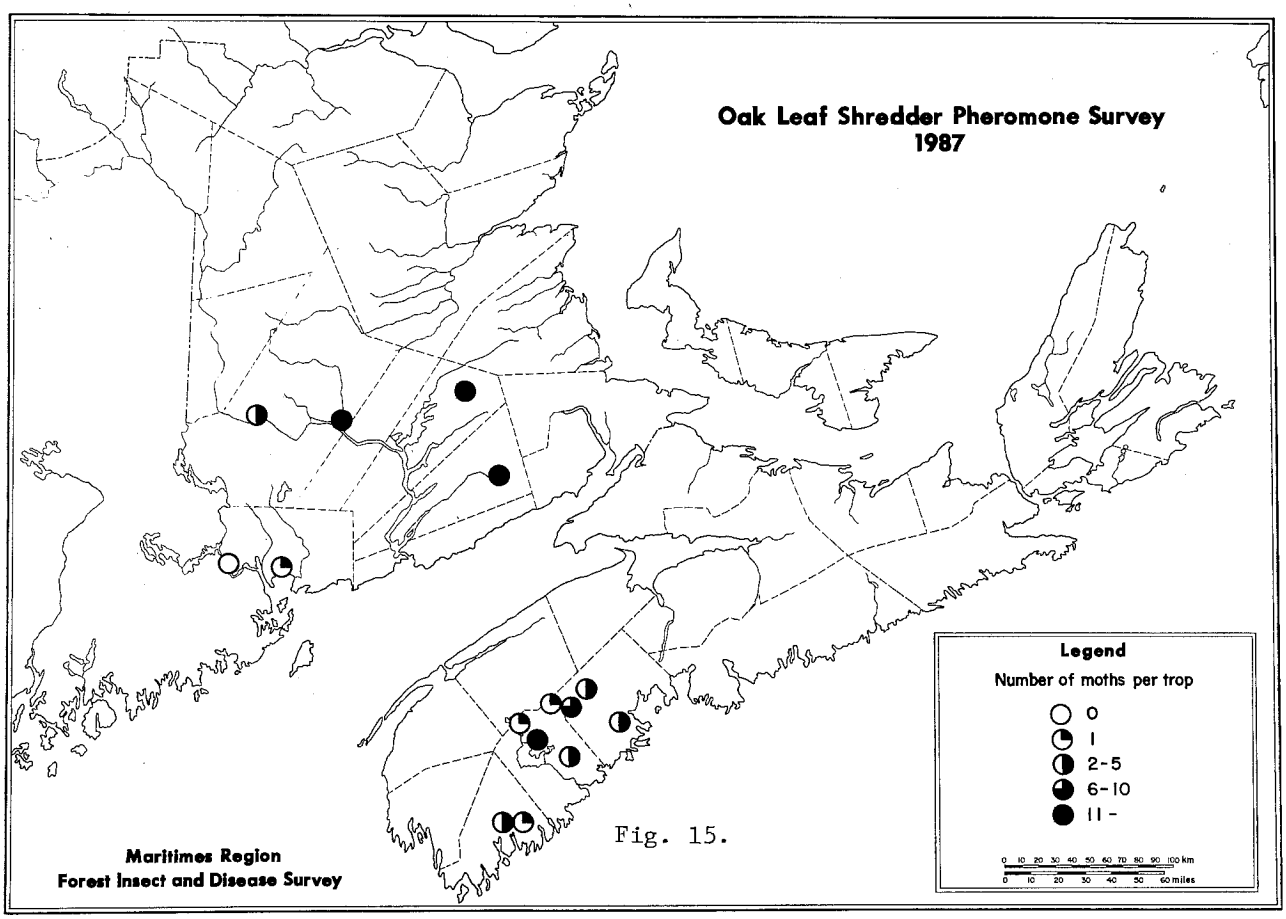

Oak Leaf Shredder Pheromone Survey
1987
Legend
Number of moths per trop
0
1
2-5
6-10
11-
0 10 20 30 40 50 60 70 80 90 100 km
0 10 20 30 40 50 60 miles
Maritimes Region
Forest Insect and Disease Survey

Fig. 15.

THE LIGHT TRAP MONITORING SYSTEM

Taking advantage of the fact that many insects are attracted to light, the Forest Insect and Disease Survey has been using light traps to monitor insect populations since shortly after the Second World War. The trap, with a built-in light source, captures and kills the insects which are identified and counted. The information is used several ways, such as in designing other types of surveys, predicting population build-ups and in research.

The 16 light traps in the Maritimes Region listed below are maintained by provincial government cooperators, National Parks personnel, industrial concerns or private individuals on behalf of the Forest Insect and Disease Survey and operate from mid-April until the late fall. Catches are collected daily and the material submitted for identification on a weekly basis. After a period of experimentation during the early years, all traps and light sources were standardized in 1976 and trap locations remained the same except in a few unavoidable situations.

Light trap locations in the Maritimes Region are as follows:

NEW BRUNSWICK

Ashton Hill, Northumberland County
Balmoral, Restigouche County
Canterbury, York County
Fredericton, York County
Fundy National Park, Albert County
Mayfield, Charlotte County
Plaster Rock, Victoria County

NOVA SCOTIA

Big Intervale, Inverness County
Georgeville, Antigonish County
Kejimkujik National Park, Annapolis County
Lawrencetown, Annapolis County
Liverpool, Queens County
Londonderry, Colchester County

PRINCE EDWARD ISLAND

Breadalbane, Queens County
Howlan, Prince County
Kilmuir, Kings County

The results of the light trap operations between 1976 and 1986 have been published as a CFS-Maritimes Information Report M-X-163.

OTHER INSECTS AND DISEASES

OTHER INSECTS AND DISEASES

This table lists, alphabetically by common name, most insects and diseases encountered in the Maritimes in 1987 but not discussed in detail elsewhere in the report. Inclusion in the table does not imply that the organism is necessarily of lesser economic importance than those discussed in the text. It may be that an organism, eg., larch sawfly, is at an ebb of biological activity and did not cause enough concern in 1987 to warrant detailed discussion. It may be that although severe, an organism, e.g., elm leaf beetle was only of localized importance in 1987.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Abiotic conditions			
Atmospheric impurities	White pine	N.S.	Crowns of white pine thin and off-color near a tin mine at East Kemptville, Yarmouth County.
Dieback	White birch maple	N.B. N.S.	White birch mortality at Red Martin Head, St. John County, New Brunswick (ARNEWS Plot 206), was 28%, and 44% of the trees had upper crown branch mortality. In Nova Scotia, crown dieback of red maple ranged from 50 to 90% at Oak Park, Shelburne County and the same degree of crown damage occurred on red maple and white birch at Beaver River, Yarmouth County.
Discolored and mottled foliage	Conifers Hardwoods	N.B. N.S.	Various amounts of foliage discoloration of several coniferous and deciduous species. Cause unknown but probably varies by location and species. Tree species affected in New Brunswick: black spruce in Restigouche County, red spruce in Westmorland County, white birch in Gloucester, Northumberland, Kent and Sunbury counties, yellow birch in St. John County, beech in York County; in Nova Scotia: balsam fir in Inverness and Guysborough counties, red spruce in Richmond County, white birch in Inverness County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Drought	Conifers Hardwoods	N.B. N.S.	Premature yellowing of white and wire birch in southern New Brunswick and of speckled alder, in much of the Province. At some locations as much as 75% of white birch and 64% of wire birch leaves turned yellow prematurely. Drought conditions similar but more widespread in Nova Scotia, affecting a broad range of hosts.
Flooding	Conifers Hardwoods	N.B.	Spring flooding on the Saint John River damaged, uprooted and destroyed trees between Perth and Hartland, Carleton County; McGowans Corner, Sunbury County and Jemseg, Queens County.
Frost	Conifers Hardwoods	N.B. N.S.	In New Brunswick, moderate shoot damage to balsam fir at two locations in Restigouche County (48% and 36% shoot damage), light or trace on various conifers in Kent, Kings, Queens, York, Madawaska and Northumberland counties. In Nova Scotia, moderate damage to white spruce in Lunenburg County, light or trace elsewhere in all but Digby and Annapolis County.
Hail	Balsam fir Jack pine Cedar	N.B.	Moderate damage over approximately 25 hectares near North Branch Burnt Hill Brook, Carleton County.
Ocean salt spray	White pine	N.S.	Moderate damage to white pine near Digby, Digby County.
Red shoots	Balsam fir	N.B. N.S.	Red flagging of unknown cause in Madawaska, York and Westmorland counties, New Brunswick and Halifax County, Nova Scotia. As much as 25% of balsam fir trees affected in Northumberland County, New Brunswick and 88% in Halifax County (ARNEWS Plot 214), Nova Scotia.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Roadside salt damage	Conifers	Region	Severe or moderate discoloration on roadside white pine throughout much of New Brunswick; 40% of balsam fir affected at Tweedie, Carleton County. In Nova Scotia, discoloration of red and white pine severe, moderate or light in the eastern half of the Province, only light or trace in the western half. Damage to 80% of white spruce at French Lake, Inverness County in Cape Breton Highlands National Park. Severe damage to red and Scots pine in Kings County, Prince Edward Island.
Snow damage	Balsam fir Jack pine Red pine	Region	In New Brunswick, snow broke branches on 16% of jack pine trees at Kouchibouguac National Park, Kent County; damage also in Northumberland, Victoria and York counties. In Nova Scotia, damage on 56% of balsam fir at MacMillan Flowage, Victoria County, 52% of red pine at East of Judique, Inverness County, damage also on balsam, fir in Inverness County. In Prince Edward Island, damage to 44% of red pine at North Granville, Queens County.
Wind damage	Hardwoods Conifers	Region	Strong winds blew down urban hardwood trees and caused property damage in Charlottetown, Queens County, Prince Edward Island and Truro, Colchester County, Nova Scotia. Blowdown affected 44% of black spruce trees near St. Luc, Kent County and caused light damage in balsam fir and red spruce stands in Victoria and York counties, New Brunswick; branch damage to 80% of white birch trees near Otter Brook, Sunbury County, New Brunswick; severe and moderate foliage damage

INSECT OR DISEASE	HOST(S)	LOCALITY	REGION
			of various hardwoods in Gloucester, Northumberland and York counties, New Brunswick and Cape Breton County, Nova Scotia.
Winter drying	Conifers	Region	Foliage browning widespread in New Brunswick with Scots pine affected more frequently than any other species. Severe, moderate and light browning of Scots pine occurred throughout; severe and moderate browning of cedar occurred from Victoria to Charlotte County; and moderate browning of balsam fir observed in St. John, York and Victoria counties. In Nova Scotia, foliage browning widespread in the eastern part of the Province at various intensities. In western Nova Scotia, 50-70% of balsam fir trees affected in Yarmouth and Digby counties. In Prince Edward Island, browning severe throughout on red pine and occurred on jack pine and Scots pine in Prince County.
Alder flea beetle *Altica ambiens alni* Harr.	Alder	Region	Patches of severe and moderate browning in Charlotte, York, Queens, Sunbury and Carleton counties, New Brunswick. Browning in western New Brunswick did not extend as far north as in 1986. In Nova Scotia, numerous patches of severe and moderate browning in Victoria, Antigonish, Pictou, Halifax, central Colchester and Hants counties, and as far southwest as Queens County. In Prince Edward Island no damage in Queens and Kings counties where small patches of severe browning occurred in 1986.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Ambermarked birch leafminer *Profenusa thomsoni* Konow	White birch Wire birch	N.S. P.E.I.	In Nova Scotia low populations light or trace in Kings, Cumberland, Lunenburg, Queens, Pictou, and with a high of 16% of white birch leaves affected at Grand Lake, Annapolis County. Highest population at Milford, Annapolis County, where 32% of wire birch leaves affected. In Prince Edward Island National Park at Dalvay, 31% of wire birch leaves, but only 4% of white birch leaves affected.
Animal damage			
Deer	Jack pine Norway spruce	N.B.	Damage by deer observed on jack pine in Victoria and Albert counties and on Norway spruce in York County.
Porcupine	Balsam fir Jack pine Red pine White pine Tamarack Red spruce	N.S. N.B.	Damage common throughout New Brunswick and Nova Scotia. Damage ranged from 4 to 48% on five hosts in ten New Brunswick counties; in Nova Scotia from 4 to 44% in affected pine plantations in Hants, Pictou, Shelburne and Queens counties.
Rabbit	Conifers	Region	Damage to 13% of white pine trees at Little Wapski Brook, Victoria County, New Brunswick. In Nova Scotia, moderate damage (36% of shoots) on 80% of white spruce trees in a stand in Victoria County, light and trace damage elsewhere in the Province. In Prince Edward Island, heavy damage on Norway spruce in a plantation in Kings County.
Squirrel	Jack pine Red pine	N.B.	Shoot damage and cone removal observed at various locations. Damage low, highest (at 9% shoot damage) on jack pine in Carleton County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Anthracnose of maple Kabatiella apocrypta (Ell. and Ev.) Arx	Red maple Sugar maple	Region	In New Brunswick, moderate browning of red maple in small areas in Kent and Queens counties and of sugar maple in York County. Present but only at trace levels elsewhere. In Nova Scotia, found on sugar maple in Colchester and Halifax counties. Not seen in Prince Edward Island.
Ants Formicidae	Conifers	N.B. P.E.I.	Present in newly established plantations in and near the root systems of all newly planted trees at very high populations in Kings County, Prince Edward Island. Bark of ornamentals damaged in a yard in Gloucester County, New Brunswick.
Ash yellows	Ash	Region	Not found in the Region to date. This disease is present in the United States and is a concern for plant quarantine officials.
Aspen leafrollers Epinotia criddleana (Kft.) Pseudexentera oregonana (Wlshm.) **Darkheaded aspen leafroller** Anacampsis innocuella (Zell.) **Lightheaded aspen leafroller** Anacampsis niveopulvella (Cham.) **Spotted aspen leafroller** Pseudosciaphila duplex (Wlshm.)	Aspen	Region	Leafrolling, mostly of trembling aspen, common throughout the Region but restricted mainly to trace and light levels. The most serious leafrolling observed at Aylesford, Kings County, Nova Scotia where all trees were affected and 64% of the leaves were rolled.
Aspen webworm and lesser aspen webworm Tetralopha aplastella (Hlst.) and Meroptera pravella (Grt.)	Trembling aspen	Region	Not found in 1987. Collapse of populations related to decline of forest tent caterpillar populations.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Bagworm *Thyridopteryx ephemeraeformis* (Haw.)	Spruce	N.S.	Found in beating samples at seven locations.
Balsam bark weevil *Pissodes dubius* Rand.	Balsam fir Black spruce Red spruce White spruce	Region	In New Brunswick, common on dead and dying balsam fir and to a lesser extent on spruces (red, black, white). About 7% of balsam fir affected at 25 locations in nine counties. In Nova Scotia, an average of 12% of balsam fir affected in Cape Breton, Richmond and Victoria counties. In Prince Edward Island, 33% of red and white spruce trees affected at Dalvay and Melville, Queens County.
Balsam fir bark beetle *Pityokteines sparsus* (Lec.)	Balsam fir	N.B. N.S.	Present in many weakened balsam fir trees throughout most of New Brunswick. Highest infestations found at Cassilis, Northumberland County (48%) and on Pabineau Falls Road, Gloucester County (40%). In Nova Scotia, 8% of tres infested in a stand in Cape Breton County.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir Black spruce Red spruce White spruce	Region	Present in low numbers at a few locations scattered throughout the Region. More common in Nova Scotia.
Balsam shootboring sawfly *Pleroneura brunneicornis* Roh.	Balsam fir	N.B. N.S.	In New Brunswick, an average of 8% of shoots infested at nine scattered locations. In Nova Scotia, 1% of the shoots infested, at one location in Queens County, of 16 areas checked in the Province.
Beech bark disease *Nectria coccinea* var. *faginata* Lohm., Wats. **Beech scale** *Cryptococcus fagisuga* Lind.	Beech	Region	Cankered trees remain common throughout the Region. Average of cankered trees was 98% in New Brunswick (4 locations) and 86% in Nova Scotia (range 68-100% at 10 locations).

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Birch sawfly *Arge pectoralis* (Leach)	White birch	N.B. N.S.	Found at Beaverbrook Road, Northumberland County, New Brunswick, and East Lake Ainslie, Inverness County, Nova Scotia.
Black leaf blister *Taphrina dearnessii* Jenkins	Red maple	N.B. N.S.	In New Brunswick, moderate (32%) infection in two areas in Northumberland County, in Nova Scotia light infection at several locations.
Bruce spanworm *Operophtera bruceata* (Hlst.)	Trembling aspen	N.S.	Found only at one location in the Region, in Cumberland County, Nova Scotia, in 1987.
Canker of larch *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	N.B. N.S.	Found at two locations each in New Brunswick and Nova Scotia.
Cedar leafminers *Argyresthia aureoargentella* Brower *Argyresthia freyella* Wlshm. *Coleotechnites thujaella* (Kft.)	Cedar	N.B. P.E.I.	In Prince Edward Island, infestations persisted in parts of Prince County in the same areas and at the same levels as in the past years in patches between Wellington and Miscouche South. Chronic attack in the Muddy Creek area caused further tree deterioration and mortality. In New Brunswick, an average of 16% of the trees affected at 11 locations in Charlotte, Gloucester, Madawaska, St. John and York counties.
Cherry blight	Pin cherry Choke cherry	Region	Present at varying levels of intensity throughout much of the Region. More common than in previous years in parts of New Brunswick.
Cherry casebearer *Coleophera pruniella* Clem.	Trembling aspen	N.S.	Light browning at Wallace, Cumberland County.
Condition of spruce	White spruce	N.B.	Continued deterioration of mature spruce trees in the Robinsonville, Dawsonville, and Glenlevit areas of Restigouche County likely due to a combination of several secondary organisms.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Conifer aphids Cinara spp. Cinara nigra (Wilson) C. ontarioensis Bradley C. nigripes Bradley C. obscura Bradley	Balsam fir	Region	Common throughout the Region, sometimes affecting the majority of trees in localized situations, but causing little damage. A first report for Cinara nigra from Hampton Corner, York County. C. ontarioensis from New Scotland, Westmorland County, both on jack pine, C. nigripes on black spruce at West Sabbies River, Northumberland County and C. obscura on spruce at Blue Mountain, Restigouche County, New Brunswick.
Deterioration of Cedar	Cedar	N.B.	Condition of cedar trees in Charlotte and St. John counties improved in 1987. Thin crowns were still evident, damage by cedar leafminer and brown cedar leafminer was trace or light. Initial cause of the deterioration remains uncertain.
Diplodia tip blight Sphaeropsis sapinea (Fr.) Dyko & Sutton	Red pine Scots pine	N.S.	Present on ornamental trees in Halifax, Yarmouth and Lunenburg counties.
Eastern blackheaded budworm Acleris variana (Fern.)	Balsam fir	Region	Present in very low numbers throughout the Region.
Eastern dwarf mistletoe Arceuthobium pusillum Peck	Spruce	Region	Present at low levels in the Region.
Eastern spruce gall adelgid Adelges abietis (L.)	Red spruce White spruce Norway spruce	Region	Present throughout the Region, generally at trace to light infestation levels. Highest infestations in 1987 were 36% in New Brunswick, 37% in Nova Scotia and 11% in Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Eastern tent caterpillar *Malacosoma americanum* (F.)	Apple Cherry	Region	Populations generally low throughout although more common than in previous years in many areas of New Brunswick especially in the southern part of the Province. Nests in only one area in Prince Edward Island.
Elm leaf aphid *Tinocallis ulmifolii* (Monell)	Elm	N.B.	Populations very high at Fredericton, York County, where cars and streets were covered with a layer of honeydew that tended to collect dust and dirt.
Elm leaf beetle *Pyrrhalta luteola* (Mull.)	Elm	N.B.	Was present at low levels at Fredericton, York County.
Elm leafminer *Fenusa ulmi* Sund.	English elm Rock elm	Region	Present at various intensity levels throughout, wherever exotic elms are present. Severe leaf browning common in all three Provinces.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Austrian pine Mugho pine	N.B. N.S.	Present on ornamentals in low numbers.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Spruce	Region	Populations remained low throughout the Region and decreased sharply at the permanent plots at the Acadia Forest Experiment Station, Sunbury Co., New Brunswick.
European pine shoot moth *Rhyacionia buoliana* (D. & S.)	Red pine Jack pine	Region	Populations low throughout Region, except at North Granville, Queens County, Prince Edward Island, where 59% of shoots were damaged in a red pine plantation.
Fall cankerworm *Alsophila pometaria* (Harr.)	Hardwoods	Region	All outbreaks collapsed in the Region, and populations were low throughout. One solitary maple tree had light to moderate defoliation at Nash Creek, Restigouche County, New Brunswick.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Fall webworm *Hyphantria cunea* (Dru.)	Deciduous	Region	In Nova Scotia, nests common again on roadside bushes in the western half of the Province and scattered nests noted elsewhere. In New Brunswick, a single nest was noted in Kouchibouguac National Park. In Prince Edward Island, scattered nests were present throughout Prince County.
Fir coneworm *Dioryctria abietivorella* (Grt.)	Conifers	N.B. N.S.	Few larvae at two locations in New Brunswick and one in Nova Scotia.
Flat leaftier *Psilcorsis reflexella* Clem.	Trembling aspen Largetooth aspen White birch Red oak	Region	Common in western Nova Scotia, as much as 85% of red oak foliage affected in a stand in Shelburne County. Present at a few locations in New Brunswick, not seen in Prince Edward Island.
Forest tent caterpillar *Malacosoma disstria* Hbn.	Hardwoods	Region	Populations very low throughout and expected to remain so in 1988 as indicated by light trap catches and pheromone surveys. Damage of trembling aspen, resulting from the recent outbreak, is widespread (see under Condition of Aspen). The only population of note present in the Granton area, Pictou County, Nova Scotia.
Foureyed spruce bark beetle *Polygraphus rufipennis* (Kby.)	Black spruce Red spruce White spruce	N.B. P.E.I.	Found at nine locations scattered throughout New Brunswick with an average of 8% of trees affected. Highest incidence (16%) in Sunbury County in New Brunswick and at Dalvay, Queens County in the Prince Edward Island National Park.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine Lodgepole pine	N.B.	Common in many areas of New Brunswick both in plantations and natural stands. As much as 56% of trees affected in some jack pine plantations.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Spruce	N.B. N.S.	Populations very low.
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Red maple	Region	Populations very low, found only in Digby, Pictou and Shelburne counties in Nova Scotia.
Ink spot of aspen *Ciborinia whetzelli* (Seaver)	Trembling aspen	Region	At generally low levels. Light infection at a few locations.
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine	Region	Declined to endemic levels throughout the Region.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Region	Defoliation severe or moderate on a few roadside trees in Kings County, moderate or light in Charlotte County and light on an ornamental tree in Fredericton, York County, New Brunswick; moderate or light on a few roadside trees in Cumberland County, Nova Scotia; moderate on a few small trees in Prince County, Prince Edward Island.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen Wire birch	Region	Leafrolling at low levels at scattered locations, except in two areas of Pictou County, Nova Scotia where light to moderate leaf rolling occurred on about 100 ha. Forest tent caterpillar was also involved in the Granton area of Pictou County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Larch needleworm *Zeiraphera improbana* (Wlk.)	Tamarack	N.S.	Found at four widely scattered locations in mainland Nova Scotia at trace level.
Leaf blister *Taphrina carnea* Johanson	Birch	N.B.	Light infection at most sample points.
Leaf blotch of horse-chestnut *Guignardia aesculi* V.B. Stew.	Horse-chestnut	Region	Foliage browning dramatically reduced from previous years. In New Brunswick leaf (Peck) browning light in Charlotte County and other areas where the host is present; in Nova Scotia moderate and light browning in Hants and scattered areas of Pictou and Kings counties.
Leaf and twig blight of aspen *Venturia macularis* (Fr.) Muell. & Arx	Largetooth aspen Trembling aspen	Region	Common throughout the Region. Leaf and shoot damage averaged 9% on 50% of trees in New Brunswick (21 locations, highest 32%) and 21% on 62% of trees in Nova Scotia (23 locations, highest 76%). Present in all three counties in Prince Edward Island but damage no higher than light at any location.
Leaf rollers on birch *Caloptilia* sp.	White birch Wire birch Yellow birch	N.B. N.S.	Widely distributed throughout New Brunswick and Nova Scotia. Leaf rolling at trace level on 73% of trees in New Brunswick (42 locations) and on 33% of trees in Nova Scotia.
Leaf spot of poplar *Drepanopeziza tremulae* Rimpau	Trembling aspen	N.S.	Browning of all leaves on every tree at West St. Andrews, Colchester County and 36% of leaves on all trees at White Rock, Kings County.
Lesser maple spanworm *Itame pustularia* (Gn.)	Red maple	Region	Populations very low throughout. Even the highest light trap catch (314 moths) in the Region in Kejimkujik National Park, Nova Scotia was the lowest in more than ten years at that location.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Maple leafroller *Sparganothis acerivorana* MacK.	Red maple Sugar maple	Region	In Prince Edward Island, general decrease in populations, except for severe leafrolling of red maple over 10 ha near Central Bedeque, Prince County and moderate at Stanhope, Queens County. In New Brunswick populations generally light except for moderate leafrolling of sugar maple at Astle, York County. In Nova Scotia populations remained very low.
Mites			
Nalepella halourga Keifer	Black spruce White spruce	N.B.	A first report for this Eriophyid mite, found on black spruce at Grindstone Brook, Victoria County and Wildcat Brook, Restigouche County. It appears to be responsible for needle stippling but its damage potential is unclear. Also on white spruce clone bank at Acadia Forest Experiment Station, Sunbury County causing reddening and stippling of foliage.
Oligonychus milleri (McGregor)	Jack pine Red pine	Region	Mite populations, at levels damaging to pines, collapsed throughout the Region except for a few pockets in jack pine plantations in Victoria and York counties, New Brunswick and Prince County, Prince Edward Island. In Nova Scotia, the mite infestation on red pine in the Trafalgar burn area on the eastern mainland collapsed and plantations appear much healthier with the loss of older damaged foliage.
Oligonychus ununguis (Jacobi)	Red spruce	N.B.	Trace discoloration by the spruce spider mite in York County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Trisetacus distinctum Smith	Cedar	N.B.	A first report for this eriophyid mite, from Upper Hainesville, York County. Its damage potential is unknown.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	Region	Severe or moderate defoliation of ornamentals at scattered locations in York County, New Brunswick, Colchester and Cape Breton counties, Nova Scotia and Kings County, Prince Edward Island. Light defoliation elsewhere.
Needle casts			
Lirula macrospora (Hartig) Darker	Spruce	N.B. N.S.	Moderate needle infection in Fundy National Park in New Brunswick. Common in Nova Scotia but infections light.
Davisomycella ampla (Davis) Darker	Jack pine	N.B.	Trace to light infection on a few trees in Kings County, New Brunswick.
Lirula nervata (Darker) Darker	Balsam fir	N.B. N.S.	At various levels of intensity at a few locations in New Brunswick and Nova Scotia. More common in Nova Scotia.
Northern cedar bark beetle *Phloeosinus canadensis* Sw.	Cedar	N.B.	Red flagging of 88% of shoots at South Knowlesville, 49% at Armond, and 23% at Hale, Carleton County, 35% of shoots affected in an area in Restigouche County. Shoot damage also in other areas of Carleton and York counties.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Jack pine Scots pine	Region	In New Brunswick, widespread in jack pine plantations with as much as 54% of the trees affected along the Big Eskedellac River in Northumberland and Gloucester counties. In Nova Scotia, nodules present on 84% of the trees near East Apple River, Cumberland County. Also observed in Pictou County. Found in one plantation in Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Obliquebanded leafroller *Choristoneura rosaceana* (Harr.)	Siberian pea Trembling aspen White birch	Region	Present in very low numbers.
Orangehumped mapleworm *Symmerista leucitys* Francl.	Beech Sugar maple	N.S.	At endemic levels.
Pepper-and-salt moth *Biston betularia cognataria* (Gn.)	Mountain ash Manitoba maple	N.S. P.E.I.	Trace defoliation only at one location each in both Nova Scotia and Prince Edward Island.
Pine bark adelgid *Pineus strobi* (Htg.)	Pine	Region	Widely distributed and common. Infestations generally low occasionally at light intensity.
Pinkstriped oakworm *Anisota virginiensis virginiensis* (Drury)	Red oak	Region	Few larvae at one location in Nova Scotia.
Poplar leaffolding sawfly *Phyllocolpa* sp.	Trembling aspen Largetooth aspen	Region	On trembling aspen an average of 13% of leaves affected in New Brunswick (36 locations), 14% in Nova Scotia (32 locations) and 8% in Prince Edward Island (8 locations). The number of trees affected averaged 77%, 88% and 55% for the three provinces, respectively. Largetooth aspen was infested in Charlotte County, New Brunswick and Pictou County, Nova Scotia. Infestation levels were light (24% and 11% respectively).
Poplar leafmining sawfly *Messa populifoliella* (Town.)	Carolina poplar Trembling aspen	N.B. N.S.	Leaf mining of ornamental Carolina poplar moderate and severe at Fredericton, York County and light in York and Victoria counties, New Brunswick. Leaf mining on trembling aspen trace in Pictou, Colchester and Digby counties, Nova Scotia.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Poplar petiolegall moth *Ectoedemia populella* Busck	Trembling aspen	N.S.	Present in some areas in the eastern part of the province, infesting up to 27% of leaf petioles on most trees at Maryvale, Antigonish County.
Premature needle loss	Black spruce	N.B.	The prematue loss of the previous year's foliage reported from Victoria and Madawaska counties in 1986 continued in 1987. This year approximately 1000 ha of high value plantations suffered light to severe loss of 1986 needles. At two severely affected locations about 75% of 1986 foliage complement was lost. The cause of the needle loss remains unexplained to date.
Ragged spruce gall adelgid *Pineus similis* (Gill.)	Red spruce	Region	At scattered locations throughout the Region at low levels. Most common in Nova Scotia.
Redheaded jack pine sawfly *Neodiprion virginiana* complex	Jack pine Scots pine	N.S.	Noticeable defoliation on ornamental Scots pine at Springville, Pictou County. Also found in a jack pine plantation near Shulie Lake, Cumberland County.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Red pine	N.B.	A few shoots infested at Sussex, Kings County.
Red spruce adelgid *Pineus floccus* (Patch)	Black spruce Red spruce	N.B. N.S.	In New Brunswick, a few galls present on scattered trees in plantations and natural stands in York, Kent, Northumberland, Gloucester, Restigouche and Madawaska counties; up to half the red spruce affected in a young stand in Northumberland County. In Nova Scotia, up to 40% of red spruce affected in a stand in Digby County and galls found on red spruce in a few widely scattered areas in Lunenburg and Queens counties.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Resin flow	White spruce	P.E.I.	Scars in bark and pitch flow common on underside of branches in areas of southern Kings County. Bark is not missing but there are numerous spots of pitch on the underside of branches.
Satin moth *Leucoma salicis* (L.)	Carolina poplar Silver poplar Trembling aspen Willow	Region	In New Brunswick, severe defoliation on Carolina poplar at New Maryland, York County, moderate defoliation on ornamental willows and poplars at Janeville, Gloucester County. No noticeable defoliation of trembling aspen in the Popple Depot, Northumberland County, area where severe defoliation occurred in 1986. In Nova Scotia, no noticeable defoliation. In Prince Edward Island, defoliation severe on ornamental poplars at Wellington, Prince County, moderate on a few trees at Royalty, Queens County and light at St. Peter, Kings County.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Sugar maple	Region	At endemic levels in the Region.
Spring cankerworm *Paleacrita vernata* (Peck)	Elm	N.S.	At endemic levels.
Spruce bud midge *Rhabdophaga swainei* Felt	Black spruce Red spruce White spruce	Region	Populations low but widespread throughout. No more than 8% of the buds infested anywhere in the Region.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Spruce bud scale *Physokermes piceae* (Schr.)	Black spruce Red spruce White spruce	Region	Present in plantations, natural forests and on ornamentals throughout Nova Scotia and scattered locations in New Brunswick and Prince Edward Island. More than 36% of branches of most black spruce infested in areas of Inverness and Digby counties, more than 23% of nearly all red spruce infested in several areas in Digby County, Nova Scotia. Moderate infestation of white spruce at Stanhope, Queens County, Prince Edward Island. In New Brunswick, infestations generally at trace level, except light in a white spruce plantation in Kent County.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Region	Populations remained low (one larva collected at each of 4 locations).
Spruce cone maggot *Hylemya anthracina* (Czerny)	Black spruce Red spruce White spruce	Region	Present at low levels in New Brunswick and Nova Scotia.
Spruce gall adelgid *Adelges lariciatus* (Patch)	White spruce Red spruce Larch	Region	Present at low numbers. Trace damage at scattered locations throughout the Region.
Spruce spittlebug *Aphrophora parallela* (Say)	Red spruce	N.S.	Found at Annapolis Royal, Annapolis County.
Spittlebugs *Aphrophora* sp.	Balsam fir Jack pine Red pine Tamarack White pine White spruce	N.S. P.E.I.	Recorded from scattered areas of Colchester, Halifax and Queens counties, Nova Scotia, and from Kings and Prince counties, Prince Edward Island.
Cercopidae	Balsam fir White birch Yellow birch	N.S.	Present on 40% of white birch trees in an area in Cape Breton County, on 28% of shoots of half the balsam fir trees in Inverness County, and in low numbers on yellow birch in Colchester County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Alder	Region	Populations are low throughout the Region. Only trace defoliation at Grand Harbour, Charlotte County, New Brunswick where defoliation was severe in 1986.
Sugar maple borer *Glycobius speciosus* (Say)	Sugar maple	Region	Present throughout most of New Brunswick. In Nova Scotia 18% of the trees infested at Island Lake, Guysborough County, a few trees near Economy, Colchester County and 20% of trees affected near Kellys Cross, Queens County, Prince Edward Island.
Sulphur dioxide damage	Conifers Hardwoods	N.B.	Condition of the various tree species continued to deteriorate and some mortality of conifers occurred in a plantation near a base metal smelter in Gloucester County.
Sweetfern blister rust *Cronartium comptoniae* Arth.	Lodgepole pine	N.B.	Present and probably causing tree mortality in a small plantation at Nevers Brook, Kent County and near West Branch Sabbies River, Northumberland County.
Tar spot of maple *Rhytisma acerinum* (Pers. ex St. Amans) Fr.	Maple	N.B. N.S.	Found at scattered locations in New Brunswick and Nova Scotia with an average of almost 25% of the leaves affected. As much as 88% of the leaves infected in an area in southwestern Nova Scotia.
Tip blight of balsam fir *Delphinella balsameae* (Waterm.) E. Muell.	Balsam fir	Region	Not found in 1987.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Cherry Poplar Willow	Region	Populations increased dramatically. Found at numerous scattered locations throughout, especially common on roadside bushes in Hants and Antigonish counties, Nova Scotia. Nests as many as $32/100m^2$ recorded in Madawaska County, New Brunswick, $50/100m^2$ in Prince County and $100/100m^2$ at Morrell, Kings County, Prince Edward Island.
Wax filament scale *Xylococculus betulae* (Perg.)	Beech White birch	Region	Infestations on white birch severe and moderate at 5 locations, light at 5 other locations in New Brunswick. In Nova Scotia, infestations severe and moderate on white birch at 5 locations, light on beech at one location. In Prince Edward Island, light infestation on scattered white birch trees in the National Park.
White pine blister rust *Cronartium ribicola* J. C. Fisch.	White pine	Region	Present throughout the Region. In 1987 it was recorded on 28%, 16% and 12% of young trees at locations in Restigouche, Northumberland and Kent counties, New Brunswick, respectively, and on 8% of the trees in an area in Pictou County, Nova Scotia. Observed but not assessed at other scattered locations.
White pine cone beetle *Conophthorus coniperda* (Sz.)	Red pine White pine	N.B. N.S.	The insect attacks the base of second year cones, causing them to shrivel and drop. Cone damage occurred in a red pine plantation at Kempt, Queens County, in a natural white pine stand near River Hebert, Cumberland County, Nova Scotia and on an ornamental white pine at Fredericton, New Brunswick.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
White pine needle blight	White pine	Region	Not reported in 1987.
White pine sawfly *Neodiprion pinetum* Nort.	White pine	N.S.	Populations increased at widespread locations. Moderate and light defoliation of a few roadside trees in the Chignecto Game Sanctuary, Cumberland County, of ornamentals at Parrsboro, Cumberland County and near Five Islands, Colchester County. Numerous larvae at a location each in Cape Breton and in Halifax counties.
White pine weevil *Pissodes strobi* (Htg.)	Jack pine Scots pine White pine Black spruce Norway spruce Red spruce White spruce	N.B. N.S.	Present in plantations and on ornamentals throughout the Region, often causing considerable damage. Selected infestation levels to illustrate extent of damage: 76% of Norway spruce at Kirkland, Carleton County; 40% of white pine at St. Luc, Kent County; 36% of white pine at Semiwagon Ridge, Northumberland County, New Brunswick; 24% of white pine at Garden of Eden Barrens, Guysborough County; 16% of white pine at Indian Fields, Shelburne County, Nova Scotia.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Whitespotted sawyer beetle *Monochamus scutellatus* (Say)	Balsam fir Red spruce White spruce Jack pine	Region	Red flagging of balsam fir caused by adult feeding on the underside of small branches common in western and northern New Brunswick, in Pictou County and scattered throughout the Musquodoboit Valley in Nova Scotia. Sawyer beetles were present in many of the trees that succumbed to the Stillwell's Syndrome (see text). In New Brunswick an average of 13% of balsam fir trees were infested at 19 locations examined. The insect is a factor on the deterioration of fire killed jack pine in northeastern New Brunswick. In Prince Edward Island, 67% of the red spruce and 20% of the white spruce trees were infested in a stand in Queens County.
Willow blight *Venturia saliciperda* Nuesch	Willow	Region	Foliage browning present but at the lowest levels in years in the Region. In western Nova Scotia, where the reduction was most significant, hedgerows and individual trees are in poor condition in parts of Kings County as a result of repeated severe willow blight during past years.
Willow flea weevil *Rhynchaenus rufipes* (Lec.)	Trembling aspen Willow	Region	Severe and moderate browning of ornamental willows and to a lesser extent trembling aspen, in much of eastern New Brunswick, throughout eastern Nova Scotia, in western Prince Edward Island and at scattered locations elsewhere in the Region.
Winter moth *Operophtera brumata* (L.)	Deciduous	N.S.	Not collected in 1987.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce	Region	Low populations found at 9 locations in New Brunswick and 20 locations in Nova Scotia. Moderate defoliation of ornamental spruce in Westmorland County, New Brunswick. In Prince Edward Island, moderate defoliation of scattered black spruce trees near Mt. Carmel, Prince County. Only light defoliation in the two black spruce plantations at Dromore, Queens County and at Peakes, Kings County where defoliation was severe in 1986.
Yellow witches broom on spruce *Chrysomyxa arctostaphyli* Diet.	Red spruce	N.S.	Present on scattered red spruce trees in Shelburne and Yarmouth counties.

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The collective experience in the Forest Insect and Disease Survey has been further depleted at the end of 1987 with the retirement of Fred Titus after 30 years of hard work, loyal and dedicated service. While we will miss Fred's knowledge, experience and comraderie, we are happy for him and wish him well. Thank you Fred and God bless!

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