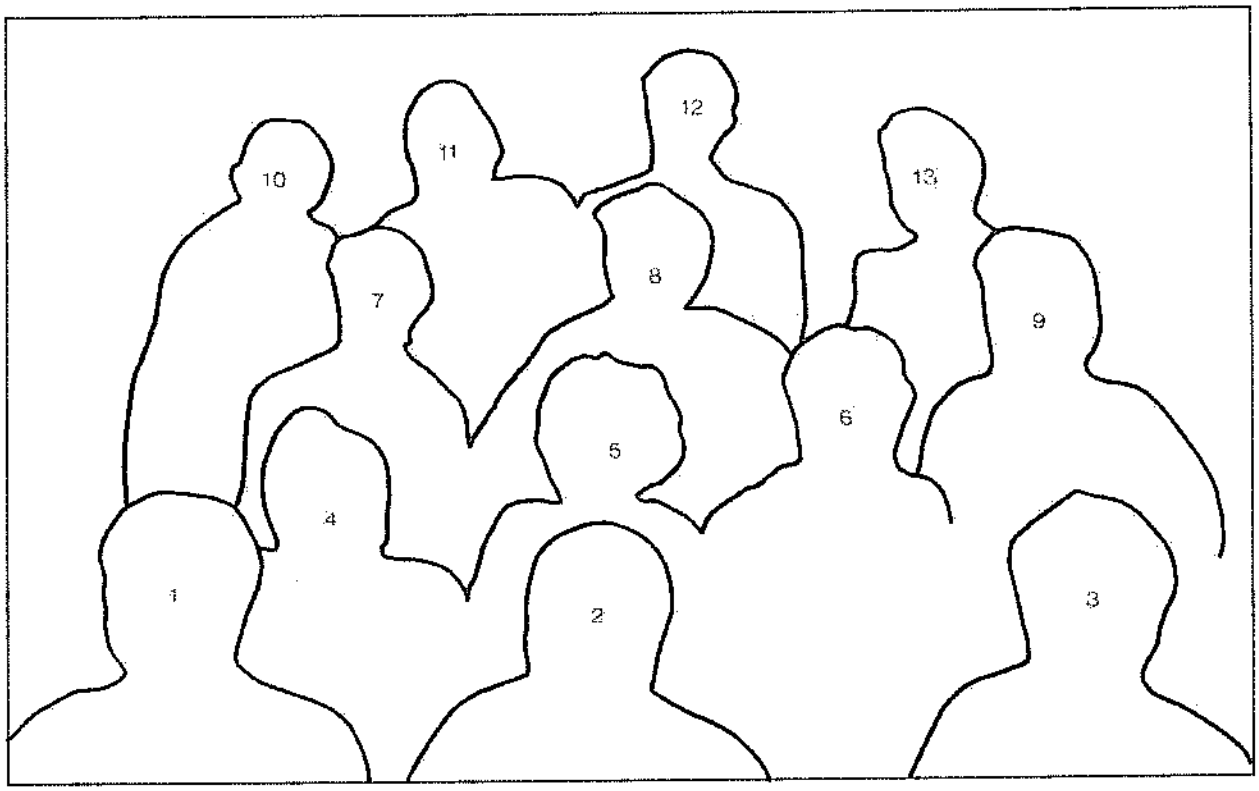
Forest pest conditions in the Maritimes in 1990

Laszlo P. Magasi

Maritimes Region • Information Report M-X - 178

Forestry Canada Forêts Canada



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(Photo on front cover)

FOREST PEST CONDITIONS IN THE MARITIMES

IN 1990

by

Laszlo P. Magasi

Information Report M-X-178

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ABSTRACT

This report reviews the status of forest insects and diseases in the Maritimes region in 1990 and forecasts conditions for 1991, when appropriate. Pests and problems of conifers, hardwoods, and high value areas, such as nurseries, seed orchards, plantations, and Christmas tree areas, are described as observed in 1990. Control operations against spruce budworm, hemlock looper, and Sirococcus shoot blight are summarized. A chapter on forest health monitoring brings together the various aspects of work dealing with changes in forest conditions, some of which are still unexplained. Forest insect monitoring systems, pheromones and light traps, both important tools in predicting population changes, are briefly described. A list of reports and publications relating to forest pest conditions is included. More detailed information is available from Forestry Canada - Maritimes Region.

RÉSUMÉ

Ce rapport fait le bilan des insectes et maladies des arbres de la région des Maritimes en 1990, et donne un aperçu des conditions prévues pour 1991, lorsqu'approprié. Ce rapport contient une description des ravageurs des conifères, des feuillus et des zones de grande valeur (Pépinères, vergers à graine, plantations, zones de culture d'arbres de Noël, etc.), ainsi que d'autres problèmes de ces arbres et zones, tels qu'ils ont été observés en 1990. On y trouve un résumé des mesures de répression prises contre la tordeuse des bourgeons de l'épinette, l'arpenteuse de la pruche et la brûlure des pousses Sirococcus. Une section est consacrée à la surveillance de la santé de la forêt; elle traite des divers aspects des tâches reliées aux changements que subit la forêt, dont un certain nombre sont encore inexpliqués. Ce rapport décrit brièvement les systèmes de surveillance des insectes forestiers, le piégeage aux phéromones et les pièges lumineux, qui sont des outils importants pour la prévision des changements dans les populations d'insectes. Ce rapport, enfin, comprend une liste de publications (rapports, etc.) sur les insectes forestiers. On peut obtenir de plus amples renseignements auprès de Forêts Canada - région des Maritimes.

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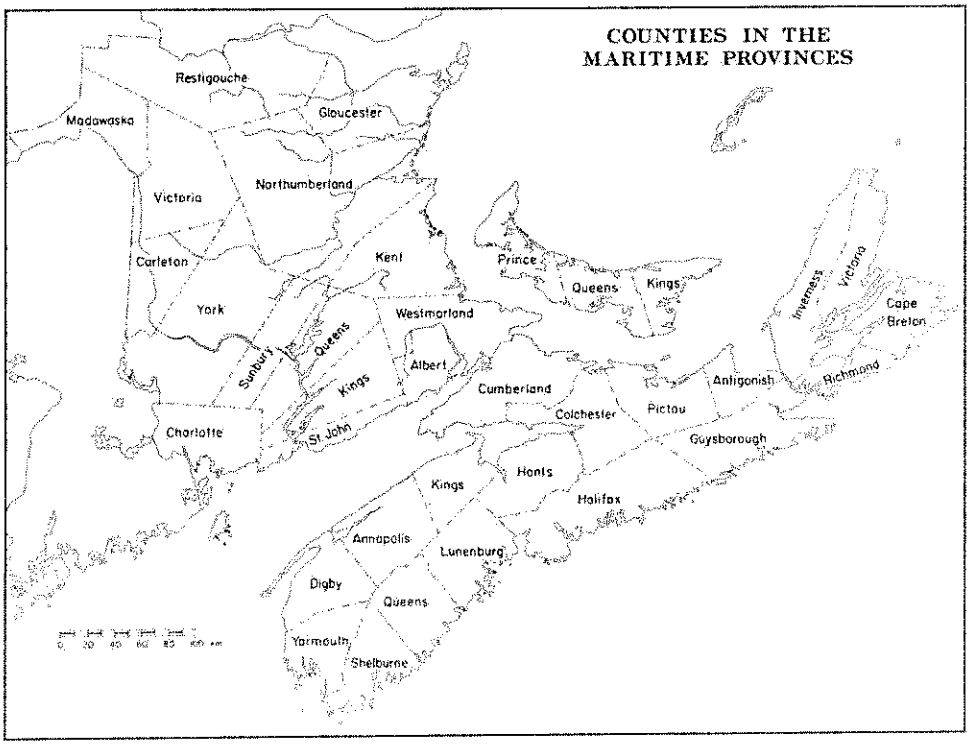
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Restigouche
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Madawaska
Northumberland
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Kent
Carleton
Prince
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Kings
Inverness
Victoria
Cape
Breton
York
Westmorland
Sunbury
Queens
Albert
Kings
Cumberland
Antigonish
Richmond
Colchester
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Halifax
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Lunenburg
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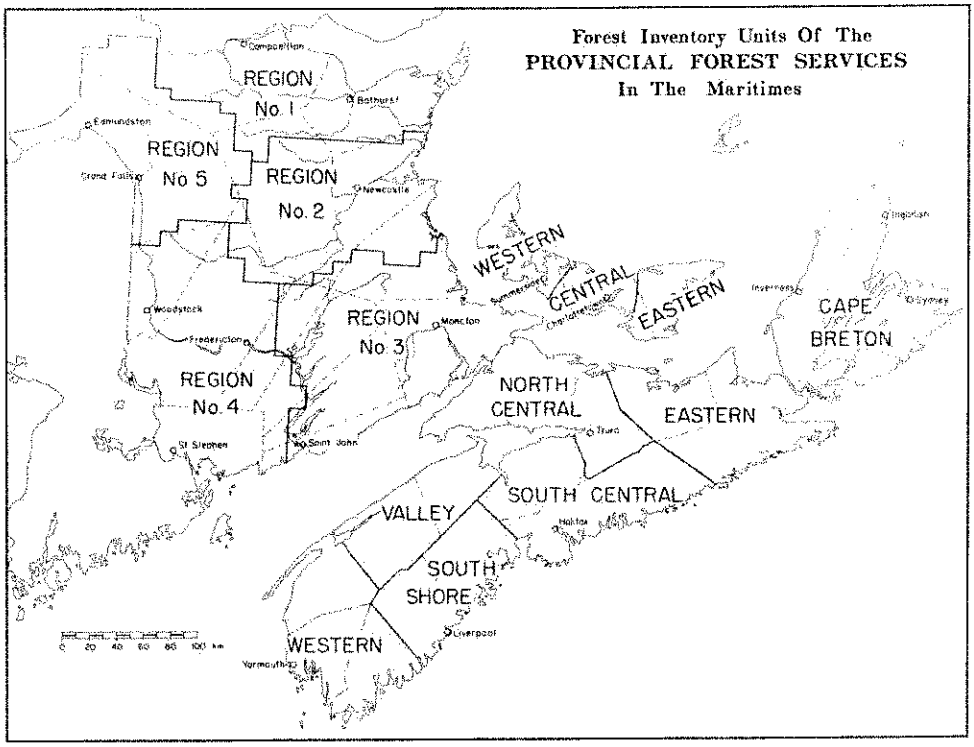
Yarmouth
Shelburne


Forest Inventory Units Of The
PROVINCIAL FOREST SERVICES
In The Maritimes
REGION
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WESTERN
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EASTERN
CAPE
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NORTH
CENTRAL
EASTERN
SOUTH CENTRAL
VALLEY
SOUTH
SHORE
WESTERN

INTRODUCTION

The recently released Strategic Plan 1990-1995 of Forestry Canada - Maritimes Region states that:

> "Forestry Canada - Maritimes will, through its Forest Insect and DiseaseSurvey, capture the condition, health,and changes in the forest conditions and report these to our clients both at the regional and national levels".

This statement is an affirmation of the mandate on which the operation of the Forest Insect and Disease Survey has been based since the establishment of the unit in 1936. In the Maritimes, information on forest pest conditions and the effect of these on the forest is disseminated 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, pests and problems of conifers, hardwoods, and high value areas, such as nurseries, seed orchards, plantations, and Christmas tree areas, are described as they were observed in 1990. Control operations against spruce budworm, hemlock looper, and Sirococcus shoot blight are summarized. A chapter on forest health monitoring brings together the various aspects of work dealing with changes in forest conditions, some of which are still unexplained. Forest insect monitoring systems, pheromones and light traps, both important tools in predicting population changes, are briefly described. A list of reports and publications relating to forest pest conditions is included.

This report aims to provide forest managers with information on pest conditions in the Maritime provinces early enough that it can be considered in management decisions before the start of the 1991 field season. Insects and diseases that were widespread and caused considerable concern in 1990 are discussed in detail, others are presented in tabular form. More information on these and on other specific conditions will be provided by Forestry Canada - Maritimes Region upon request.

Two maps are included on the page facing this introduction 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.

Efforts towards collecting and reporting information in quantitative terms are 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%

Much of the information contained in this report has been collected by personnel of the Forest Insect and Disease Survey. However, the level of cooperation with clients has increased significantly in recent years and more and more of the work now is being done on a cooperative basis. While the contribution of our clients is acknowledged, the Forest Insect and Disease Survey remains responsible for the contents of this report.

The cover of this report, in a departure from the usual practice of illustrating either a forest pest of current concern or some specific activity, introduces the personnel of the regional Forest Insect and Disease Survey, the "FIDS Team from the Maritimes", as we embark on a new decade.

CONIFERS - PESTS AND PROBLEMS

SPRUCE BUDWORM

Information presented on the spruce budworm, *Choristoneura fumiferana* (Clem.), is summarized from various sources: New Brunswick Department of Natural Resources, Forest Protection Limited, J.D. Irving Limited, Nova Scotia Department of Lands and Forests, and Forestry Canada - Maritimes Region. 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 one of the major defoliators in the fir-spruce forest, the area of defoliation is generally declining.

New Brunswick

Defoliation of balsam fir and spruce stands was recorded on 297,000 ha in the province in 1990 (Fig. 1). Defoliation was severe on 91,000 ha, moderate on 146,000 ha and light on 60,000 ha. The 237,000 ha of severe and moderate defoliation was about 40% less than the 396,000 ha recorded in these categories in 1989 and was the lowest since 1967. Even more significant is the reduction in the proportion of severe defoliation in the severe and moderate defoliation class to just over one-third (38%) in 1990 from two-thirds (67%) in 1989. All defoliation, as recorded during aerial surveys, occurred in the northern half of the province, mostly in northcentral New Brunswick.

Control operations - Foliage protection against the spruce budworm in New Brunswick was conducted over 561 785 ha in 1990: 533 185 ha by Forest Protection Ltd. and 28 600 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd.

Forest Protection Ltd. treated 533 185 ha of forest in 1990. All but 0.4% of this received two applications in the following sequence: fenitrothion-fenitrothion (68%); *B.t.*-*B.t.* (23.3%); fenitrothion-*B.t.* (9.3%). The rates of application were 210 g/ha for fenitrothion (Sumithion®) and 15 BIU/ha for *B.t.* (Futura XLV-HP®). The remaining 0.4% of the area received a single application of *B.t.* at the rate of 30 BIU/ha.

Forest Patrol Ltd. treated 28 600 ha of forest in 1990. Of this, approximately 27 200 ha received two applications of fenitrothion (Sumithion®) at the rate of 210 g/ha/application, and the remaining 1400 ha received a single application of fenitrothion. Several stream buffers in the Deersdale area were treated by a single application of *B.t.* (Futura XLV-HP®).

Forecast - Based on overwintering larval (L_2) surveys conducted by the New Brunswick Department of Natural Resources, the prediction for 1991 is a total infestation area of over 990 000 hectares. Of this, 770 000 ha are expected to be in the medium to high infestation categories and 220 000 ha to be 'variable', mostly light to medium. Most of the infestation is again expected in northcentral New Brunswick.

Nova Scotia

Defoliation - For the fourth consecutive year, no defoliation of balsam fir or spruce was observed during the annual spruce budworm aerial survey in Nova Scotia in 1990. However, ground observation detected low levels of defoliation in small areas in all four counties on Cape Breton Island.

Control - No control measures on an operational scale were carried out against the spruce budworm in Nova Scotia in 1990.

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 240 sample locations indicates that, while spruce budworm populations remain either negligible or low at 83% of these locations, some population increases are present. Population levels are moderate at 10.8%, high at 1.3%, and extreme at 0.4% of the locations sampled. The high and extreme areas were found along western coastal Inverness County and these will need to be watched closely in 1991.

Prince Edward Island

Defoliation - Noticeable defoliation, mostly of white spruce and to a lesser extent of balsam fir, was present again in 1990, almost exclusively on the eastern part of the province. The total area of

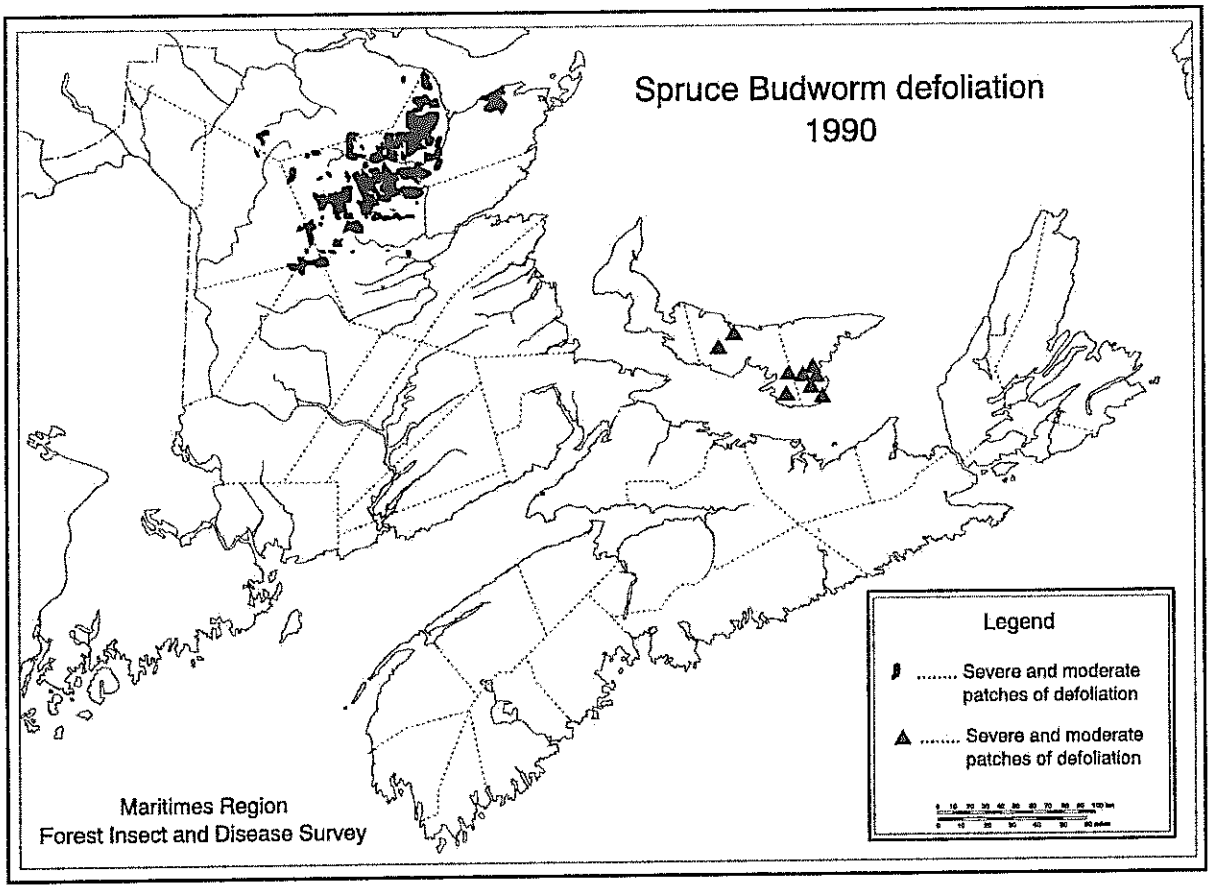

Figure 1

severe and moderate defoliation, which occurred in isolated patches (Figure 1), was approximately 100 ha, about the same as recorded in 1989. Most of the defoliation was moderate, severe defoliation was observed only on a few scattered trees. The defoliated patches were recorded in the area of Springton, Oyster Bed Bridge, Newton Cross, South Pinette, and Orwell, in Queens County, and near Pooles Corner, Victoria Cross, Montague, Commercial Crosss, and Milltown Cross in Kings County. In western Prince Edward Island, defoliation was negligible.

Control - No control measures on an operational scale were carried out against the spruce budworm in Prince Edward Island in 1990.

Forecast - The survey of overwintering larvae (L_2) was conducted by Forestry Canada - Maritimes Region at 41 locations. Populations were moderate at 5%, low at 75%, and nil at 20% of the locations sampled. These population levels are almost identical to those in 1989 and defoliation is expected to be similar.

HEMLOCK LOOPER

Hemlock looper, *Lambdina fiscellaria fiscellaria* (Gn.), caused defoliation for the second consecutive year in the Christmas Mountain area of northwestern Northumberland County of New Brunswick (Figure 2). Balsam fir was severely defoliated by hemlock looper alone over an area of 765 ha along the East Branch of the North Pole Stream. An additional 2712 ha of forest was defoliated in the same general area by a combination of hemlock looper and spruce budworm for a total of almost 3500 ha. This outbreak is the first ever reported in New Brunswick since the establishment of the Forest Insect and Disease Survey in 1936. Elsewhere in the province, larvae were found throughout. Populations were generally low except in western Charlotte and southwestern York counties but no noticeable defoliation occurred.

An estimated 71 000 m^3 of balsam fir was killed by hemlock looper in the 2350 ha outbreak area in Northumberland County during 1989-1990. To es-

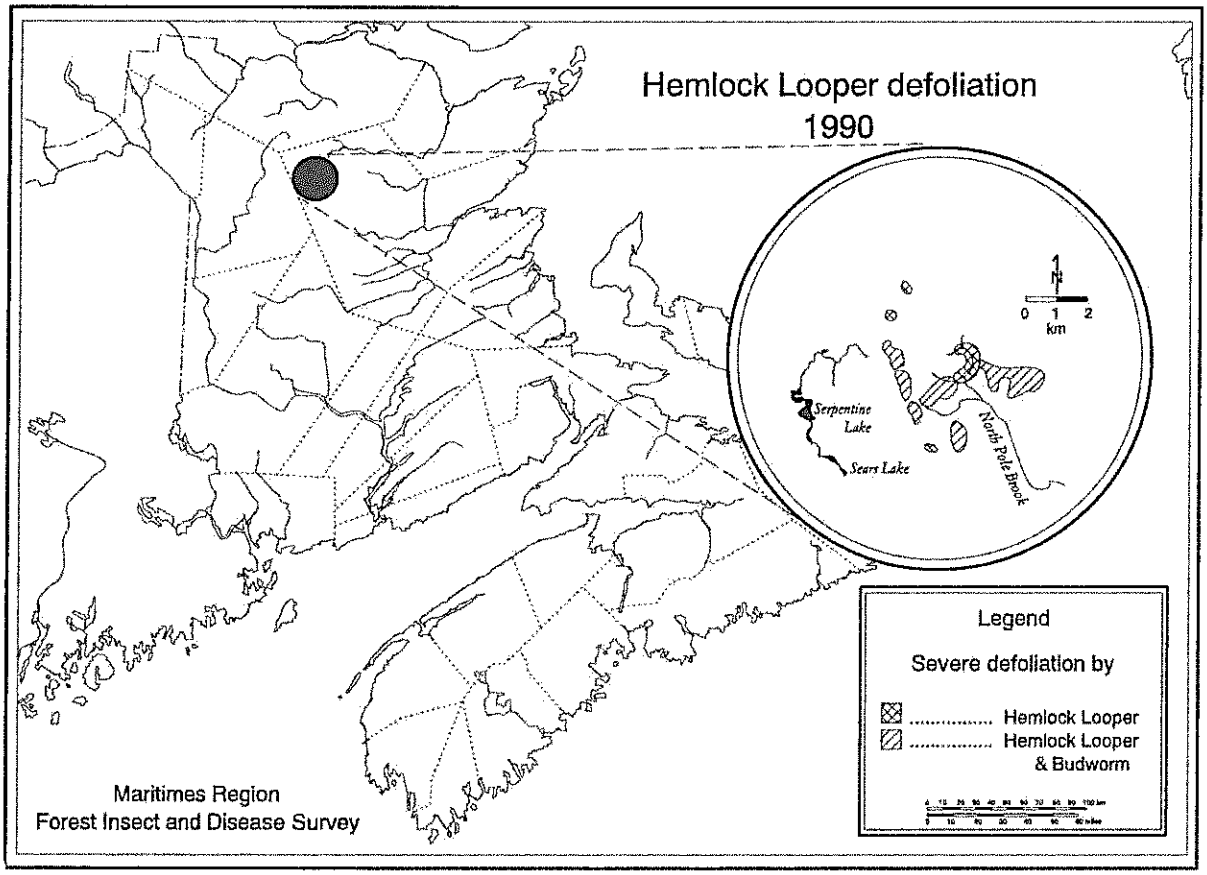

Figure 2

timate the damage caused by hemlock looper, tree condition was assessed in the spring and fall of 1990 on nine prism points in each of three areas with different degrees of defoliation in 1989 (severe, moderate, and none). The area has a history of spruce budworm damage, as evidenced by the high percentage of old-dead trees. Hemlock looper also may have contributed to this earlier mortality, as it may have been present before the discovery of the outbreak in 1989. However, recently dead trees were almost certainly killed by hemlock looper, a voracious feeder of all age classes of balsam fir foliage. A summary of some of the results (Table 1) shows both a close relationship between recent tree mortality and degree of defoliation, and that tree mortality is continuing. Salvage operations are in progress in the area.

In Nova Scotia, hemlock looper larvae were present on a wide variety of coniferous and deciduous hosts in all 18 counties of the province but the populations were very low and no defoliation occurred.

In Prince Edward Island, the population that caused defoliation of larch in the Camp Tamawaby Demonstration Woodlot in 1989, collapsed. No defoliation occurred anywhere in the province, although a few larvae were found in many areas of Prince and Queens counties. The highest population, 51 larvae/m^3 of foliage, was found in the Foxley River Demonstration Woodlot in Prince County on white spruce but no noticeable defoliation occurred even there.

Control operations - Foliage protection and population suppression against the hemlock looper in New Brunswick was conducted over 21200 ha by Forest Protection Limited. Of this, 17,800 ha were treated in three applications in a sequence of fenitrothion - *B.t.* - fenitrothion, the remaining 3400 ha received two applications of *B.t.* The rates of application were 210 g/ha for fenitrothion (Sumithion®) and 30 BIU/ha for *B.t.* (Futura XLV-HP®).

Table 1. Tree mortality in forest stands defoliated to different degrees by hemlock looper in New Brunswick in 1990

Stand Defoliation Level	Tree Condition Class	Percent of Total Volume	
		May 1990	Oct. 1990
Severe	Living	16	9
	Recent dead	45	52
	Old dead	39	39
Moderate	Living	63	56
	Recent dead	8	15
	Old dead	29	29
None (control)	Living	70	Stand cut
	Recent dead	5	Stand cut
	Old dead	25	Stand cut

SPRUCE BEETLE

Spruce beetle, *Dendroctonus rufipennis* (Kby.), activity further increased in 1990 causing significant white spruce mortality in some areas in all three provinces.

In New Brunswick, most of the new infestations were observed in the northern part of the province, adding to an already serious situation that started to develop in the early 1980s. Many mature trees along the Tobique and Little Tobique rivers from Plaster Rock, Victoria County, to Nictau Lake, Restigouche County, are newly infested and dying. An infestation in a 260-ha area near Sewell Brook, Victoria County, has already killed many trees and many more are infested and dying. Other infestations were observed in the Murray Brook area and in the Cook-Savoie Gulch in Restigouche County, at 44 Mile Brook and along a 1-2 km stretch of South Branch of Tomogonops River in Northumberland County. In the southern part of the province, a few dead and dying trees were found from Aulac to Port Elgin, Westmorland County, in Fundy National Park, Albert County, and at North Head, Grand Manan Island, Charlotte County.

In Nova Scotia, trees are dead and dying in many small pockets, ranging from a few trees to several hectares in size, in Inverness, Antigonish, Guysborough, Pictou, Colchester, Cumberland, Hants, Kings and Queens counties. Infestation levels are generally higher than in the past few years in all but Queens County. More than 70% of the trees are now dead in a stand in Lower Truro, Colchester County; 48% of the trees are dead, 28% are dying and the remaining 24% of the trees are infested near Casey Corner, Kings County. Red spruce is affected in a small (1-2 ha) area south of North Kingston, Kings County, with most of the trees already dead.

In Prince Edward Island, the upsurge in beetle activity was significant in 1990, especially compared to the decline in beetle populations during the past few years. The infestations were mostly in eastern Queens and in Kings counties. Small pockets of 6-8 newly infested trees were too numerous to count during aerial surveys. The greatest number of pockets were observed in the areas of Belfast, Eldon, Iona, and Wood Islands, Queens County, Gowan Brae, Harmony Junction, Hermanville, and Elmira in the northeastern tip of Kings County. Fewer trees were infested in the western part of the province but they were still common at New Annan, Bayside, Glenwood, and Cabot Provincial Park, Prince County.

EASTERN LARCH BEETLE

Although the populations of the eastern larch beetle, *Dendroctonus simplex* Lec., have been declining since the mid-1980s, the insect continued to attack and kill mature and semi-mature larch trees in all three provinces in 1990.

In New Brunswick, tree mortality was observed in many areas in the southern part of the province. In some of these, infestations are continuing and both newly infested and already dead trees are present. In others, no newly attacked trees were found. Accumulated mortality of 30-40% is common, although in one area south of Fredericton, York County, 71% of the trees died during the past three years.

One additional tree became infested at the central New Brunswick larch mortality plot in 1990. The infestation rate of 1.0% in 1990 contrasts with the peak year of 1987, when the infestation rate was 7.6%. Cumulative larch mortality due to attack by the eastern larch beetle has increased from 6% in the spring of 1979, when the plot was established, to 41% in 1990, an average of 3.2% annual tree mortality during those years.

In Nova Scotia, the situation was similar to that found in New Brunswick, with most of the larch beetle activity recorded in Hants and Cumberland counties. At Lakelands, Cumberland County, 16% of the surviving larch trees were attacked in 1990.

In Prince Edward Island, there was an intensification of beetle activity compared to previous years, especially in Prince County. More than 25 newly killed trees were observed in the Milo and in the North Bedeque areas and new infestations were recorded in eight other areas in the county. Newly infested trees were found at one location in each of Queens and Kings counties.

EUROPEAN LARCH CANKER

The known range of the European larch canker, which is caused by the fungus *Lachnellula willkommii* (Hartig) Dennis, changed only slightly in 1990 with the discovery of the disease at Lower Mount Thom, Pictou County, at the edge of the large infected area in central Nova Scotia. This does not represent a recent spread of the disease as 53% of the semi-mature trees possess 1-3 cankers, indicating a long standing infection. The disease was not found at any of the other 58 locations examined outside the known range, which has not changed significantly since 1981-1982 when the first surveys were conducted.

SCLERODERRIS CANKER

Damage by Scleroderris canker, caused by the fungus *Gremmeniella abietina* (Lagerb.) Morelet, has been increasing in New Brunswick pine plantations since 1987 when there was an upsurge in new infections following several years of minimal activity. The disease is widespread in the Deersdale area of York and Carleton counties in both jack pine and red pine plantations. Even though all trees are infected in some plantations, the damage in most cases is confined to the lower 1/3-1/4 of the crown - and is often mistaken for natural pruning in 10- to 20-year-old plantations. The disease is also common and, in some plantations, incidence is just as high, along the Little River and Grindstone River in Victoria County, the Despres Lake area of Northumberland County, and the Blue Mountain area in Restigouche County.

The disease was observed in some of the areas where the European race of Scleroderris canker was identified in the past. Laboratory testing is not yet complete but the fact that this race has not been found since 1981 in any but one of the areas and that recent research indicates that past identifications of the European race on jack pine may have been in error, suggests that the distribution of this race is very limited in New Brunswick.

Scleroderris canker has not been seen in Nova Scotia since 1978 and has never been found in Prince Edward Island.

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

Stillwell's Syndrome, a condition of balsam fir, occurs 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. The loss of surviving trees in spruce budworm damaged stands during the recovery stage, even years after the collapse of the outbreak, is referred to as Stillwell's Syndrome. 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, among them Armillaria root rot and several species of beetles (such as balsam bark weevil, balsam fir bark beetle, and sawyer beetle).

The incidence of affected trees varied by province and year throughout the 1980s. Incidence was low in 1989 in New Brunswick and Nova Scotia, while no affected trees were observed in Prince Edward Island.

Table 2. Frequency of Armillaria root rot infected pine and spruce plantations in New Brunswick and Nova Scotia, 1986-1990

Year	New Brunswick				Nova Scotia			
	Pine		Spruce		Pine		Spruce	
	Plant Assessed	% Inf.	Plant Assessed	% Inf.	Plant Assessed	% Inf.	Plant Assessed	% Inf.
1986	44	9	95	27	--	--	--	--
1987	34	6	113	23	--	--	--	--
1988	50	12	131	18	22	5	37	11
1989	68	7	187	22	14	7	42	21
1990	52	10	117	15	38	5	104	14
Total	248	9	778	17	74	5	183	15

In 1990, the number of red, recently dead, balsam fir trees was again low in New Brunswick and Nova Scotia. Mortality of scattered individuals or pockets of a few trees occurred in Restigouche, Victoria, Carleton, and northern York counties in New Brunswick, and in Inverness, Antigonish, Pictou, Colchester, and Cumberland counties in Nova Scotia.

In Prince Edward Island, the number of affected trees increased significantly. Red balsam fir trees were present throughout, but tree mortality was most dramatic in the eastern half of the province. Small groups of dead trees were observed at scattered locations throughout Prince Edward Island: 9 locations in Kings County, 10 in Queens County, and 4 in Prince County. In addition, individual red balsam fir trees were present everywhere, most numerous in Kings and eastern Queens counties. It is estimated that there was a recently dead tree for every 10 ha of forest land in eastern Prince Edward Island, thus approximately 13 200 balsam fir trees died in 1990.

ARMILLARIA ROOT ROT

Armillaria Root Rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, is widely distributed in the region and mortality of trees, both young and old, was again common in 1990.

Armillaria root rot killed trees in 11% of the 169 spruce and pine plantations surveyed in New Brunswick and 12% of the 142 spruce and pine plantations assessed in Nova Scotia (Table 2). Infection rates were generally low, mostly in the 2% to 8% range. Spruce plantations appear to be more vulnerable to the disease than pine plantations. This difference has been consistent since plantation surveys have been conducted.

Armillaria root rot also caused tree mortality in other forest situations. In New Brunswick, mature and semi-mature balsam fir, black spruce, red spruce, white spruce, trembling aspen, and hemlock were killed and a few young larch died in regeneration in a clearcut near Lake Edward, Victoria County. In Nova Scotia, mature and semi-mature balsam fir and white pine were affected. In Prince Edward Island, 8% of the hemlock was killed near High Brook, Kings County and 4% of balsam fir at Norway, Prince County.

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. A summary of observations is presented in Table 3. Only two plots were assessed in 1990 and no intensification was observed at either location. 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 condition without significant stress. Some of our study plantations are reaching this age. These plots will be observed annually but, unless conditions change significantly, will be assessed only on a 5-year cycle.

Table 3. Armillaria root rot - spread of disease in plantations 1983-1990

Species	Year planted	Year plot est.	Former cover type	Mortality (%) 1983	1984	1985	1986	1987	1988	1989	1990
Black spruce	1976	1983	Softwood	8	10	10	10	--	--	--	--
Black spruce	1973	1983	Softwood Hardwood	4	4	4	4	--	--	--	--
Black spruce	1978	1983	Softwood Hardwood	8	12	20	20	--	--	--	--
Black spruce	1980	1983	Softwood Hardwood	8	16	24	24	24	26	28	28
Jack pine	1978	1984	Softwood Hardwood	--	2	2	2	--	--	--	--
Jack pine	1981	1984	Softwood Hardwood	-	2	4	4	6	8	8	--
Jack pine	1978	1984	Softwood Hardwood	-	2	2	2	--	--	--	--
Black spruce*	1980	1985	Softwood Hardwood	-	-	2	2	4	4	4	4

*Seed orchard plantation 'rogued' (selectively thinned) in 1990, the plot was destroyed after the assessment

SIROCOCCUS SHOOT BLIGHT

Sirococcus shoot blight, caused by the fungus *Sirococcus conigenus* (DC.) P. Cannon & Minter, is present in all three provinces but is most widely distributed and most damaging 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 1990, the disease intensified in all three provinces. In many areas, the repeated infection has resulted in serious deterioration of red pine stands and plantations.

In New Brunswick, the disease was confined to previously affected areas in the southern part of the province but the damage intensified and resulted in increased shoot mortality. The most serious infections were observed in the MacDougall Lake area in Charlottte County and Shin Creek, Sunbury County. Red pine deterioration continued in Fundy National Park, Albert County, both in the Headquarters and the Hastings Road areas. Infected trees are numerous in a 1978 red pine plantation at Deersdale, Carleton County. Ornamental blue spruce was infected at Sackville, Westmorland County.

In Nova Scotia, the ravages of the disease are continuing in the low lying areas of the southwestern part of the province. Entire plantations are completely discolored, trees are dying and many of these plantations are doomed. In many other plantations, both the incidence of infected trees and the intensity of infection (shoot mortality) are in the moderate (30-70%) range. The disease is becoming more widespread on the eastern mainland and appears to be spreading from the original infection centers into surrounding plantations. A detailed survey of all red pine plantations by the Nova Scotia Department of Lands and Forests is underway to determine the status of the disease in the province. Sirococcus shoot blight has also been recorded on other tree species: on white spruce at Loch Katrine, Antigonish County, where infection was severe on a few trees but intensity was generally trace or light; Millen Mountain, Halifax County; Blue Mountain, Pictou County, where infection ranged from trace to moderate on scattered trees; Dalem Lake, Victoria County; in a clone bank at Debert, Colchester County; on black spruce at Upper South River, Antigonish County; and on red spruce at Hemlock Hill Road, Lake Rossignol, Queens County.

The deterioration of pine stands caused by this disease in western Nova Scotia and the spread of the disease to plantations in the eastern half of the

Table 4. Summary of results of the Sirococcus shoot blight control experiment in Nova Scotia

Plot location	Tree height 1988 (m)	1988 Trees infected %	1988 Treatment	1989 Trees infected %	1989 Treatment	1990 Trees infected %
Debert, Colchester Co.	2.5	19	pruned	4	pruned	0
Pleasant River, Lunenburg Co.	2.8	66	pruned	26	pruned	7
Shulie Lake Rd., Cumberland Co.	3.5	37	pruned	17	none	37
Kedge River Mgmt. Area, Queens Co.	3.5	63	none	67	none	67

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, the disease was present in all previously infected areas and continued to intensify at Goose River, Kings County and at Selkirk, Queens County. The disease was found on an understory red pine at Murray River, Kings County and on a blue spruce at Tignish, Prince County.

Control - Prompted by concern over the fate of red pine plantations, a silvicultural control (pruning) experiment was carried out in Nova Scotia during the fall of 1988 under the aegis of Forestry Canada. The experiment has been continued by FIDS since then. Preliminary results (Table 4) indicate that pruning may prove to be an effective control measure.

SPRUCE BUDMOTHS

Shoot damage by spruce budmoths, *Zeiraphera* sp., on white spruce was slightly lower in New Brunswick and Prince Edward Island and slightly higher in Nova Scotia in 1990 than reported in 1989. Damage occurred throughout much of the region. Spruce budmoths comprise a group of closely related species: the spruce budmoth, *Zeiraphera canadensis* Mut. & Free., the purplestriped shootworm, *Zeiraphera unfortunana* Powell, and the yellow spruce budworm, *Zeiraphera fortunana* (Kft.). *Z. canadensis* is usually the most common and most important of the three, but occasionally the species-mix changes in favor of one of the other two.

In New Brunswick, damage was generally light, an average of 11% of the shoots were damaged at 24 locations examined but over 95% of the trees were affected. The most serious damage, 29% of shoots affected, was at Deep Cove on Grand Manan Island.

In Nova Scotia, average shoot damage was 15% at the 66 locations examined but ranged from 1% to 64%, the latter at Wallace Ridge, Cumberland County. Other areas with moderate (more than 30%) shoot damage included Berwick, Kings County (57%), Malignant Cove, Antigonish County (48%), South Williamston (44%), north of Round Hill (35%), Mount Hanley (35%), and Douglas Road (32%), all in Annapolis County, and Cregnish, Inverness County (31%). At Swallow Hill, Cumberland County, where 41% of the new shoots were reported damaged last year, 51% of the new shoots were affected in 1990.

In Prince Edward Island, an average of 11% of the shoots were damaged at the 22 locations examined. Damage was light in all but one of these areas but not all trees were damaged at any given location. The greatest amount of damage was recorded at New Harmony, Prince County, where 33% of the new shoots on about half of the trees in the area were affected.

SEEDLING DEBARKING WEEVIL

The seedling debarking weevil, *Hylobius congener* D.T., Sch. & Marsh., continued to damage newly established plantations in Nova Scotia and Prince Edward Island in 1990. However, reports of damage were much reduced from previous years. In Nova Scotia, this is directly related to the practice of delay-planting, which creates a 2 to 3 growing-season gap between the harvest operation and planting, allowing the weevil to complete its life cycle and disperse from the site. This practice leaves behind a remnant population, but the damage it does is generally not significant. Where significant damage did occur in 1990 the recommended minimum delay was not provided. On Prince Edward Island, the results of a 1989 field study confirmed that the use of site preparation to reduce *Hylobius* damage has been successful. Simple brush raking does not reduce damage but techniques which disturb the soil surface, such as the use of anchor chains or a "forestry disk", kept damage levels within acceptable limits.

PINE LEAF ADELGID

Pine leaf adelgid, *Pineus pinifoliae* (Fitch), populations, although reduced from 1989 levels, were still present in Hants, Queens, Lunenburg, Shelburne, Annapolis, and Digby counties in Nova Scotia. On average, 18% of the new shoots of white pine were infested or killed in 1990 (compared to 36% in 1989) but infestation levels ranged from 1% to 63%, the latter observed at Rogers Brook in Kejimkujik National Park, Annapolis County. The infestation persisted at Jeremy's Bay, also in the National Park, where 45% of the shoots were damaged this year, compared to 40% in 1989, which was the highest infestation reported in the province last year. Shoot damage was 44% at Jordan Falls, Shelburne County, and 40% at Duck Nest Meadow, Digby County. Infestation levels elsewhere in the affected area were generally light or trace, especially in Queens, Lunenburg, and Hants counties. Only a few galls were noted on red spruce, the alternate host. Pine leaf adelgid was not observed on either host in New Brunswick or Prince Edward Island.

NEEDLE RUSTS

Although needle rusts were widespread in the Maritimes in 1990 infection levels, with a few exceptions, were very low and averaged from 1% to 5% on a provincial basis. The species recorded included: *Pucciniastrum epilobii* Otth and *Uredinopsis* sp. on balsam fir in all three provinces; *Pucciniastrum vaccinii* (Wint.) Jorst. in Nova Scotia and Prince Edward Island and *Melampsora farlowii* (Arth.) J.J. Davis in Nova Scotia on hemlock; *Melampsora medusae* Thuem. in Nova Scotia on larch; *Chrysomyxa ledi* dBy. in New Brunswick and Nova Scotia, *Chrysomyxa ledicola* Lagh. in all three provinces on spruce and *Chrysomyxa weirii* Jacks. on a few ornamental blue spruce trees in Nova Scotia; *Coleosporium asterum* (Diet.) Syd. in Nova Scotia and Prince Edward Island and *Coleosporium viburni* Arth. at a single location in New Brunswick on pine.

All cases of severe or moderate infections involved spruce trees. In New Brunswick, in Northumberland County, infection on ornamental blue spruce trees by *C. ledi* was so heavy in the Newcastle area that the trees could be spotted from a distance by their orange color; 88% of new needles of all young black spruce trees were infected along Acadia Road to West Collette and 72% of black spruce needles were affected at Cold Brook; infection on blue spruce was moderate in the Buctouche, Kent County area. In Nova Scotia, the infection level of white spruce needles by *C. ledicola* was 43% at Grand River, Richmond County, and 33% by *C. ledi* at Loch Katrine, Antigonish County.

LARCH CASEBEARER

Larch casebearer, *Coleophora laricella* (Hbn.) populations increased for the second consecutive year throughout much of the Maritimes. Although feeding was mainly confined to patches of trees ranging in size up to a hectare, these patches were extremely numerous and the insect was one of the most frequently observed forest pests in the early part of the 1990 season. The level of foliage discoloration as a result of feeding was also variable; in most areas it was trace or light, but moderate and severe patches also occurred throughout.

In New Brunswick, severe discoloration occurred at Bay du Vin and Black River Bridge, Northumberland County, Point Sapin southward into Kouchibouguac National Park in Kent County, along 5 km of road in the Bayfield area of Westmorland County, Dorchester Cape, Westmorland County, Poley Mountain, Kings County, Coles Island, Queens County, and the Fredericton area of York County. Populations increased along the upper St. John River but brown-

ing was less pronounced than elsewhere in the province with the exception of Restigouche and northern Madawaska counties where the insect was relatively rare.

In Nova Scotia, discoloration was severe, with all shoots affected at Clarksville and north of Lantz, Hants County, Carrs Brook, Portapique and north of Masstown, Colchester County, and south of Loon Lake, Queens County, Upper Fisher Lake, Grassy Lake, and Middle River, Halifax County, Lakelands, Cumberland County, and Glendale, Inverness County. Other areas of severe foliage discoloration included Upper Musquodoboit, Halifax County, south of Birchtown, Shelburne County and Beaverbrook, Colchester County.

In Prince Edward Island, discoloration was severe in the area south of Wellington, Prince County, where the population has been increasing since 1988, and at Village Green, and south of Mount Stewart, Kings County.

BALSAM WOOLLY ADELGID

Balsam woolly adelgid, *Adelges piceae* (Ratz.), a major cause of balsam fir tree mortality a few decades ago, has shown a slight increase in New Brunswick and Prince Edward Island and has always been present at chronic levels in coastal areas of Nova Scotia.

In 1990, in New Brunswick, the adelgid became more common although the intensity of attack has not increased appreciably. On Grand Manan Island dead and dying trees were present from continued attack. Gouty twigs and flat tops, an expression of adelgid attack, were common on both old and young trees in southern coastal areas and on Grand Manan, Deer, and Campobello Islands. White waxy "wool" was present on tree stems, another expression of attack, although light, on 40% of trees at Meadow Brook, Westmorland County and on 20% of the trees in Fredericton, York County.

In Nova Scotia, most of the damage occurred in the form of twig attack which was largely restricted to coastal areas. An average of 39% of twigs were deformed at 13 locations examined and at Rocky Brook, Guysborough County, all trees had at least some gouty twigs. Young trees in Christmas tree areas suffered severe damage in Queens County (see details under Christmas tree pests). In Prince Edward Island, both stem and twig attack were observed at Glenwood and Milligans Wharf, Prince County and Rustico Island, Queens County. Stem-wool only was found on 40% of the trees on Souris Line Road, Kings County and on 16% of the trees at Elliotville, Queens County. Gouty twigs were observed at Goose River and Munns Road, Kings County and Irishtown, Queens County.

WHITE PINE BLISTER RUST

White pine blister rust, *Cronartium ribicola* J.C. Fisch., is widespread in the region, causes branch or stem cankers, and kills some trees. With renewed interest in white pine as a plantation species, the status of the disease will once again become important, even though there are some questions as to the actual impact of the disease.

In 1990, in New Brunswick, 40% of white pine trees were infected at Nictau, Victoria County, 32% at km 18 on the NBIP Road in Restigouche County, and 20% at Mitchell Lake, Northumberland County. Scattered understory and semi-mature trees had a few branch cankers along a 3-km stretch of road between Petitcodiac, Westmorland County and Elgin, Albert County. In an old field near Black River in Kouchibouguac National Park, 32% of the young white pine trees were affected, some were dead, others were cankered.

In Nova Scotia, a group of white pine trees were infected near Oak (Twin) Lakes, Pictou County, four trees were affected at South River Road, and damaged trees were observed elsewhere in Antigonish County.

In Prince Edward Island, the disease is common but affects only a few trees at a given location. Active infection areas with some branch mortality were observed at North Enmore, Prince County and Iona, Queens County in 1990.

PINEWOOD NEMATODE

Even though surveys during the 1980s have shown that pinewood nematode exists at only extremely low levels in the Maritimes and has never been known to kill a single tree, its very presence has created an economic problem in the forest product export industry because of plant quarantine regulations in potential importing countries in Europe.

Past surveys, conducted to determine the status of the pinewood nematode in the Maritimes and to comply with specific requests from plant quarantine agencies or the forest industry, have been described previously.

In 1990, a survey was carried out in cooperation with the Maritime Lumber Bureau to determine the extent to which hemlock is attacked by sawyer beetles (*Monochamus* sp.), the often suspected vector for pinewood nematode, in order to propose hemlock for an exemption from the mandatory kiln drying requirements to come into effect in 1992 in Europe. No pinewood nematode was found during the study of 1766 hemlock logs and 420 pieces of lumber from 20 mills from Nova Scotia and New Brunswick. The frequency of "grub holes", the galleries of cerambycid larvae, to which group of woodboring insects sawyer beetles belong, was less than 0.7% in logs and less than 1.4% in sawn lumber.

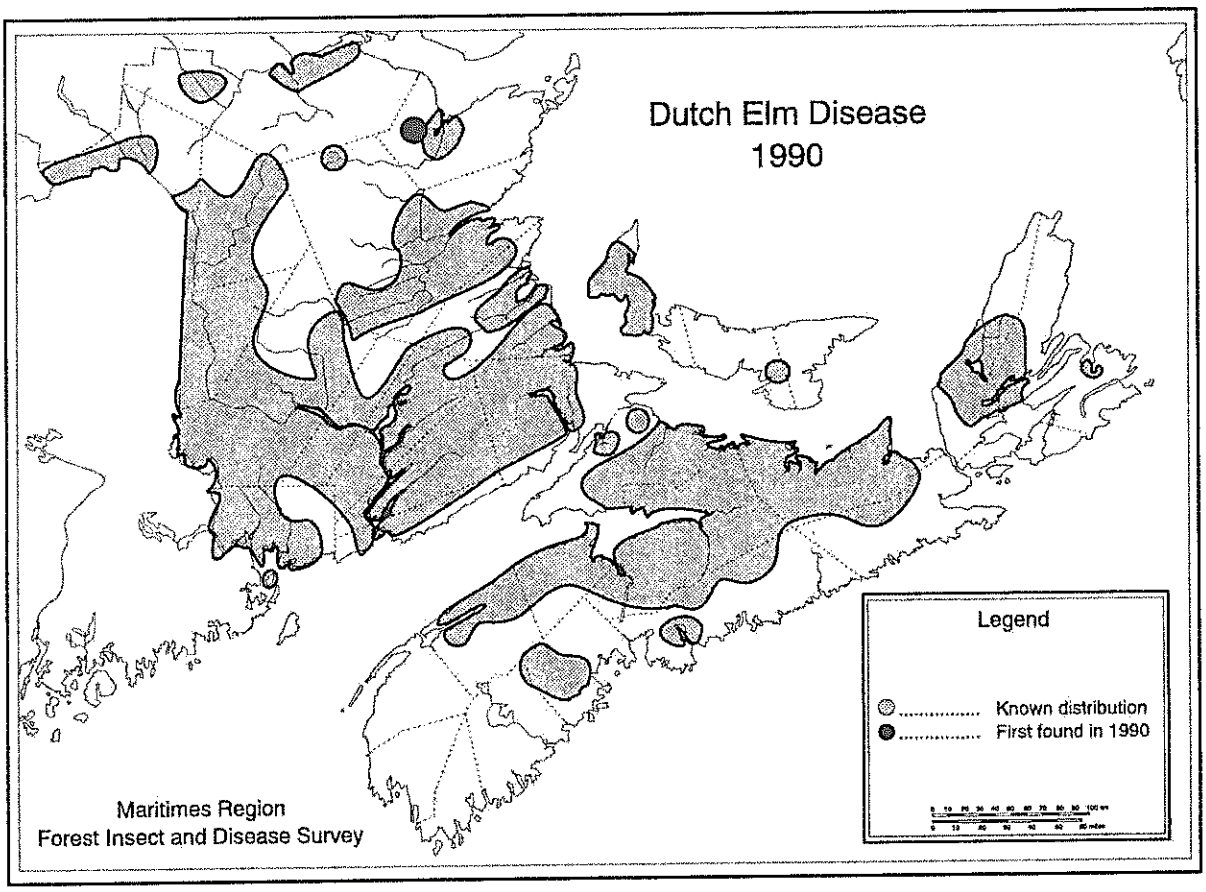

Figure 3

HARDWOODS - PESTS AND PROBLEMS

DUTCH ELM DISEASE

Dutch elm disease, caused by the fungus *Ceratocystis ulmi* (Buism.) C. Moreau, was of major concern in all three Maritime provinces in 1990 (Figure 3).

In New Brunswick, the disease is present wherever elm trees are found. The resurgence of infection, commencing 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 1990. The "new" location, at Arsenault, Gloucester County, only updates documentation of the occurrence of Dutch elm disease.

In Nova Scotia, the disease did not spread to new areas in 1990 but intensification continued within outbreak areas as evidenced by great numbers of dead and dying elm trees in Annapolis, Kings, Hants, Colchester, Cumberland, Halifax, Pictou, and Antigonish counties. Sanitation, where practised consistently, is having a beneficial effect in lowering the losses.

In Prince Edward Island, in spite of extensive searching throughout the province in 1990, diseased trees were found only in western Prince County, where the disease was first found in 1979 and every year since 1985. Although the incidence of infection is generally low, the spread of the disease in the province is of considerable concern.

In Fredericton, N.B., 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 15 trees killed by the disease in 1990 represent 0.5% of the current elm population within the Dutch Elm Disease Management Area, the lowest annual loss since 1972. The trend of decreasing losses has continued since 1980 when the loss rate peaked at 7.8% after a steady climb during the 1970s. Cumulative loss to date amounts to 29.9% of the

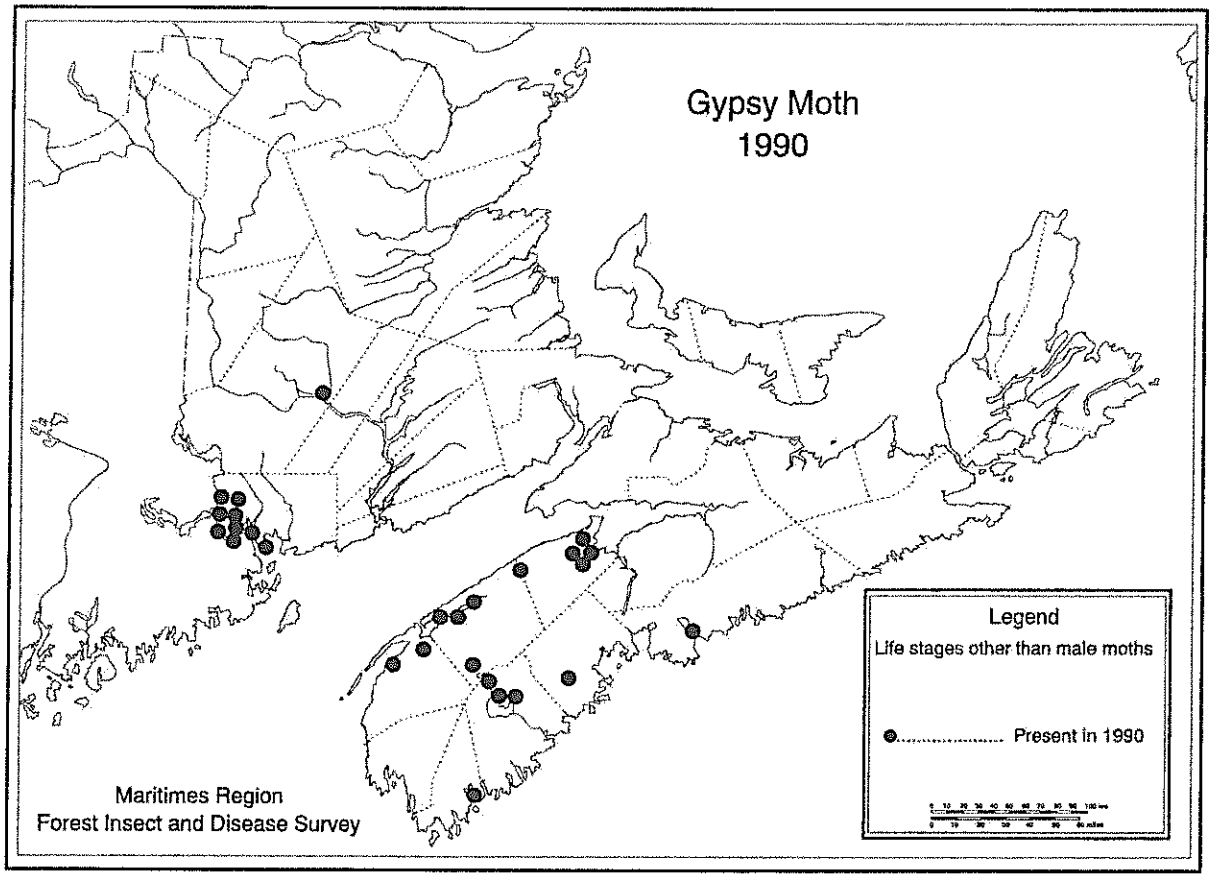

Figure 4

urban elm stand in 1961, the year the disease first appeared in the city.

No systematic survey was conducted by the Forest Insect and Disease Survey in 1990 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. The European elm bark beetle, *Scolytus multistriatus* (Marsh.), was not captured in 1990.

GYPSY MOTH

The gypsy moth, *Lymantria dispar* (L.), situation in 1990 remained unchanged in New Brunswick but changed in Nova Scotia from an essentially urban to a more general distribution. After its reappearance in the Maritimes in 1981, the gypsy moth has been present in both New Brunswick and Nova Scotia but caused visible defoliation in the region only once, at Moores Mills, N.B. in 1987.

In 1990, early season egg mass surveys, larval surveys, adult trapping programs and late fall egg mass surveys were conducted to determine the current status of gypsy moth in the region. The Gypsy Moth Coordinating Committee again coordinated all surveys, the work being carried out by federal, provincial, municipal, and industrial agencies.

Adult-male trapping programs were conducted in all three provinces. Information was obtained from 5567 traps in the region, 2443 in New Brunswick, 2824 in Nova Scotia, and 300 in Prince Edward Island. These programs are aimed at defining areas where egg mass searches should be conducted. In infested areas, traps are placed at higher densities with the dual objectives of better defining infestations and of reducing the number of fertile egg masses through the capture of males, thereby reducing the mating frequency. The trapping programs are summarized for New Brunswick (Table 5), Nova Scotia (Table 6), and Prince Edward Island (Table 7).

Table 5. Summary of the pheromone trapping program for gypsy moth in New Brunswick in 1990

Location	Number of Traps			Moths Caught			Egg
	Placed	Ret'd	Posit.	Total	Per trap	Range	Mass
St. Andrews	563	559	496	3125	5.6	0-21	Yes
St. Stephen	600	578	525	3143	5.4	0-21	Yes
CFB Gagetown/ Oromocto	50	41	16	25	0.6	0-4	--
Saint John	10	8	4	5	0.6	0-4	--
Fundy National Park	25	25	10	15	0.6	0-2	--
Fredericton	706	697	111	263	0.4	0-20	Yes
CFB Chatham	10	10	2	2	0.2	0-1	--
Moncton	10	9	2	2	0.2	0-1	--
Trans-Canada Highway	140	130	?	117	N/A	0-6	--
Horticultural Nurseries	21	20	?	34	N/A	0-9	--
Woodstock-Doaktown	139	133	100	242	N/A	0-12	--
St. Leonard -Campbellton	25	25	14	36	N/A	0-5	--
Provincial Parks	120	70	30	185	N/A	0-25	--
Kouchibouguac National Park	15	15	0	0	0	0	--

Note: The table accounts for 95% of traps retrieved.

The status of the gypsy moth in the Maritimes at the end of 1990, based on surveys for larvae, pupae, and egg masses is summarized in Figure 4 and in Table 8 for New Brunswick and Table 9 for Nova Scotia.

In New Brunswick, gypsy moth was found at three "new" locations in 1990, bringing the total number of positive areas to 51 in the ten years since the re-discovery of the insect in 1981. However, since all three locations are very close or immediately adjacent to previous finds, they represent only local extensions of the known distribution. All but four of the 51 locations listed in Table 8 are in western Charlotte and adjacent southwestern York counties. There are few locations where gypsy moth has been found consistently throughout the years. Even at those locations, egg masses have not been numerous in any given year and, with the exception of Moores Mills in 1987, no visible defoliation has occurred in any of the areas. The success rate of finding egg masses has been less than 3% in both 1989 and 1990, when 300 and 277 locations, respectively, were searched, in areas of suitable habitat, aided by the results of the pheromone trap program. Results and observations indicate that a generally low level but widespread gypsy moth population exists in the extreme southwestern part of the province. Outside of this area, gypsy moth exists only in Fredericton where 82 egg masses were found in three distinct areas of the city this fall.

A trapout program was repeated for a fifth year in a small area of Fredericton. The following information indicates that gypsy moth, if not eliminated, was reduced to sub-detectable levels in the trapout area. (In 1985, the year before the program started, 15 egg masses were found.) However, two egg masses were found in 1989 and 34 in 1990 adjacent to the border of the trapout area (on the opposite side of the street). Almost all the moths caught within the trapout area in 1990 were in traps next to this infestation.

1986 - 650 traps; 231 male moths; 4 egg masses
1987 - 572 traps; 9 male moths; 0 egg masses
1988 - 556 traps; 5 male moths; 0 egg masses
1989 - 290 traps; 146 male moths; 0 egg masses
1990 - 299 traps; 54 male moths; 0 egg masses

In Nova Scotia, gypsy moth was found at three new locations in 1990 (Table 9). One of these, Upper Clements, Annapolis County, represents only a minor extension in the Annapolis Valley. The other two finds at Lake Rossignol and south of West Caledonia, Queens County, added to the fact that the insect has been present in four distinct

Table 6. Summary of the pheromone trapping program for gypsy moth in Nova Scotia in 1990

Location	Number of Traps			Moths Caught			Egg
	Placed	Ret'd	Posit.	Total	Per trap	Range	Mass
Canning	30	29	28	453	15.6	0-25	Yes
New Minas	323	320	312	3799	11.9	0-26	Yes
Rte 8 (Annapolis Royal -Milton)	33	31	30	267	8.6	0-23	Yes
Yarmouth	50	40	39	338	8.5	0-18	--
Kejimkujik National Park	501	471	393	3283	7.0	0-26	Yes
Fort Anne Nat. Historical Site	9	9	8	60	6.7	0-19	--
Bridgetown	50	43	37	232	5.4	0-14	Yes
Port Williams	30	29	23	153	5.3	0-17	Yes
Kings Co. Apple Orchards	25	25	19	85	3.4	0-18	--
Bridgewater	75	70	48	200	2.9	0-16	Yes
Shelburne	150	138	97	371	2.7	0-20	Yes
Dartmouth	103	69	36	189	2.7	0-26	--
Halifax	499	453	220	668	1.5	0-17	Yes
Rte 10 (Bridgewater -Middleton)	25	23	17	32	1.4	0-6	--
Rte 12 (Chester Grant to Kentville)	12	12	7	17	1.4	0-6	--
Digby	50	48	25	38	0.8	0-4	--
Kentville	202	135	39	67	0.5	0-7	Yes
Kejimkujik Nartional Park Seaside Adjunct	40	39	12	12	0.3	0-1	--
Grand Pre Nat. Hist. Site	14	14	1	2	0.1	0-2	--
Port Royal Nat. Hist. Site	7	7	1	1	0.1	0-1	--
Eastern mainland	192	178	11	18	0.1	0-6	--
CFB Greenwood	50	48	2	2	<0.1	0-1	Yes
Cape Breton Island	102	99	1	1	<0.1	0-1	--
Cape Breton Highlands Nat. Park	21	21	1	1	<0.1	0-1	--
Nova Scotia Christmas Tree Council	175	157	122	477	N/A	0-21	--
Provincial Parks	44	34	9	31	N/A	0-12	--

Note: Table accounts for 90% of traps retrieved.

Table 7. Summary of the pheromone trapping program for gypsy moth in Prince Edward Island in 1990

Location	Number of Traps			Moths Caught			Egg
	Placed	Ret'd	Posit.	Total	Per trap	Range	Mass
Prince Edward Island - general	275	270	4	4	<0.1	0-1	--
P.E.I. National Park	25	25	0	0	0	0	--

areas in Kejimkujik National Park and that in 1989 a larva was found in another forest situation at Lake Paul, Kings County, all indicate that gypsy moth can no longer be considered to occur only along major highways around the "rim" of south-western Nova Scotia. The gypsy moth situation in Nova Scotia is changing from a pest of almost exclusively urban areas to one of more general distribution.

Egg masses were not numerous at most locations but even in areas where egg mass counts were relatively high (Annapolis Royal, Shelburne, New Minas), defoliation was negligible in 1990.

In Prince Edward Island, gypsy moth is not known to occur to date although occasionally a few male moths, probably blown in by storms from the main-land, are captured in pheromone traps. There were only four male moths caught in the 300 traps in the province and all were single catches.

Table 8. Summary of the results of detection surveys for gypsy moth in New Brunswick 1981-1990

County	Location	UTM Grid[1]	Gypsy moth life stages found[2]									
			81	82	83	84	85	86	87	88	89	90
Carleton	Peel	19-61-513					■	□	□	□	□	
Charlotte	Mohannes	19-62-500	■	■	■	■	■	■	■	■	■	■
	Little Ridge						■	■	□	□	□	□
	Beaver Harbour	19-67-499	■	□	■	□	□	□	□	□	□	□
	St. George			■	■	■	□	□	□	□	□	□
	Pennfield	19-68-499	■	□	□	□	□	□	□	□		□
	Grand Manan Island	19-67-494	■	□	□	□	□	□	□	□		□
	Oak Hill	19-63-502		■	■	■	■	■	□	■	■	■
	Lynnfield			■	□	□	□	■	□	□		□
	Baillie Settlement							■	□	□	□	□
	Indian Pond									■	□	□
	Digdequash	19-66-500		■	□	□	□	□	■	□	■	□
	Campobello Island	19-66-497		■	□	□	□	□	□	□		
	NW of Oak Hill	19-62-502			■	■	□	□	■	□	□	□
	N of Oak Hill								■	□	□	□
	Canoose Stream											■
	Upper Mills	19-63-499			■	□	□	□	□	□	□	□
	Oak Bay area	19-64-501			■	□	□	□	□	□	□	□
	Greenrock									■	□	
	St. Stephen	19-63-500			■	■	■	□	□	■	■	■
	Burnt Hill					■	□	□	□	□	□	
	Old Ridge						■	□	□	■	■	■
	Heathland								■	□	□	
	Mayfield								■	□		□
	S of Maxwell Crossing								■	□	□	□
	Milltown										■	□
	Crocker Hill											■
	St. Andrews	19-65-499			■	■	■	■	■	■	■	■
	Bayside	19-64-500					■	■	□	□		□
	Ledge Road								■	□	■	■
	Oak Bay Prov. Park								■	□	□	
	Grand Falls Dam	19-61-501					■	□	□	□	□	□
	Basswood Ridge	19-62-501					■	□	□	□	□	■
	SE of Scotch Ridge								■	□	□	□
	NE of Scotch Ridge								■	□		□
	Scotch Ridge									■	■	□
	Pomeroy Ridge											■
	Moores Mills	19-63-501						■	■	■	■	□
	W of Moores Mills Lake								■	□	□	□
	S of Cranberry Lake								■	□	□	
	NW of Pleasant Ridge	19-65-503						■	□	□	□	□
	Anderson Settlement	19-63-503						■	□	□	□	□
	S of Beaconfield	19-62-503							■	□	□	
	Rollingdam	19-65-501							■	□	□	□
St. John	Saint John	19-72-501		■	□	□	□	□	□	□		
York	Fredericton	19-68-509			■	■	■	■	□	□	■	■
	Forest City	19-59-505					■	□	□	■		□
	St. Croix	19-62-504					■	□	□	□	□	□
	McAdam	19-63-505						■	□	□	■	□
	Woukichegan Lake	19-62-505						■	□	□		
	Beaverdam	19-67-507							■	□		

1 U.T.M. = Universal Transverse Mercator System. Each UTM is listed only once, the first year gypsy moth was found in the grid. The locations following without UTM are in the grid last listed.

2 Life stages other than adults: ■ = Gypsy moth found; □ = Gypsy moth not found. Blank space indicates that no search was made.

Table 9 Summary of the results of detection surveys for gypsy moth in Nova Scotia 1981-1990

County	Location	UTM Grid[1]	Gypsy moth life stages found[2]									
			81	82	83	84	85	86	87	88	89	90
Yarmouth	Yarmouth	20-24-485	■	■	■	❑	■	❑	❑	❑		❑
	Tusket	20-26-486			■	■	■	❑	❑	❑		
Digby	Grosses Coques	20-25-491		■	■	❑	❑	❑	❑	❑		
	Smiths Cove	20-28-494		■	❑	❑	❑	❑	❑	❑		
	Digby				■	❑	❑	❑	❑	❑	❑	❑
	Weymouth	20-26-492				■	■	■	■	■	■	■
	Weymouth Falls	20-26-492				■	■	❑	❑	❑		
	Bear River	20-28-493					■	❑	❑	❑	■	■
Annapolis	Clementsport	20-29-494		■	❑	■	❑	❑	❑	❑		
	CFB Cornwallis							■	❑	❑		
	Upper Clements	20-29-495										■
	Paradise	20-32-497		■	■	❑	❑	❑	❑	❑		
	Kejimkujik Nat. Pk	20-31-492			■	❑	❑	❑	❑	❑		■
	Middleton	20-33-497				■	■	❑	❑	❑	■	❑
	Annapolis Royal	20-30-495					■	■	■	■	■	■
	Bridgetown	20-31-496								■	■	■
Queens	Kejimkujik Nat. Pk	20-32-491						■	■	■	■	■
	Lake Rossignol	20-33-490										■
	S of West Caledonia											■
Kings	New Minas	20-38-499			■	■	■	■	■	■	■	■
	Port Williams						■	■	■	■	■	■
	Kentville								■	■	■	■
	CFB Greenwood	20-34-498						■	■	■	■	■
	Canning	20-38-500							■	■	■	■
	Lake Paul	20-36-496									■	❑
Halifax	Halifax	20-45-494			■	■	■	■	■	■	■	■
	Dartmouth					■	■	❑	❑	■	❑	❑
Shelburne	Shelburne	20-31-484			■	■	■	■	■	■	■	■
	CFB Shelburne							■	■	❑		
	Clyde River	20-30-483			■	❑	❑	❑	❑	❑		
Lunenburg	Bridgewater	20-37-491					■	■	■	■	■	■
Hants	Windsor	20-41-498					■	■	❑	❑	❑	

1 U.T.M. Grid = Universal Transverse Mercator System. Each UTM is listed only once, the first year gypsy moth was found in the grid. The locations following without UTM are in the grid last listed.

2 Life stages other than adults: ■ = Gypsy moth found; ❑ = Gypsy moth not found; blank space indicates that no search was made.

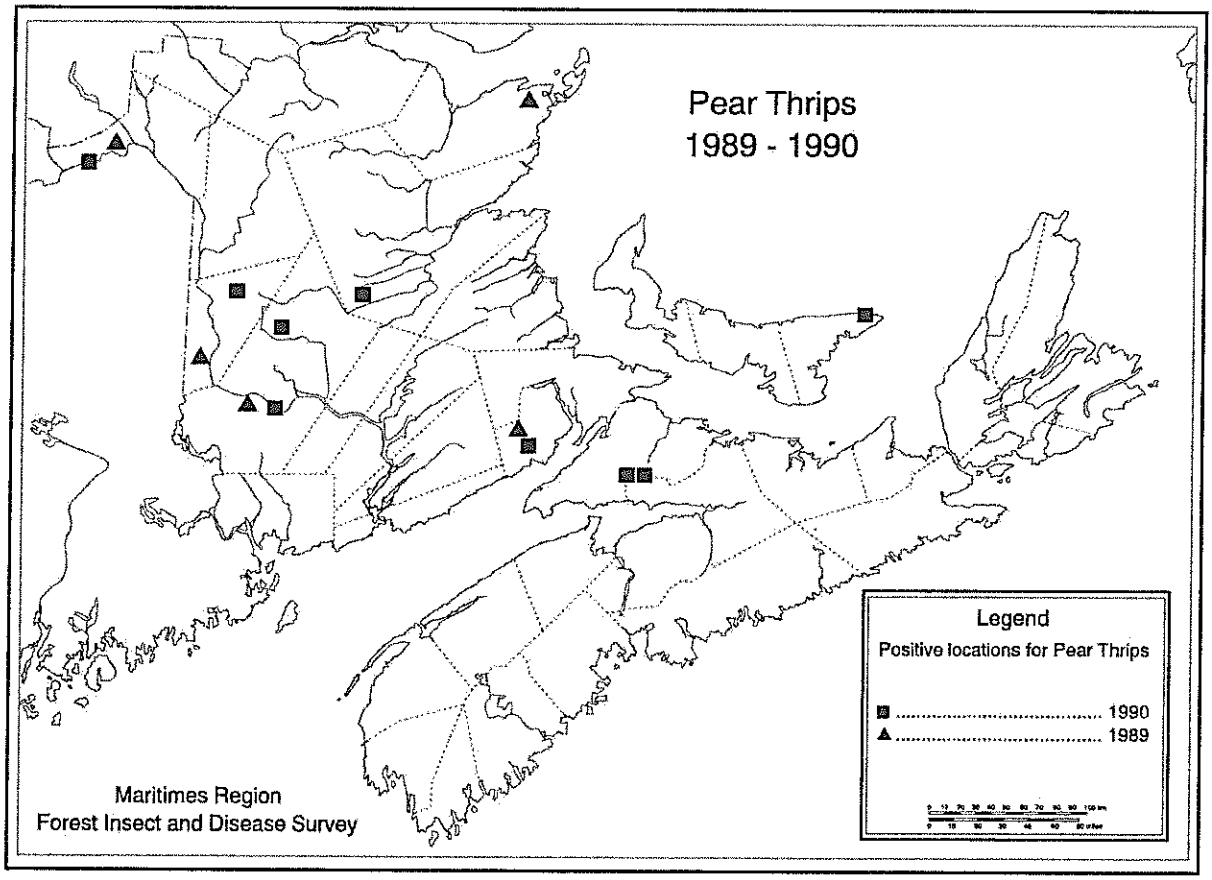

Figure 5

PEAR THRIPS

Pear thrips, *Taeniothrips inconsequens* (Uzel), caused major concern in the early summer of 1988 when widespread defoliation of sugar maple occurred in several New England states. Surveys in 1989 found pear thrips on sugar maple in New Brunswick at five widely separated locations.

In 1990, pear thrips were found at five new locations in New Brunswick, two in Nova Scotia, and at one location in Prince Edward Island (Figure 5). It was also found for the second consecutive year at Meadow Brook, Albert County, New Brunswick. Pear thrips was found on sugar maple in New Brunswick, on red maple in Prince Edward Island, and adults were captured on yellow sticky traps in Nova Scotia. Soil samples collected from eight locations in Nova Scotia and three in Prince Edward Island failed to yield pear thrips.

Surveys to date established the presence of pear thrips in all three Maritime provinces, although no detailed statement can yet be made on its actual distribution. Even though the majority of the finds were on stressed sugar maple trees, those trees were stressed by other factors. The only visible damage by pear thrips to date occurred at Lac Unique, Madawaska County, New Brunswick, where a few cupped and wilted leaves were observed on a few scattered sugar maple trees.

OAK LEAFROLLER AND OAK LEAF SHREDDER

Oak Leafroller, *Pseudexentera spoliana* (Clem.), and the Oak Leaf Shredder, *Croesia semipurpurana* (Kft.), have been defoliating red oak since the early 1970s and are the most serious pests of this species in the Maritimes. As a result of repeated defoliation, trees in many areas are suffering from various degrees of twig, branch, and crown dieback.

In 1990, in Nova Scotia, where the outbreak persists, both the intensity and the area of defoliation, predominantly by the oak leafroller, was similar to that reported in 1989. Defoliation occurred mostly

Table 10 Tree condition of red oak after repeated defoliation in western Nova Scotia, 1988-1990

Tree Condition Class	Percent of trees in class		
	1988[a]	1989[b]	1990[c]
Healthy	9.1	1.0	0.2
Twig dieback only	22.6	18.2	8.6
Branch dieback 1-25%	42.9	52.2	77.1
26-50%	14.3	18.9	7.9
51- %	5.0	4.9	2.0
dying	0.6	0.9	1.0
Dead	5.5	3.9	3.2

[a] based on assessment of 931 trees
[b] based on assessment of 1004 trees
[c] based on assessment of 975 trees

in scattered red oak stands in Annapolis, Lunenburg, Queens, and Shelburne counties. The level of defoliation ranged from 1% to 85% and averaged 40% assessed in these areas. This represents a minor (5%) increase from last year but is significantly (29%) lower than it was in 1988 at the peak of the outbreak. The average defoliation also increased, at the permanent red oak observation plots in Queens and Lunenburg counties. It was 25.5% in 1990 compared with 16.0% in 1989. (In last year's report, the defoliation was erroneously reported as 23%.) The most severely defoliated oak stand was once again in Queens County, at George Lake, where 85% defoliation occurred.

As a result of repeated serious defoliation, red oak stands in western Nova Scotia are in generally poor condition. The summary of tree condition surveys in 35 stands in 1988, 40 in 1989 and 39 stands in 1990 is presented in Table 10. Results show that few trees remain healthy and, in spite of reduced population and defoliation levels, tree deterioration is progressive. However, there is some improvement in the condition of trees in the 26-50% dieback class and the tree mortality rate appears to be slowing down.

In addition to the serious damage these insects are causing in western Nova Scotia, an indirect problem could be the delay in the early detection of infestations by gypsy moth, a recently introduced insect which appears to be spreading in this part of the province and for which oak is one of the most favored host species.

In New Brunswick, at the one remaining "trouble spot", at Cranberry Lake, Queens County, moth catches in pheromone traps for both species were very high, indicating damaging population levels. Trace to light defoliation occurred also in the Little Lake Road area in Sunbury County and all oak trees were affected.

In Prince Edward Island, moderate defoliation occurred early in the season at Brudenell Point, Kings County, and at Afton Road, Queens County.

VARIABLE OAK LEAF CATERPILLAR

Variable oak leaf caterpillar, *Lochmaeus manteo* Dbly., was first found in the Maritimes in 1952 and has been present occasionally as a minor component in the hardwood defoliator complex. The insect, closely related to saddled prominent, became a major defoliator of beech in New Brunswick in 1990. It also caused defoliation of beech and red oak in Nova Scotia.

In New Brunswick, the insect was last recorded in 1976 when a few larvae were collected from wire birch, white birch, and sugar maple in the First Eel Lake and North Lake areas of southwestern York County. In 1990, complete defoliation of beech occurred in many scattered patches varying in size mostly from 1 to 10 ha in the southern half of York County. In uneven-aged stands the understory trees and the lower branches of large trees were completely stripped of foliage, in mixed hardwood stands, beech was severely defoliated while other hardwoods, notably sugar maple, were affected to a lesser degree. The largest area of severe defoliation was in an approximately 75-ha stand in

Spednic Lake Provincial Park. Elsewhere defoliation was severe at Graham Corner, Sixth Lake, East Brook Lake, and Pokiok Settlement Road, moderate near Forest City, Musquash Lake, near McAllister Cove, Skiff Lake, near Pokiok, and Claudie Road near Fredericton. Larvae were found in beech stands but caused negligible defoliation in many other areas in southern York and Charlotte counties. The insect is a late summer defoliator and, because beech in all areas is already stressed by the presence of beech bark disease, it is expected that tree mortality may occur in some of the infested stands. Assessment plots were established to determine the impact of defoliation.

In Nova Scotia, severe defoliation occurred at East Kemptville, Yarmouth County in a 4-ha stand of mainly beech, where less than 5% of the leaves remained. Severe defoliation on the lower branches of beech was recorded at Cameron Lake, Harmony Lake, and south of Minards Bay, Queens County, at Bull Hill and north of Travis Lake, Yarmouth County. Red oak was similarly affected at Loon Lake, Queens County and Seffernsville, Lunenburg County. Lesser amounts of defoliation of beech and oak occurred in other areas of Queens County and of beech in Annapolis County.

ASH RUST

The chronic infection by ash rust, *Puccinia sparganioides* Ell. & Barth., continued in most parts of western Nova Scotia and severe or moderate damage occurred in many areas often affecting small groups of trees. Trees were seriously affected in Yarmouth, Shelburne, Queens, and Lunenburg counties. The most serious damage occurred at Jordan Falls, Shelburne County, where several dozen riverside trees had moderate or severe discoloration and early leaf fall, and at East Kemptville, Yarmouth County, where trees along several hundred meters of roadside were similarly affected. Ash rust also occurred, but at much lower intensity, in Digby, Annapolis, Kings, and Hants counties. The disease was not observed in 1990 in either New Brunswick or Prince Edward Island.

BIRCH FOLIAGE FEEDERS

A group of insects with specialized feeding habits occurs on birch in the Maritimes. Unlike defoliators that eat the entire leaf, these insects consume only specific parts of it. Although their feeding patterns vary somewhat, the effect in each case is the same. All of these insects cause foliage discoloration, usually browning.

Birch Casebearer

Birch casebearer, *Coleophora serratella* (L.), populations remained high in Prince Edward Island, decreased in New Brunswick, and remained low in Nova Scotia, resulting in corresponding levels of foliage discoloration of white birch and to some extent of wire birch, yellow birch, and alder.

In New Brunswick, an average of 10% of white birch foliage was discolored in 1990, half of that reported last year. Light foliage browning occurred in most areas although discoloration was moderate in a few scattered areas. The highest level of foliage discoloration occurred at Mohannes, Charlotte County, where 75% of the leaves were affected. Yellow birch, alder, and wire birch were affected to a much lesser extent in a few scattered areas.

In Nova Scotia, the insect was present throughout the province and caused mainly trace to light foliage discoloration of white birch. An average of 15% of foliage was affected, the highest level of browning recorded at North Shore, Victoria County, where 51% of the leaves were discolored. Foliage browning was light on speckled alder but only a trace on yellow birch and wire birch.

In Prince Edward Island, severe browning occurred in many areas where white birch and alder are present. Alder often appeared to be affected to a greater degree than birch in Queens and Kings counties. An average of 42% of the white birch foliage was discolored on 83% of the trees at the 22 locations assessed.

Birch Leafminer

Birch leafminer, *Fenusa pusilla* (Lep.), caused severe foliage discoloration of white birch and wire birch at a few scattered locations in eastern and southern New Brunswick and in western Nova Scotia. Populations were generally low in the rest of the region.

In New Brunswick, leaf browning was severe at Mohannes, Charlotte County, Smith Creek, Kings County, and Kellys Beach in Kouchibouguac National Park, Kent County, and moderate at Long

Point and Moose Horn Creek in Kings County. White birch had an average of 13% of leaves affected on 62% of the trees at 18 locations while on wire birch 9% of the leaves were discolored on 72% of the trees at the 13 locations assessed. Foliage browning was negligible in northwestern part of the province.

In Nova Scotia, severe or moderate foliage discoloration was observed on a few trees at many locations in Queens, Lunenburg, Annapolis, and Kings counties. Trace or light leaf browning occurred in the rest of western Nova Scotia and the insect caused only trace discoloration in a few areas in the eastern half of the province.

In Prince Edward Island, the insect was present but caused no noticeable foliage browning. An average of only 9% of wire birch leaves and 4% of white birch leaves were affected on about half of the trees assessed.

Birch Skeletonizer

Birch skeletonizer, *Bucculatrix canadensisella* Cham., was of importance only in eastern Nova Scotia, where the current outbreak has persisted since 1988. The insect was found at only one location, at trace level, in Prince Edward Island and was not reported in New Brunswick.

In Nova Scotia, skeletonizing of white birch leaves by this insect further increased in 1990. Foliage browning was very common on Cape Breton Island and on the eastern mainland. While most of the foliage browning was still in the moderate category (an average of 53% of foliage was affected at 50 locations), many more areas had severe browning than in previous years. All leaves were discolored at Portage, Sydney River, and Sydney in Cape Breton County; Northeast Margaree and Rigwash Brook in Inverness County; James River and Ashdale in Antigonish County; and at Barneys River in Pictou County. Discoloration was 99% at Neils Harbour, Victoria County, 93% at West Lakevale, Antigonish County, and 89% at Big Pond, Cape Breton County. Severe and moderate discoloration occurred along several hundred meters of roadside at Card Hill Lake, Lunenburg County, and on a few scattered trees in Halifax and Lunenburg counties in the western half of the province. Foliage browning was moderate at Truro, Colchester County.

POPLAR SERPENTINE LEAFMINER

Population levels of the poplar serpentine leafminer, *Phyllocnistis populiella* Cham., remained high in New Brunswick and caused twig and branch dieback of trembling aspen in the northern half of the province but continued to be low in both Nova Scotia and Prince Edward Island.

In New Brunswick, the silverish-gray appearance of trembling aspen foliage was once again much in evidence in the north and also to some extent in the south. Both incidence and intensity decreased towards the Fundy coast. This outbreak has persisted since 1981. Twig and branch dieback as well as "thin tops" are more and more common. Although population levels are still high in Restigouche, Gloucester, Madawaska, Victoria, and Northumberland counties, averaging 50% of the foliage affected on most (93%) of the trees, this population level is a reduction from the 61% reported last year. In the ten southern counties, the average infestation level of 11% of foliage affected on two-thirds of the trees (66%) is virtually unchanged from last year.

In Nova Scotia, population levels are low, the insect was found at only 11 locations and the highest infestation was only 9% of foliage affected on 70% of the trees.

In Prince Edward Island, an average of only 5% of the leaves was affected on 23% of the trees, and even the highest infestation at DeBlois, Prince County was only 19% of leaves affected on 30% of the trees.

WIND DAMAGE IN NOVA SCOTIA

Wind damage, mainly in the form of foliage injury, occurred at the end of June, 1989 on both hardwoods and conifers in various areas of eastern Nova Scotia. Damage was most serious on Cape Breton Island, where severe and moderate foliage browning of most hardwood species occurred in a coastal strip along the entire length of Inverness and the northern tip of Victoria counties. Stands were affected mostly on the upper elevations of hills and along ridges. The area involved was approximately 20,000 ha, of which 6,300 ha had severe and 8,700 ha had moderate foliage browning. Browning was most severe on sugar maple, but most hardwood species were discolored.

In 1990, trees in some of those affected areas exhibited poor growth and varying amounts of top dieback with bare branches evident on 30-50% of the upper crowns. The areas where these residual effects were observed were all in Inverness County; Pollets Cove, Fishing Cove, Cap Rouge, Robert Brook, Point Cross, Cap Le Moyne, Chimney Corner, and on the Mabou Highlands, covering a total area of almost 9,000 ha.

Hardwood foliage was affected by wind again in 1990 in eastern Nova Scotia and foliage discoloration was widespread. An average of 12% of the leaves were damaged at the 45 locations recorded, but as much as 60% of the white birch foliage was damaged and discolored at Cape Smokey, Victoria County. In some areas, anthracnose of sugar maple, a leaf disease caused by the fungus *Kabatiella apocrypta* (Ell. & Ev.) Arx, either contributed to the browning or was occasionally the primary cause of foliage discoloration.

NURSERY AND GREENHOUSE PROBLEMS

Although a wide variety of pest related problems were encountered in Maritime forest nurseries in 1990, damage in most cases was not significant and was usually in the less than 5% range. Increased vigilance, early intervention, and good nursery practices deserve the credit for minimizing the damage by some potentially important pests.

The identification of the **tarnished plant bug** or Lygus bug, *Lygus lineolaris* (Pallsot), on 3-year-old black spruce container stock in New Brunswick, was the highlight of the season. First identified as feeding on tree seedlings on the west coast of Canada in 1983, this species commonly feeds on the cereal grains used as a cover crop in bareroot nurseries. On trees, they feed on succulent growing shoots causing the loss of growing tips, stunting and twisting of needles, and the development of multiple leaders.

Weevils, *Curculionidae*, probably the strawberry root weevil, *Otiorhynchus ovatus* L., in most cases, were observed frequently and in many locations in 1990 but caused damage in only a few cases. Weather conditions in 1989 and 1990 are thought to have contributed to a population build-up.

Overwintering losses in crops have generally been reduced from levels recorded in the mid-1980s although winter climate remains a significant factor. Major losses often result from inattention to recommended cultural practices and schedules, such as removing crops from greenhouses for overwintering without adequate development of buds and cold hardiness.

Summer climate was a contributing factor to a variety of problems in 1990. A hot spell in mid-June, which followed cold spring conditions, resulted in or contributed to heat lesions and fertilizer burn, in addition to water deficiency problems. A large crop in a holding area was damaged by pesticide applied under unsuitable conditions.

Gray mold, *Botrytis cinerea* Pers. ex Fr., was common throughout the region on a variety of host species whenever nursery stock was stressed by other factors or air movement was restricted.

Other pests encountered in nurseries in 1990 included: Sirococcus shoot blight (*Sirococcus conigenus* (DC.) P. Cannon and Minter), the smothering fungus (*Thelephora terrestris* Ehrh. ex Fr.), globose gall rust (*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka), brown larch tubemaker (*Spilonota lariciana* Heinr.), large yellow underwing (*Noctua pronuba* (L.)), gall adelgids, mites, spider mites, and thrips.

SEED ORCHARD PESTS

Seed orchard pests fall into three distinct categories, those that damage the seeds or cones directly, those that affect the trees and thus have an indirect effect on cone and seed production, and those that are primarily defoliators but may feed on young, green immature cones thus causing direct damage. In 1990, pests from all three categories were present in Maritime seed orchards.

Spruce cone maggots infested from 1-18% of cones examined in six black spruce orchards in New Brunswick and Prince Edward Island and 3% of cones in two white spruce orchards in New Brunswick. Adults of *Strobilomyia appalachensis* Michelsen were caught on colored sticky traps in a black spruce seed orchard near Bettsburg, Northumberland County, New Brunswick (Sweeney, unpub. data). *S. appalachensis* is a new species, described by Michelsen, (previously confused with *Hylemya anthracina*) whose larval behavior is unknown but which probably feeds in spruce cones. Cone collections were made at several sites in the

Maritimes in 1990 to determine the distribution of *S. appalachensis* and *S. neanthracina*. The results should be known in the spring of 1991.

Coneworms - very few spruce coneworm, *Dioryctria reniculelloides* Mut. & Mun., larvae were found damaging white spruce cones at the Queensbury Seed Orchard, York County, New Brunswick. No moths were caught in pheromone traps set out in nine black spruce and seven white spruce seed orchards in New Brunswick, Nova Scotia, and Prince Edward Island. The fir coneworm, *D. abietivorella* (Grt.), damaged about 9% of the cones at the Queensbury white spruce and tamarack orchards and fewer still at the Pokiok, York County, New Brunswick, black spruce orchard.

Spruce seed moth, *Cydia strobilella* (L.), larvae were found in less than 1% of the black spruce cones from the Sirois Road, Victoria County, New Brunswick, seed orchard. Pheromone traps were set out in three white spruce and three black spruce seed orchards and at the Fredericton Golf Club. A total of seven male moths (two traps) were caught at the Three Brooks black spruce orchard near Plaster Rock, Victoria County, New Brunswick, and 422 (two traps) at the Fredericton Golf Club; about 30% of the cones were damaged at the latter site.

Larch cone maggots - two species of maggots, *Strobilomyia laricis* Michelsen and *S. viaria* (Huckett), infested from 20-65% of cones from three tamarack seed orchards in New Brunswick, but only 4-5% of cones from two orchards in Prince Edward Island.

Midges - *Resseliella* sp. infested from 9-47% of tamarack cones in three New Brunswick seed orchards but only 5-7% of cones in two Prince Edward Island orchards.

Adelgids, *Adelges* sp. infested from 72-99% of cones in five tamarack orchards but did not appear to directly harm seed.

Needleminers, *Coleotechnites* sp. infested from 1-55% of tamarack cones in three New Brunswick seed orchards and 27-30% in two Prince Edward Island seed orchards; many cones were already infested by the cone maggot.

Spruce budmoth, *Zeiraphera canadensis*, Mut. & Free., was observed feeding on a small percentage of white spruce cones at the Queensbury seed orchard. Budmoth-damaged shoots were numerous on white spruce at the Pokiok seed orchard.

Spruce cone axis midge, *Dasineura rachiphaga* Tripp, was found in 6% of white spruce cones in a Nova Scotia orchard.

Spruce needle rust, *Pucciniastrum americanum* (Farl.) Arth. caused less than 5% damage to cones harvested from grafted white spruce trees in a Nova Scotia orchard.

Other pests found in seed orchards in 1990 included: Armillaria root rot (*Armillaria mellea* (Vahl ex Fr.) Kummer), spruce bud scale (*Physokermes piceae* (Schr.)), pine leaf adelgid (*Pineus pinifoliae* (Fitch)), ragged spruce adelgid (*Pineus similis* (Gill.)), pine bark adelgid (*Pineus strobi* (Htg.)), white pine weevil (*Pissodes strobi* (Peck)), larch needleworm (*Zeiraphera improbana* (Wlk.)), pine needle sheathminer (*Zelleria haimbachi* Busck), pine sphinx (*Lapara bombycoides* Wlk.), pepper-and-salt moth (*Biston betularia cognataria* (Gn.)), dot-and-dash swordgrass moth (*Xylena curvimacula* (Morr.)), scale insects, gall adelgids, aphids, mites, and sawflies.

PLANTATION PEST ASSESSMENT SURVEYS

Multi-agency plantation pest assessment surveys determined pest conditions on over 18,500 trees in more than 350 plantations and 17 thinned areas in New Brunswick and Nova Scotia.

Plantation assessments required detailed examination of 50 trees in each plantation. Ten subplots, of five trees each, were selected along a pre-determined line of travel. The distance between subplots varied according to the size of the plantation to provide for uniform coverage. The level of damage on each tree part by each pest found was recorded. Field assessments were carried out mostly by staff of our various cooperating organizations while identification of samples and summarizing were done by the Forest Insect and Disease Survey.

In 1990, there were 355 plantations assessed by the various organizations, 202 in New Brunswick and 153 in Nova Scotia (Table 11). N.B. Department of Natural Resources also assessed 17 thinned areas (Table 12). Over 18,500 trees were examined in the course of the surveys. Cooperat-

Table 11 Summary of plantation assessments by tree species and organization conducting field work in New Brunswick and Nova Scotia in 1990

Tree species	Total plant. assess.	New Brunswick					Nova Scotia			
		DNR	Fras	JDI	SCI	Total	NSLF	Stora	FIDS	Total
Balsam fir	3	2	-	-	-	2	-	-	1	1
Larch	2	2	-	-	-	2	-	-	-	-
Jack pine	45	35	2	6	-	43	2	-	-	2
Red pine	40	6	1	2	-	9	25	3	3	31
White pine	3	-	-	-	-	-	3	-	-	3
Mixed pine	1	-	-	-	-	-	1	-	-	1
Black spruce	144	40	32	18	1	91	29	21	3	53
Norway spruce	11	-	-	2	-	2	8	1	-	9
Red spruce	21	1	-	-	-	1	20	-	-	20
White spruce	46	3	3	22	1	29	15	2	-	17
Mixed spruce	14	5	2	-	-	7	5	2	-	7
Spruce unspec	4	2	-	-	-	2	-	2	-	2
Mixed species	20	13	-	-	-	13	-	7	-	7
Yellow birch	1	-	-	1	-	1	-	-	-	-
Totals	355	109	40	51	2	202	108	38	7	153

Table 12 Number of thinned areas assessed in the New Brunswick Department of Natural Resources in the Resource Management Regions in 1990

Stand composition	Total assessed	Thinned areas by Region				
		1	2	3	4	5
Black spruce	1	0	0	0	1	0
Mixed softwood	12	2	5	1	4	0
Mixed hardwood	4	0	0	0	4	0
Total	17	2	5	1	9	0

Table 13 The condition of trees in plantations and thinned areas in New Brunswick and Nova Scotia in 1990

Province	Species	Tree Condition (%)			
		Healthy	Fair	Poor	Dead
New Brunswick	Pine	91.8	4.6	2.3	1.3
	Spruce	94.3	2.9	1.2	1.6
	Other	94.3	3.3	1.3	1.0
	Thinned	94.7	3.2	1.2	0.9
	Average	93.8	3.4	1.4	1.4
Nova Scotia	Pine	92.1	4.0	3.1	0.9
	Spruce	91.8	5.4	1.8	1.1
	Other	94.5	1.5	2.8	1.3
	Average	91.9	4.9	2.2	1.1

ing agencies, in addition to the Forest Insect and Disease Survey in 1990 were: N.B. Department of Natural Resources (DNR), Fraser Inc. (Fras), J.D. Irving Ltd. (JDI) and Stone Consolidated Inc. (SCI) in New Brunswick; N.S. Department of Lands & Forests (NSLF) and Stora Forest Industries (Stora) in Nova Scotia.

Results show that, although over 90% of the trees assessed in New Brunswick and Nova Scotia were classified as healthy (Table 13), there were at least some trees with severe damage in 29% of the plantations assessed in both New Brunswick and Nova Scotia (Table 14).

Table 15 lists the various plantation problems encountered at severe or moderate levels in the two provinces on pine while Table 16 lists the problems on spruce. In Table 17 the problems found in the 17 thinned areas in New Brunswick are listed.

Table 14 Frequency of plantations and thinned areas containing trees with moderate or severe damage in New Brunswick and Nova Scotia in 1990

Province	Species	Plantations		
		Number assessed	Frequency(%) with	
			Moderate	Severe
New Brunswick	Pine	52	27	33
	Spruce	132	22	26
	Other	18	17	44
	Thinned	17	41	23
	Total/Average	219	24	29
Nova Scotia	Pine	37	35	35
	Spruce	108	27	30
	Other/Average	8	37	0
	Total/Average	153	29	29
Region Total		372	26	29

Table 15 Number of pine plantations containing trees with moderate or severe problems in the various regions of New Brunswick and Nova Scotia in 1990

Problem	New Brunswick Regions					Nova Scotia Regions						
	1	2	3	4	5	W	SS	V	NC	SC	E	CB
Adelgid	1	-	-	1	-	1	-	-	-	-	1	-
Animal damage	-	2	2	8	3	1	1	-	2	4	2	1
Aphid	-	-	-	1	3	-	1	-	-	-	-	-
Bark beetle	-	-	-	1	1	-	-	-	-	-	-	-
Competition - Hardwood	-	-	-	3	-	-	-	-	-	-	-	-
- Unspec.	-	-	-	-	-	-	-	-	-	-	1	-
- Herb.	-	-	-	-	-	-	-	-	-	1	-	-
Coneworm	-	-	-	1	-	-	-	-	-	-	-	-
Development	-	-	-	-	-	-	-	-	-	-	-	1
European pine shoot moth	-	-	-	-	-	1	2	-	-	-	2	-
Frost damage	-	-	1	-	1	-	-	-	-	-	-	-
Jack pine budworm	-	1	-	-	-	-	-	-	-	-	-	-
Jack pine sawfly	-	-	1	-	-	-	-	-	-	1	-	-
Mechanical damage	-	-	2	-	1	-	-	-	-	1	-	-
Needle flecking	-	-	-	-	-	1	-	-	-	-	2	-
Needle rust	2	1	1	1	-	-	-	-	1	1	-	-
Northern pitch twig moth	-	-	-	-	1	-	-	-	-	-	-	-
Planting	-	-	-	3	-	-	-	1	-	2	5	1
Shoestring root rot	1	-	2	2	-	-	-	-	-	1	1	-
Shoot moth	-	-	-	-	-	-	-	-	-	1	-	-
Snow damage	-	1	2	3	1	1	-	-	-	1	3	-
Weather	-	-	2	1	-	-	-	-	-	-	-	-
White pine blister rust	-	-	-	-	-	-	-	-	-	1	-	-
White pine weevil	-	1	3	3	-	1	-	-	-	1	1	-
Wind damage	-	-	-	1	-	-	-	-	-	-	1	-
Winter damage	-	-	-	-	-	1	-	-	-	-	1	-

W=western; SS=South Shore; V=Valley; NC=North Central; SC=South Central; E=Eastern; CB=Cape Breton.

Note: Moderate or severe problems in plantations other than pine or spruce included: in New Brunswick in Region 1: mechanical damage, needle rust, planting problems and spruce budworm; in Region 4: animal damage, aphids, canker, competition, spruce gall adelgid, mechanical damage, planting problems, weather damage, spruce budworm, white pine weevil, and wind damage; in Region 5: an unidentified canker. In Nova Scotia, from the Eastern Region: porcupine damage and competition.

Table 16 Number of spruce plantations containing trees with moderate or severe problems in the various regions of New Brunswick and Nova Scotia in 1990

Problem	New Brunswick Regions					Nova Scotia Regions						
	1	2	3	4	5	W	SS	V	NC	SC	E	CB
Adelgid	-	-	-	-	2	-	1	-	-	-	-	1
Animal damage	-	-	1	4	-	-	-	3	1	5	5	6
Aphids	-	1	-	-	4	-	-		-	-	-	3
Competition Hardwood	-	-	-	3	-	-	-	-	-	1	-	-
Softwood	-	-	-	2	-	1	-		-	-	2	-
Herb.	-	-	-	1	-	-	-	-	-	1	3	-
Unspec.	-	-	-	-	-	-	-	1	-	-	5	-
Coneworm	-	-	-	1	-	-	1	-	-	-	1	-
Development	-	-	-	1	3	-	-	-	-	-	1	-
Frost	-	-	-	-	7	-	-	-	-	-	-	7
Gall midge	-	-	-	-	12	-	-	-	-	-	-	-
Looper	-	-	-	-	-	-	-	-	-	-	-	1
Mechanical damage	-	-	-	-	2	-	-	-	-	2	-	-
Needle miner	-	-	-	-	-	-	-	-	-	-	-	1
Needle rust	-	-	1	1	1	-	-	-	-	1	-	-
Nutrient deficiency	-	-	-	-	3	-	-	-	-	-	-	1
Planting	-	1	-	5	1	2	-	-	-	3	17	5
Root collar weevil	-	-	-	-	-	-	-	-	-	3	1	1
Sawfly	-	1	-	-	-	-	-	-	-	-	1	3
Shoestring root rot	1	2	3	7	4	-	1	-	1	-	8	6
Sirococcus shoot blight	-	-	-	-	-	-	-	-	-	-	-	1
Snow damage	1	-	-	1	10	-	-	1	-	-	2	2
Spittlebugs	-	-	-	-	-	-	-	-	-	-	-	1
Spruce bud midge	-	-	-	2	5	-	-	-	-	-	-	-
Spruce budmoth	-	-	-	-	16	-	-	-	-	1	2	1
Spruce budworm	-	1	-	-	8	-	-	-	-	-	-	-
Spruce gall adelgid	-	-	-	-	-	-	-	1	-	-	-	-
Weather	-	-	-	-	-	-	-	-	-	-	1	-
White pine weevil	-	1	-	1	-	2	-	-	-	-	-	1
Wind damage	-	-	-	-	1	-	-	-	-	1	-	-
Winter damage	-	-	-	-	1	-	1	-	-	3	5	5

W=Western; SS=South Shore; V=Valley; NC=North Central; SC=South Central; E=Eastern; CB=Cape Breton

Table 17 Number of thinned areas with moderate or severe problems in the New Brunswick management regions in 1990

Problem	Region				
	1	2	3	4	5
Animal damage	-	-	2	1	-
Canker	-	-	-	1	-
Competition Hardwood	-	-	-	1	-
Softwood	-	-	1	-	-
Development	-	-	-	1	-
* Forest tent caterpillar	-	-	-	1	-
Frost damage	-	-	1	-	-
* Leafminer	-	-	-	1	-
* Leaf skeletonizer	-	-	-	1	-
* Leaf tier	-	-	-	1	-
Mechanical damage	-	-	-	4	-
Needle rust	-	1	-	-	-
Planting	-	-	1	-	-
White pine weevil	-	2	-	2	-
Wind damage	-	-	-	1	-

*Hardwood species in thinned areas

CHRISTMAS TREE PESTS

Many pests of balsam fir Christmas trees are mentioned elsewhere in this report. The balsam gall midge and the balsam twig aphid are discussed here because of their widespread occurrence both in Christmas tree areas and in natural stands, and because they affect the quality and, consequently, the value of Christmas trees. Similarly, balsam woolly adelgid is mentioned because of its demonstrated economic effect in Nova Scotia.

Balsam gall midge, *Paradiplosis tumifex* Gagné, was widespread throughout the Maritimes but population levels were generally low and little needle damage resulted.

In New Brunswick, balsam gall midge was recorded in all 15 counties of the province. Although almost two thirds (63%) of the trees were affected, only an average of 6% of the balsam fir needles had galls at the 60 locations assessed. There were only three areas in the province where more than 20% of the needles were affected. Infestation levels by the balsam gall midge were also determined at 782 locations by the New Brunswick Dept. of Natural Resources. Of these, 39% were negative, 1-10% of the needles were affected at 59% of the locations, the infestation level was in the 11-20% range at 2% of the locations, and 20% or more of the needles were affected at two locations (0.3%). These figures ae very similar to last year's and indicate no change in populations from 1989 levels.

In Nova Scotia, an average of 3% of the needles were affected on less than half (48%) of the trees assessed at 25 locations. Nowhere was the incidence of galls in excess of 10% in these areas.

In Prince Edward Island, an average of 9% of the needles were affected on 62% of the trees at the 13 locations assessed. The highest infestation, 17% of the needles affected on half of the trees, was recorded at Howe Bay, Kings County.

Balsam twig aphid, *Mindarus abietinus* Koch, infestations were common throughout the Maritimes. Damage levels were generally light and slightly higher than last year's in all three provinces.

In New Brunswick, an average of 14% of balsam fir shoots were affected on 60% of the trees at the 39 locations assessed. Damage was light or trace in most areas, moderate only at Allainville, Northumberland County (39%), Hardwicke, Northumberland County (33%), and at West Branch Little Forks, Kent County (31%). There was a slight decrease in the distribution of the aphid, as indicated by the survey conducted by the New Brunsick Department of Natural Resources. Twig aphid was present at 42% of the 782 locations assessed compared to 50% positive locations in 1989, 39% in 1988 and 16% in 1987.

In Nova Scotia, an average of 9% of balsam fir shoots were affected on 36% of the trees at the 30 locations assessed. Damage was light or trace except at north of Lake George, Kings County, where moderate damage (36%) occurred.

In Prince Edward Island, an average of 14% of balsam fir shoots were affected on 39% of the trees at the ten locations assessed. Damage was light or trace except west of Munns Road along Route 304 in Kings County, where 57% of the new shoots on 60% of the trees were damaged.

Balsam woolly adelgid, *Adelges piceae* (Ratz.) has been causing serious damage in a few balsam fir Christmas tree areas in South Brookfield, Queens County, Nova Scotia. Deterioration of trees resulted in loss of grade and forced the disposal of trees. In one area, where Christmas trees have been grown for 25 years, the adelgid infestation was first noted five years ago and has resulted in a progressively worsening situation. The number of trees discarded from the 12-ha area due to damage by balsam woolly adelgid was 200 trees in 1986, 250 in 1987, 300 in 1988, 400 in 1989 and more than 400 trees in 1990. In a nearby 32-ha Christmas tree area, 2000 trees were discarded both in 1989 and 1990.

FOREST HEALTH MONITORING

Observing and reporting on changes in the condition of the forest has been an integral part of the work done by the Forest Insect and Disease Survey in its more than 50 years of existence. Monitoring changes, regardless of the cause, has been explicit in our mandate and predates currently fashionable terminology. FIDS personnel are always on the lookout for unusual or unexplained forest conditions and we have been reporting on these under various titles. To focus attention on our forest health monitoring activities we have brought them together in this chapter and those changes that are not attributable to actions of forest pests are briefly described.

ACID RAIN NATIONAL EARLY WARNING SYSTEM (ARNEWS)

The Acid Rain National Early Warning System (ARNEWS) was established by Forestry Canada in 1984 to monitor the condition and changes in the condition of the forest in order to detect early signs of acid rain damage.

The ARNEWS system consists of (1) permanent plots, where detailed measurements and observations are made at regular intervals; (2) condition appraisal points where trees are checked for symptoms and specific measurements (such as needle retention) are made; and (3) continuous general surveillance for signs of changes in the health and condition of the forest.

In the Maritimes region, in 1990, the 17 ARNEWS plots were visited monthly from June to September to determine forest insect and disease conditions; detect "acid rain" symptoms; observe seed crop and premature fall discoloration; and collect ground vegetation samples. In August, the 5-year detailed assessments of all plots were carried out following the procedures developed by the Maritimes FIDS unit for the national system (DPC-X-25, Magasi, 1988). The plots were remeasured, in-grown trees were added, soil and foliage samples and increment cores were collected for analysis, in addition to the regular annual assessments. Results will be presented in a separate report.

NEEDLE RETENTION BY CONIFERS

Observations are made for signs of possible acid rain or other pollution damage at all locations where detailed pest conditions are assessed. Special attention is directed to the number of years of needle retention on coniferous species. A summary of needle retention values obtained from the 328 locations assessed in 1990 is presented in Table 18. It is apparent that the percentage of needles retained decreases with the age of foliage and the rate of the decrease varied among tree species and between provinces. It is important to realize that these figures represent provincial averages and, more importantly, that at least some of the loss is definitely attributable to feeding by defoliating insects. Similar information has been collected annually since 1985 in our effort to build a data base which will allow analysis of possible changes.

NORTH AMERICAN SUGAR MAPLE PROJECT (NAMP)

The North American Sugar Maple Decline Project (NAMP) collected a third year of data in 1990 from 12 New Brunswick and two Nova Scotia plots. No drastic changes in tree condition were observed, however the data is being examined in comparison with the other NAMP plots (approximately 168) in the northeastern part of the continent.

In 1989, the NAMP plot trees showed, in comparison with 1988, a tendency to slightly higher levels of dieback and reduced leaf density on managed sugarbush stands as opposed to non-sugarbush stands incurring little disturbance by man. As yet no relationship has been found between dieback levels on trees and deposition levels of some atmospheric pollutants. The overall amount of dieback on NAMP plots was actually reduced between 1988 and 1989, while the leaf density decreased. These data are as yet too preliminary for extrapolations to be made as to the health of sugar maple in general. These same trends were also found in Maritime plots, however the dieback differences were not significant. Evaluation techniques have improved over the course of this project and some of the effects may be related to these improvements. The project is to continue for two additional field seasons, by which time there should be a clearer understanding of the data.

On Prince Edward Island five sugar maple plots on which the NAMP tree assessment methodology was used were assessed. No plot trees exceeded 10% dieback or 30% leaf density, essentially the same healthy condition as in 1989.

Table 18 Retention of needles produced in different years by various coniferous trees in the Maritimes Region - 1990

Species	Province	No. of observ-ations	Needles retained of the needles produced in the year indicated(%)							
			1990	1989	1988	1987	1986	1985	1984	1983
Balsam fir	New Brunswick	97	99	96	89	81	65	46	28	17
	Nova Scotia	40	100	98	92	87	76	58	43	23
	Prince Edward Is.	20	99	96	96	85	75	47	17	5
White spruce	New Brunswick	38	99	98	93	81	69	50	30	21
	Nova Scotia	34	99	96	92	84	68	45	25	12
	Prince Edward Is.	24	93	95	87	73	57	35	11	6
Black spruce	New Brunswick	19	95	99	96	91	79	68	43	25
	Nova Scotia	12	100	100	98	87	68	58	35	25
	Prince Edward Is.	1	100	100	100	90	90	70	10	10
Red spruce	New Brunswick	33	100	100	98	92	74	55	38	25
	Nova Scotia	27	100	97	93	83	66	51	34	16
Spruce (Unspec.)	Prince Edward Is.	1	100	100	100	100	100	60	10	0
Spruces (combined)	New Brunswick	90	98	99	96	88	74	58	37	24
	Nova Scotia	73	99	98	94	85	67	51	31	18
	Prince Edward Is.	26	98	98	96	88	82	55	10	5
Red pine	New Brunswick	1	100	100	0	0	0	0	0	0
	Nova Scotia	3	100	100	87	60	3	0	0	0
	Prince Edward Is.	1	100	100	80	20	0	0	0	0
White pine	New Brunswick	1	100	90	10	0	0	0	0	0
	Nova Scotia	9	99	91	22	0	0	0	0	0
Jack pine	New Brunswick	1	100	100	50	0	0	0	0	0
	Nova Scotia	1	100	100	60	40	0	0	0	0
Pines (combined)	New Brunswick	3	100	97	20	0	0	0	0	0
	Nova Scotia	13	100	97	56	33	1	0	0	0
	Prince Edward Is.	1	100	100	80	20	0	0	0	0
Hemlock	New Brunswick	2	100	95	80	65	45	5	0	0
	Nova Scotia	6	100	85	82	67	42	28	7	0
	Prince Edward Is.	1	100	100	50	10	0	0	0	0

Table 19 Condition of white birch along the Bay of Fundy in New Brunswick on permanent plots, 1982-1990

Tree Condition Class	Percentage of trees in class								
	1982	1983	1984	1985	1986	1987	1988	1989	1990
No dieback	92.9	83.7	64.0	45.3	14.5	--	--	--*	--*
Twig dieback only	1.5	8.6	24.9	34.9	47.3	42.6	38.0	43.0	47.0
Twig and branch dieback	4.7	6.0	7.8	14.4	31.3	49.8	54.0	47.0	42.0
Dead	0.9	1.7	3.3	5.4	6.9	7.6	8.0	10.0	11.0

Each plot consists of 50 tagged trees
11 plots 1982-88
10 plots 1989
*one tree was classified as "no dieback"

MAPLE MONITORING IN NOVA SCOTIA

In Nova Scotia, tree condition improved slightly at the three sugar maple and one red maple stands which have been monitored annually since 1982. In 1989 a slight deterioration was measured, but this year the trees have almost returned to their pre-1989 condition.

DETERIORATION OF WHITE BIRCH ALONG THE BAY OF FUNDY

Recurring, early, and usually severe, foliage browning and premature leaf fall along the Bay of Fundy has resulted in serious deterioration of white birch trees in this area. The cause of the condition, first reported in 1979, is not known, but insects and diseases have been ruled out and some type of pollution is suspected as the causal agent. Multidisciplinary research was initiated in 1986 to investigate possible causes, including acid rain, acid fog, and ozone. There is now strong indication that coastal acid fog may be a major contributing factor.

In 1990, although foliage browning of white birch occurred again along the Bay of Fundy, both in New Brunswick and along the Cumberland County shores of Nova Scotia, the browning was not very pronounced in most areas. Severe browning, in early September, was noted only on patches of trees in the Dorchester to Johnsons Mills area of Westmorland County, New Brunswick and in a few areas in Cumberland County. Elsewhere, discoloration was generally light or only trace with a few areas of moderate browning. This is in sharp contrast to the condition in the first half of the 1980s, when severe foliage browning in most years was already general in the area by early to mid-August. The change in the timing and intensity of the foliage discoloration during the past several years may be reflected in the improving condition of trees on the assessment plots.

Tree condition has been assessed annually since 1982 on permanent plots. Summarized results from the plots in New Brunswick are shown in Table 19. Eleven plots were assessed from 1982 to 1988. In 1989, one of the plots was lost to harvesting operations in the area. The results indicate that the improvement in the condition of surviving trees, first noted last year, continued in 1990.

Foliage browning of birch, similar to that along the Bay of Fundy, also occurred in other areas of New Brunswick and Nova Scotia. In New Brunswick, young trees were affected and foliage browning was severe in several areas along roadsides and in cutovers while older trees in nearby undisturbed stands remained unaffected: near Londonderry, Kings County, west of Fowler Mountain along the Plaster Rock-Renous Highway, Northumberland County, and in the Newcastle area, Northumberland County. Both young and old trees were affected at Second Falls Road, Gounamitz River, Rapid Depot, Hornes Gulch, Kedgewick area in northwestern New Brunswick. Severe foliage browning occurred between McGraw Brook and North Renous Lake, Northumberland County. *Septoria betulina* Pass., a leaf spot fungus, was frequently associated with the foliage browning. In Nova Scotia, generally light foliage browning was common on the northern mainland and on Cape

Breton Island but the intensity of discoloration much reduced from last year in most areas. Patches of severe or moderate discoloration were noted in Antigonish, Guysborough, Halifax, and Pictou counties and on Cape Breton Island.

WHITE SPRUCE AT LOCH KATRINE, NOVA SCOTIA

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 hectares. 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 normal. Some of the trees have thin crowns and a few died. Since 1988, there has been a slight but gradual increase in the size of the affected area. The cause of this condition is unknown but insects or diseases do not appear to be involved. Neither foliage nor soil samples, collected in 1987, showed major differences between affected and non-affected areas which might explain the chlorotic foliage. However, tree growth in the affected area was drastically reduced in 1984 and this rate was maintained until 1987 when growth was last measured. The average annual radial increment during 1984-1987 was reduced by 35% compared to growth in the preceding 10-year period. The stands affected are on shallow soil in an area of former agricultural activity. The "old field" spruce scenario is among the factors being considered among the possible causes.

In 1990, the condition was present again and the size of the affected area increased marginally. Yellowing was most pronounced at the tips of the one-year-old needles but was also present on all older foliage. A few additional trees have died since last year. Two plots were established in 1990 to obtain more detailed information on the stands and to monitor changes.

RED SPRUCE IN SOUTHERN NEW BRUNSWICK AND IN NOVA SCOTIA

In 1985, in the southern part of New Brunswick, red spruce was found to be deteriorating at many locations on Deer Island, Charlotte County. Although trees in many of these areas had been defoliated by the spruce budworm in the past, this did not adequately explain the conditions observed. In 1986, permanent observation plots, each consisting of 50 trees, were established in Charlotte and Sunbury counties in New Brunswick and in Hants, Cumberland, and Halifax counties in Nova Scotia to monitor changes in the condition of trees. The plot in Halifax County was cut in the summer of 1987. The summary of tree conditions at the remaining four plots is presented in Table 20. Observations to date indicate an overall improvement on the plots, even though the rate of recovery appears to vary and a few trees died in the Sunbury County plot.

BLACK SPRUCE IN NORTHWESTERN NEW BRUNSWICK PLANTATIONS

Serious loss of previous-year needles of black spruce in plantations in northwestern New Brunswick has occurred around the time of bud break for a number of consecutive years. The needles turn yellow and shed, leaving the previous year's shoots bare of foliage. The area affected varied annually in size but, at its peak, affected plantations over several hundred hectares. The condition was first noticed in 1986 but needle retention assessments in two severely affected areas and a control area indicate that it must have occurred as early as 1985. (Table 21). Needle shedding was considerably reduced in 1988 and the condition has not reappeared since 1989 (Table 22). Shoot growth was reduced following needle drop and, in some of the most severely affected areas, Armillaria root rot was present. The cause of the problem remains unknown; soil nutrient deficiency, mycorrhizal relationships, off-site planting (seed source), and insufficient late-summer precipitation have all been advanced as possible contributing factors.

Table 20 Condition of red spruce at four permanent plots in the Maritimes 1986-1990

Tree condition classes	Percent of trees in various tree condition classes																			
	New Brunswick										Nova Scotia									
	Charlotte Co.					Sunbury Co.					Hants Co.					Cumberland Co.				
	86	87	88	89	90	86	87	88	89	90	86	87	88	89	90	86	87	88	89	90
1. Healthy, no defoliation	4	90	100	100	88	0	0	0	50	46	14	40	40	0	92	0	0	0	0	0
2. Healthy, only current defoliation	38	10	0	0	12	0	56	38	18	0	0	0	0	46	0	0	0	0	44	38
3. More than current but less than 25% total defoliation	50	0	0	0	0	64	30	50	18	2	46	58	54	46	8	12	16	22	36	50
4. Total defoliation 26-50%, no bare top	6	0	0	0	0	28	10	4	4	36	36	2	6	8	0	74	82	72	20	12
5. Total defoliation 26-50%, with bare top	2	0	0	0	0	8	0	2	4	8	4	0	0	0	0	14	2	2	0	0
6. Total defoliation 50-75%, no bare top	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0
11. Total defoliation more than 90%, with bare top	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
12. Dead 1 year or less	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	0	0
13. Dead - more than 1 year	0	0	0	0	0	0	2	0	2	6	0	0	0	0	0	0	0	0	0	0

Table 21 Needle loss by age-class in black spruce plantations in 1987

Year needles produced	Needle Age class	Needle loss by age class (%)		
		Salmon River	Grindstone Road	Control
1987	Current	0	0	0
1986	1-yr-old	78	73	2
1985	2-yr-old	84	84	14
1984	3-yr-old	20	25	17
1983	4-yr-old	34	31	24
1982	5-yr-old	39	37	33
1981	6-yr-old	48	49	43
1980	7-yr-old	60	63	54

Table 22 Loss of one-year-old needles in black spruce plantations between 1987 and 1990

Year	Loss of one-year-old needles (%)		
	Salmon River	Grindstone Road	Control
1987	78	73	2
1988	38	57	5
1989	7	10	6
1990	1	1	0

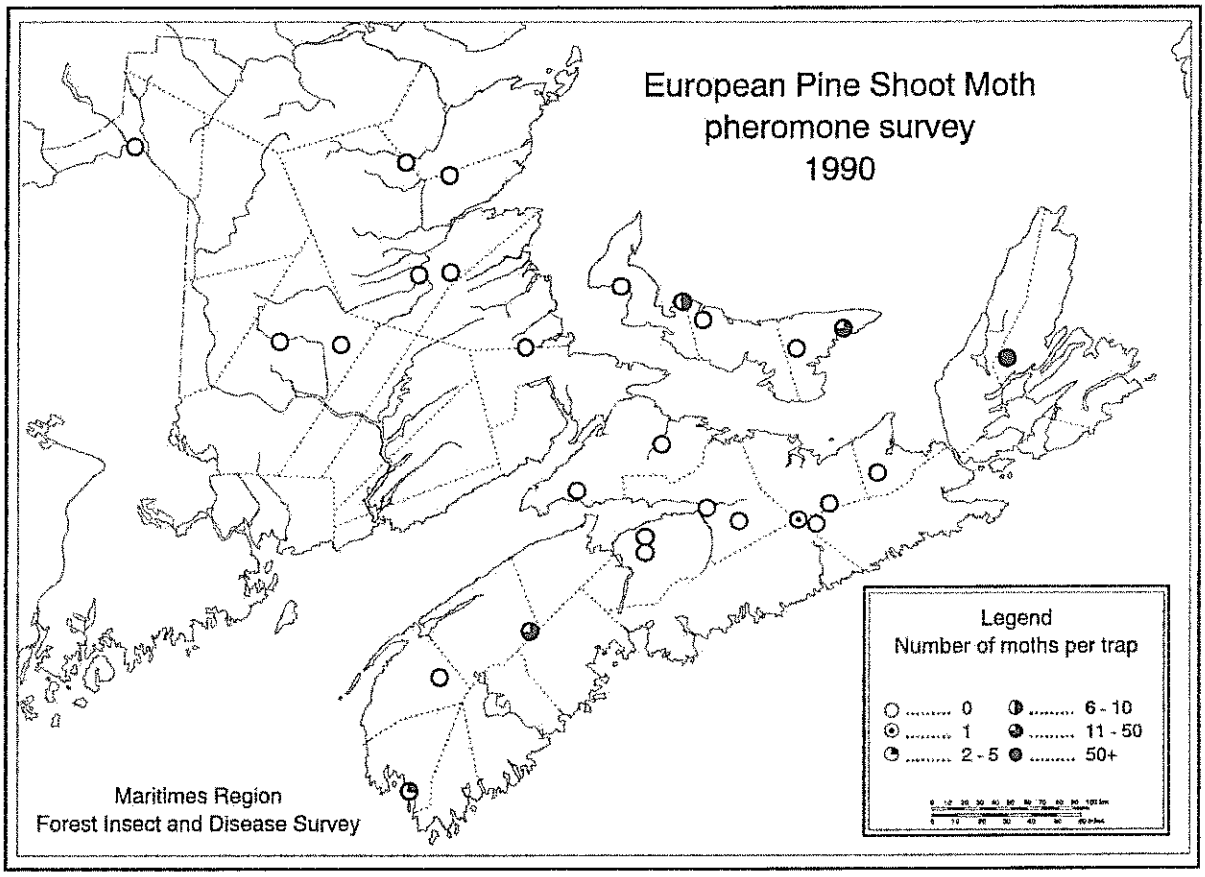

Figure 6

INSECT POPULATION MONITORING SYSTEMS

PHEROMONE TRAPPING PROGRAM

In the Maritimes, the Forest Insect and Disease Survey has been using pheromones as survey tools since 1969, when traps were first used in detection surveys for the gypsy moth. In 1990, pheromones were used for ten insects in some manner.

Pheromone traps are used to detect low level insect populations, to monitor the fluctuation of populations and, with varying degrees of accuracy, to predict population levels and the damage which will result.

An important aspect of our pheromone trapping program is standardization, that is keeping the many aspects of the trapping system uniform: the traps, lures, locations, timing of placement, and methods of handling lures. In the Maritimes, delta traps are used for most general monitoring in two-trap clusters, with traps separated by at least 20 m, while a three-trap cluster of the multi-pher non-saturating trap is standard for the spruce budworm. In addition to "operational" testing reported here, research is also under way to develop more efficient systems.

In 1990, pheromones were used for ten species of insects. Comments on each follow:

European pine shoot moth - Several trapping locations were changed in 1990 as the red pine trees in former locations have grown to the point where they are no longer susceptible to the pine shoot moth. The criterion for new trapping locations was that they be in young plantations, with trees about 1 m in height, to give early warning of an outbreak. Because changes in locations will be an annual feature of European pine shoot moth trapping, it is not appropriate to make detailed comparisons of mapped results between years except in the sense of the overall trends. Results (Figure 6) for 1990 were: no positive locations in New Brunswick, but some relatively high trap cap-

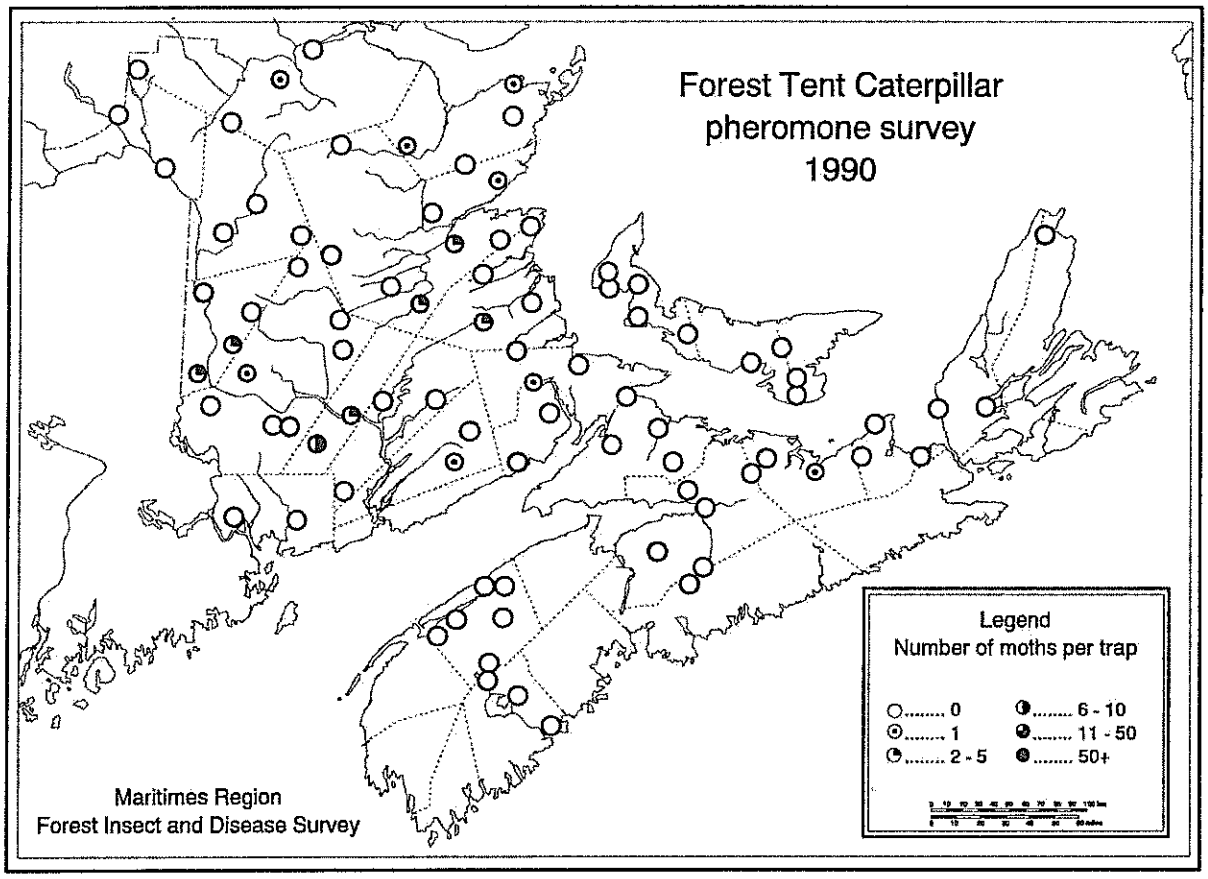

Figure 7

tures in Nova Scotia and in Prince Edward Island. Any number of moths caught in a very young plantation should be of concern and warrant an early spring inspection, removal of infested shoots or a decision on other control methods.

Forest tent caterpillar - The increase in numbers of moths caught in 1989 failed to continue in 1990, and populations remained about the same. (Figure 7). The change in percent of positive traps (below) is mostly a reflection of the additional numbers of traps placed in 1990. These results compliment the absence of reports of defoliation and egg masses, and confirm that an outbreak is not likely in the coming year. All of the positive traps, with one exception, were found in New Brunswick.

Year	No. Traps	Positive
1984	158	60%
1985	98	40%
1986	78	12%
1987	76	1%
1988	59	7%
1989	52	23%
1990	90	17%

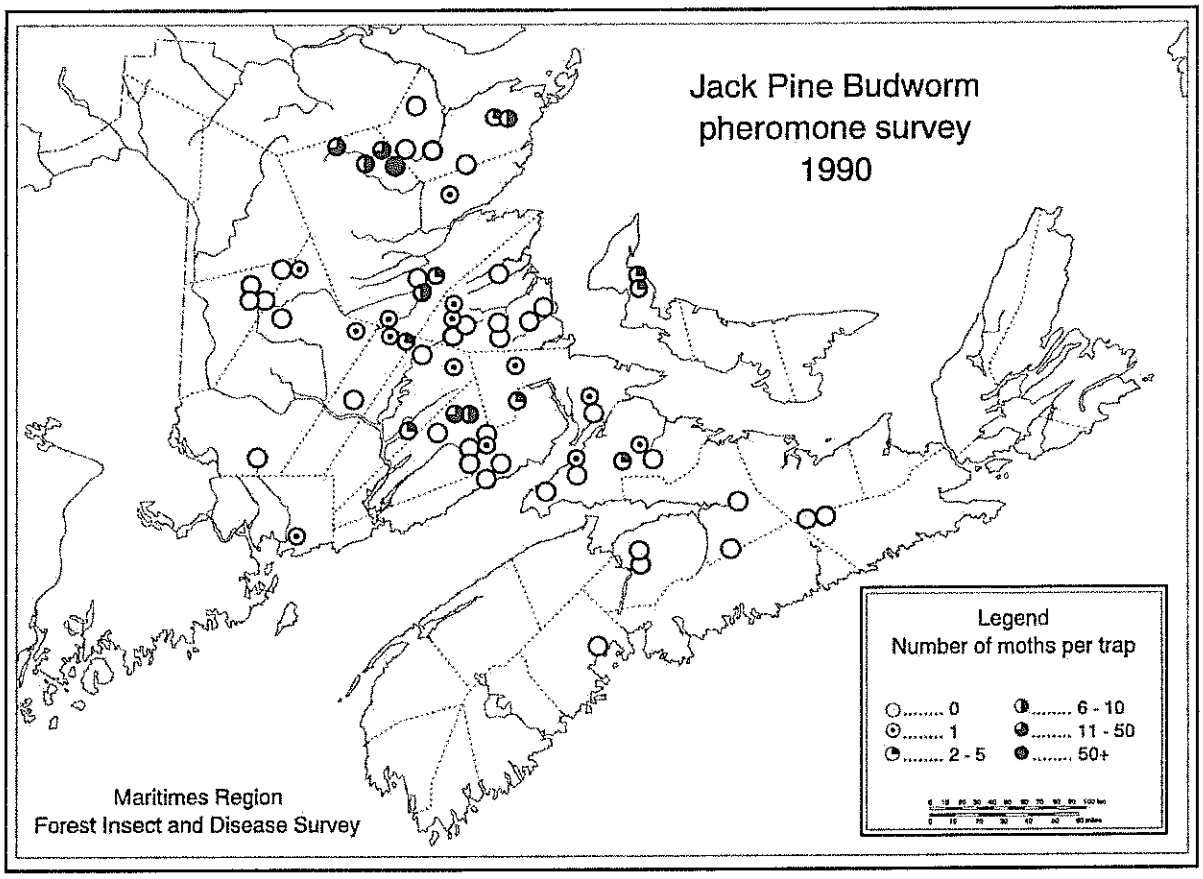

Figure 8

Gypsy moth - the pheromone trapping detection survey has been used in the Maritimes since 1969. The survey program is discussed in detail elsewhere in this report.

Jack pine budworm - 1990 trap captures were very similar to 1989, being low in most areas, with some north-central New Brunswick traps having higher numbers (Figure 8). These results are consistent with a lack of larval populations and defoliation this year.

Year	No. Traps	Positive
1984	67	72%
1985	64	84%
1986	64	60%
1987	53	49%
1988	52	35%
1989	58	43%
1990	69	45%

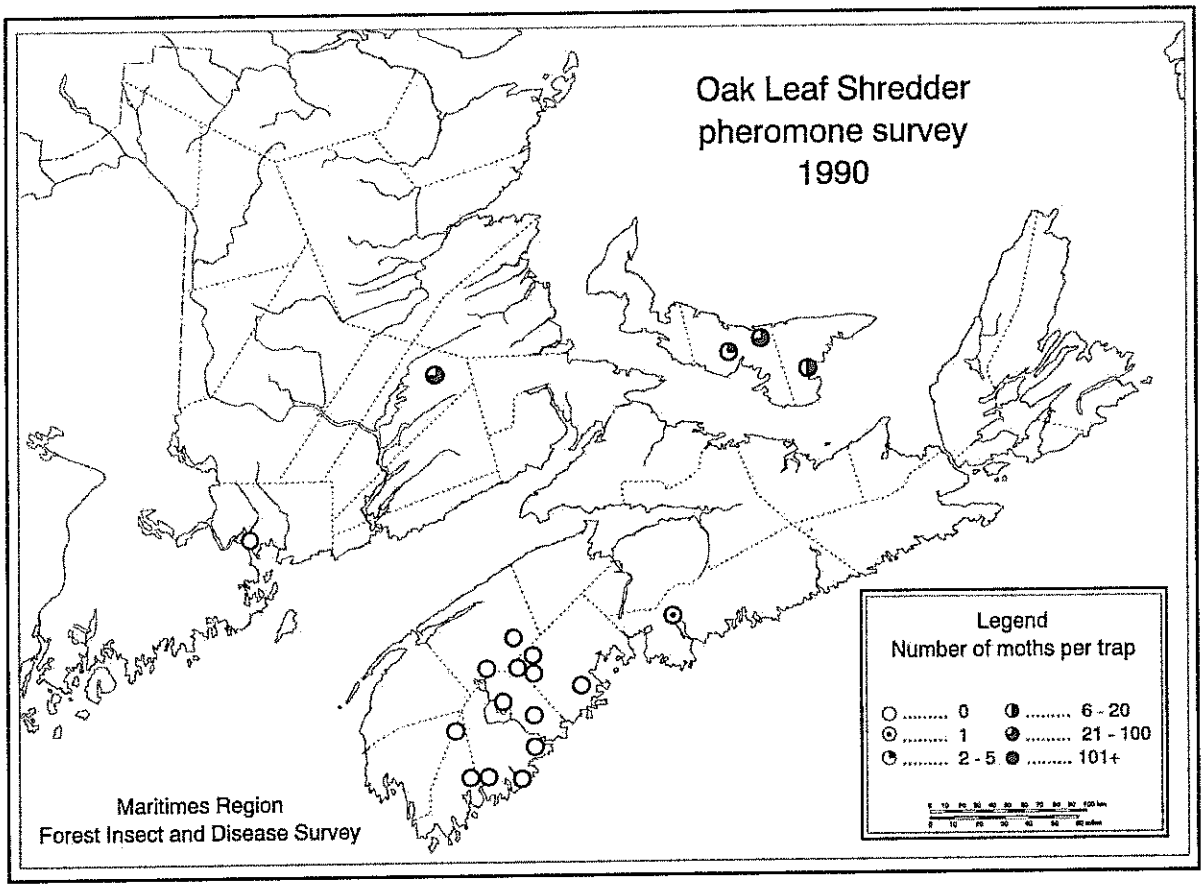

Figure 9

Oak leaf shredder - Moth catches (Figure 9) were reduced for the second year at most Nova Scotia locations, with all but one of the traps negative. Significant catches were recorded in Prince Edward Island and New Brunswick, although captures were reduced somewhat from 1989 in the chronically infested Cranberry Lake area of Queens County, New Brunswick. These results should be compared with those for the oak leafroller which shares the same host resource.

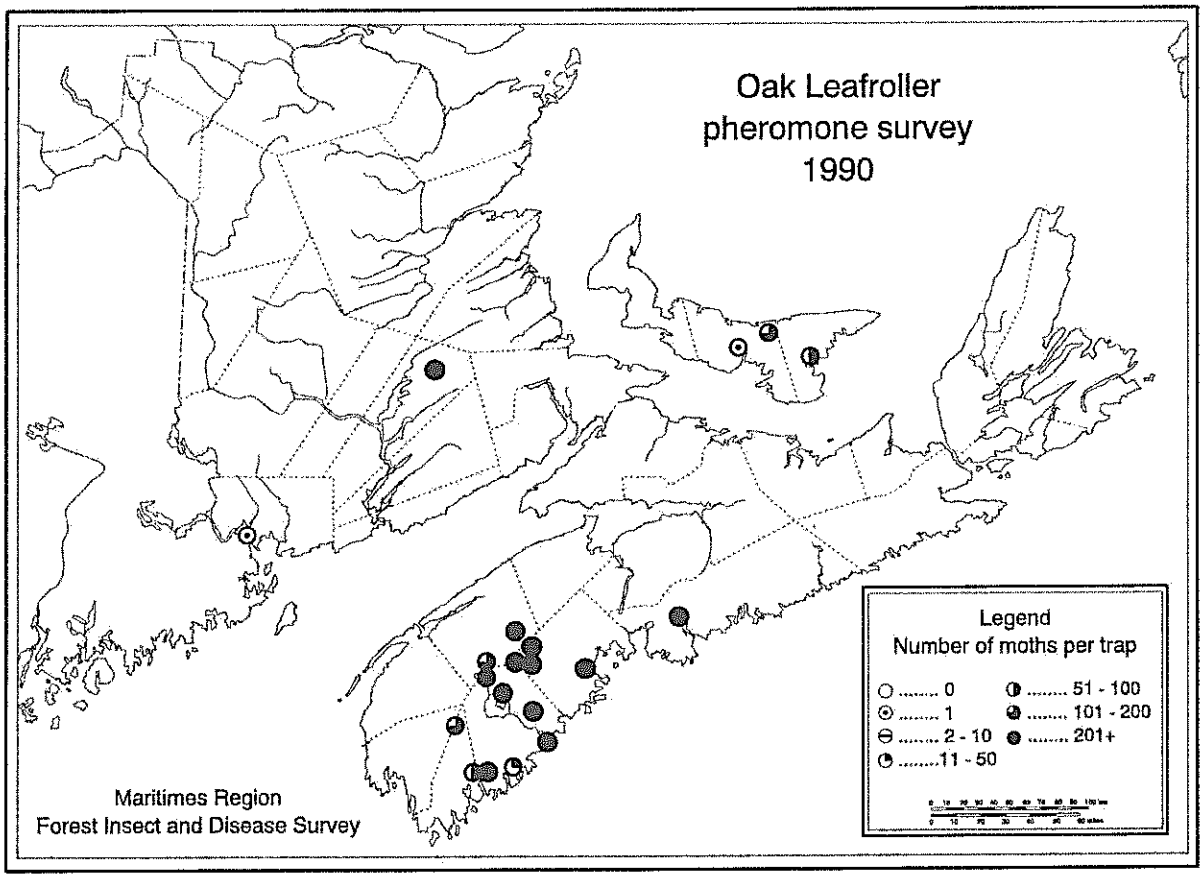

Figure 10

Oak leafroller - The new lure for the oak leafroller saw greater use in 1990 as we gained a better understanding of what the number of moths caught means (Figure 10). In the western part of Nova Scotia, where high populations of the insect are found, moth catches were extremely high, often saturating the standard delta traps. In Prince Edward Island, where the insect co-exists with the oak leaf shredder, numbers were high but somewhat reduced from 1989. Numbers were also extremely high at Cranberry Lake, Queens County, New Brunswick, and coincided with even higher numbers of the oak leaf shredder. Traps became saturated in stands where defoliation was 20%-40%, suggesting that either a non-saturating trap or a less potent lure might be required in order to predict levels of defoliation in this range. On the other hand, this very sensitive lure has a good potential for early warning of outbreaks and, combined with trapping for the oak leaf shredder, may shed light on the relationship between these two insects.

Spruce budworm - pheromone trapping was conducted at 24 Maritime locations as part of the inter-regional and international testing program to monitor and predict budworm infestations. Numbers caught were relatively low, the highest average catch for a three-trap cluster being only 15 moths. However, most traps were placed in areas where little or no defoliation was noted.

Spruce budmoths - Lures for two spruce budmoths, *Zeiraphera canadensis* and *Zeiraphera unfortunana*, were tested again in 1990. Moths of both species were caught in white spruce stands throughout the Maritimes and a good range in numbers was achieved, an important feature during the development of any pheromone monitoring and predictive system. Difficulties were encountered in separating the two species caught, as traps intended for one species also caught the other species as well. This is believed to be more a problem of trap placement than lure selectivity, requiring a new trap placement procedure before meaningful results are obtained.

Spruce coneworm - Of 23 Maritime locations trapped for the spruce coneworm, two traps were positive in New Brunswick and one in each of Nova Scotia and Prince Edward Island. These traps caught only a few moths, consistent with the apparently low populations of the insect throughout the region. Traps were also placed at nine black spruce and seven white spruce seed orchards but no moths were caught.

THE LIGHT TRAP MONITORING SYSTEM

Light traps have been used in the Maritimes to monitor forest insect populations since shortly after the Second World War. The traps use a built-in light source to attract insects which are killed in the trap, identified, and counted. The information is used in the design of surveys, prediction of population build-up, and research.

The 16 light traps in the Maritimes region are maintained by federal forestry personnel, provincial government cooperators, National Parks personnel, industrial concerns or private individuals on behalf of the Forest Insect and Disease Survey; they operate from mid-April until late fall. Catches are collected daily and the material is submitted for identification on a weekly basis. Trap design and light source were standardized in 1976 and trap locations remained the same except in unavoidable situations.

Light trap locations in the Maritimes region in 1990 were as follows:

NEW BRUNSWICK
Acadia Forest Exp. Sta., Ripples, Sunbury County
Ashton Hill, Northumberland County
Canterbury, York County
Fundy National Park, Albert County
Mayfield, Charlotte County
Nash Creek, Restigouche County
Plaster Rock, Victoria County

NOVA SCOTIA
Big Intervale, Victoria 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

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Much of the information on the status and control of the spruce budworm and hemlock looper is based on data provided by other organizations as listed in the appropriate chapters.

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Thanks go to the companies whose participation in the expanded plantation pest assessment surveys made this project a truly federal-provincial-industrial undertaking. Some of them also participated in other projects, especially the pheromone program.

The contribution and cooperation of private citizens and of personnel at all levels of industrial organizations, various municipalities, and educational institutions are noted with thanks. Their efforts on our behalf in so many ways not only make our work easier but also make us a more effective unit. Special thanks to Don Murray of the City of Fredericton.

We acknowledge the contribution of scientists of the Biosystematic Research Centre for identifications provided.

My personal thanks go to all my staff, for gathering and putting together the information in this report, for their hard work, dedication, and enthusiasm, for understanding the importance of cooperation and, in general, for making FIDS the team it is. I am proud to be a member of this team.

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OTHER INSECTS AND DISEASES

This table lists alphabetically, by common name, most insects and diseases encountered in the Maritimes in 1990 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, e.g., larch sawfly, is at an ebb of biological activity and did not cause enough concern in 1990 to warrant detailed discussion. It may be that, although severe, an organism, e.g., poplar leafmining sawfly, was only of localized importance in 1990.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Alder flea beetle *Altica ambiens alni* Harr.	Alder	Region	Overall intensity similar to 1989 in New Brunswick and Nova Scotia. Light and moderate in northwestern and central New Brunswick but most intense in the southwest. Light and moderate throughout Nova Scotia with scattered patches of severe browning. Scattered patches of moderate and severe browning in Queens and Kings counties, from Prince Edward Island.
Ambermarked birch leafminer *Profenusa thomsoni* Konow	White birch Wire birch	Region	Found at a few scattered locations throughout, principally New Brunswick; highest at Dark Harbour, Charlotte Co., where damage was light on 60% of wire birch.
Anthracnose of hardwoods *Discula quercina* (West.) Arx	Black ash White ash Beech	Region	In New Brunswick, only light discoloration on beech and black ash at two locations in Charlotte Co. In Nova Scotia, browning of beech decreased dramatically to trace and light. Highest at Ingonish Ferry, Victoria Co. (11% of leaves affected.) No reports from Prince Edward Island.
Anthracnose of maple *Kabatiella apocrypta* (Ell. & Ev.) Arx	Red maple Sugar maple	Region	In New Brunswick, a single report of moderate leaf browning on scattered maples from Coverdale to Hopewell Cape, Albert Co. In Nova Scotia, scattered patches of moderate browning in the Highlands of Inverness Co., where extensive severe and moderate wind damage occurred in 1989 (see Wind Damage in Nova Scotia); elsewhere scattered and trace. No reports from Prince Edward Island.
Ants	Conifers	Region	In New Brunswick, 12% mortality of young balsam fir at Montagne-de-la-Croix, Madawaska Co. Damage at reduced intensity in Prince Edward Island. No reports from Nova Scotia.
Ash yellows	Ash	Region	Not found in the region to date. This disease is present in the United States and is of concern to plant quarantine officials.

IINSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Aspen leafrollers *Epinotia criddleana* (Kft.) *Pseudexentera oregonana* (Wlshm.)	Trembling aspen	Region	Leafrolling, at several locations throughout the region, remained at trace or light levels of damage.
Darkheaded aspen leafroller *Anacampsis innocuella* (Zell.)			
Lightheaded aspen leafroller *Anacampsis niveopulvella* (Cham.)			
Spotted aspen leafroller *Pseudosciaphila duplex* (Wlshm.)			
Aspen webworm *Tetralopha aplastella* (Hlst.)	Aspen	N.B.	Only one larva collected from Little Lake Road, Charlotte Co., New Brunswick. No reports from Nova Scotia and Prince Edward Island.
Atmospheric impurities	White pine	Region	No reports in 1990.
Bagworm *Thyridopteryx ephemeraeformis* Haw.	White pine	Region	No reports in 1990.
Balsam bark weevil *Pissodes dubius* Rand.	Balsam fir	Region	Trace incidence of dead and dying balsam fir in New Brunswick and Nova Scotia. In Prince Edward Island, common on Stillwell's syndrome trees at Milburn and West Devon, Prince Co. At Milburn, 32% of trees were attacked successfully and many other trees had been "tested" by adult weevils.
Balsam fir bark beetle *Pityokteines sparsus* (Lec.)	Balsam fir	Region	Remains present throughout much of New Brunswick in weakened trees. Highest infestations at Bon Accord, Victoria Co. and Hornes Gulch, Restigouche Co. (Both, 8% of trees infested.) No reports from Nova Scotia or Prince Edward Island.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir	Region	Few larvae at scattered locations in New Brunswick and Nova Scotia. No reports from Prince Edward Island.
Balsam fir tip blight *Delphinella balsameae* (Waterm.) E. Muell.	Balsam fir	Region	In New Brunswick, widespread and common throughout, with trace to severe shoot damage on individual or groups of trees in Christmas tree stands, natural stands, and at roadside. Light to moderate damage very noticeable in southwestern Restigouche and

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			part of western Gloucester counties. Overall shoot damage averaged 16% on 25% of trees at 11 locations with highest at Hastings Road, Fundy National Park, Albert Co., with 48% damage on 20% of trees. In Nova Scotia, scattered trees with damage in Christmas tree areas and natural stands with isolated trace and moderate damage in Colchester and Inverness counties. In Prince Edward Island, trace to severe damage on scattered individual trees, averaging 14% on 12% of trees at eight locations with highest at Bridgetown, Kings Co., with 30% shoot damage on 8% of trees.
Balsam shootboring sawfly *Pleroneura brunneicornis* Roh.	Balsam fir	N.B. N.S.	Widespread in New Brunswick and Nova Scotia but caused only light shoot damage. Highest at Berry Brook, Restigouche Co., N.B. (19% of shoots damaged) and at Diligent River, Cumberland Co., N.S. (17%).
Beech bark disease *Nectria coccinea* var. *faginata* Lohm., Wats. & Ayers and Beech Scale *Cryptococcus fagisuga* Lind.	Beech	Region	Cankered trees are common throughout the region with most beech stands being affected. Infection ranges from 70% to 100% of trees.
Birch sawfly *Arge pectoralis* (Leach)	White birch	N.S.	Trace defoliation south of Ingonish Centre, Victoria Co.
Bruce spanworm *Operophtera bruceata* (Hlst.)	Silver maple	Region	Light and moderate defoliation on ornamental silver maple at Bathurst, Gloucester Co., N.B. No reports from Nova Scotia and Prince Edward Island.
Canker of larch *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	Region	Found at a few scattered locations throughout the region.
Cedar leafminers *Argyresthia aureoargentella* Brower *Argyresthia freyella* Wlshm. *Argyresthia thuiella* (Pack.) *Coleotechnites thujaella* (Kft.)	Cedar	Region	In New Brunswick, foliage damage moderate to severe at Lynnfield and Letang, Charlotte Co., and at Martinon, Ketepec, and Black River Road, St. John Co. Damage was moderate at four locations in York County. In Nova Scotia, damage was trace on ornamental cedar throughout the province. In Prince Edward Island, Prince Co., severe browning of foliage was observed at six locations and moderate damage at three locations.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Cherry blight	Chokecherry Pin cherry	Region	Present throughout region, with trace and light levels of damage, most common in southeastern New Brunswick and Cape Breton Co., Nova Scotia.
Cherry casebearer *Coleophora pruniella* Clem.	Trembling aspen	Region	Uncommon in Nova Scotia, except south of Georgeville, Hants Co., where 84% of leaves were damaged. In Prince Edward Island, leaf browning severe at Iona, Queens Co., in the Commercial Cross to Kilmuir area and Pooles Corner, Kings Co.; light at South Brockton, Prince Co. (21%), and Oyster Bed Bridge, Queens Co. (27%). No reports from New Brunswick.
Deterioration of cedar	Cedar	N.B. P.E.I.	In New Brunswick and Prince Edward Island, damage by cedar leafminer and brown cedar leafminer remained active. In New Brunswick in Charlotte, Saint John, and Restigouche counties and in Prince Edward Island, tree deterioration continued in Prince Co.
Diplodia tip blight *Sphaeropsis sapinea* (Fr.) Dyko & Sutton	Austrian pine Red pine	N.S.	Present on ornamentals at two locations, on Austrian pine at Dartmouth, Halifax Co., and on red pine at Truro, Colchester County.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir Black spruce Red spruce White spruce	Region	Few larvae throughout region but most common in Prince Edward Island.
Eastern dwarf mistletoe *Arceuthobium pusillum* Peck	Spruce	Region	Found at scattered locations throughout the region, the highest incidence at Stanhope, Queens Co., P.E.I. where 50% of black spruce had at least one broom.
Eastern spruce gall adelgid *Adelges abietis* (L.)	Black spruce Red spruce White spruce	Region	Present throughout region generally at trace to light infestation levels. Highest, 40% of shoots, at Grassy Lake, York Co., N. B.; 55% east of Maccan, Cumberland Co., N. S.; and 16% at Brookvale Demonstration Woodlot, Queens Co., P.E.I.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Apple Cherry	Region	In New Brunswick, more common than in 1989 in all but the northwestern counties of Victoria, Madawaska and Restigouche. In Nova Scotia, nests common in western counties and scattered to the east, overall, incidence similar to 1989. Only scattered nests found in Prince Edward Island.
Elm leaf aphid *Tinocallus ulmifolii* (Monell)	Elm	N.B.	No reports in 1990.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Elm leaf beetle *Pyrrhalta luteola* (Mull.)	Elm	N.B.	Moderate and severe foliage browning continued for the second year in Fredericton, York Co. Heavily damaged leaves fell early which improved appearance but not tree condition.
Elm leafminer *Fenusa ulmi* Sund.	English elm Rock elm	Region	Moderate browning in Westmorland and Albert counties, New Brunswick. In Nova Scotia, severe or moderate browning with some areas light on exotic elms wherever they occurred. Browning less severe than in 1989 but present throughout Prince Edward Island on exotic elms.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Pine	Region	No reports in 1990.
European pine shoot moth *Rhyacionia buoliana* (D.&S.)	Red pine Scots pine	Region	In Nova Scotia, generally trace with incidence lower than in 1989, except west of Hastings, Annapolis Co. where light damage on 70% of trees in 1989 increased to 80% incidence in 1990. In Prince Edward Island, in red pine plantations at North and South Granville, Queens Co., populations remained high after severe damage reported in 1989; light damage at West of Brookdale, Queens Co., and New Harmony Demonstration Woodlot, Kings Co., with 8% and 19% of trees infested, respectively; trace elsewhere. No reports from New Brunswick.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Spruce	Region	Populations remained low throughout region.
Fall cankerworm *Alsophila pometaria* (Harr.)	Hardwoods	Region	Generally, populations are low throughout the region; exceptions were at New Minas, Kings Co., Nova Scotia, where moderate and severe defoliation occurred on apple, and Charlottetown, Prince Edward Island, where moderate defoliation occurred on various hardwood species.
Fall webworm *Hyphantria cunea* (Dru.)	Hardwoods	Region	Nests more common than in 1989, especially Charlotte Co., N.B., eastern Nova Scotia, and throughout Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Flat leaf tier *Psilocorsis* sp.	Hardwoods	Region	Found mainly in southern New Brunswick, trace and light leaf damage at 12 locations; highest at MacDougal Lake, Charlotte Co., where 19% of the leaves attacked on 100% of trembling aspen. In Nova Scotia, leaf tying averaged 12% (40 locations); highest (47%) at Lequille, Annapolis County. Trace damage at Afton Rd., Queens Co., P.E.I.
Forest tent caterpillar *Malacosoma disstria* Hbn.	Hardwoods	Region	Larval populations very low throughout the region.
Foureyed spruce bark beetle *Polygraphus rufipennis* (Kby.)	Black spruce Red spruce White spruce	N.B.	Found at one location in New Brunswick with 4% trees attacked. No reports from Nova Scotia and Prince Edward Island.
Frost damage	Conifers Hardwoods	Region	Common throughout New Brunswick, mostly on balsam fir and spruce, averaging 17% of shoots on 48% of trees; most severe at MacDougal Lake, Charlotte Co., where 50% of shoots were damaged on 80% of both balsam fir and white spruce. Only trace damage at three locationsin Nova Scotia. In Prince Edward Island, found only at Howland, Prince Co., where 13% of white spruce shoots were damaged.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine Mugho pine Scots pine	Region	Scattered in plantations and on ornamentals throughout the region. In New Brunswick, widespread in natural stands as well; highest, 52% of plantation jack pine, at St. Luc, Kent Co., N. B.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Spruce	Region	Populations remained low throughout the region.
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Maple	Region	In New Brunswick, trace and light defoliation at four locations, one in each of Gloucester, Northumberland, Charlotte, and York counties. In Nova Scotia, generally trace and light damage on the mainland except at Middle Musquodoboit, Halifax Co., where 42% of leaves were damaged. No reports from Prince Edward Island.
Hail damage	Conifers Hardwoods	Region	No reports in 1990.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) Mill.	Trembling aspen	Region	In New Brunswick, infected trees averaged 12% at 22 locations (all positive) in 11 counties; highest (32%) at Weisner Brook, Westmorland Co.; in Nova Scotia, 7 of 12 locations in six counties were positive and averaged 14%; and highest (60%) at Georgeville, Antigonish Co.; and in Prince Edward Island, averaged 6% at four locations and highest (12%) at Auburn Demonstration Woodlot, Queens Co.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	N.B. P.E.I.	In New Brunswick, moderate at Napadogan Brook, York Co. (50% of leaves browned on 100% of of trees) and light at both Juniper, Carleton Co. and Grand John Brook, York Co. In Prince Edward Island, trace and light at Dromore, Queens Co.
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine	Region	No defoliation observed in the region. The increase, predicted for northeastern New Brunswick based on pheromone trap catches, did not materialize in 1990.
Larch needleworm *Zeiraphera improbana* (Wlk.)	Tamarack	N.S.	No reports in 1990.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Japanese larch Tamarack	Region	In New Brunswick, the severe and moderate defoliation of Japanese larch at MacDonald's Corner, Queens Co. reported last year, did not recur in 1990; elsewhere only light and and moderate defoliation of scattered, semi-mature tamarack at Rexton, Kent Co. In Nova Scotia, widespread light to moderate defoliation (severe on a few trees) in Lunenburg, Kings, Shelburne, and Hants counties; a major change from no defoliation in 1989. No reports from Prince Edward Island.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Hardwoods	Region	No reports in 1990.
Leaf and twig blight of aspen *Venturia macularis* (Fr.) E. Muell. & Arx	Trembling aspen	Region	Common and widespread shoot damage throughout New Brunswick, averaging 14% on 70% of trees (22 locations, highest 33%); in Nova Scotia, averaging 17% on trembling aspen (16 locations, highest 27%); and in Prince Edward Island, light damage, averaging 8% on 35% of trees (eight locations, highest 25%).

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Leaf blister *Taphrina carnea* Johanson	White birch Yellow birch	Region	Affected 17% of leaves at 13 locations in New Brunswick; highest (37%) at Halfway Depot, Madawaska Co. In Nova Scotia 16% of leaves at eight locations, highest (36%) on white birch near Chaplin, Halifax Co. Present on 8% of yellow birch foliage on most trees along Munns Road, Kings Co., P.E.I.
Leaf blotch of horse-chestnut *Guignardia aesculi* (Peck) V.B. Stew.	Horse-chestnut	Region	Found wherever host occurs in the region. In New Brunswick, foliage browning moderate and light at Fox Creek, Westmorland Co.; in Nova Scotia, moderate and light with numerous severely damaged individual or small groups of trees at scattered locations throughout(an increase from 1989); and in Prince Edward Island, moderate on two trees at Marshfield, Queens Co.
Leafrollers on birch *Caloptilia* sp.	White birch Wire birch Yellow birch	Region	In New Brunswick, similar to 1989, common throughout the province, averaging 16% of leaves on 69% of trees at 43 locations; highest (60%) at Jardine Brook, Victoria Co. on 100% of white birch. Trace at four locations in Nova Scotia. Trace at one location in Prince Edward Island.
Lesser maple spanworm *Itame pustularia* (Gn.)	Hardwoods	Region	In New Brunswick, a single report of trace defoliation of a few sugar maple near Mount Pleasant, Charlotte Co. In Nova Scotia, reported from 39 scattered locations on beech, red maple, and sugar maple but numbers low with only trace defoliation. No reports from Prince Edward Island.
Maple leafroller *Sparganothis acerivorana* MacK.	Red maple Sugar maple	Region	In New Brunswick, leafrolling remained light, averaging 9% on 60% of red maples at nine locations in six counties, highest was 17% on 70% of stand near Bronson Settlement, Queens Co. In Prince Edward Island, trace leafrolling on red maple and sugar maple at two widely separated points in Kings and Prince counties. No reports from Nova Scotia.
Maple spindlegall mite *Vasates aceris-crumena* (Rly.)	Red maple Sugar maple	Region	Common throughout region; in New Brunswick, affecting 26% of red maple leaves and 21% of sugar maple; highest, 57% of red maple, at Acadia Forest Experiment Station, Sunbury Co., and 47% of sugar maple foliage along Little Tobique River, Restigouche Co. In Nova Scotia, an average of 23% of sugar maples leaves at 17 locations, highest (51%) at Strathglass, Antigonish Co. In Prince

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			Edward Island, 28% of sugar maple leaves at four locations; highest (65%) at east of Cross River, Kings County.
Mites *Oligonychus milleri* (McGregor) *Oligonychus ununguis* (Jacobi)	Red pine	Region	Trace damage, probably *O. milleri*, on all trees at Pubnico, Yarmouth Co., N.S. No reports for either mite species from New Brunswick or Prince Edward Island.
Mite piles *Phyllocoptes didelphis* Keifer	Trembling aspen	Region	In New Brunswick, 18% of leaves infested on 72% of trees at 14 locations; highest (49% of leaves, on most trees) at Bronson Settlement, Queens Co. In Nova Scotia, 8% of leaves affected on most trees at nine locations. Present on 9% of leaves at six locations in Prince Edward Island.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	Region	In Nova Scotia, trace defoliation on one tree at Truro, Colchester Co. No reports from New Brunswick and Prince Edward Island.
Needle casts *Davisomycella ampla* (Davis) Darker	Jack pine	Region	No reports in 1990.
Hypodermella laricis Tub.	Tamarack	N. S.	Trace on scattered trees from North Kemptville, Yarmouth Co. to Southville, Digby Co.
Isthmiella faullii (Darker) Darker	Balsam fir	Region	No reports in 1990.
Lirula macrospora (Hartig) Darker	Black spruce Red spruce White spruce	Region	In New Brunswick, moderate on red spruce foliage near Piskahegan Stream, Charlotte Co., light on scattered red spruce along Hastings and Point Wolfe road in Fundy National Park, Albert Co. In Nova Scotia, trace and light on all spruce species at 21 scattered locations. No reports from Prince Edward Island.
Lirula mirabilis (Darker) Darker	Balsam fir	N. S.	Light needle infection at Barren Hill, Richmond Co., and trace at Loch Katrine, Antigonish Co.
Lirula nervata (Darker) Darker	Balsam fir	Region	In New Brunswick, trace needle infection on 50% of trees at Hardwicke, Northumberland Co.; in Nova Scotia, widespread and trace, except moderate to severe at Maitland Bridge, Annapolis Co. No reports from Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Phaeocryptopus gaeumannii (Rohde) Petr.	Douglas fir	Region	In New Brunswick, severe again on older foliage in a 1-ha plantation near Tay Falls, York Co. Severe on a few trees at Canning, Kings Co., N.S. and in a small plantation at Brookvale Demonstration Woodlot, Queens Co., P.E.I.
Needle flecking	Balsam fir Black spruce Eastern hemlock Eastern white pine Red pine Red spruce White spruce	Region	Needle flecking is a term used to describe characteristic discoloration of coniferous foliage. Yellow chlorotic spots that sometimes merge into larger necrotic areas, were found on a variety of conifers throughout the Maritimes. Cause is unknown.
Northern cedar bark beetle *Phloeosinus canadensis* Sw.	Cedar	Region	No reports in 1990.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Jack pine	Region	Low populations in plantations and natural stands at scattered locations in New Brunswick. In Nova Scotia, trace and light incidence, highest was 16% of trees affected at Battery Lakes, Pictou Co. No reports from Prince Edward Island.
Obliquebanded leafroller *Choristoneura rosaceana* (Harr.)	Hardwoods	Region	In northwestern New Brunswick, light and moderate leafrolling, averaging 27% on four hardwood species at eight locations in Madawaska, Victoria, Restigouche and Northumberland counties and highest at Clearwater Brook, Victoria Co., where 48% of trembling aspen and 33% of red maple leaves were rolled; in Nova Scotia, a trace (3%) of leafrolling at one location, elsewhere only a few larvae collected; and in Prince Edward Island, populations remain endemic.
Ocean salt spray	Balsam fir Birch Pine Spruce	Region	Trace to light browning occurred at scattered coastal areas in all three provinces.
Ocellate gall midge *Acericecis ocellaris* (O.S.)	Red maple Sugar maple	Region	Common throughout region, affecting only the appearance of heavily infested leaves.
Orangehumped mapleworm *Symmerista leucitys* Francl.	Beech	Region	No reports in 1990.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Orange spruce needleminer *Coleotechnites piceaella* (Kft.)	Balsam fir Spruce	Region	Populations remained low, but present in Nova Scotia and Prince Edward Island, highest needlemining (5%) on white spruce at Cavendish, Queens Co., Prince Edward Island National Park. No reports from New Brunswick.
Pepper-and-salt moth *Biston betularia cognataria* (Gn.)	Hardwoods Tamarack	Region	In New Brunswick, no defoliation in 1990 after light defoliation reported in 1989 from Fundy National Park; very few larvae collected in Nova Scotia and Prince Edward Island.
Pine bark adelgid *Pineus strobi* (Htg.)	White pine	Region	In New Brunswick, 28% of white pine infested at km 18.0 along the CIP Road, Restigouche Co. Found at six locations averaging 20% of white pine in Nova Scotia, highest 72% at Cow Moose Lake, Queens Co. No reports from P.E.I.
Pine engraver *Ips pini* (Say)	Jack pine	Region	No reports in 1990.
Pinkstriped oakworm *Anisota virginiensis virginiensis* (Drury)	Red oak	Region	One larva found in Annapolis Co., N.S. No reports from New Brunswick or Prince Edward Island.
Poplar flea beetle *Altica populi* Brown	Balsam poplar	N.B. N.S.	Populations much reduced from 1989. Moderate and light foliage browning present in Woodstock and Irish Settlement area of Carleton Co., N.B. Moderate and light browning in hedgerow at Summerville, Hants Co., N.S.
Poplar leaffolding sawfly *Phyllocolpa* sp.	Trembling aspen	Region	In New Brunswick, average of 16% of leaf edges folded on 85% of trees at 34 locations; highest 80% of leaves at Forest City, York Co. In Nova Scotia, 17% folded at 34 locations, highest (67%) at Florence, Cape Breton Co. In Prince Edward Island, 23% of leaves folded on 80% of trees at 18 locations, highest (63%) at Foxley River, Prince Co.
Poplar leafmining sawfly *Messa populifoliella* (Town.)	Trembling aspen Balsam poplar Carolina poplar	Region	Light browning on more than half of trembling aspen trees at three locations. Populations highest at Fredericton, York Co., N. B., infesting 24% of Carolina poplar foliage. Light browning present on trembling aspen near Brockton, Prince Co., P.E.I. No reports from Nova Scotia.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Poplar petiolegall moth *Ectoedemia populella* Busck	Trembling aspen	N.S. P.E.I.	In Nova Scotia, an average of 26% of petioles infested at seven locations; highest (87%) at West River, Pictou Co. Three percent of petioles infested on a few trees at South Brockton, Prince Co. and common at Goose River, Kings Co., P.E.I.
Porcupine	Balsam fir Black spruce Jack pine Norway spruce Red pine Red spruce White pine White spruce Tamarack	N.B. N.S.	Damage continues to be common throughout New Brunswick and Nova Scotia. Most serious damage, 78% of Norway spruce, at Monument Settlement, Carleton Co., N.B. In Nova Scotia, 100% of jack pine girdled in a 3-ha plantation, 48% of red pine in a 7-ha plantation near Ingramport, Halifax Co. and 18% of tamarack at Apple River, Cumberland Co.
Rabbit damage	Red pine Red spruce	Region	In Nova Scotia, 12% of red pine damaged near Taylor Lake, Pictou Co. Scattered spruce damaged in Brookvale Demonstration Woodlot, Queens Co., P.E.I. No reports from New Brunswick.
Ragged sprucegall adelgid *Pineus similis* (Gill.)	Spruce	Region	In New Brunswick, light infestation of white spruce shoots at only one location, Chipman, Queens Co. Light shoot damage averaged 6% on red and white spruce at 11 locations in central and western Nova Scotia, highest with 15% on red spruce at Heber Meadows, Kejimkujik National Park, Annapolis Ci, No reports from Prince Edward Island.
Red flag of balsam fir *Fusicoccum abietinum* (Hartig) Prill. & Delacr.	Balsam fir	N.S.	Much reduced from 1989. Only one report of trace to light flagging along 1-km section of highway at Nine Mile River, Hants Co.
Redheaded jack pine sawfly *Neodiprion virginiana* Roh. (complex)	Jack pine Scots pine	Region	No reports in 1990.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Red pine	Region	In Nova Scotia, found at one location, Baddeck, Victoria Co. No reports from New Brunswick or Prince Edward Island.
Red spruce adelgid *Pineus floccus* (Patch)	Red spruce	Region	Low numbers on red spruce in Shelburne, and Cumberland Counties, N.S. No reports from New Brunswick or Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Roadside salt damage	Conifers	Region	Not as severe as in previous years, foliage discoloration mostly of pines, occurred along roadsides in all three provinces. Most severe damage occurred in a red pine plantation at Bridgetown, Kings Co., P.E.I.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Red maple Sugar maple	Region	In Nova Scotia, more common than in 1989, trace and light defoliation found at locations in the southwest. No reports from New Brunswick and Prince Edward Island.
Satin moth *Leucoma salicis* (L.)	Carolina poplar Largetooth aspen Silver poplar	Region	Endemic in New Brunswick; found at nine scattered locations in Nova Scotia, most severe damage occurring in Antigonish Co.; numbers and defoliation noticeably down in Prince Edward Island except at Milton, Queens Co.
Snow damage	Red pine White spruce	Region	Little damage observed in 1990. A few scattered trees damaged at a few locations in Nova Scotia and Prince Edward Island.
Spearmarked black moth *Rheumaptera hastata* (L.)	White birch Wire birch Yellow birch	N.B. N.S.	Damage more widespread throughout northern New Brunswick, averaging 8% of leaves on 60% of birch, highest (28%) on wire birch at Birch Ridge, Victoria Co. Trace damage on white birch at Crowdis Mtn., Victoria Co., N.S.
Spittlebugs *Aphrophora* sp. *Cercopidae*	Conifers White birch Yellow birch	Region	Populations generally low in region with trace and light damage. The highest infestation of 64% of white pine shoots affected occurred at Coles Island, Queens Co., N.B.
Spotted tussock moth *Lophocampa maculata* Harr.	Hardwoods	Region	In Nova Scotia, two adults collected at Brookdale, Cumberland Co., but populations remain low. No reports from New Brunswick and Prince Edward Island.
Spring cankerworm *Paleacrita vernata* (Peck)	Hardwoods	Region	No reports in 1990.
Spruce bud midge *Rhabdophaga swainei* Felt	Black spruce Red spruce White spruce	Region	Populations low but widespread throughout.
Spruce bud scale *Physokermes piceae* (Sch.)	Black spruce Red spruce White spruce	Region	Present throughout region but at very low numbers.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Region	Populations remain low in region. See under: Seed orchard pests.
Spruce gall adelgid *Adelges lariciatus* (Patch)	Spruce	Region	No reports in 1990.
Spruce micro moth *Coleotechnites atrupictella* (Dietz)	White spruce	P.E.I.	No reports in 1990.
Spruce twig aphid *Mindarus obliquus* (Cholod)	Red spruce White spruce	Region	Less common in Nova Scotia than in 1989. Reported from eight locations averaging 6% of shoots, highest 21% of red spruce shoots on 40% of trees in Chignecto Game Sanctuary, Cumberland Co. Infested 9% of shoots on scatterd trees near Bangor, Kings Co., P.E.I. No reports from New Brunswick.
Sugar maple borer *Glycobius speciosus* (Say)	Sugar maple	Region	Present in many sugar maple stands in the region. In New Brunswick, 12% of trees affected at Forest City, York Co. In Nova Scotia an average of 5% of trees at three locations and two mature trees affected at Glenwood, Prince Co., P.E.I.
Sulphur dioxide damage	Conifers Hardwoods	Region	No reports for 1990.
Tar spot of maple *Rhytisma acerinum* (Pers. ex St. Amans) Fr.	Maple	N.B. N.S.	In New Brunswick, averaged 27% of leaves spotted at 5 locations, highest 41% at West Branch Little Forks Stream, Kent Co. In Nova Scotia, averaged 20% of leaves at 13 locations, highest 85% west of Low Landing, Queens Co.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Alder Cherry	Region	Found throughout the region, more common in southern New Brunswick and Prince Edward Island than in 1989. In Nova Scotia nest numbers similar to last year.
Wax filament scale *Xylococculus betulae* (Perg.)	Beech White birch	Region	Present throughout New Brunswick; averaged 43% of white birch infested at eight locations, highest, 76% of white birch, at Martin Head, Saint John Co. In Nova Scotia, averaged 25% of beech and white birch at eight locations in the western half of the mainland, highest infestations, 72% of white birch and 68% of beech at Gibraltar, Halifax Co., and east of Douglas Road, Annapolis Co., respectively. No reports from Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Weevil damage *Strophosoma melanogrammus* Forst.	Conifers Hardwoods	Region	No reports in 1990.
Whitemarked tussock moth *Orgyia leucostigma* (J.E. Smith)	Balsam fir Black spruce Elm Red maple Tamarack	Region	Populations low throughout New Brunswick and Nova Scotia with most larvae collected in Fredericton, York Co., N. B. and noticeable defoliation on red maple at New France-Havelock area, Digby Co., N. S. No reports from Prince Edward Island.
White pine cone beetle *Conophthorus coniperda* (Sz.)	Pine	Region	No reports in 1990.
White pine sawfly *Neodiprion pinetum* Nort.	White pine	Region	Populations remain low. Light to moderate defoliation of ornamentals at St. Joseph, Madawaska Co., N.B. No reports from Nova Scotia or Prince Edward Island.
White pine weevil *Pissodes strobi* (Peck)	Black spruce Norway spruce Jack pine Scots pine White pine White spruce	Region	Common and widespread in region. In New Brunswick, an average of 32% trees infested at 20 locations, highest, 80% of Norway spruce at Kirkland, Carleton County. In Nova Scotia, an average of 10% at 19 locations, highest 28% of white pine near Blockhouse, Lunenburg Co. In Prince Edward Island, 16% of red spruce and 14% of Norway spruce infested in Auburn Demonstration Woodlot, Queens Co., and St. Patrick Road, Kings Co., respectively.
Whitespotted sawyer beetle *Monochamus scutellatus* (Say)	Balsam fir	Region	Remained common throughout the region; in New Brunswick, averaged 10% of balsam fir infested (two locations, highest 16% at Cedar Brook, Madawaska Co.); in Nova Scotia, averaged 32% of balsam fir infested (6 locations, highest 68% at northeast of Goffs, Halifax Co.); and in Prince Edward Island, 7% of balsam fir infested at Brookvale Demonstration Woodlot, Queens Co. (see also: Pinewood Nematode).
Willow blight *Venturia saliciperda* Nuesch	Willow	Region	Light at Lyons Brook, Pictou Co., N.S. No reports from New Brunswick or Prince Edward Island.
Willow flea weevil *Rhynchaenus rufipes* (Lec.)	Willow	Region	Severe and moderate leaf browning in northwestern and southeastern New Brunswick; light, moderate or severe throughout Nova Scotia and severe at two locations in Prince Co., P.E.I.

INSECT AND DISEASE	HOST(S)	LOCALITY	REMARKS
Wind damage	Conifers Hardwoods	Region	Trace to light damage occurred at scattered locations in all three provinces.
Winter drying	Conifers	Region	In New Brunswick, severe and moderate foliage damage to an 18-ha white spruce plantation in Victoria County, on balsam fir and hemlock along highways at Cambridge Narrows, Queens Co., and balsam fir in the Moncton area and Ritchie, York Co., where hemlock were severely browned. Light browning present at five locations in Nova Scotia. Severe and moderate browning of ornamentals and scattered forest trees, common in many areas of P.E.I. Few larvae at three locations in Nova Scotia and one location in Prince Edward Island.
Winter moth *Operophtera brumata* (L.)	Hardwoods	Region	Numerous moths observed flying in Truro area of Nova Scotia. No reports from New Brunswick.
Witches' broom of balsam fir *Melampsorella caryophyll-acearum* Schroet.	Balsam fir	Region	Widespread but not common in New Brunswick, not as common as in 1989 in Nova Scotia, present on 21% of trees at 16 locations, highest (60%) at New Harmony, Kings Co., P.E.I.
Witches' broom of spruce *Chrysomyxa arctostaphyll* Diet.	Black spruce	Region	No reports in 1990.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce	Region	In New Brunswick, 15 ha of a 400-ha black spruce plantation was severely defoliated at Hammondvale, Kings County; light and moderate defoliation of scattered red and white spruce trees in Albert, Carleton, Charlotte, and Victoria counties. Trace and light damage at nine locations in Nova Scotia. Common and more widespread in Prince Edward Island, black spruce (0.5 ha area) severely defoliated at St. Patrick Road, Kings Co., 20% severely defoliated (2-ha area) at Conway, Prince Co. and scattered trees at South Granville and MacNeills Mills, Queens and Prince counties, respectively.

Forestry Canada

Forestry Canada is the main focus for forestry matters in the federal government. It provides national leadership through the development, coordination, and implementation of federal policies and programs to enhance long-term economic, social, and environmental benefits to Canadians from the forest sector.

The Department is a decentralized organization with six regional forestry centres, two national research institutes, and seven regional sub-offices located across Canada. Headquarters is located in the National Capital Region.

In support of its mandate, Forestry Canada carries out the following activities:

- Administers forest development agreements negotiated with the provinces
- Undertakes and supports research, development, and technology transfer in forest management and utilization.
- Compiles, analyzes, and disseminates information about national and international forest resources and related matters.
- Monitors disease and insect pests in Canada's forests.
- Provides information, analyses, and policy advice on economics, industry, markets, and trade related to the forest sector.
- Promotes employment, education, and training opportunities in the forest sector.
- Promotes public awareness of all aspects of the forest sector.

The Department interacts regularly with provincial and territorial governments, industry, labor, universities, conservationists, and the public, through such bodies as the Canadian Council of Forest Ministers, the Forest Sector Advisory Council, the Forestry Research Advisory Council of Canada, the Canadian Forest Inventory Committee, the Canadian Committee on Forest Fire Management, the Canadian Interagency Forest Fire Centre, and regional consultative committees. The Department is also active in international forestry agencies, such as the International Union of Forest Research Organizations and the Food and Agriculture Organization, as well as in technical and trade missions.

Forêts Canada

Forêts Canada est l'organisme principal en matière de foresterie à l'intérieure du gouvernement fédéral. Chef de file sur le plan national, il assure la préparation, la coordination et la mise en oeuvre des politiques et programmes fédéraux et environnementaux à long terme offerts aux Canadiens par le secteur forestier.

Le ministère est une organisation décentralisée: six centres de foresterie régionaux, deux instituts de recherche nationaux ainsi que sept sous-bureaux régionaux sont répartis dans tout le Canada. Le siège social est établi dans la région de la Capitale nationale.

Pour remplir son mandat, Forêts Canada assume les tâches suivantes:

- il administre les accords de développement forestier conclus avec les provinces
- il entreprend et appuie la recherche, la mise au point et le transfert technologique dans le domaine de la gestion et de l'utilisation des forêts
- il rassemble, analyse et diffuse de l'information sur les ressources forestières nationales et internationales et les domaines connexes
- il fait des relevés des maladies et des insectes ravageurs des forêts canadiennes
- il fournit de l'information, des analyses et des conseils (quant aux politiques) concernant l'économie, l'industrie, les marchés et le commerce reliés au secteur forestier
- il favorise les occasions d'emploi et de formation universitaire et technique dans le secteur forestier
- il encourage les Canadiens à prendre conscience de tous les aspects du secteur forestier.

Le ministère entretient des rapports sur une base régulière avec les gouvernements provinciaux et territoriaux, l'industrie, le monde du travail, les universités, les environnementalistes et le public par l'entremise d'organismes comme le Conseil canadien des ministres des Forêts, le Conseil consultatif du secteur forestier, le Conseil consultatif de la recherche forestière du Canada, le Comité de l'inventaire des forêts du Canada, le Comité canadien de gestion des incendies de forêt, le Centre interservices des feux de forêt du Canada et des comités consultatifs régionaux. Le ministère joue également un rôle actif dans des organismes internationaux de foresterie comme l'Union internationale des organisations de recherche forestière et l'Organisation pour l'alimentation et l'agriculture, de même qu'au sein de délégations de nature technique ou commerciale.