Forest pest conditions in the Maritimes in 1991

Laszlo P. Magasi

Maritimes Region • Information Report M-X-181E

Forestry Canada Forêts Canada

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 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.

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By

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Information Report M-X-181

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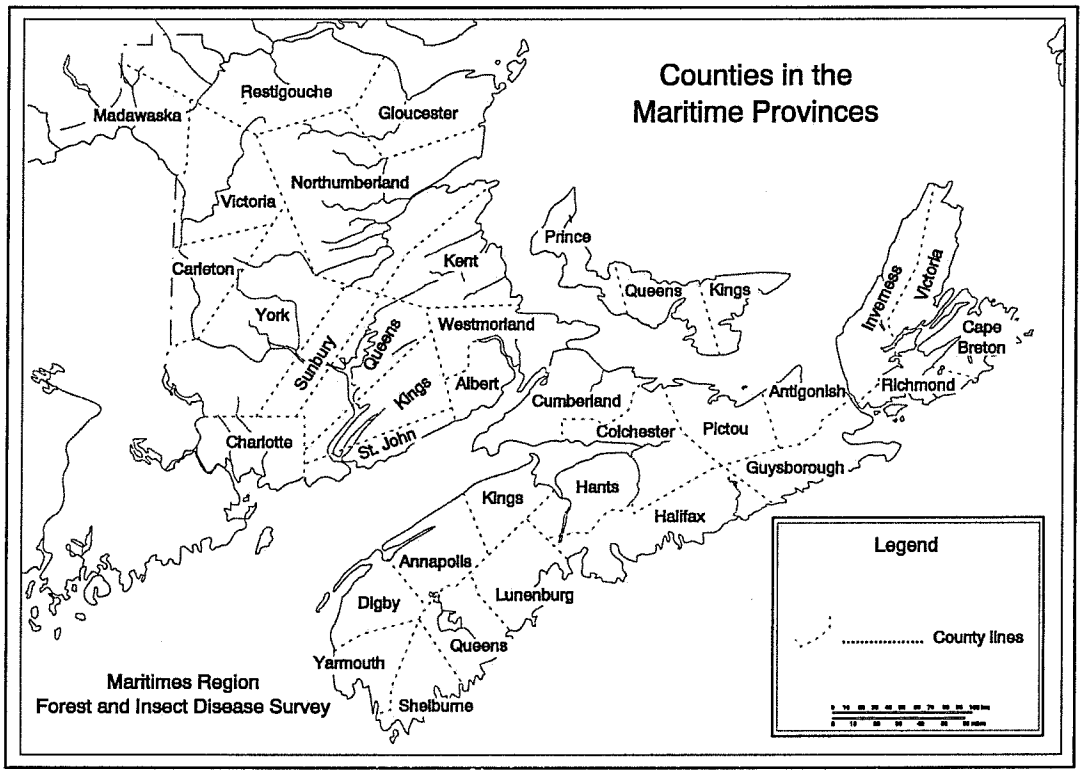
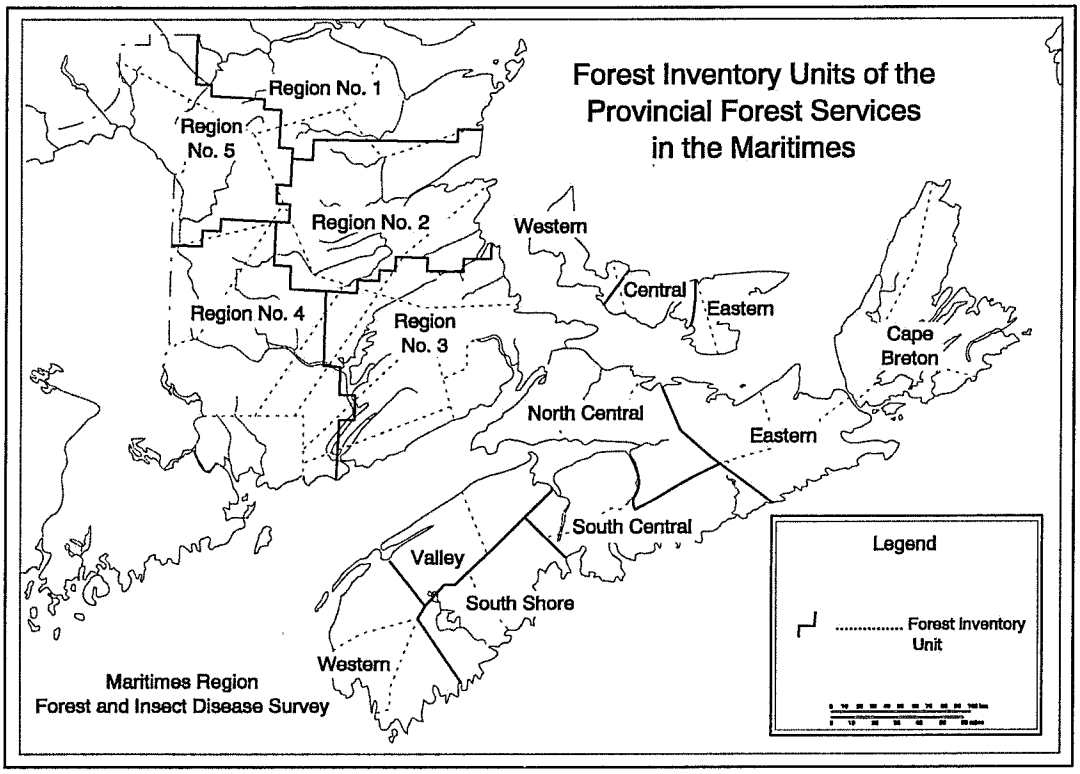
1992

TABLE OF CONTENTS


Counties in the
Maritime Provinces
Restigouche
Madawaska
Gloucester
Northumberland
Victoria
Prince
Carleton
Kent
Queens
Kings
Inverness
Victoria
York
Westmorland
Cape
Breton
Sunbury
Queens
Albert
Kings
Cumberland
Antigonish
Richmond
Charlotte
St. John
Colchester
Pictou
Guysborough
Hants
Kings
Halifax
Annapolis
Digby
Lunenburg
Queens
Yarmouth
Shelburne
Maritimes Region
Forest and Insect Disease Survey
Legend
County lines


Forest Inventory Units of the
Provincial Forest Services
in the Maritimes
Region No. 1
Region
No. 5
Region No. 2
Western
Central
Eastern
Region No. 4
Region
No. 3
Cape
Breton
North Central
Eastern
South Central
Valley
South Shore
Western
Maritimes Region
Forest and Insect Disease Survey
Legend
Forest Inventory
Unit

INTRODUCTION

Forestry Canada - Maritimes Region's recently released Strategic Plan 1990-1995 states that:

> "Forestry Canada - Maritimes will, through its Forest Insect and Disease Survey, 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 (FIDS) 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 stands and plantations are described as they were observed in 1991. 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 1992 field season. Insects and diseases that were widespread and caused considerable concern in 1991 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 should be interpreted as follows:

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 was chosen to illustrate the importance we place on technology transfer, training, and on cooperation with our clients.

PESTS OF CONIFERS

Spruce Budworm

Information about spruce budworm, *Choristoneura fumiferana* (Clem.), is summarized from various sources: New Brunswick Department of Natural Resources and Energy (NBDNRE), Forest Protection Limited, J.D. Irving Limited, Nova Scotia Department of Natural Resources (NSDNR), and Forestry Canada - Maritimes Region (FC-MR). 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.

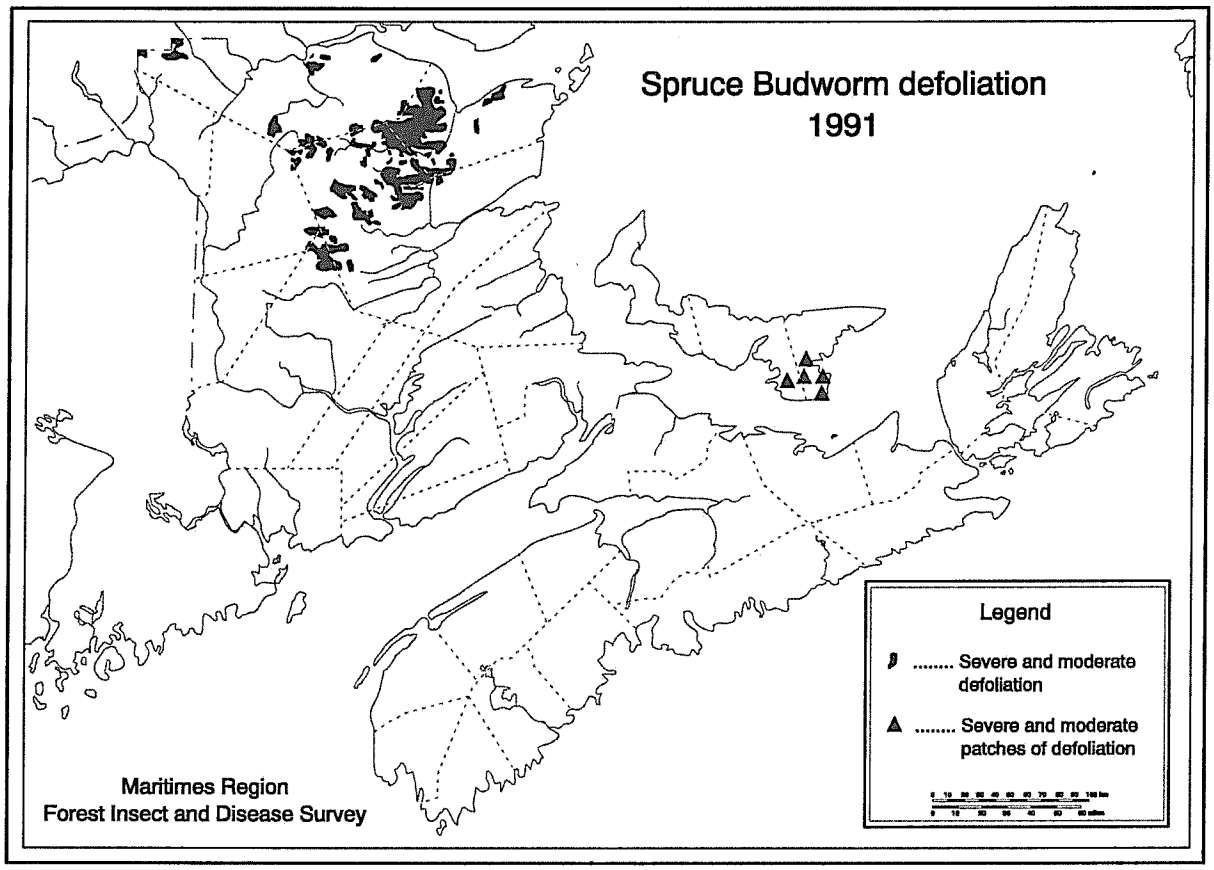


Figure 1 Source: Aerial Surveys by NBDNRE, NSDNR, and FC-MR (FIDS)

New Brunswick

Defoliation of balsam fir and spruce stands was recorded for 301,000 ha in the province in 1991 (Fig. 1). Defoliation was severe on 134,000 ha, moderate on 132,000 ha, and light on 35,000 ha. The 266,000 ha of severe and moderate defoliation was 12% more than the 237,000 ha recorded in these categories in 1990. The area of moderate defoliation decreased by 10% (from 146,000 ha in 1990), while the area of severe defoliation increased by 47% (from 91,000 ha in 1990). Overall, the total area of severe and moderate defoliation was still one of the lowest since the mid-1960s. All defoliation, recorded during aerial surveys, occurred in the northern half of the province, mostly in north-central New Brunswick.

Control Operations - Foliage protection against spruce budworm in New Brunswick was conducted over 318,190 ha in 1991: 288,150 ha by Forest Protection Ltd. and 30,040 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd.

Of the area treated by Forest Protection Ltd., 176,705 ha received two applications of fenitrothion; 19,080 ha were treated with fenitrothion followed some days later by an application of *Bacillus thuringiensis* (*B.t.*); 83,365 ha were treated twice with *B.t.*, and 9,000 ha received one application of *B.t.* Rates of application were 210 g/ha for fenitrothion (Sumithion®) and 15 BIU/ha for *B.t.* (Futura XLV-HP®, Dipel 64AF® and Foray 48B®), except for the 9,000 ha single application of *B.t.* where the rate was 30 BIU/ha.

Of the area treated by Forest Patrol Ltd., approximately 26,325 ha received two applications of fenitrothion (Sumithion®) at the rate of 210 g/ha/application, approximately 2,160 ha received one application of fenitrothion, and the remaining 1,555 ha received a single application of *B.t.* (Futura XLV-HP®) at 30 BIU/ha.

Forecast - Based on overwintering larval (L_2) surveys conducted by the New Brunswick Department of Natural Resources and Energy, the prediction for 1992 is a total of 615,000 ha of

moderate to high infestation. The area of moderate to high populations decreased by 20% from 770,000 ha in 1990, and the total area of infestation is 38% lower. Areas with variable populations last year (220,000 ha) either collapsed or became more uniform at slightly higher populations this year.

Nova Scotia

Defoliation - For the fifth consecutive year, no defoliation of balsam fir or spruce was observed during the annual spruce budworm aerial survey in Nova Scotia in 1991. Larvae were hard to find during ground sampling and their presence was recorded only at a few locations in Pictou, Antigonish, Inverness, and Victoria counties. No moths were captured in any of the six FIDS light traps and only a few at the eight pheromone trap locations in the province.

Control - No control measures on an operational scale were carried out against the spruce budworm in Nova Scotia in 1991.

Forecast - The overwintering larval (L_2) survey was conducted by the Nova Scotia Department of Natural Resources, with sampling assistance from Bowater-Mersey Ltd. personnel. Information from 239 sample locations indicated that spruce budworm populations in 1992 should be even lower than in 1991. Overwintering population levels were negligible or low at 97.6% of the locations sampled and moderate at 2.1%. No high or extreme populations were found anywhere in the province. Of the five sample locations classified "moderate", three were in Inverness Co. and one each in Pictou and Cumberland counties.

Prince Edward Island

Defoliation - Noticeable defoliation, mostly of white spruce and, to a lesser extent, balsam fir, was present again in 1991. Defoliation was very patchy and ranged from trace to severe with the majority in the light defoliation category. Defoliation occurred mainly in southern Kings and southeastern Queens counties, as in 1990, but the size of the area involved increased from last year. The total area of patches of severe and moderate defoliation is estimated to be about 130 ha. Elsewhere in the province, defoliation was usually only trace or light but was more common and widespread than in 1990.

Aerial surveys in 1991 were supplemented by ground checks because the heavy cone crop and male flowers on white spruce made color separation from the air unreliable. Light trap catches, which have been steadily increasing in eastern P.E.I. since 1988 (3,500 spruce budworm moths caught), have again increased dramatically from last year (from 18,600 to 34,400 moths) at Kilmuir, Kings Co. In comparison, the next highest catch in 1991 was recorded at Ashton Hill, N.B., where only 87 moths were captured. This catch is the highest ever recorded for spruce budworm in P.E.I. and higher than any catch in the Maritimes since 1983, when 73,500 moths were captured at Canterbury, N.B.

Control - No control measures on an operational scale were carried out against the spruce budworm in P.E.I. in 1991.

Forecast - The survey of overwintering larvae (L_2) was conducted by FC-MR at 40 locations. Populations were high at 5%, moderate at 12%, low at 73%, and nil at 10% of the locations sampled. These population levels are higher than those in 1990. All the high and moderate locations were in Kings and southern Queens counties. In 1992, significant levels of defoliation are likely to occur in the southeastern part of the province and patchy defoliation can also be expected in the rest of Prince Edward Island.

Hemlock Looper

Hemlock looper, *Lambdina fiscellaria fiscellaria* (Gn.), caused severe defoliation in New Brunswick for the third consecutive year and in Nova Scotia 3 years after the collapse of a small outbreak.

In New Brunswick, 3,600 ha of severe defoliation of balsam fir occurred in three distinct areas in the western half of the province (Fig. 2) as determined during aerial surveys conducted jointly with the NBDNRE. Defoliation was often patchy with small groups of trees affected. Severely defoliated areas were:

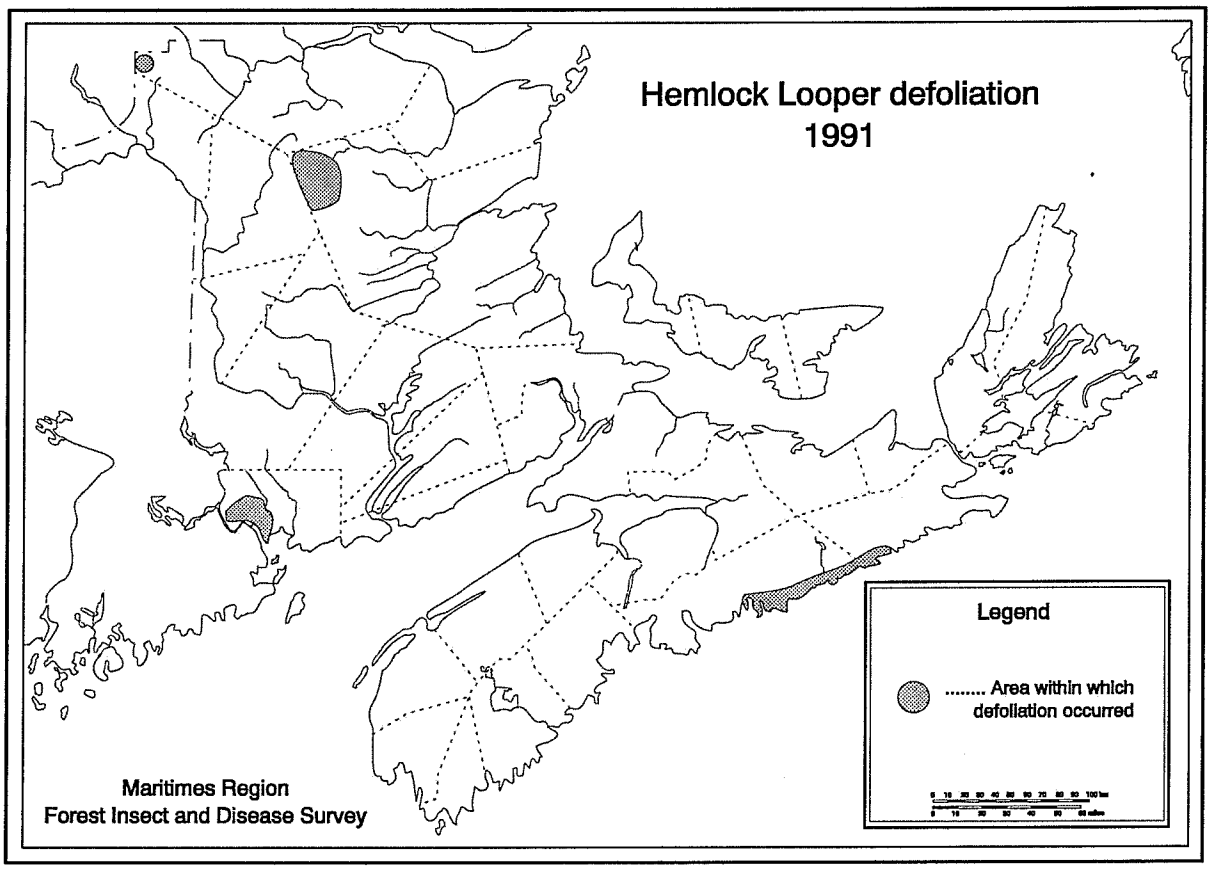


Figure 2 Source: Aerial surveys by NBDNRE, NSDNR, and FC-MR (FIDS)

Northwest (Restigouche Co.)	
Miller Lake	150 ha
Central-North (Northumberland Co.)	
Christmas Mountain area	1900 ha
Mt. Carleton	200 ha
Big South area	830 ha
South (Charlotte Co.)	
Mainland	160 ha
Deer Island	340 ha
Other islands	25 ha

In the Christmas Mountain area and on Mt. Carleton, defoliation was caused by a mixed population of hemlock looper and spruce budworm. In Charlotte County, balsam fir and hardwood trees were defoliated. Populations in the south were extremely high. In a light trap at Mayfield, 5,885 adults were captured compared with 1,853 moths caught in 1990.

To determine tree mortality as a result of hemlock looper defoliation, tree condition was assessed on permanent plots in Northumberland County. in the spring and fall of 1990 and again in the fall of 1991. To date, the total volume loss of balsam fir is approximately 94,000 m^3, of which 71,000 m^3 was killed during 1989-1990. Table 1 shows the close relationship between recent tree mortality and degree of defoliation during 1990. There was no defoliation in 1991 in these areas. Although mortality of balsam fir continued, most of the surviving plot trees "greened up" very well. In 1991, Armillaria root rot was associated with approximately 30% of the recently dead trees.

Control operations - Foliage protection and population suppression against the hemlock looper was conducted in New Brunswick over 17,000 ha by Forest Protection Ltd. The area received a single application of *B.t.* at the rate of 30 BIU/ha. Foray 48B® was used on 15,500 ha and Futura XLV-HP® on the remaining 1,500 ha.

In Nova Scotia, defoliation, mainly of balsam fir, occurred along the south-central coast of the province, affecting many small islands and peninsulas from Grand Desert, Halifax Co. to Liscomb Island, Guysborough Co. (Fig. 2). An aerial survey, con-

Table 1. Tree mortality in forest stands defoliated to different degrees by hemlock looper in New Brunswick in 1990-1991.

Stand Defoliation Level (1990)	Tree Condition Class	Percent of Total Volume		
		May 1990	Oct. 1990	Sept 1991
Severe	Living	16	9	7
	Recent dead	45	52	54
	Old dead	39	39	39
Moderate	Living	63	56	50
	Recent dead	8	15	21
	Old dead	29	29	29
None (control)	Living	70	Stand cut	---
	Recent dead	5	Stand cut	---
	Old dead	25	Stand cut	---

ducted jointly with the NSDNR, showed defoliation over 3,500 ha, of which about 100 ha was severe, 2,050 ha moderate, with the remaining 1,350 ha varying from light to severe. Elsewhere, larvae were found on a wide variety of coniferous and deciduous hosts at 64 locations in 16 counties across the province, but usually only a few larvae in any given area. Insect survival in much of the defoliated area was good as indicated by large numbers of moths and eggs, thus the infestation is expected to continue in 1992.

In Prince Edward Island, no defoliation was observed and larval populations were very low. No larvae were found at Foxley River, Prince Co., where the population was 51 larvae/m^3 foliage in 1990.

Spruce Beetle

Spruce beetle, *Dendroctonus rufipennis* (Kby.), activity was unchanged in much of Nova Scotia and decreased in New Brunswick and Prince Edward Island in 1991.

In New Brunswick, the infestations reported in the previous 2 years from both the north and south have subsided and no newly attacked white spruce trees were observed anywhere in the province in 1991. This is in sharp contrast to the earlier situation when, especially in 1989, many trees were dying as a result of new beetle attacks over widespread areas in northern New Brunswick.

In Nova Scotia, white and red spruce trees are dead and dying in many small pockets, ranging from a few trees to several hectares in size, in Inverness, Richmond, Antigonish, Guysborough, Pictou, Cumberland, Hants, and Annapolis counties. Infestation levels are similar to those observed in the past few years. About 80% of the trees are recently dead or dying at Greenhill, Pictou Co., near Mulgrave and near Havendale, Guysborough Co. The infestations were especially noticeable in northeastern Pictou and northern Antigonish counties.

In Prince Edward Island, mortality of mature and overmature white spruce continued throughout the province but newly infested, dying trees were less common than in 1990. At Rustico Island, Queens Co., 4% of the white spruce trees were attacked this year compared to 12% last year. Spruce beetle appears to be most active in southern Kings and southeastern Queens counties where trees are under additional stress from spruce budworm defoliation.

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 New Brunswick, tree mortality was observed in many areas in the central and southern parts of

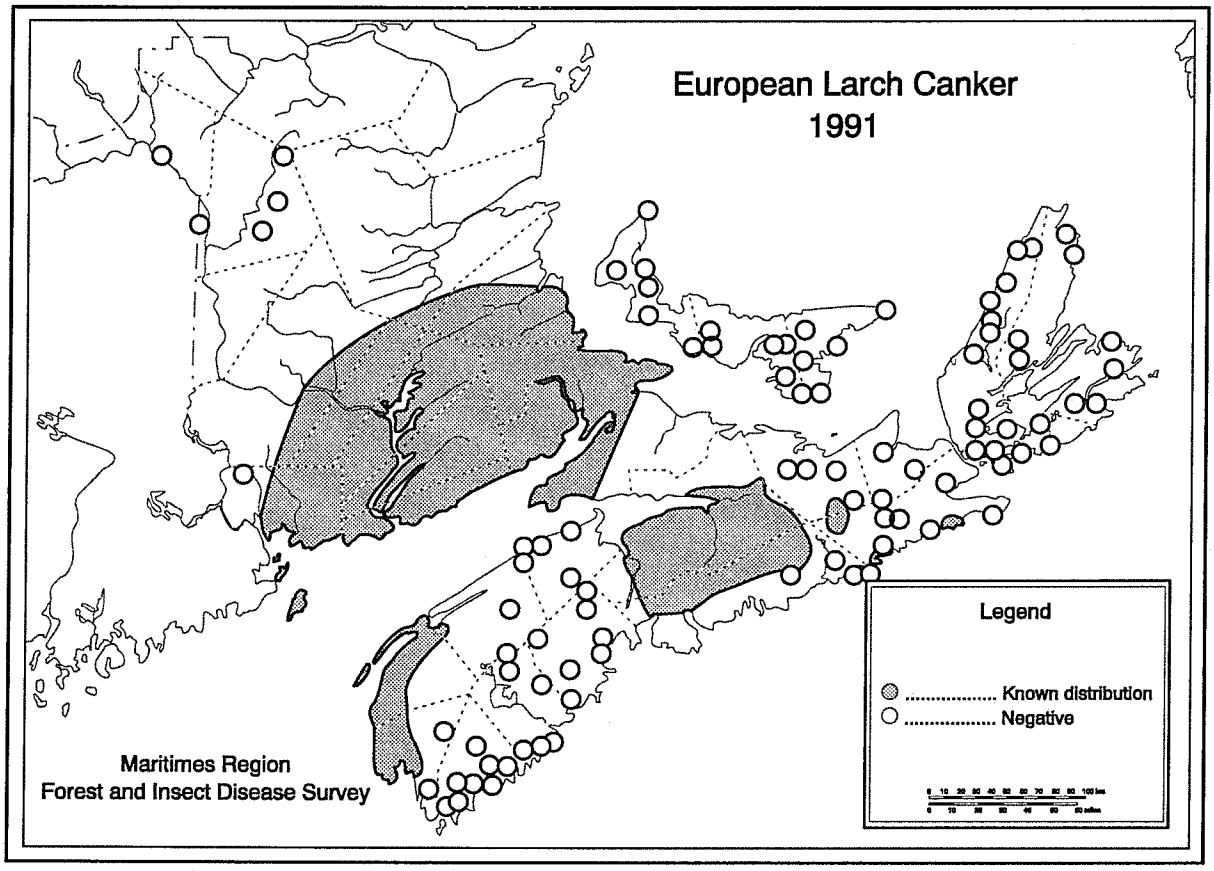


Figure 3

the province. Old dead trees abound and newly infested trees, ranging up to half-a-dozen at any given location, are common. At Beckim Settlement, Carleton Co., an area of continuing beetle attack, all larch trees are now dead.

In Nova Scotia, newly infested trees were found at two locations, one in each of Hants and Cumberland counties.

In Prince Edward Island, all new larch mortality associated with beetle attack was found in Prince County, where the insect was also active in 1990. The highest tree mortality was recorded at Green Provincial Park, Prince Co., where 16% of the semi-mature trees were recently killed.

European Larch Canker

The known range of the European larch canker, caused by the fungus *Lachnellula willkommii* (Htg.) Dennis, has not changed significantly since 1981-1982 when the first surveys were conducted.

In 1991, no infected trees were found at any of the 80 locations examined in New Brunswick and Nova Scotia outside the known distribution (Fig. 3) or at any of the 20 locations examined in Prince Edward Island, where the disease is not known to occur. The disease was found at 11 locations within the known range in southern New Brunswick. In some of these areas, all trees were infected. A European larch plantation was infected at MacDonalds Corner, Queens Co., N.B.

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, especially in the northern half of the province, and affects jack pine, red pine, and Scots pine. Lower branch discoloration and mortality was observed in Restigouche,

Table 2. Frequency of Armillaria root rot infection in pine and spruce plantations in New Brunswick and Nova Scotia, 1986-1991

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
1991	36	14	109	17	24	0	81	11
All years	284	10	752	20	98	4	264	14

Madawaska, Victoria, Northumberland, and Kings counties, mostly in plantations already known to be infected.

The disease was observed in two of the 12 areas where the European race of Scleroderris canker was identified in the past. Laboratory testing for 1991 is not yet complete. However, this race has not been found since 1981 in any but one of the areas. Also, recent research indicates that past identifications of the European race on jack pine may have been in error (six of the 12 areas are jack pine). These facts suggest that the distribution of the European race is very limited in New Brunswick.

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

Armillaria Root Rot

Armillaria root rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, is widely distributed in the region and mortality of young and old trees was common again in 1991.

In 1991, Armillaria root rot killed trees in nearly 16% of the 145 spruce and pine plantations surveyed in New Brunswick and 9% of the 105 spruce and pine plantations assessed in Nova Scotia (Table 2). Infection rates were generally low,

Table 3. Armillaria root rot - spread of disease in plantations 1983-1991

Species	Year planted	Year plot est.	Former cover type	Cumulative Mortality (%)								
				1983	1984	1985	1986	1987	1988	1989	1990	1991
Black spruce	1976	1983	Softwood	8	10	10	10	-	-	-	-	12
Black spruce	1973	1983	Softwood Hardwood	4	4	4	4	-	-	-	-	8
Black spruce	1978	1983	Softwood Hardwood	8	12	20	20	-	-	-	-	20
Black spruce	1980	1983	Softwood Hardwood	8	16	24	24	24	26	28	28	28
Jack pine	1978	1984	Softwood Hardwood	-	2	2	2	-	-	-	-	2
Jack pine	1981	1984	Softwood Hardwood	-	2	4	4	6	8	8	-	8
Jack pine	1978	1984	Softwood Hardwood	-	2	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 not assessed in 1991.

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 %	1990 Treatment	1991 Trees infected %
Debert, Colchester Co.	2.5	19	pruned	4	pruned	0	pruned	2
Pleasant River Lake, Lunenburg Co.	2.8	66	pruned	26	pruned	7	pruned	4
Shulie Lake Rd., Cumberland Co.	3.5	37	pruned	17	none	37	none	50
Kedge River Mgmt. Area, Queens Co.	3.5	63	none	67	none	67	none	69

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 the start of plantation surveys.

Armillaria root rot also caused tree mortality in other forest situations. Mature, semi-mature, suppressed or stressed trees were killed in all three provinces. Mortality was sporadic but occurred throughout the region.

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. All the plots still in existence were assessed in 1991. Tree mortality increased at two locations since the last assessment. Trees in older plantations are said to acquire some resistance to fatal attack by Armillaria root rot. Resistance is retained as long as they are in a vigorous condition without significant stress. All of the study plantations are reaching this age. They will be inspected annually but will be assessed on a 5-year cycle unless conditions change significantly.

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 1991, 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 infected areas in the southern part of the province but the damage intensified resulting in increased shoot mortality. Red pine deterioration continued in Fundy National Park, Albert Co., and some tree mortality occurred. About a third of the trees were infected in a patch at Herring Cove Provincial Park on Campobello Island, Charlotte Co., with 5-10 damaged shoots on each of the young trees. The disease continued to intensify on natural regeneration at MacDougall Lake, Charlotte Co.

In Nova Scotia, the disease continues to ravage red pine in the low lying areas of the southwestern part of the province. Entire plantations are dead or dying. 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 NSDNR 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 Nuttby Mountain, Colchester Co. (21% of shoots

infected), and at Middle Musquodoboit, Halifax Co. (7%), and in a white and Norway spruce clone bank at Debert, Colchester Co. The intensity and incidence of the damage on white spruce was reduced considerably from 1990, probably due to this year's warm, dry spring weather conditions, unfavorable for infection and spread.

The deterioration of pine stands in western Nova Scotia and the spread of the disease to plantations in the eastern half of the province, makes Sirococcus shoot blight the major plantation problem in Nova Scotia.

In Prince Edward Island, the disease was present in all previously infected areas and continued to intensify at Goose River, Kings Co. and at Selkirk and Iona, Queens Co.

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. Since preliminary results (Table 4) indicated pruning to be an effective control measure, further experiments were initiated in 1991, involving both young and pole-sized red pine plantations.

Spruce Budmoths

Shoot damage by spruce budmoths, *Zeiraphera* spp., on white spruce was slightly lower in New Brunswick and Nova Scotia and slightly higher in Prince Edward Island in 1991 than reported in 1990. 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 22 locations examined. This damage was more common and occurred at higher intensity in the northwest than in other parts of the province. The most serious damage was recorded at Kincardine, Victoria Co., where 61% of new shoots were affected on most young white spruce trees in a 10-ha stand.

In Nova Scotia, average shoot damage was 11% (ranging from 1% to 43%) at the 59 locations examined, the highest at Whale Cove, Inverness Co. The only other area with moderate (more than 30%) shoot damage was found at Capstick, Victoria Co., where the damage level was recorded at 35%. Spruce budmoth was the most common of the species. The purplestriped shootworm was found at three locations and the yellow spruce budworm at one of the 59 locations assessed.

In Prince Edward Island, an average of 15% of the shoots were damaged at the 25 locations examined. Damage was trace or light in all but two of these areas: at Green Provincial Park, Prince Co. (36% shoot damage), and at Riverdale, Queens Co. (35%).

Larch Casebearer

Larch casebearer, *Coleophora laricella* Hbn., populations increased for the third consecutive year in southern New Brunswick and much of Nova Scotia. Although feeding was mainly confined to trees in patches of up to 2-3 hectares, these patches were numerous and the insect was one of the most frequently observed forest pests in the early part of the 1991 season. The level of foliage discoloration as a result of feeding was variable, but moderate and severe patches were very common.

In New Brunswick, foliage discoloration was severe or moderate in most areas of the southern half of the province. The most severely affected patches were observed at Bethel, Charlotte Co. (where a semi-mature stand was completely discolored); North Forks, Sunbury Co.; Chipman, Queens Co.; Sussex, Kings Co.; and Upper Sackville, Westmorland Co. No visible foliage discoloration was observed in the northern counties of Restigouche, Madawaska, and Gloucester in 1991.

In Nova Scotia, the distribution and severity of foliage discoloration approached that of 1985 when the last outbreak peaked with high populations occurring throughout much of the province. Discoloration was patchy as a consequence of host distribution, but severe in many areas. Complete discoloration was observed at the Harbourville, Margaree Forks, and Queensville areas in Inverness Co.; Baddeck, Victoria Co.; Hammonds Plains, Halifax Co., and East Kemptville, Yarmouth Co. Only an estimated 20% of the larch

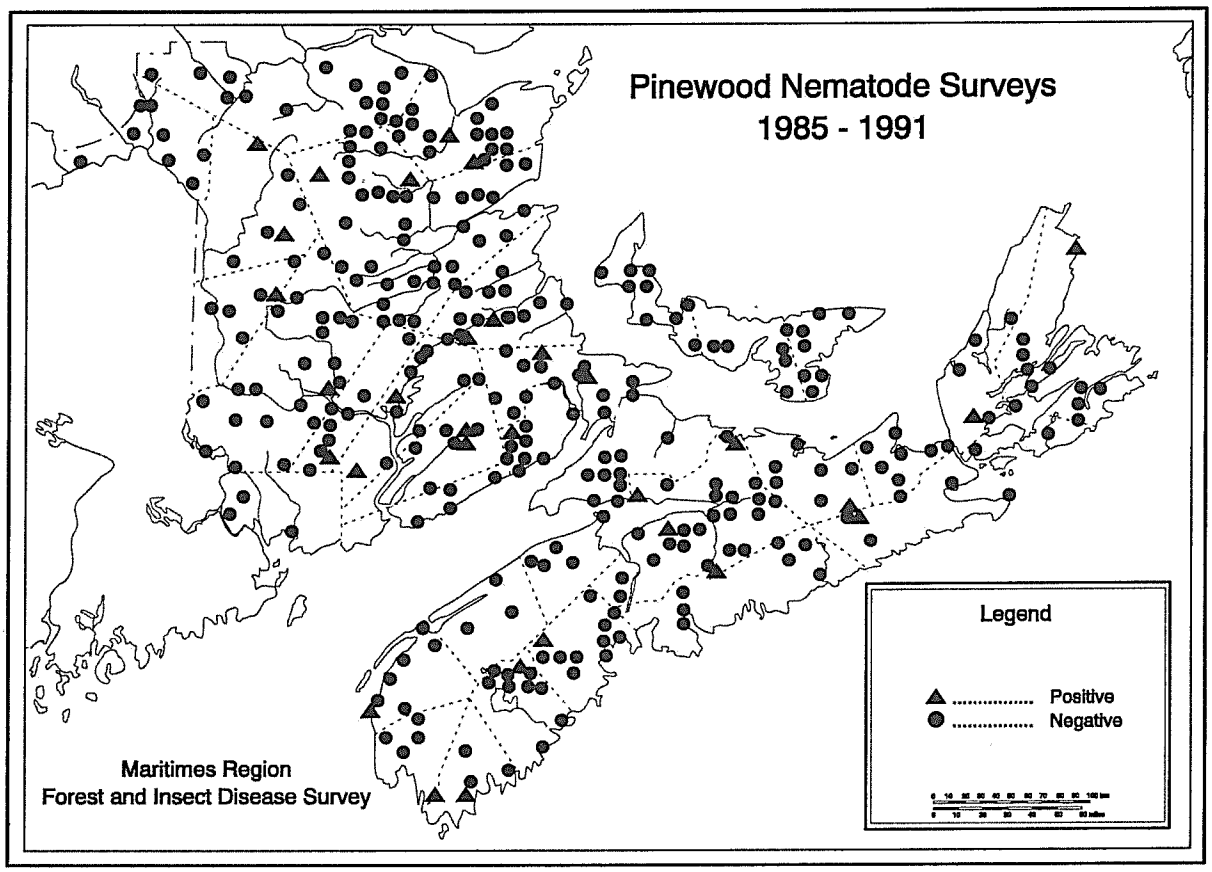


Figure 4

in the province escaped at least some feeding by larch casebearers.

In Prince Edward Island, discoloration caused by larch casebearer was reduced from the past 3 years. Only scattered patches of light discoloration were observed in 1991, the highest being at Sailors Hope, Kings Co., where 20% of the needles were discolored.

Pinewood Nematode

Surveys since the early 1980s have shown that pinewood nematode, *Bursaphelenchus xylophilus* (Steiner and Buhrer) Nickle, exists at only extremely low levels in the Maritimes and that it has never been known to kill a single tree. However, its very presence has created an economic problem in the forest product export industry because of plant quarantine regulations in importing countries in Europe.

The results of surveys from 1985 to 1991 are summarized in Fig. 4. All locations where pinewood nematode was found are shown. For other areas sampled, each UTM grid (10 x 10 km) is indicated only once, regardless of the number of samples taken in the grid. The number of samples per grid ranged from 1 to 14.

PESTS OF HARDWOODS

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 1991 (Fig. 5).

In New Brunswick, the disease is present wherever elm trees are found. Numerous infected and dying trees, both residual old trees and young saplings, were observed throughout the province in 1991. The "new" location, at Eight Mile Lake, Restigouche Co., only updates documentation of the occurrence of Dutch elm disease.

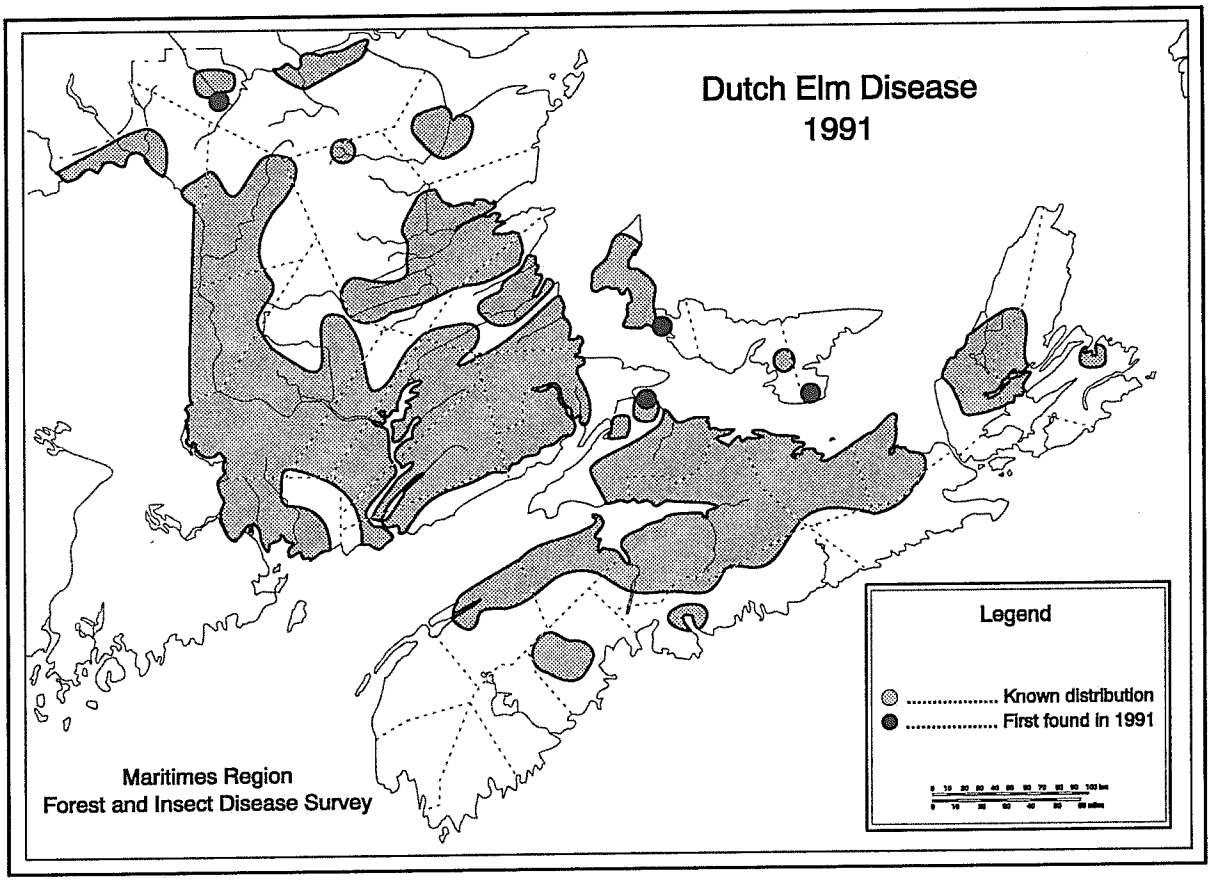


Figure 5

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 disease has been kept below an annual tree loss of 1% for the sixth consecutive year, and is apparently well under control due mainly to a consistent, long-term, sanitation program.

In Nova Scotia, the disease did not spread in 1991. Intensification, evidenced by great numbers of dead and dying trees, continued, especially where sanitation is not practised. Cumberland, Colchester, Pictou, Antigonish, Guysborough, Inverness, Halifax, and Hants counties were the most seriously affected.

In Prince Edward Island, a diseased tree was found at Little Sands, Kings Co. With this find, Dutch elm disease has now been documented in all three counties. Infected trees were first found in Prince County in 1979, in Queens County in 1988, and in Kings County In Prince County, the disease expanded its known distribution. An infected tree was found in Wilmot on the outskirts of Summer-side, a city with a significant population of elm shade trees. Diseased trees are becoming more common in the western part of Prince County in the areas with the longest history of Dutch elm disease. The infected trees at Little Sands and in Wilmot were promptly removed to prevent the spread of the disease.

Gypsy Moth

The gypsy moth, *Lymantria dispar* (L.), situation in 1991 remained unchanged both in New Brunswick and Nova Scotia. Since its reappearance in the Maritimes in 1981, the gypsy moth has been present in southeastern New Brunswick and in western Nova Scotia but caused visible defoliation only at Moores Mills, N.B. in 1987 and at New Minas, N.S. in 1991.

In 1991, 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

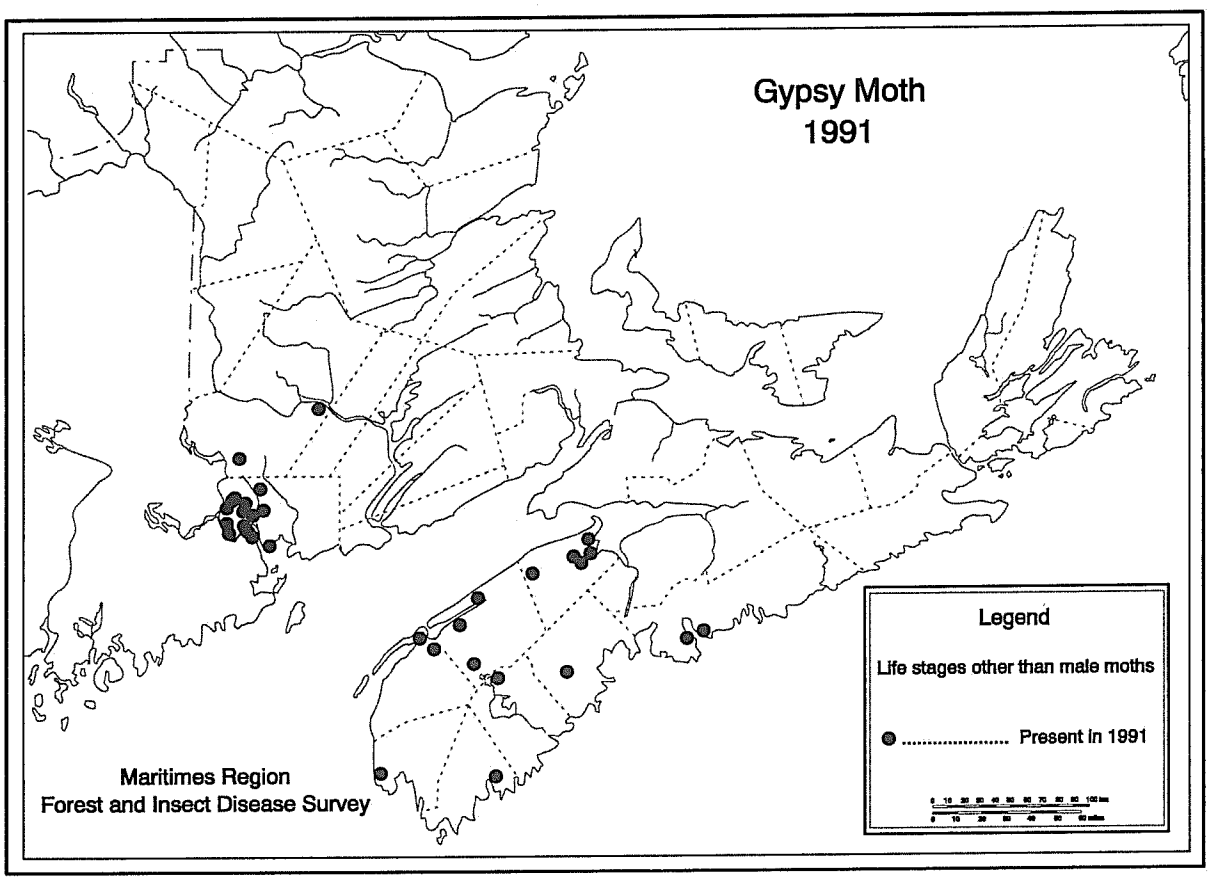


Figure 6

Gypsy Moth Coordinating Committee again coordinated all surveys, the work being carried out by federal, provincial, municipal, and industrial agencies.

The status of the gypsy moth in the Maritimes at the end of 1991, based on surveys for larvae, pupae, and egg masses, is summarized in Figure 6.

In New Brunswick, gypsy moth was found at 15 locations in 1991. Of these, three were "new" locations, bringing the total number of positive areas to 54 in the 11 years since 1981. However, since all three locations, Lower Little Ridge, Meadow Brook, and Lawrence Station in Charlotte Co., are very close or immediately adjacent to previous finds, they represent only local extensions of the known distribution. All but four of the 54 locations 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 these 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. Egg masses have been found at less than 3% of areas of suitable habitat. Surveys 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 is known to exist only in Fredericton, where egg masses were found in two areas of the city this fall.

No defoliation was observed in New Brunswick in 1991.

In Nova Scotia, gypsy moth was found at 16 locations in 1991, all of them areas where the insect was known previously. At most locations, only a few egg masses were found. A trace of hardwood defoliation occurred at New Minas, Kings Co. This represents the first time that visible defoliation by gypsy moth has been reported in Nova Scotia.

Table 5. Summary of the pheromone trapping program for gypsy moth in New Brunswick in 1991.

Location	Number of traps			Total	Moths caught per trap	Range
	Placed	Returned	Positive			
Roosevelt-Campobello Int. Park	2	2	2	68	34.0	24-44
Fundy National Park	25	25	25	450	18.0	9-29
St. Andrews	564	545	537	5434	10.0	0-28
Saint John	6	6	6	49	8.2	3-12
St. Stephen	561	497	486	3719	7.5	0-28
Oromocto	25	23	22	141	6.1	0-12
CFB Gagetown	25	21	19	57	2.7	0-7
Moncton	10	10	9	26	2.6	0-6
Fredericton	695	664	191	344	0.5	0-11
CFB Chatham	10	10	3	5	0.5	0-2
Kouchibouguac National Park	16	12	3	3	0.2	0-1
St. Leonard-Campbellton	25	25	0	0	n.a	0
Horticultural Nurseries	19	17	13	160	n.a	0-22
General	75	61	33	280	n.a	0-26
Trans-Canada Highway	142	134	89	483	n.a	0-14
Provincial Parks	120	79	41	216	n.a	0-22

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

Table 6. Summary of the pheromone trapping program for gypsy moth in Nova Scotia in 1991.

Location	Number of Traps			Total	Moths Caught per trap	Range
	Placed	Returned	Positive			
Yarmouth	50	25	25	750	30.0	19-41
Rte 8 (Milton-Annapolis Royal)	25	25	25	438	17.5	10-32
Canning	52	50	50	823	16.5	3-29
New Minas	299	297	292	4139	13.9	0-32
Kejimkujik National Park	300	283	278	3368	11.9	0-35
Bridgetown	50	42	42	463	11.0	1-25
Rte 10 (Bridgewater-Middleton)	25	23	23	173	7.5	1-17
Digby	50	46	45	269	5.8	0-16
CFB Cornwallis	15	5	5	29	5.8	2-10
Shelburne	200	126	107	690	5.5	0-28
Port Williams	37	35	30	166	4.7	0-22
Bridgewater	75	69	66	302	4.4	0-16
Rte 12 (Chester Grant-Kentville)	25	21	19	64	3.0	0-7
CFB Greenwood	50	39	31	70	1.8	0-9
Dartmouth	209	59	37	109	1.8	0-15
Halifax	506	305	181	473	1.5	0-14
Kentville	200	119	51	121	1.0	0-11
CFB Shearwater	15	13	7	9	0.7	0-2
Cape Breton Highlands Nat. Park	20	20	2	2	0.1	0-1
Cape Breton Island	108	104	3	3	>0.1	0-1
Kings Co. apple orchards	25	24	20	145	n.a	0-23
Nova Scotia Christmas Tree Council	250	184	127	1055	n.a	0-35
Provincial Parks	44	29	10	47	n.a	0-8
Eastern mainland	200	187	29	41	n.a	0-5

Note: Table accounts for 99% of traps retrieved.

Table 7. Summary of the pheromone trapping program for gypsy moth in Prince Edward Island in 1991.

Location	Number of Traps			Moths caught		
	Placed	Returned	Positive	Total	per trap	Range
P.E.I. National Park	25	25	11	14	0.6	0-3
P.E.I. - general	210	197	45	92	n.a	0-7
P.E.I. Forestry PDOs	15	25	5	35	n.a	0-13

Note: Table accounts for 100% of traps retrieved.

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 mainland, are captured in pheromone traps.

Adult male pheromone trapping programs were conducted in all three provinces, aimed at defining areas where egg mass searches should be conducted. Information was obtained from 4498 traps in the region, 2131 in New Brunswick, 2130 in Nova Scotia, and 237 in Prince Edward Island. Traps are placed at higher densities in infested areas with the dual objectives of better defining infestations and 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).

Forest Tent Caterpillar

After years of virtual absence, the forest tent caterpillar, *Malacosoma disstria* Hbn., was back on the scene in 1991, in south-central New Bruns-

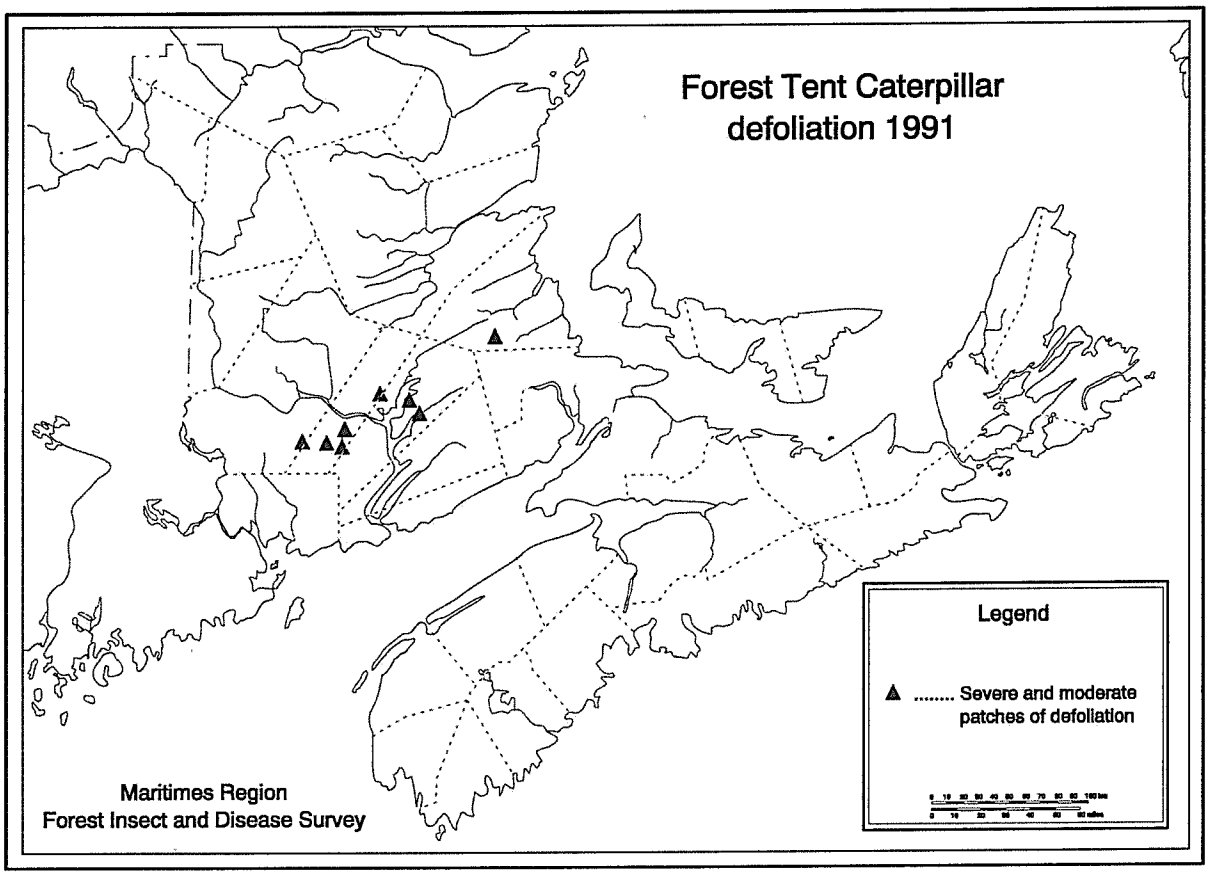


Figure 7

wick, probably indicating the beginning of a new outbreak cycle.

In New Brunswick, trembling aspen was defoliated in small pockets in several areas of York, Sunbury, and Kent counties (Fig. 7). The level of defoliation varied among locations from light to severe. The total area affected was 3,100 ha, of which 2,200 ha was severe, 700 ha moderate, and 200 ha light defoliation. Although most of the patches affected were only 1-10 ha in size, close to 200 ha of trembling aspen was severely defoliated at the Acadia Forest Experiment Station in Sunbury Co. The infestation was not unexpected since catches in both light traps and pheromone traps have been increasing in the last few years, indicating a buildup in forest tent caterpillar populations in this area. Light trap catches in 1990 were similar to those that preceded the start of the last major outbreak in 1979.

Only a few larvae (highest collection: 6 larvae) were collected at half a dozen locations in Nova Scotia and the insect was not found in Prince Edward Island in 1991.

Oak Leafroller and Oak Leaf Shredder

The 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.

The outbreak is persisting in Nova Scotia. In 1991, both the intensity and the area of defoliation (predominantly by the oak leafroller) were significantly reduced from that reported in 1990. The main reason for this reduction was the late frost which occurred in Nova Scotia in late May. The frost killed the newly flushed oak leaves and starved most of the insects. Although the trees produced a second flush of leaves, which is stressful to the trees, the insect populations could not rebound (or reproduce) in the same year, thus the red oak foliage looked better this year than in any year since the current outbreak started.

What little defoliation there was in 1991, occurred in scattered red oak stands in Lunenburg, Queens, Shelburne, Yarmouth, Annapolis, Kings, and Hants counties. The average level of defoliation was 5% (range 1-25%) compared to last year's 40% average (range 1-85%). This is a significant reduction in defoliation from 1990 and especially from 1988, the peak of the outbreak, when the average defoliation was 69%. The most severely defoliated oak stand was seen at Moses Mountain, Hants Co., where 25% defoliation occurred. The average defoliation also decreased at the permanent red oak observation plots in Queens and Lunenburg counties. Defoliation was 18.1% in 1991 compared to 25.5% in 1990, 26% in 1989, and 54% in 1988.

As a result of repeated serious defoliation, red oak stands in western Nova Scotia are generally in poor condition. The summary of tree condition surveys in 35 randomly selected oak stands in 1988, 40 in 1989, 39 in 1990, and 42 in 1991, is presented in Table 8. Results show that, although

Table 8. Tree condition of red oak after repeated defoliation in western Nova Scotia, 1988-1991.

Tree Condition Class		Percent of Trees in Class			
		1988a	1989b	1990c	1991d
Healthy		9.1	1.0	0.2	0.1
Twig dieback only		22.6	18.2	8.6	32.4
Branch dieback	1-25%	42.9	52.2	77.1	56.8
	26-50%	14.3	18.9	7.9	8.6
	51+%	5.0	4.9	2.0	0.8
	dying	0.6	0.9	1.0	0.7
Dead		5.5	3.9	3.2	0.8

a Based on assessment of 931 trees.
b Based on assessment of 1004 trees.
c Based on assessment of 975 trees.
d Based on assessment of 1050 trees.

few trees are healthy, trees are responding to the reduced defoliation of the past 2 years.

In New Brunswick, oak leaf shredder caused severe defoliation of red oak at Mohannes, Charlotte Co., while oak leafroller caused moderate defoliation at Douglas, York Co., and light defoliation of an ornamental tree at Perth-Andover, Victoria Co. The two insects fed together on oak at Cranberry Lake, Queens Co., causing light or moderate defoliation.

In Prince Edward Island, the oak leafroller caused moderate defoliation at North Milton, Queens Co., and Brudenell Point, Kings Co., and trace defoliation at Afton Road, Queens Co. This represents a situation very similar to that reported in 1990.

Birch Skeletonizer

Birch skeletonizer, *Bucculatrix canadensisella* Cham., remained common in Nova Scotia, where the current outbreak has persisted since 1988, and also caused foliage discoloration in New Brunswick and Prince Edward Island.

In New Brunswick, the insect was found for the first time since 1988 and caused severe foliage discoloration of white birch at three locations in Kent County. The largest of these, an area of 3-4 ha, was at East Galloway.

In Nova Scotia, skeletonizing of white birch leaves remained at the same high intensity as in 1990, but foliage browning was less widespread. Most of the discoloration was found in central and eastern Nova Scotia, especially on Cape Breton Island. A total of 26 locations in 11 counties showed damage ranging from 7 to 100% of the leaves skeletonized. Several pockets, 1-2 ha in size, had severe browning at James River, Antigonish Co., East of Margaree Forks and Dunvegan, Inverness Co. Scattered patches of severe browning were found east of Port Hawkesbury and Grand Anse, Richmond Co.; Port Hastings, Northeast Margaree, Inverness, and Southwest Mabou, Inverness Co.; Aulds Cove, South of Brierly Brook, Linwood, and Pomquet Forks, Antigonish Co.; and Sherbrooke, Guysborough Co. At Grand River Falls, Richmond Co., moderate or severe browning occurred along several hundred meters on roadside trees. Moderate discoloration was observed at Hubbards, Halifax Co., and at Chester Grant and Card Hill Lake, Lunenburg Co.

In Prince Edward Island, foliage browning was much more prevalent than in 1990, when it was reported at only one location at a trace level. In 1991, moderate and severe leaf browning occurred throughout Kings and Queens counties, with only one report of trace damage in Prince County. The majority of the damage was on white birch, but some wire birch was also skeletonized.

Poplar Serpentine Leafminer

Population levels of the poplar serpentine leafminer, *Phyllocnistis populiella* Cham., remained high in New Brunswick, causing 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 from the northern part of the province towards the Fundy coast. This outbreak has persisted since 1981. Twig and branch dieback as well as thin topped, unhealthy trees are becoming more and more common. Although population levels are still high in Restigouche, Gloucester, Madawaska, Victoria, and Northumberland counties, averaging 46% of the foliage affected on most (92%) of the trees, this represents a population reduction for the third consecutive year (50% in 1990, 61% in 1989). In the ten southern counties, the average infestation level of 10% of foliage affected is virtually unchanged from the last 4 years, but the number of trees affected has decreased to 43% in 1991 from the 66% the previous year.

In Nova Scotia, population levels remained low, the insect was found at only 7 locations, and the highest infestation was only 7% of foliage affected on 30% of the trees.

In Prince Edward Island, an average of only 2% of the leaves were affected, and even the highest infestation, at Wellington and MacNeills Mills, Prince Co., was only 4%.

NURSERY AND GREENHOUSE PROBLEMS

Although a wide variety of pest-related problems were encountered in Maritime forest nurseries in 1991, damage in most cases was not significant and was usually in the less than 5% range. Seed-

lings of most species were affected by one or more of the pests encountered at one or more of the nurseries. For many of the pests, their occurrence on a given host was a consequence of the host's presence rather than host specificity of the pest. The same applies to geographic locations, especially now that greenhouses create their own climate and environment, independent of those of the surrounding area.

Overwintering losses were the most serious problem in nurseries and entire crops were involved in a few cases. Probable causes of seedling loss included cold late-spring weather, frozen plugs during periods of thaw and oversized stock succumbing to gray mold infection.

Some of the more interesting or noteworthy nursery and greenhouse problems in 1991 were: root weevils, *Otiorhynchus* spp.; black vine weevil, *Otiorhynchus sulcatus* (F.); tarnished plant bug, *Lygus lineolaris* (Palisot); leatherjackets, *Tipulidae*; thrips, *Thysanoptera*; fungus gnats, *Mycetophilidae*; northern pitch twig moth, *Petrova albicapitana* (Busck); owlet moths, *Noctuidae*; mites, *Nalepella halourga* Keifer; aphids; gray mold, *Botrytis cinerea* Pers. ex Fr.; smothering fungus, *Thelephora terrestris* Ehrh. ex Fr.; damping off, associated with *Fusarium* sp.; hot summer weather; extended drought; and fertilizer burn.

Increased vigilance, early intervention, and good nursery practices are minimizing damage by these and some other potentially important pests.

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 and cause direct damage. In 1991, pests from all three categories were present in Maritime seed orchards.

Spruce cone maggots infested an average of 8% (0-21%) of cones in six black spruce orchards in New Brunswick and Prince Edward Island, and an average of 6% (<1-14%) of cones in five white spruce orchards in New Brunswick and Nova Scotia. Adults of both *Strobilomyia appalachensis* Michelsen and *S. neanthracina* Michelsen were caught on yellow sticky traps in spruce seed orchards.

Larch cone maggots - The percentage of larch cones infested by the maggots, *Strobilomyia laricis* Michelsen and *S. viaria* (Huckett), was up from 1990 and ranged from 43-93% in two New Brunswick seed orchards and from 6-47% in two Prince Edward Island orchards.

Coneworms - Spruce coneworm, *Dioryctria reniculelloides* Mut. and Munn, larvae were scarce; no moths were caught in pheromone traps set out in 15 spruce seed orchards in New Brunswick, Nova Scotia, and Prince Edward Island. Fir coneworm, *D. abietivorella* (Grt.), damage was down from 1990 and ranged from <1 to 2% in spruce orchards.

White pine cone beetle, *Conophthorus coniperda* Sz., destroyed about 10% of the cones in the white pine seed orchard near Debert, Colchester Co., N.S.

Spruce seed moth, *Cydia strobilella* (L.), damaged 2% of the black spruce cones at the Second Falls seed orchard near Edmundston, Madawaska Co., N.B.; an adjacent natural stand of white spruce had about 20% of cones infested. The number of moths caught in pheromone traps were up slightly from 1990. Mean moth catch per trap ranged from 0-3 in six white spruce orchards and from 0-24 in nine black spruce seed orchards (the mean catch of 24 moths was at Second Falls). A trap set out at the Fredericton Golf Club, York Co., N.B., caught 156 moths.

Spruce budmoth, *Zeiraphera canadensis* Mut. & Free., was observed feeding on a few white spruce cones and vegetative shoots at the Queensbury, York Co., N.B. seed orchard. Budmoth damage in vegetative shoots was low in a white spruce orchard near Debert and high in the Pokiok, York Co., N.B. white spruce seed orchard.

Midges - A variety of midges were found in Maritime seed orchards. The spruce cone axis midge, *Dasineura rachiphaga* Tripp, infested an average of <1% of white spruce and 4-5% of black spruce cones. *Resseliella* spp. infested 0-30% of black spruce cones and 28-35% of larch cones in New Brunswick orchards, and 0-38% of larch cones in Prince Edward Island orchards. *Karshomyia* sp. larvae were found in 11-15% of larch cones in Prince Edward Island orchards and 28-50% of larch cones in New Brunswick orchards. *Lestodiplosis* sp. larvae were found occasionally in larch and spruce cones.

Brown larch tubemaker, *Spilonota lariciana* Heinr., destroyed 6% of the young conelets in the larch seed orchard at Dover, Kings Co., P.E.I.

Twig aphids, *Mindarus* sp., were present in heavy populations in black spruce seed orchards in New Brunswick and Prince Edward Island. Adelgids, *Adelges* sp., infested most cones in larch orchards but did not appear to directly injure seeds.

Needleminers, *Coleotechnites* spp., infested 0-21% of larch cones. Larvae of the conifer micro moth, *Holcocerina immaculella* (McD.), were found in small numbers of cones in white pine and white spruce orchards near Debert. A cone moth, *Barbara* sp., was found in a few white pine and black spruce cones in Nova Scotia and New Brunswick. Larvae of spruce budworm, *Choristoneura fumiferana* Clem., were found occasionally in white and black spruce cones in New Brunswick and Prince Edward Island. Egg masses of the large yellow underwing, *Noctua pronuba* L., were found on a few red spruce trees in the Debert clone bank.

The redheaded pine sawfly, *Neodiprion lecontei* (Fitch), Swaine jack pine sawfly, *N. swainei* Middle Kauf, and the European pine sawfly, *N. sertifer* (Geoffroy), were present in low numbers on the foliage in the jack pine seed orchard at Parkindale, Albert Co., N.B. Larvae of the white pine sawfly, *N. pinetum* (Nort.), were common in the white pine clone bank at Debert, but appeared to cause little damage to foliage. Webspinning sawflies, *Cephalcia* spp., infested a small number of trees in spruce seed orchards in New Brunswick.

White pine weevil, *Pissodes strobi* Peck, damaged 5-10% of black spruce grafts at Parkindale.

Spider mites, *Tetranychidae*, damaged white spruce at Kingsclear, York Co., N.B., and black spruce at Springhill, Cumberland Co., N.S.

Frost damage was very common and ranged from trace to severe, depending on the location and species. Twig mortality was at trace or low levels on many species throughout the region. Conelet mortality in white spruce ranged from <1% at Parkindale, Albert Co., N.B. to about 30% in orchards near Debert and Waterville, Kings Co., N.S. Red spruce orchards in Kings and Annapolis counties, N.S., suffered 70% and 90% conelet mortality, respectively. Conelet mortality in larch orchards ranged from 8% near Upton Road, Queens Co., P.E.I., to a mean of 27% at Parkindale, Albert Co., N.B. Damage at Parkindale was highly variable, depending on the clone and its phenology; two early flowering clones suffered 49 and 76% conelet loss, whereas three later flowering clones suffered only 0-5% loss. Black spruce orchards had only trace damage levels throughout the region.

Armillaria root rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, was present on eastern white pine in a seed orchard at Debert.

Spruce needle rust, *Pucciniastrum americanum* (Farl.) Arth., was at trace levels on white spruce cones at orchards in the region, except 7% infection near Waterville, and 22% near Debert. The successive droughts in 1990 and 1991 limited infection and intensification on the alternate host, raspberry.

Needle rusts, including *Chrysomyxa ledi* dBy. and *Melampsora medusae* Thuem., on spruce and larch, respectively, were at endemic levels with only trace infections.

PLANTATION PEST ASSESSMENT SURVEYS

Multi-agency plantation pest assessment surveys determined pest conditions on close to 14,000 trees in 271 plantations and eight thinned areas in the region in 1991.

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 uniform coverage. The level of damage on the different parts of each tree by each pest found was recorded. Field assessments were carried out primarily by staff of cooperating organizations, while identification of samples and data summarization were done by the Forest Insect and Disease Survey.

Cooperating agencies, in addition to the Forest Insect and Disease Survey in 1991 were: New Brunswick Department of Natural Resources and Energy (DNRE), J.D. Irving Ltd. (JDI), Stone Consolidated Inc. (SCI), Nova Scotia Department of Natural Resources (DNR), Stora Forest Industries (Stora), and Prince Edward Island Department of Energy and Forestry (DEF).

Table 9. Summary of plantation assessments by tree species and organization conducting field work in the three Maritime provinces in 1991.

Tree Species	Total plant. assess.	New Brunswick					Nova Scotia				Prince Edward Island	
		DNRE	JDI	SCI	FIDS	Total	DNR	Stora	FIDS	Total	DEF	Total
Balsam fir	3	-	-	-	-	-	3	-	-	3	-	-
Larch	3	3	-	-	-	3	-	-	-	-	-	-
Jack pine	32	19	7	1	3	30	1	-	1	2	-	-
Red pine	28	2	1	1	2	6	19	-	2	21	1	1
Scots pine	1	-	-	-	-	-	1	-	-	1	-	-
Black spruce	97	28	30	6	1	65	12	19	1	32	-	-
Norway spruce	16	-	8	-	-	8	7	1	-	8	-	-
Red spruce	20	1	-	-	-	1	17	2	-	19	-	-
White spruce	48	5	30	-	-	35	12	-	1	13	-	-
Mixed spruce	8	-	-	-	-	-	5	2	1	8	-	-
Spruce unspec.	2	-	-	-	-	-	1	1	-	2	-	-
Mixed species	10	4	-	1	-	5	2	3	-	5	-	-
Cedar	1	-	-	1	-	1	-	-	-	-	-	-
Hardwoods	2	2	-	-	-	2	-	-	-	-	-	-
Thinned	8	6	-	-	1	7	-	-	1	1	-	-
Totals	279	70	76	10	7	163	80	28	7	115	1	1

In 1991, there were 271 plantations assessed, 156 in New Brunswick, 114 in Nova Scotia, and 1 in Prince Edward Island by the cooperating agencies (Table 9). In addition, eight thinned areas were also assessed, seven in New Brunswick and one in Nova Scotia. Of these, four were balsam fir stands, one of them in Nova Scotia, two were black spruce, and one each were spruce (species unspecified) and mixed softwood.

Most plantation trees are healthy in the Maritimes as over 90% of the nearly 14,000 trees fell into this category (Table 10). There were at least some trees severely affected in 26% of the 271 plantations assessed (Table 11). This may or may not be serious, depending on the cause of damage and the percentage of affected trees. However, those plantations need further investigation. Table 12 lists the various plantation problems encountered at severe or moderate levels in the three provinces on pine, while Table 13 lists the problems on spruce. Problems identified at these levels on "Other" tree species were: animal damage, mechanical damage, competition, frost, spruce budworm, and shoestring root rot.

Table 10. Tree condition in plantations in the Maritime provinces in 1991.

Province	Species	Tree Condition (%)			
		Healthy	Fair	Poor	Dead
New Brunswick	Pine	93.6	2.6	1.5	2.3
	Spruce	95.3	2.9	0.8	1.0
	Other	93.9	2.9	1.3	1.9
Nova Scotia	Pine	83.7	8.2	6.6	1.5
	Spruce	91.1	5.7	2.0	1.2
	Other	90.9	3.5	3.3	2.3
Prince Edward Island	Pine	96.0	0.0	2.0	2.0

Table 11. Frequency of plantations containing at least one tree with moderate or severe damage in the three Maritime provinces in 1991.

Province	Species	Plantations		
		Number assessed	Frequency (%) with damage level	
			Moderate	Severe
New Brunswick	Pine	36	19	33
	Spruce	109	33	19
	Other	11	9	36
Nova Scotia	Pine	24	25	45
	Spruce	82	37	24
	Other	8	37	12
Prince Edward Island	Pine	1	0	100

Trees with moderate or severe damage were found in four of the New Brunswick thinned areas and in the thinned stand in Nova Scotia. The damaging agents were: animals, snow, mechanical injury, competition, beech bark disease, forest tent caterpillar, aphids, gall midge, and witches' broom.

Table 12. Number of pine plantations containing trees with moderate or severe problems in the various regions of New Brunswick and Nova Scotia in 1991.

Problem	New Brunswick Regions					Nova Scotia Regions						
	1	2	3	4	5	W	SS	V	NC	SC	E	CB
Adelgids	-	-	-	-	-	-	-	-	-	-	-	1
Animal damage	-	-	2	2	-	1	1	-	3		-	-
Aphids	-	-	-	-	-	-	1	-	-	-	-	-
Bark beetle	-	-	1	-	-	1	-	-	-	-	-	-
Coneworm	-	-	-	-	-	-	-	1	-	-	-	1
European pine shoot moth	-	-	-	-	-	4	-	2	-	-	-	-
Gall midge	1	-	-	-	-	-	-	-	-	-	-	-
Globose gall rust	-	-	1	-	-	-	-	-	-	-	-	-
Mechanical damage	-	-	1	1	-	1	-	-	-	-	-	-
Needle rust	-	-	1	2	-	-	-	-	-	-	-	-
Northern pitch twig moth	-	-	-	2	-	-	-	-	-	-	-	-
Pine tortoise scale	-	1	-	-	-	1	-	-	-	-	-	-
Planting problems	-	-	1	2	-	2	-	-	-	-	-	1
Scleroderris canker	-	-	-	1	-	-	-	-	-	-	-	-
Shoestring root rot	-	-	-	2	-	-	-	-	-	-	-	-
Sirococcus shoot blight	-	-	-	-	-	2	-	-	1	-	-	-
Snow damage	-	-	-	3	-	-	-	-	2	-	-	-
Spider mite	-	-	-	-	-	1	-	-	1	-	-	-
White pine weevil	-	1	1	2	-	1	-	-	-	-	-	1
Winter damage	-	-	-	1	-	2	-	-	-	-	-	-

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

Table 13. Number of spruce plantations containing trees with moderate or severe problems in the various regions of New Brunswick and Nova Scotia in 1991.

Problem	New Brunswick Regions					Nova Scotia Regions						
	1	2	3	4	5	W	SS	V	NC	SC	E	CB
Adelgids	-	1	-	-	1	1	1	-	-	-	-	1
Animal damage	1	-	-	-	4	4	2	-	-	-	6	1
Aphids	-	1	-	4	-	-	-	-	-	-	-	1
Bark beetles	1	-	-	-	1	-	-	-	-	-	-	-
Competition Hardwood	-	-	-	1	-	-	-	-	-	-	2	2
Softwood	-	-	-	1	-	-	-	-	-	-	-	-
Herbaceous	1	-	-	-	-	1	-	-	-	-	1	1
Unspecified	-	-	-	-	-	3	-	-	-	-	1	1
Coneworm	-	-	-	1	-	-	-	-	-	1	-	-
Drought	-	-	-	-	-	-	-	1	1	-	-	2
Frost	-	-	-	2	16	3	1	3	-	-	-	5
Gall midge	-	-	-	-	6	-	-	-	-	-	-	-
Mechanical damage	1	-	-	1	-	1	-	-	-	-	-	-
Needle rust	-	-	-	2	1	-	-	-	-	-	-	-
Planting problems	1	-	-	5	2	10	-	-	-	-	11	4
Pyralid moth	-	-	-	1	-	-	-	-	-	-	-	-
Root collar weevil	-	-	-	-	-	-	-	-	-	-	-	2
Sawfly	-	-	2	-	1	1	-	-	-	-	-	-
Shoestring root rot	2	-	-	1	1	-	-	-	-	-	1	2
Snow damage	-	-	-	-	5	-	-	-	-	-	1	1
Spider mite	-	-	-	-	-	2	-	-	-	-	-	-
Spittlebugs	-	-	-	-	-	-	-	-	-	-	-	1
Spruce bud midge	-	-	-	1	18	-	-	-	-	-	-	-
Spruce budmoth	-	-	-	1	13	-	-	-	-	-	-	1
Spruce budworm	-	-	-	-	2	-	-	-	-	-	-	-
White pine weevil	-	1	-	2	2	7	1	-	-	1	-	1
Wind damage	-	-	-	-	-	-	-	-	-	-	1	-
Winter damage	-	-	-	4	4	1	-	2	-	-	2	5

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

CHRISTMAS TREE PESTS

Many pests of balsam fir Christmas trees are mentioned elsewhere in this report. The balsam twig aphid and the balsam gall midge 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. Pine needle scale is mentioned because its presence caused export problems in 1991.

Balsam twig aphid, *Mindarus abietinus* Koch, infestations were common, severe and serious throughout much of the Maritimes. It appears that aphid populations built up dramatically during the dry summer period and that standard monitoring techniques during the early development phase grossly underestimated of aphid populations. A similar monitoring failure was also reported in Maine. Excessively high population levels could still be found well into the second week of July. Shoots, having reached 70 to 80% of their elongation, were dripping profuse amounts of honeydew. Surprisingly, very little needle curling occurred on even these very heavily infested shoots late in the summer. Short but heavy rains appeared to have played a role in washing most of the aphids off the shoots. A higher than usual incidence of coccinellid and syrphid larval predators observed by plantation owners might bode well for 1992.

In New Brunswick, an average of 27% of balsam fir shoots were affected on 76% of the trees at the 94 locations assessed. Damage was variable but severe infestations were common, most frequent in Gloucester County. The highest infestation was recorded at Millstream, Gloucester Co. There has been a gradual increase in the distribution of the aphid, as indicated by the surveys conducted by the NBDNRE. Twig aphid was present at 66% of the 707 locations assessed, compared to 42% in 1990, 50% in 1989, 39% in 1988, and 16% in 1987.

In Nova Scotia, an average of 24% of balsam fir shoots were affected on 36% of the trees at the 68 locations assessed but severe shoot damage was widespread throughout the province, both in natural forests and Christmas tree areas. Among the highest infestations were: Crowdis Mountain, Victoria Co., 88%; South of Shag Roost, Inverness Co., 80%; Upper Musquodoboit, Halifax Co., 80%; Cherryfield, Lunenburg Co., 77%; Central North River and Dickey Lake Road, Colchester Co., both 75%.

In Prince Edward Island, an average of 30% of balsam fir shoots were affected on 88% of the trees at the 11 locations assessed, an increase from last year, when the average was 14% on 39% of the trees. The worst damage occurred at the Foxley River Demonstration Woodlot, Prince Co., and at Valleyfield, Kings Co., where 65% and 59%, respectively, of the shoots were affected.

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

In New Brunswick, balsam gall midge was recorded in 12 of the counties in natural forests. Less than half (42%) of the trees were affected, and only an average of 5% of the balsam fir needles had galls at the 39 locations assessed. There was only one area in the province where more than 20% of the needles were affected. Infestation levels by the balsam gall midge were also determined at 707 locations by the NBDNRE. Of these, 44% were negative, 1-10% of the needles were affected at 54% 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 are very similar to those of the last 2 years and indicate continuing low populations. The balsam gall midge was of no concern to growers in Christmas tree areas in 1991.

In Nova Scotia, balsam gall midge was found throughout the province in natural forests, with the exception of Cumberland Co. An average of 6% of the needles were affected at the 31 locations assessed. This represents a slight increase from last year, when the average was 3%. The incidence of galled needles was in excess of 20% at only a few locations: at Cameron Settlement, Guysborough Co., and north of Garden of Eden Barrens, Pictou Co., where it was 25%. Balsam gall midge populations were also low in Christmas tree areas. Incidence exceeded 10% needle damage only at MacKenzie Settlement, Cumberland Co., where 2-3% of the trees were unmarketable.

In Prince Edward Island, the highest infestation level found was 5% in the seven areas examined.

Pine needle scale, *Chionaspis pinifoliae* (Fitch), infested balsam fir trees found by local plant health authorities in a Christmas tree shipment from Nova Scotia upon arrival in Bermuda. Even though only a few of the minute white scales were found on any given tree, their presence resulted in the destruction of a portion of the shipment. Pine needle scale, common on most species of pine, especially on ornamental Mugho pine, has been reported previously on fir but it appears that the only authentic records of it are from Nova Scotia. The scale insect was found twice, both times within the past 4 years, on balsam fir needles on an ARNEWS plot in western Nova Scotia. The discovery of the scale on balsam fir Christmas trees added another insect to the growing list of pests with which growers have to contend.

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

In the Maritimes region, in 1991, the 17 ARNEWS plots were visited in June and July to: determine forest insect and disease conditions, detect "acid rain" symptoms, observe seed crop and premature change in foliage coloration, and to collect ground vegetation samples. In August, 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). In the late fall, six additional areas were selected (two in New Brunswick, three in Nova Scotia, and one in Prince Edward Island), in preparation for a planned expansion of the system in 1992.

Table 14. Retention of needles produced in different years by various conifer trees in the Maritimes region - 1991.

Species	Province	No. of locations	Percent needles retained of needles produced in the year indicated							
			1991	1990	1989	1988	1987	1986	1985	1984
Balsam fir	New Brunswick	96	99	97	90	80	68	50	33	21
	Nova Scotia	54	99	95	88	84	71	57	35	17
	Prince Edward Island	9	98	92	90	82	69	53	43	27
White spruce	New Brunswick	27	100	99	95	85	68	51	32	23
	Nova Scotia	53	97	94	88	79	62	38	21	8
	Prince Edward Island	23	95	93	85	75	59	39	18	9
Black spruce	New Brunswick	22	100	100	98	93	82	67	45	31
	Nova Scotia	8	100	100	96	81	73	51	34	19
	Prince Edward Island	4	100	93	85	73	73	63	48	33
Red Spruce	New Brunswick	42	99	97	91	82	71	60	42	31
	Nova Scotia	31	99	95	88	83	71	56	34	22
Norway Spruce	Nova Scotia	1	100	90	70	50	60	70	70	50
Red pine	New Brunswick	1	100	100	100	90	0	0	0	0
	Nova Scotia	5	100	96	86	52	22	0	0	0
Jack pine	New Brunswick	3	100	100	87	0	0	0	0	0
	Nova Scotia	1	100	90	80	10	0	0	0	0
	Prince Edward Island	1	100	90	10	0	0	0	0	0
White pine	New Brunswick	2	100	95	85	0	0	0	0	0
	Nova Scotia	10	100	89	56	1	0	0	0	0
Hemlock	New Brunswick	1	90	90	50	90	10	10	20	0
	Nova Scotia	5	100	84	74	42	10	4	2	0

Needle Retention By Conifers

Observations are made for signs of acid rain or other pollution damage at all locations where detailed pest conditions are assessed. Special attention is directed to the number of years coniferous species retain their foliage. A summary of needle retention values obtained from the 398 locations assessed in 1991 is presented in Table 14. 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, most 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 database which will enable us to analyze possible changes.

North American Sugar Maple Decline Project (NAMP)

The North American Sugar Maple Decline Project (NAMP) collected a fourth year of data in 1991 from the 12 New Brunswick and two Nova Scotia plots. Analyses of results to date show that, on average, sugar maple condition changed little in the Maritimes since the plots were established, as expressed by measurements of diebacks and leaf density. The results apply to both managed sugar bushes and unmanaged stands.

Trees also remained in good condition on the five maple plots in Prince Edward Island, assessed by NAMP methodology.

NAMP objectives are to determine the rate of change in tree condition, to relate this to sugar bush management, initial levels of stand condition and atmospheric pollution, and to identify the geographical relationship between cause and damage. Tree condition during the period of the study has not deteriorated significantly, relative to observations before 1988.

Maple Monitoring in Nova Scotia

Tree condition at two sugar maple plots and one red maple plot deteriorated slightly in 1991, to about 1989 levels, after a modest recovery in 1990; a fourth plot showed little change. In 1991, the methodology of the NAMP for estimating dieback and leaf transparency was adopted to improve precision and provide data comparable with that from NAMP plots. These estimates suggest that most of the sugar maples are within a "normal healthy" range, but that about 25% of the red maple are exhibiting more dieback and lower foliage density than would be expected on a normal-healthy tree.

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 are now strong indications that coastal acid fog may be a major contributing factor.

In 1991, 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. 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 present in the area by early to mid-August. The change in the timing and intensity of the foliage discoloration during the past several years is 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 15. The results indicate that the improvement in the condition of surviving trees, first noted in 1989, continued in 1991.

Foliage discoloration on white birch, similar to that along the Bay of Fundy, also occurred in other areas of New Brunswick and Nova Scotia. In New

Table 15. Condition of white birch along the Bay of Fundy in New Brunswick on permanent plots, 1982-1991.

	% of trees in class			
Year	No dieback	Twig dieback	Twig & Branch dieback	Dead
1982	92.9	1.5	4.7	0.9
1983	83.7	8.6	6.0	1.7
1984	64.0	24.9	7.8	3.3
1985	45.3	34.9	14.4	5.4
1986	14.5	47.3	31.3	6.9
1987	0.0	42.6	49.8	7.6
1988	0.0	38.0	54.0	8.0
1989	0.2	43.0	47.0	10.0
1990	0.2	47.0	42.0	11.0
1991	20.5	48.3	18.8	12.4

Based on 540 trees in 11 plots.

Brunswick, curled, off-color foliage was observed in the Grand John Brook, Crow Hill, and Napadogan areas of York Co. Discoloration was generally only trace or light but some trees exhibited moderate browning. It is suspected that drought stress was largely responsible for the condition in these areas. In Nova Scotia, generally light foliage browning was common along the Highland Road in Cape Breton Island. Patches of severe or moderate discoloration were noted in Shelburne, Halifax, and Antigonish 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 Co., N.S. 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 have 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 that might explain the chlorotic foliage. However, tree growth in the affected area was drastically reduced in 1984 and remained slow until 1987 when growth was last measured. The average annual radial increment between 1984 and 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 succession scenario is being considered as a possible cause.

In 1991, the condition was present again and the size of the affected area increased marginally. Two plots were established in 1990 to obtain more detailed information on the stands and to monitor changes. One plot is in a stand of mature and overmature trees, the other in a nearby immature stand. A few additional trees died in 1991 and five of the old trees were attacked by spruce beetle, an indication of trees under stress. Heavy cone crop, another indicator of stress, was observed on 80% of the older and 49% of the younger plot trees. Total needle loss has not changed much from 1990. Needle retention was better on the young trees than on the older ones by an age class (i.e., more than 30% of needles retained for 4 years on younger, for 3 years on older trees).

Red Spruce in Southern New Brunswick and 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 Co. Although trees in many of these areas have 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 and construction damage in 1989 rendered the plot in Cumberland County unsuitable for further use. Observations in 1991 indicate an overall improvement on the plots in New Brunswick. On the remaining Nova Scotia plot, Armillaria root rot killed one tree and has probably invaded at least three others.

INSECT POPULATION MONITORING SYSTEMS

Pheromone Trapping Program

In the Maritimes, pheromones have been used as survey tools since 1969, when traps were first used in detection surveys for the gypsy moth. In 1991, pheromones were used for 11 forest insects.

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 may result.

An important aspect of our pheromone trapping program is standardization, that is keeping all 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

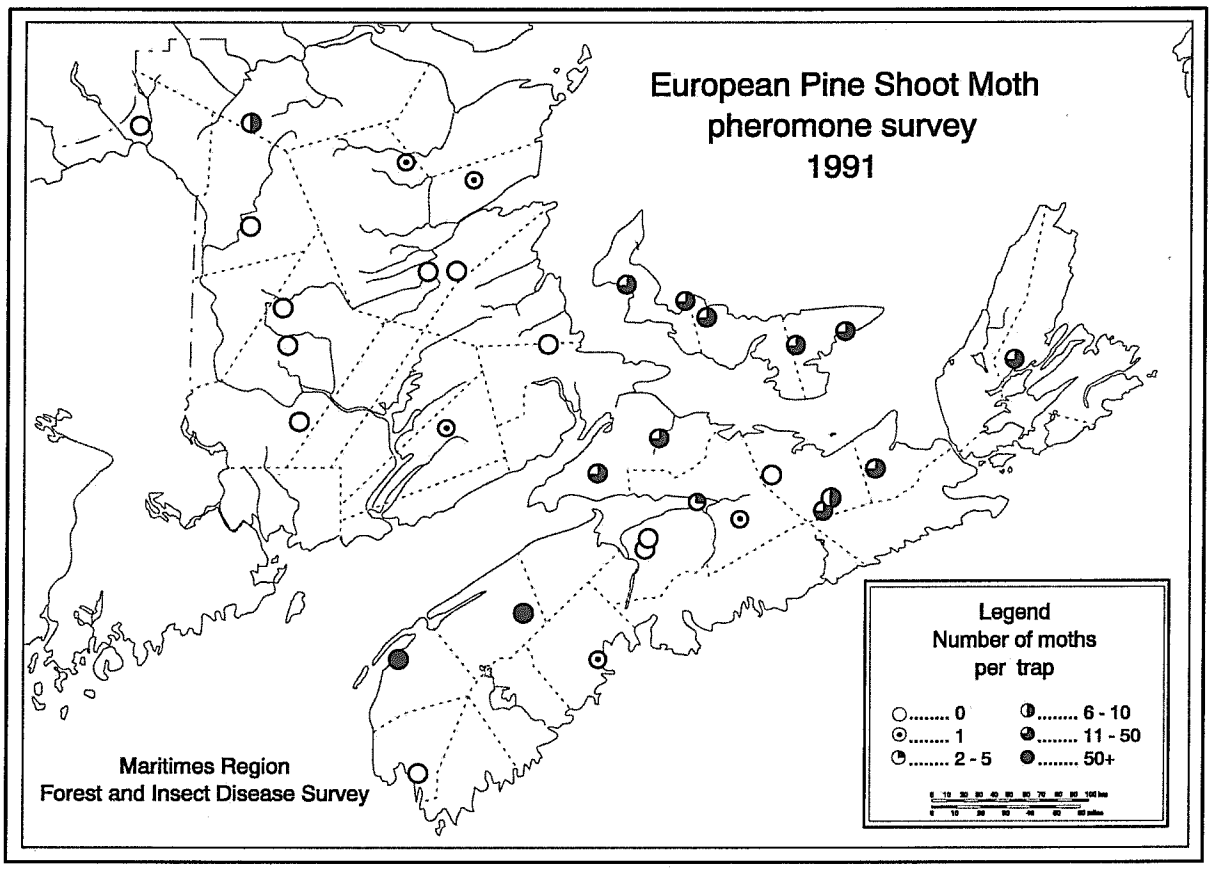


Figure 8

addition to "operational" testing reported here, research is also under way to develop more efficient systems.

European pine shoot moth - The overall trend in moth capture is up in 1991 (Fig. 8), with some of the highest captures being obtained since trapping started in 1984. As in previous years, higher populations are predominant in Nova Scotia and Prince Edward Island. One New Brunswick location, in southern Restigouche County, had a significant catch.

The criterion for selecting locations for European pine shoot moth traps is that they be in young red pine plantations. The purpose of this trapping system is primarily to give early warning of a possible outbreak in the plantation being monitored. Trees 1 m in height are selected as new locations, then the sites are changed when the trees are considered seriously infested or when they reach a height of 3 m. Because changes in locations will be an annual feature of European shoot moth trapping, it is not appropriate to make detailed comparisons of mapped results between years, except in the sense of overall trends.

Forest tent caterpillar - there was a significant increase in numbers of forest tent caterpillar moths captured in traps in the Maritimes in 1991 (Fig. 9). This increase corresponded with the first signs of defoliation seen in New Brunswick since 1984. An increase in pheromone trap captures in New Brunswick was noted in 1989 and, while there was little change in 1990, it appears that pheromone trapping has given a 2-year advance warning of population increase to levels when visible defoliation occurs. The 1991 trapping results suggest that defoliation may be more widespread in south-central and eastern New Brunswick during 1992. Small increases in trap catches also occurred in Nova Scotia and Prince Edward Island. The magnitude of these do not suggest defoliation in 1992, however, if the New Brunswick experience holds true, defoliation may occur in these two provinces in 1993.

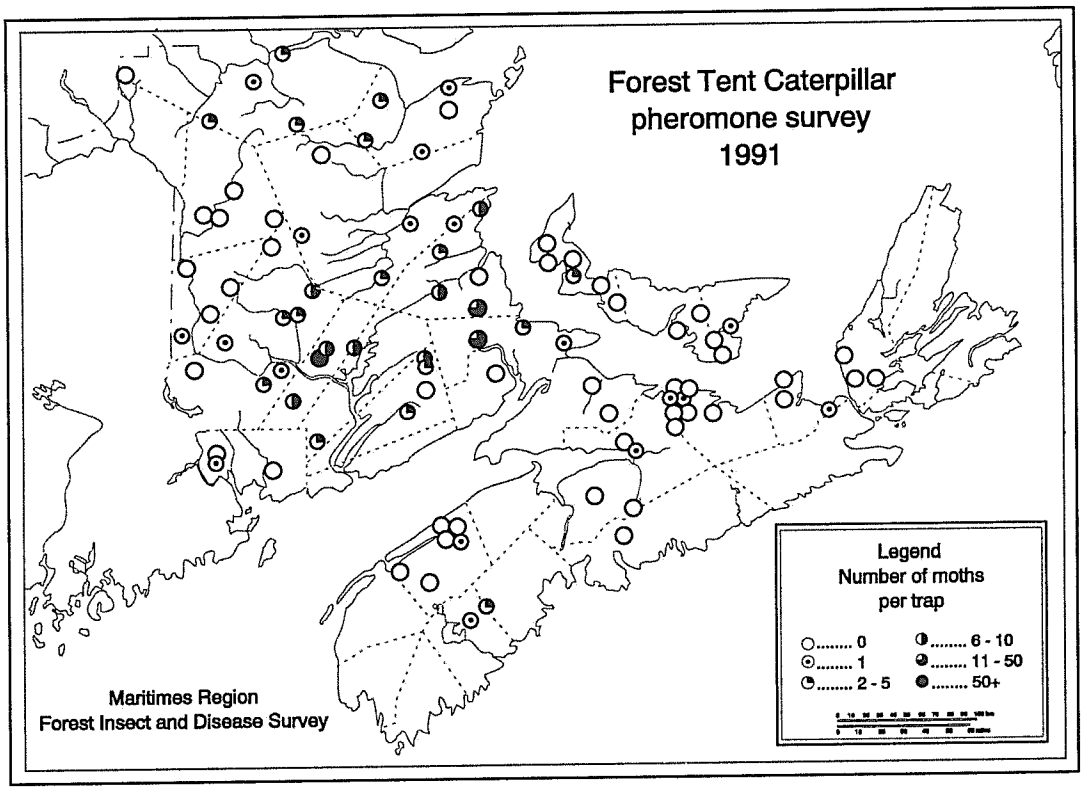


Figure 9

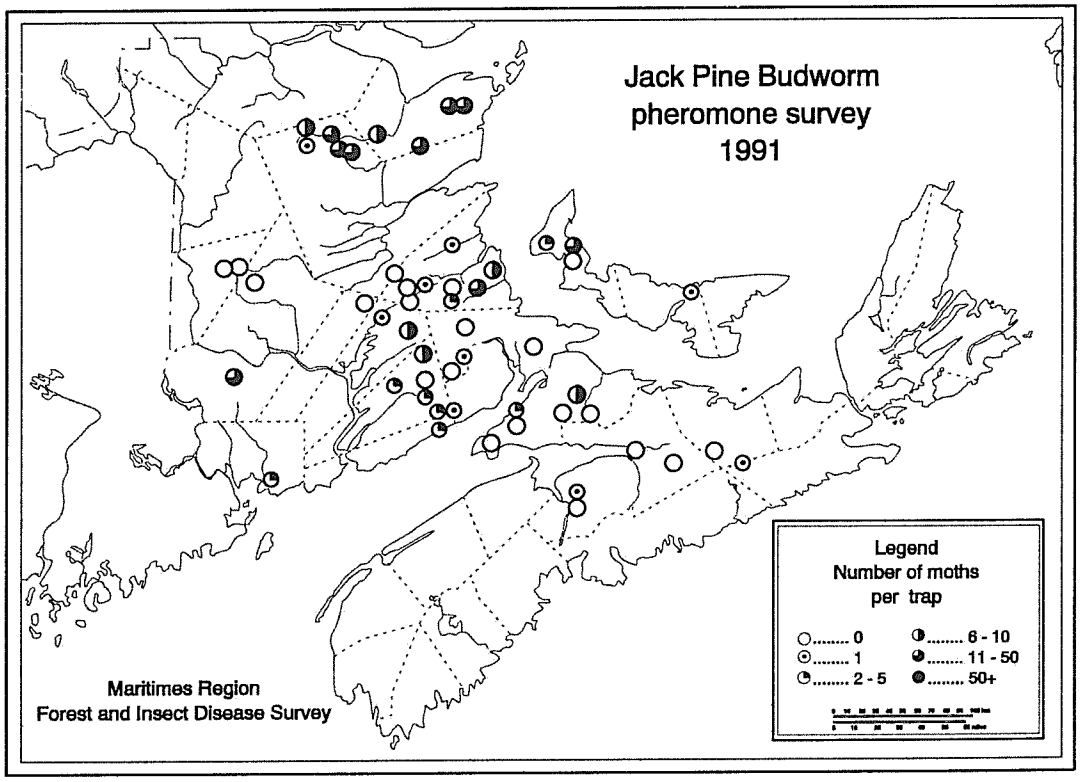


Figure 10

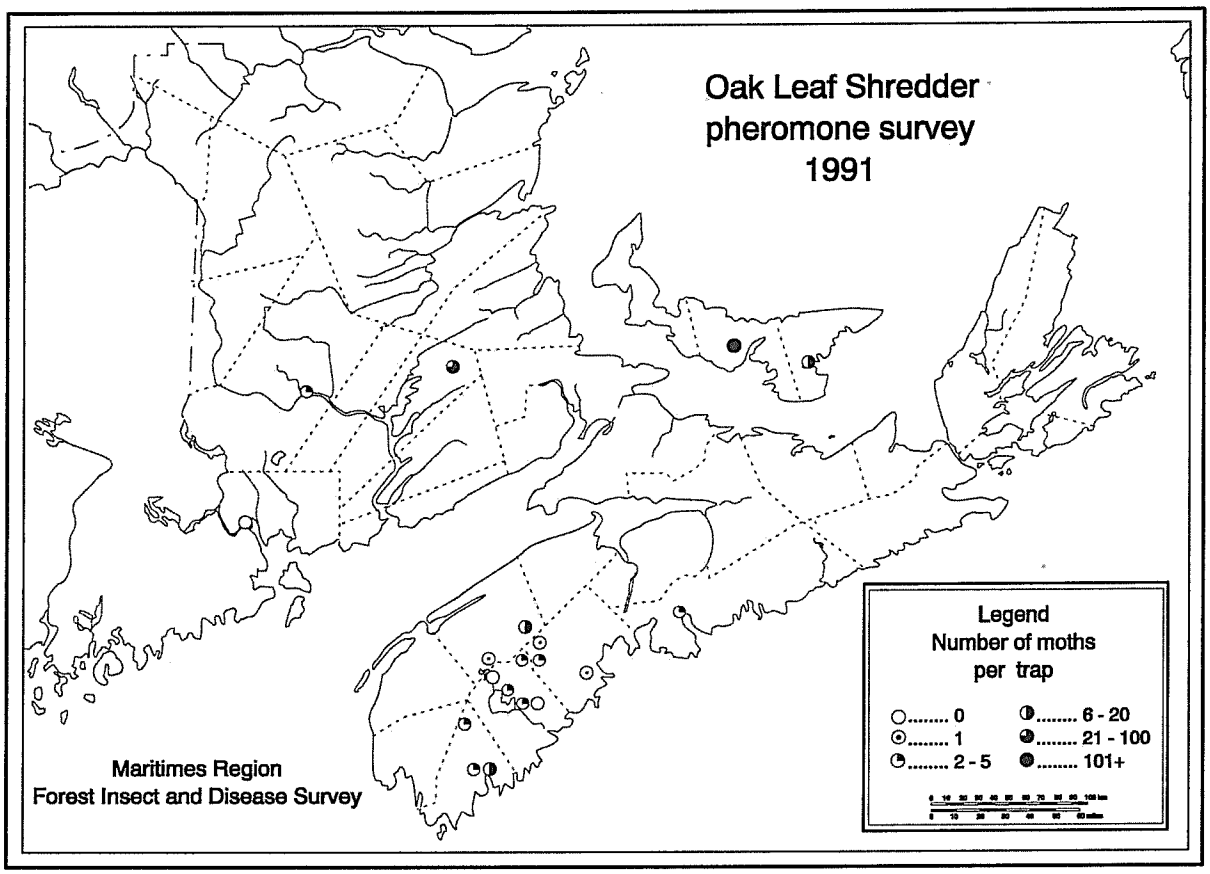


Figure 11

Pheromone trapping can be relied upon only for general predictions at this stage of the system development. It is anticipated that, as the current population develops, additional correlations of trap capture with defoliation levels and egg mass numbers will result in more precise and reliable predictions.

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 - Although both the proportion of positive traps and the number of moths caught per trap increased in New Brunswick in 1991 (Fig. 10), these increases cannot be considered significant due to variations expected in trap capture, and they do not fit any general trends. The results remain consistent with a lack of larval populations and defoliation during the year.

Oak leaf shredder - The number of moths captured in 1991 in Nova Scotia increased from the very low catches of 1990; however, numbers are still relatively low (Fig. 11). Catches were higher in Prince Edward Island and in New Brunswick in the few traps there. Results should be compared with those for the oak leafroller which feeds on the same host at the same time.

Oak leafroller - Fewer traps were saturated with moths in western Nova Scotia in the area of chronic infestation than in 1990, when most traps were completely saturated and unable to capture all the moths attracted to them (Fig. 12). This reduction in catch corresponds with observations of reduced feeding damage, attributed to a late spring frost (see Hardwoods - Oak leafroller and oak leaf shredder) which was thought to have starved many of the larvae. The 1991 observations will aid in the calibration of the trapping system and our ability to make predictions in the future.

The increase in oak leaf shredder (OLS) numbers in Nova Scotia at a time when oak leafroller (OLR) numbers are decreasing suggests reduced com-

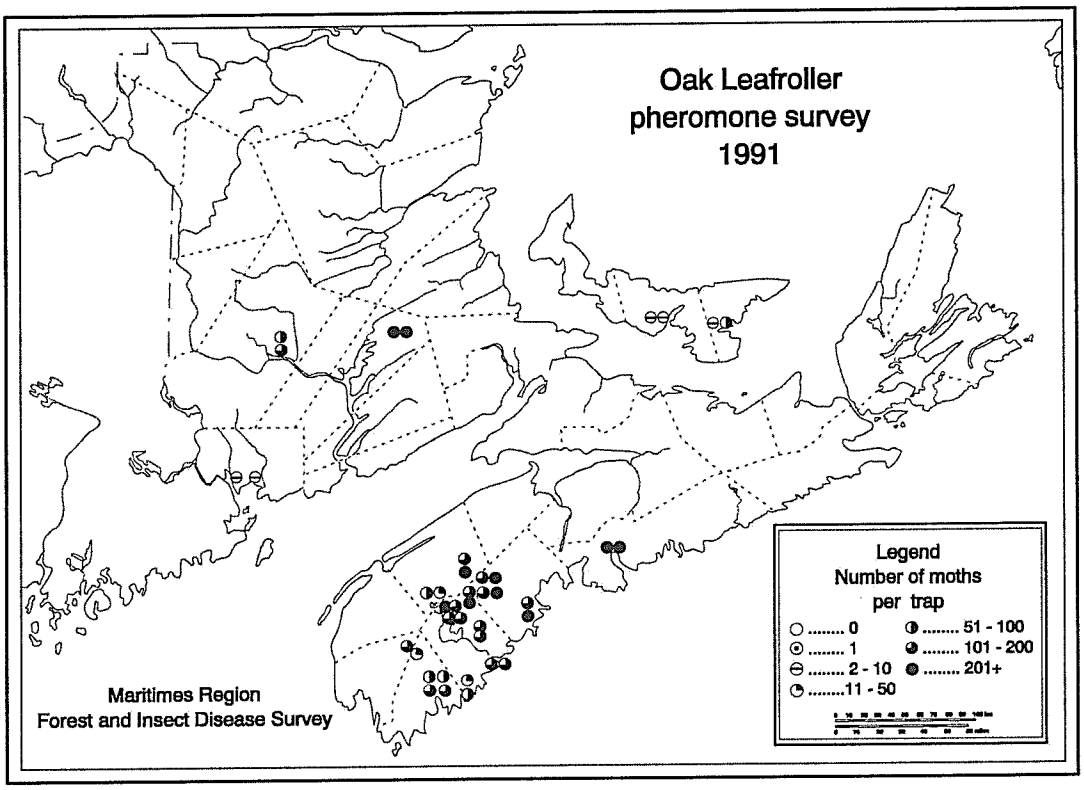


Figure 12

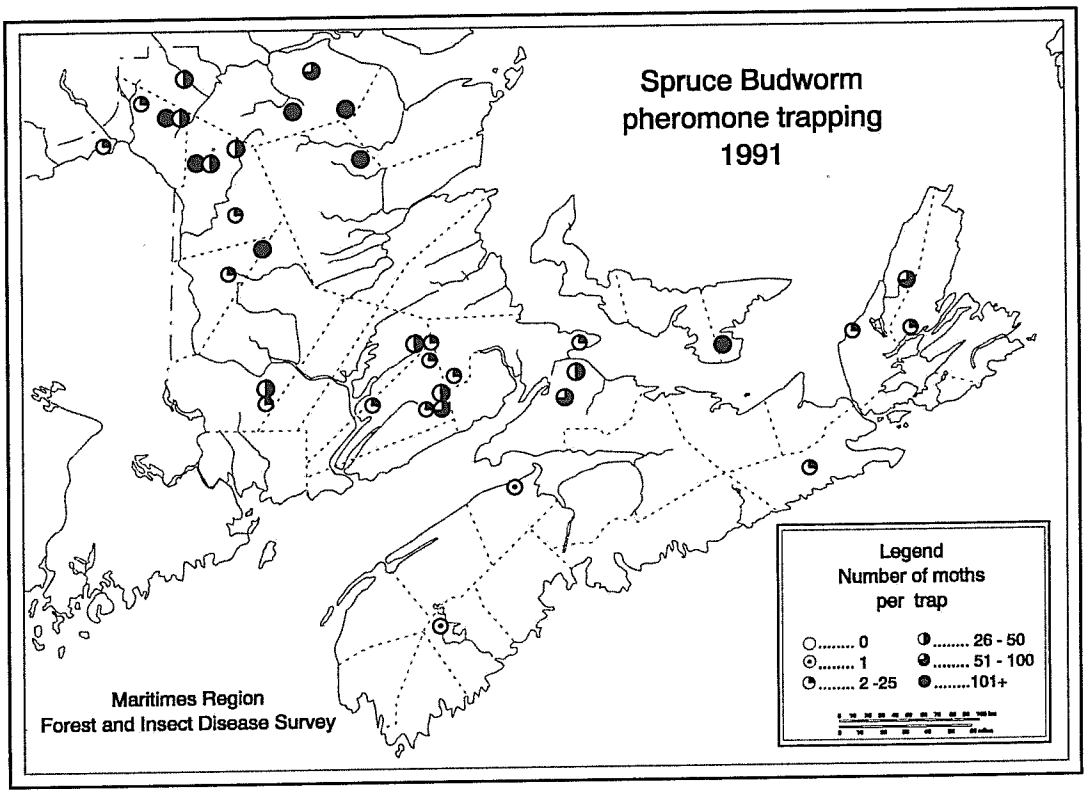


Figure 13

petition for the OLS. The relationship between these two sympatric (sharing the same habitat) species, their combined effects on the forest, and the differing ratios of the two species in western Nova Scotia (where the OLR is usually predominant) and in New Brunswick (where the OLS is usually predominant) have long been of interest. Identifying the pheromone and developing a trapping system for the OLR (see: Grant *et al.* 1991) provides the tools necessary for studying the relative dynamics of the two insects, in addition to monitoring their populations.

Spruce budworm - The number of spruce budworm pheromone trapping locations was increased to 35 in 1991 from 24 in 1990, in an effort to better describe the population distribution. Pheromone trapping results for 1991 (Fig. 13) correspond well with spruce budworm defoliation. A feature of this trapping system is that the traps are sensitive enough to detect populations even where no visible defoliation occurs. Data from additional years with a more dense and more even distribution of sample points may be required before the system can be used to make predictions regarding defoliation.

Spruce budmoths - Testing continues for two species of budmoth, *Zeiraphera canadensis* and *Z. unfortunana*. While regional trapping programs suggest a distribution of these pests, difficulties remain in separating the two species and finding an effective trap placement. It is not appropriate to present results until these problems are resolved.

Spruce coneworm - Trapping conducted at 24 Maritime locations resulted in 6 of 14 traps positive in New Brunswick, 1 of 7 traps positive in Nova Scotia, and 2 of 3 traps positive in Prince Edward Island. While the catches were small, these are the greatest number of positive traps found since trapping began in 1988. At this point no meaningful interpretation can be made of the results. Additional traps placed at 12 seed orchard locations failed to attract any moths.

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, then shipped to be identified and counted. The information is used in the design of surveys, prediction of populations, and research.

The 16 light traps in the Maritimes region are maintained by Forestry Canada 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 are submitted weekly for identification. Trap design and light source were standardized in 1976 and trap locations remained the same wherever possible.

Light trap locations in the Maritimes region in 1991 were:

New Brunswick
- Acadia Forest Experiment Station, Ripples, Sunbury Co.
- Ashton Hill, Northumberland Co.
- Canterbury, York Co.
- Fundy National Park, Albert Co.
- Mayfield, Charlotte Co.
- Nash Creek, Restigouche Co.
- Plaster Rock, Victoria Co.

Nova Scotia
- Big Intervale, Victoria Co.
- Georgeville, Antigonish Co.
- Kejimkujik National Park, Annapolis Co.
- Lawrencetown, Annapolis Co.
- Liverpool, Queens Co.
- Londonderry, Colchester Co.

Prince Edward Island
- Breadalbane, Queens Co.
- Howlan, Prince Co.
- Kilmuir, Kings Co.

ACKNOWLEDGEMENTS

This report is the result of the combined efforts of all members of the Forest Insect and Disease Survey in 1991: J.R. Cormier, A.S. Doane, C.M.B. Dobson, D.E. Doucette, K.J. Harrison, J.E. Hurley, A.M. Jones, A.W. MacKay, L.P. Magasi, D.B. Marks, S.M. McInnis, D.A. McPhee, O.A. Meikle, B.A. Pendrel, T.R. Renault, R.A. Simpson, G.A. Smith, and T.J. Walsh. All staff have been involved in the production of the report from data collection to writing and editing. Any credit is to be shared equally by all. We wish to thank our summer students, casuals, and the numerous staff members at Forestry Canada - Maritimes Region who contributed in many ways.

Special thanks go to Tracy Burns, Ron Hallett, Ed Kettela, Scott McConaghy, Richard Morin, Harvey Munn and his staff, Caroline Simpson, and Jon Sweeney.

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.

Information contributed by the Pest Detection Officers of the New Brunswick Department of Natural Resources and Energy, the Nova Scotia Department of Natural Resources, and the Prince Edward Island Department of Energy and Forestry is acknowledged and appreciated. Special thanks go to those who participated in the various pheromone surveys.

The Canadian Parks Service of Environment Canada, the New Brunswick Department of Natural Resources and Energy, the Nova Scotia Department of Natural Resources, Bowater-Mersey Ltd., and private individuals operated light traps during the season, in addition to the staff at the Acadia Forest Experiment Station.

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.

In 1991, the Forest Insect and Disease Survey lost the services of two long-term members. Charlie Dobson, the Ranger Supervisor in New Brunswick retired in June after 32 years, and Don Marks, Forest Pest Extension Specialist in Nova Scotia, retired in October after 44 years of service. While we miss them and their combined experience of over three quarters of a century, we wish them both well in their retirement. Congratulations, thanks, and best wishes to Charlie and Don.

My personal thanks go to all my staff, 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.

LIST OF PUBLICATIONS

Reports and publications by the staff of the Forest Insect and Disease Survey and forest pest related articles by other members of Forestry Canada - Maritimes Region produced in 1991.

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Dobson, C.M.B., and MacKay, A.W. 1991. Forest insects and diseases in Prince Edward Island National Park in 1990. FC-MR Tech. Note 247.

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Grant, G.G., Pendrel, B., Slessor, K.N., Meng, X.Z., and Miller, W.E. 1991. Identification of sex pheromone components for two lepidopteran defoliators, the oak olethreutid leafroller, *Pseudexentera spoliana* (Clemens), and the aspen leafroller, *Pseudexentera oregonana* (Walsingham). Can. Ent. 123: 1209-1218.

Hurley, J.E., and Magasi, L.P. 1991. Highlights of forest pest conditions in the Maritimes in mid-June 1991. FC-MR Tech. Note 252.

Hurley, J.E., and Magasi, L.P. 1991. Highlights of forest pest conditions in the Maritimes at the end of June 1991. FC-MR Tech. Note 253.

Hurley, J.E., and Magasi, L.P. 1991. Highlights of forest pest conditions in the Maritimes at the end of July 1991. FC-MR Tech. Note 254.

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Pendrel, B.A. 1991. Insect- and disease-caused losses of wood volume in forests of the Maritime provinces, 1982-1987. FC-MR Info. Rep. M-X-180.

Pendrel, B.A. 1991. Managing the seedling debarking weevil in the Maritimes. As. Proc. Symp. on Regeneration Insect Problems, 1st N.A. For. Ins. Work Conf., Denver, CO, March 1991.

Simpson, R.A., and Magasi, L.P. 1991. Plantation pest assessment survey in New Brunswick in 1990. FC-MR Tech. Note 249.

Simpson, R.A., and Magasi, L.P. 1991. Plantation pest assessment survey in Nova Scotia in 1990. FC-MR Tech. Note 250.

Walsh, T. 1991. Forest insects and diseases in Cape Breton Highlands National Park in 1990. FC-MR Tech. Note 246.

OTHER INSECTS AND DISEASES

This table lists alphabetically, by common name, most insects and diseases encountered in the Maritimes in 1991 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 1991 to warrant detailed discussion. It may be that, although severe, an organism, e.g., seedling debarking weevil, was only of localized importance in 1991.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Alder flea beetle *Altica ambiens alni* Harr.	Alder	Region	Overall, intensity increased in the region. Moderate and severe in northwest and central New Brunswick, severe in the south and southwest; in Nova Scotia, light and moderate with many scattered patches of severe browning throughout; in Prince Edward Island, light damage with moderate and severe patches in southern Kings and Queens counties.
Ambermarked birch leafminer *Profenusa thomsoni* Konow	White birch Wire birch Yellow birch	Region	Found at a few locations in the region, typically trace and light leafmining, except 81% of white birch leaves mined at St. Ann, Queens Co., Prince Edward Island.
Anthracnose of hardwoods *Discula quercina* (West.) Arx	Black ash White ash Beech	Region	Found at three locations in Nova Scotia at low levels. No reports from New Brunswick or Prince Edward Island.
Anthracnose of maple *Kabatiella apocrypta* (Ell. & Ev.) Arx	Red maple Sugar maple	Region	No reports in 1991.
Ants	Conifers	Region	No reports in 1991.
Ash rust *Puccinia sparganioides* Ell. & Barth.	White ash	Region	In Nova Scotia, only two reports in 1991 at trace levels, a major reduction from 1990. No reports from New Brunswick or Prince Edward Island.
Ash yellows	Ash	Region	Not found in the region to date. This disease is present in the United States and remains a concern to plant quarantine officials.
Aspen leafrollers *Epinotia criddleana* (Kft.) *Pseudexentera oregonana* (Wlshm.) Birch-aspen leafroller *Epinotia solandriana* (L.) Darkheaded aspen leafroller *Anacampsis innocuella* (Zell.)	Trembling aspen White birch Poplar	Region	Leafrolling, at many locations throughout the region, generally trace and light. *Pseudexentera oregonana* most damaging in 1991; in New Brunswick, highest at Costigan, Victoria Co., with 40% leafrolling on 100% of trees; in Nova Scotia, 24% leafrolling at Sundridge, Pictou Co.; and in Prince Edward Island, 13% leafrolling at Goose River, Kings Co. with a mixed population causing 23% leafrolling at Riverdale, Queens Co. Light

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Lightheaded aspen leafroller *Anacampsis niveopulvella* (Clem.) Spotted aspen leafroller *Pseudosciaphila duplex* (Wlshm.)			trap catches of spotted aspen leafroller increased at seven of 16 locations in the region, highest was 41 adults at Ashton Hill, Northumberland Co., New Brunswick.
Aspen webworm *Tetralopha aplastella* (Hlst.)	Trembling aspen	Region	In New Brunswick, moderate foliage damage (33%) on 100% of trees at Blue Mountain, Victoria Co. Trace damage at Fitzpatrick, Pictou Co., Nova Scotia. No reports from Prince Edward Island.
Bagworm *Thyridopteryx ephemeraeformis* Haw.	White pine	Region	No reports in 1991.
Balsam bark weevil *Pissodes dubius* Rand.	Balsam fir	Region	Present at low levels in New Brunswick, one report of trace damage, at Otter Brook, Northumberland Co. No reports from Nova Scotia and Prince Edward Island.
Balsam fir bark beetle *Pityokteines sparsus* (Lec.)	Balsam fir	Region	Present, on weakened trees, at very low levels, at few locations throughout the region.
Balsam fir sawfly *Neodiprion abietis* (Harr.)	Balsam fir	Region	Unchanged from 1990; 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	Incidence much reduced from 1990. In New Brunswick, light damage on several trees at MacDonald Brook, Restigouche Co. No reports from Nova Scotia or Prince Edward Island.
Balsam shootboring sawfly *Pleroneura brunneicornis* Roh.	Balsam fir	Region	Widespread in New Brunswick but caused only light shoot damage. Found in only four counties in Nova Scotia at trace to light levels. Highest at Youngs Cove, Queens Co., N.B. (17% of shoots damaged) and at Whycocomagh, Inverness Co., N.S. (7%). No reports from Prince Edward Island.
Balsam woolly adelgid *Adelges piceae* (Ratz.)	Balsam fir	Region	Incidence and infestation levels were about the same as 1990 in New Brunswick. Light twig attack occurred at MacDougall Lake, Restigouche Co., light twig and stem attack occurred on Campobello and Grand Manan Islands with both old and new dead balsam fir present, light stem attack at Fredericton, York Co. In Nova Scotia, light twig attack at

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			13 locations in eight counties; highest, 52% of twigs in an area south of Lennox, Richmond Co. In Prince Edward Island, two reports of twig attack, highest at Goose River, Kings Co.
Beech bark disease *Nectria coccinea* var. *faginata* Lohm., Wats. & Ayers and Beech Scale *Cryptococcus fagisuga* Lind.	Beech	Region	Cankered trees common throughout the region. Infection ranged from 16 to 100% of trees in stands examined.
Birch casbearer *Coleophora serratella* (L.)	White birch Wire birch Yellow birch Alder	Region	In New Brunswick, foliage browning was moderate in a few areas, highest (45% of white birch leaves) was found at Good Corner, Carleton Co. In Nova Scotia, browning occurred throughout, but mostly at trace or light levels. The highest (55% of white birch leaves) damage was found at Cap Rouge, Inverness Co. Moderate damage was also found on white ash at Cameron Settlement and Eight Mile Lake, Guysborough Co. In Prince Edward Island, damage was reported throughout with severe damage (70%) at Green Provincial Park, Prince Co.
Birch leafminer *Fenusa pusilla* (Lep.)	White birch Wire birch	Region	In New Brunswick, damage ranged from light to moderate leaf browning in the southern part of the province. The heaviest damage (61%) was reported on wire birch at Dunsinane, Kings Co. In Nova Scotia, damage ranged from trace to light in the four central counties, highest (9%) was on wire birch at Weasel Hill, Annapolis Co. In Prince Edward Island, damage was mainly light, highest, 19% on white birch at Stanley Bridge, Queens Co.
Birch sawfly *Arge pectoralis* (Leach)	White birch	Region	Two reports of trace damage from New Brunswick. In Nova Scotia, a few larvae were found at three locations. No reports from Prince Edward Island.
Bruce spanworm *Operophtera bruceata* (Hlst.)	Apple Maples Trembling aspen	Region	Moderate and severe defoliation in Albert Co., N.B. In Nova Scotia, a combination of Bruce spanworm and winter moth caused moderate and severe damage on apple in Heatherton and Meadow Green, Antigonish Co. Trace damage occurred in Prince Co., Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Canker of larch *Potebniamyces coniferarum* (Hahn) Smerlis	Tamarack	Region	Light damage at ten locations in Nova Scotia. Trace damage at Foxley River, Prince Co., Prince Edward Island. No reports from New Brunswick.
Cedar leafminers *Argyresthia aureoargentella* Brower *Argyresthia freyella* Wlshm. *Argyresthia thuiella* (Pack.) *Coleotechnites thujaella* (Kft.)	Cedar	Region	In New Brunswick, moderate and severe foliage damage was found at Letete, Charlotte Co., and at Rothesay, St. John Co. Damage was light at two locations in York Co., and one location in Charlotte Co. In Nova Scotia, two locations in Halifax Co. had 50% of the shoots mined. In Prince Edward Island, damage was moderate at Miscouche and light at two other locations in Prince Co.
Cherry blight	Chokecherry Pin cherry	Region	Trace and light damage at a few locations in New Brunswick and Prince Edward Island. In Nova Scotia, there was an increase in intensity from 1990 but not in area. Most commonly found in Cape Breton Island and on the eastern mainland.
Cherry casebearer *Coleophora pruniella* Clem.	Trembling aspen	Region	In Nova Scotia, trace damage at South McLellans Mountain, Pictou Co. Leaf browning was more intense and widespread throughout Prince Edward Island than in 1990. Moderate and severe in southeastern Kings Co., southern Queens Co., and in Lower Freetown, Prince Co. No reports from New Brunswick.
Deterioration of cedar	Cedar	N.B.	In New Brunswick, deterioration due to damage by cedar leafminers, mainly in St. John Co., was less serious than in 1990.
Diplodia tip blight *Sphaeropsis sapinea* (Fr.) Dyko & Sutton	Scots pine	N.S.	Present on three ornamentals at Upper Nine Mile River, Hants Co.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir Red spruce White spruce	Region	A few larvae and moths were collected throughout the region, but more common in Nova Scotia.
Eastern dwarf mistletoe *Arceuthobium pusillum* Peck	Spruce	Region	Found at several locations throughout the region; highest incidence at Arisaig, Antigonish Co., N.S. where 100% of white spruce were infected and 48% were dead over 1-2 ha.
Eastern spruce gall adelgid *Adelges abietis* (L.)	Black spruce Red spruce White spruce	Region	Present throughout the region at trace, light, and occasionally moderate infestation levels. Highest levels were 56% of shoots at Thomaston Corner, York Co., N.B.; 52% south of

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			Lennox, Richmond Co., N.S.; and 16% at Cavendish, Queens Co., P.E.I.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Alder Cherry Apple Red maple	Region	In New Brunswick, population levels remained similar to 1990, nests common in all areas except the northwest counties of Victoria, Madawaska, and Restigouche. In Nova Scotia, nests scattered throughout the mainland and in Inverness Co., Cape Breton Island, up slightly from1990. In Prince Edward Island, only a few scattered nests were found.
Elm leaf aphid *Tinocallus ulmifolii* (Monell)	Elm	N.B.	No reports in 1991.
Elm leaf beetle *Pyrrhalta luteola* (Mill.)	Elm	N.B.	Moderate and severe foliage browning widespread throughout the city of Fredericton.
Elm leafminer *Fenusa ulmi* Sund.	English elm Rock elm	Region	In Nova Scotia and Prince Edward Island, moderate and severe browning on exotic elms wherever they occur. No reports from New Brunswick.
European pine sawfly *Neodiprion sertifer* (Geoffroy)	Red pine Scots pine	Region	In New Brunswick, a few larvae at Saint John, St. John Co. In Prince Edward Island, light damage on a hedgerow at Commercial Cross, Kings Co. No reports from Nova Scotia.
European pine shoot moth *Rhyacionia buoliana* (D.&S.)	Austrian pine Scots pine Red pine	Region	In Nova Scotia,a few insects found at several scattered locations. In Prince Edward Island, moderate and severe damage was repeated in red pine plantations at North and South Granville, Queens Co., and there was also severe damage on ornamentals at St. Eleanors, Prince Co. No reports from New Brunswick.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Spruce	Region	Present at low numbers throughout the region, most common in Nova Scotia.
Fall cankerworm *Alsophila pometaria* (Harr.)	Hardwoods	Region	Present in very low numbers in New Brunswick. In Nova Scotia, light and moderate damage in Antigonish, Cape Breton, Lunenburg, Queens, and Shelburne counties. Mixed populations with winter moth and Bruce spanworm caused severe defoliation on apple in Antigonish Co. In Prince Edward Island, mixed populations with winter moth caused light and moderate damage throughout.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Fall webworm *Hyphantria cunea* (Dru.)	Hardwoods	Region	Nests were common throughout southern New Brunswick and all of Nova Scotia, where numbers were similar to 1990. Nests were more common than in 1990 throughout Prince Edward Island.
Flat leaf tiers *Psilocorsis reflexella* Clem.	Hardwoods	Region	In New Brunswick, an average of trace damage at nine locations. Light damage at 12 locations in nine counties in Nova Scotia. In Prince Edward Island, trace and light damage at a few locations.
Psilocorsis spp.			In New Brunswick, trace damage in three counties, except at Quisbis River, Madawaska Co., where 32% of yellow birch leaves were affected on 100% of trees. In Nova Scotia, an average of 11% at 37 locations in 14 counties; highest (41%) on beech at Brookland, Pictou Co., and on willow (33%) at Pebbleloggitch Lake, Digby Co. Trace and light damage were reported throughout Prince Edward Island.
Foureyed spruce bark beetle *Polygraphus rufipennis* (Kby.)	Black spruce Red spruce White spruce	N.B. N.S.	A few trees were affected at two locations in New Brunswick and at Lawrencetown, Annapolis Co., N.S.
Frost damage	Conifers Hardwoods	Region	Severe damage was very common in New Brunswick and Nova Scotia on oak, ash, and beech and, to a lesser extent, balsam fir, white spruce, and black spruce. Common throughout Prince Edward Island, but usually only trace to light damage on conifers, with the highest damage (68%) reported on balsam fir at Auburn Demonstration Woodlot, Queens Co.
Gall mites *Eriophyidae*	Hardwoods	Region	Mites affected an average of 20% of leaves in each of the provinces, ranging from 5 to 80%.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine Red pine Scots pine	Region	Common on ornamentals, in plantations, and natural stands throughout the region, most common in New Brunswick.
Greenheaded spruce sawfly *Pikonema dimmockii* (Cress.)	Spruce	Region	Populations remained low throughout the region.
Greenstriped mapleworm *Dryocampa rubicunda rubicunda* (F.)	Maple	Region	Common at ten locations throughout Nova Scotia, damage usually light. Light defoliation at one location in Prince Edward Island. No reports from New Brunswick.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Hail damage	Conifers Hardwoods	Region	A major hail storm in late May caused moderate and severe damage to both hardwoods and conifers at Glassville and area, Carleton Co., N.B. In Nova Scotia, an August hail storm caused light damage on hardwood trees at Tatamagouche, Colchester Co. No reports from Prince Edward Island.
Hare damage	Jack pine Red pine Scots pine	Region	Trace damage occurred at two locations in New Brunswick and one in Prince Edward Island. No reports from Nova Scotia.
Hypoxylon canker *Hypoxylon mammatum* (Wahl.) Mill.	Trembling aspen	Region	In New Brunswick, infected trees averaged 11% at 20 locations in 11 counties; highest (28%) at Trout Brook, Northumberland Co. In Nova Scotia, 14% at three locations; highest (30%) at St. Andrews, Antigonish Co. In Prince Edward Island, 6% at five locations; highest (12%) at Green Meadows, Kings Co.
Ink spot of aspen *Ciborinia whetzelii* (Seaver) Seaver	Trembling aspen	N.B.	In New Brunswick, light damage of leaves reported at Madran, Gloucester Co., trace damage at both Lake Utopia, Charlotte Co. and Britt Brook, Victoria Co. No reports from Prince Edward Island or Nova Scotia.
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine	Region	No defoliation occurred in the region. In New Brunswick, catches at pheromone traps were similar to 1990, with moderately high numbers in northern Northumberland and Gloucester counties. No reports from Nova Scotia or Prince Edward Island.
Larch needleworm *Zeiraphera improbana* (Wlk.)	Tamarack	P.E.I.	In Prince Edward Island, trace damage at Sailors Hope, Kings Co. No reports from Nova Scotia or New Brunswick.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Region	In New Brunswick, severe damage occurred on 2 ha at Rexton, Kent Co. In Nova Scotia, moderate and severe damage occurred at several locations. No reports from Prince Edward Island.
Large aspen tortrix *Choristoneura conflictana* (Wlk.)	Trembling aspen	P.E.I.	One larva collected at Bloomfield, Prince Co., Prince Edward Island. No reports from New Brunswick or Nova Scotia.
Leaf and twig blight of aspen *Venturia macularis* (Fr.) E. Muell. & Arx	Largetooth aspen Trembling aspen	Region	Common and widespread shoot damage throughout New Brunswick, averaging 14% of shoots on 65% of the trees (nine locations, highest 24%). In Nova Scotia, averaged 21% (eight locations, highest 68%). In Prince Edward Island, light damage at two locations.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Leaf blister *Taphrina carnea* Johanson	White birch Yellow birch	Region	Affected 21% of leaves at eight locations in New Brunswick, highest (50%) at Mt. Carleton, Northumberland Co. In Nova Scotia, 6% of leaves at five locations, highest (11%) at Silver Mine, Cape Breton Co. In Prince Edward Island, 7% at Brookvale, Queens Co.
Leaf blotch of horse-chestnut *Guignardia aesculi* (Peck) V.B. Stew.	Horse-chestnut	Region	Found wherever host occurs in the region. In New Brunswick, moderate and severe browning at Deer and Campobello Islands, Charlotte Co. In Nova Scotia, moderate and severe browning at numerous locations. In Prince Edward Island, moderate damage occurred at New London, Queens Co.
Leafrollers on birch *Caloptilia* spp.	Trembling aspen White birch Wire birch Yellow birch Pin cherry	Region	Similar to 1990 in New Brunswick, common throughout the province, averaging 18% of white birch leaves on 65% of the trees at 39 locations, highest (35%) at Caribou Depot, Victoria Co. Trace on 100% of white birch at two locations in Nova Scotia. No more than light damage on other hardwoods at a few locations in New Brunswick and Nova Scotia. No reports from Prince Edward Island.
Lesser maple spanworm *Itame pustularia* (Gn.)	Red maple Sugar maple	Region	In New Brunswick, light damage at three locations in Restigouche Co. Light trap catches increased at all N.B. traps; highest catch was 323 moths at Ashton Hill, Northumberland Co. In Nova Scotia, found at 60 locations in 15 counties but most damage was only trace and light. In Prince Edward Island, trace and light damage at three locations.
Maple bladdergall mite *Vasates quadripes* (Shim.)	Red maple Sugar maple	Region	Common and widespread throughout the region. In New Brunswick, affected 21% of leaves on 68% of trees at 23 locations; highest (53% of leaves on 100% of trees) at Haynesville, York Co. In Nova Scotia, 30% of red maple leaves affected at 74 locations. In Prince Edward Island, 37% affected at six locations, highest (85%) at Harmony Demonstration Woodlot, Kings Co.
Maple leafroller *Sparganothis acerivorana* MacK.	Red maple Sugar maple	Region	In New Brunswick, leafrolling remained light, averaging 8% of leaves on 57% of the maples at four locations in three counties; highest (11% on 60% of trees) at South Waterville, York Co. In Nova Scotia, one report on sugar maple at Maccan, Cumberland Co. No reports from P.E.I.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Maple spindlegall mite *Vasates aceris-crumena* (Rly.)	Red maple Sugar maple	Region	Common throughout the region. In New Brunswick, an average of 24% of sugar maple leaves had galls at 18 locations and 5% of red maple at two locations; highest (45%) on sugar maple at Benjamin River, Restigouche Co. In Nova Scotia, 23% of sugar maple leaves at 16 locations; highest (52%) at Rear Big Hill, Victoria Co. In Prince Edward Island, 35% of sugar maple leaves at six locations, highest (72%) at Harmony Demonstration Woodlot, Kings Co.
Mites *Oligonychus milleri* (McGregor) *Oligonychus ununguis* (Jacobi)	Conifers	Region	No reports in 1991.
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain ash	P.E.I.	In Prince Edward Island, trace defoliation on one tree at Margate, Prince Co. No reports from New Brunswick or Nova Scotia.
Needle casts *Lirula macrospora* (Hartig) Darker	Black spruce Red spruce White spruce	Region	In New Brunswick, found at two locations; highest, 76% of needles affected, at Saddleback Mountain, Queens Co. In Nova Scotia, 7% at 16 locations from nine counties; highest, 50% on red spruce at Advocate Harbour, Cumberland Co. No reports from Prince Edward Island.
Lirula mirabilis (Darker) Darker	Balsam fir	N.B. N.S.	Light damage on balsam fir found at one location each in New Brunswick and Nova Scotia.
Lirula nervata (Darker) Darker	Balsam fir	Region	In Nova Scotia, averaged 6% of needles at 26 locations in 11 counties, highest (30%) at Middle Beaver Lake, Halifax Co. In New Brunswick and Prince Edward Island, found at low levels at a few locations.
Phaeocryptopus gaeumannii (Rohde) Petr.	Douglas fir	Region	In Nova Scotia and Prince Edward Island, trace damage found at a few locations. No reports from New Brunswick.
Rhabdocline weirii Parker & Reid	Douglas fir	P.E.I.	Light damage at Camp Tamawaby Demonstration Woodlot, Prince Co.
Needle flecking	Conifers	Region	Trace damage at three locations in New Brunswick. In Nova Scotia, found at 50 locations, average needle flecking was 33%. Moderate damage to a red pine plantation was found at Brackley Beach, Queens Co, Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Needle rusts on balsam fir *Melampsora abieti-capraearum* Tub. *Pucciniastrum epilobii* Otth. *Uredinopsis* sp.	Balsam fir	Region	Generally trace infection at 19 locations in the region. Highest, light damage, by *P. epilobii* in a young, thinned stand at Mount Gray, Northumberland Co., New Brunswick. *M. abieti-capraearum* not found in P.E.I.
Needle rusts on eastern hemlock *Melampsora farlowii* (Arthur) Davis *Pucciniastrum vaccinii* (Wint.) Jorst.	Eastern hemlock	Region	No reports in 1991.
Needle rusts on pine *Coleosporium asterum* (Diet.) Syd. *Coleosporium viburni* Arthur	Jack pine Red pine	Region	*C. asterum* on red pine: in New Brunswick, light infection in three plantations and moderate at Mohannes, Charlotte Co. Only trace at two locations in Nova Scotia and one in Prince Edward Island. *C. viburni* on jack pine: in New Brunswick, moderate and severe on most trees in three young plantations at Tracadie Range and Cold Brook, Northumberland Co. and MacDougall Brook, Sunbury Co., generally trace elsewhere. In Prince Edward Island, light and moderate at North Enmore, Prince Co., moderate and severe at Goose River, Kings Co., and severe on 100% of trees at Afton Road, Queens Co. No reports from Nova Scotia.
Needle rusts on spruce *Chrysomyxa ledi* dBy. *Chrysomyxa ledicola* Lagh.	Black spruce Red spruce White spruce	Region	Generally trace in the region. Highest infections: by *C. ledi*, light on red spruce at Hemlock Hill, Queens Co., N.S. and by *C. ledicola*, light on black spruce at Cold Brook, Northumberland Co., N.B. Both were found at trace levels at Abney, Kings Co., P.E.I.
Needle rust on tamarack *Melampsora medusae* Theum.	Tamarack	N.S.	Trace infection at Albany Cross, Annapolis Co.
Northern cedar bark beetle *Phloeosinus canadensis* Sw.	Cedar	Region	No reports in 1991.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Jack pine	Region	Low populations in plantations and natural stands in New Brunswick. In Nova Scotia, trace damage at four locations. Found at several locations in Prince Edward Island; highest, 72% of trees affected at Afton Road, Queens Co.
Oak leaf tier *Psilocorsis quercicella* Clem.	Hardwoods	Region	Two reports of trace damage and one larval collection in New Brunswick. In Nova Scotia, an average of 21% at six locations in four counties; highest, 48% on beech at Moody's

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			Corner, Digby Co. No reports from Prince Edward Island.
Obliquebanded leafroller *Choristoneura rosaceana* (Harr.)	Hardwoods	Region	In New Brunswick, trace and light defoliation found at three locations. A few larvae found at four locations in Nova Scotia. In Prince Edward Island, damage was trace at five locations.
Ocean salt spray	Apple Red pine Scots pine	Region	Trace to light browning at one location in New Brunswick and two locations with moderate and severe damage in Prince Edward Island. No reports from Nova Scotia.
Ocellate gall midge *Acericecis ocellaris* (O.S.)	Red maple Sugar maple	Region	Present on 9% of foliage on 67% of the trees at 105 locations. Highest on sugar maple from Halfway Depot, Madawaska Co., N.B. (10% of foliage on 78% of trees), red maple at French Lake, Yarmouth Co., N.S. (28% on 100% of trees), and on red maple at Oyster Bed Bridge, Queens Co., P.E.I. (63% on 100% of trees).
Orangehumped mapleworm *Symmerista leucitys* Francl.	Beech	Region	No reports in 1991.
Orange spruce needleminer *Coleotechnites piceaella* (Kft.)	Balsam fir spruce	N.S. P.E.I.	In Nova Scotia, average of 12% of needles mined at 37 locations in 12 counties, highest (39%) at Bras d'Or, Cape Breton Co. In Prince Edward Island, 8% of needles mined at 11 locations, highest (12%) at St. Patrick Road, Kings Co.
Pear thrips *Taeniothrips inconsequens* (Uzel)	Sugar maple	Region	Found at nine locations in New Brunswick, four in Nova Scotia, and one in Prince Edward Island. No visible damage detected.
Pepper-and-salt moth *Biston betularia cognataria* (Gn.)	Tamarack Balsam fir	Region	A few larvae at two locations in Nova Scotia. No reports from New Brunswick or Prince Edward Island.
Pine bark adelgid *Pineus strobi* (Htg.)	White pine	Region	More common in Nova Scotia than in 1990, light damage at 19 locations. Trace and light damage found at two locations in Prince Edward Island. No reports from New Brunswick.
Pine engraver *Ips pini* (Say)	Jack Pine	Region	No reports in 1991.
Pine leaf adelgid *Pineus pinifoliae* (Fitch)	Jack pine White pine	Region	In New Brunswick, trace damage on jack pine at one location, St. Luc, Kent Co. In Nova Scotia, an average of 3% of white pine

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			shoots were infested at seven locations in four counties; highest (8%) at Garden of Eden Barrens, Guysborough Co., where the alternate host, red spruce, had 60% of shoots infested. The average dropped from 18% in 1990 and 36% in 1989. No reports from Prince Edward Island.
Pinkstriped oakworm *Anisota virginiensis virginiensis* (Drury)	Red oak White birch	Region	One report from Nova Scotia, 8% of white birch leaves damaged at Yankee Lake, Guysborough Co. No reports from New Brunswick or Prince Edward Island.
Poplar felt mite *Phyllocoptes didelphis* Keifer	Trembling aspen Largetooth aspen	Region	In New Brunswick, 16% of leaves infested on 78% of trees at nine locations; highest (25% of leaves on 80% of trees) at Mohannes, Charlotte Co. In Nova Scotia, 13% on most trees at 18 locations; highest (55%) at North Mabou, Inverness Co. Present on 5% of leaves at five locations in Prince Edward Island.
Poplar flea beetle *Altica populi* Brown	Balsam poplar	Region	No reports in 1991.
Poplar leaffoliding sawfly *Phyllocolpa* spp.	Trembling aspen Largetooth aspen	Region	In New Brunswick, an average of 49% of leaf edges folded on 69% of trees at 36 locations; highest (90%) at Porter Settlement, Charlotte Co. In Nova Scotia, 10% at 20 locations; highest (43%) at Russell Lake, Pictou Co. In Prince Edward Island, 16% on 85% of trees at 14 locations; highest (55%) at Wellington, Prince Co.
Poplar leafmining sawfly *Messa populifoliella* (Town.)	Trembling aspen Balsam poplar Carolina poplar	Region	In New Brunswick, trace and light browning of 90% of trembling aspen trees at two locations. No reports from Nova Scotia or Prince Edward Island.
Poplar petiolegall moth *Ectoedemia populella* Busck	Trembling aspen	N.S.	In Nova Scotia, one report of 15% of petioles at Glenroy, Antigonish Co. No reports from Prince Edward Island or New Brunswick.
Porcupine damage	Balsam fir Black spruce Jack pine Red pine Silver fir	N.B. N.S.	Damage common throughout New Brunswick and Nova Scotia. Most serious damage 88% of red pine at Armond and 62% of balsam fir at Kilfoil, Carleton Co., N.B. In Nova Scotia, 32% of jack pine at Hollow Brook, Cumberland Co.; 56% of red pine trees girdled north of Smithfield, Colchester Co., and 36% of red pine at Cox Brook Rd., Pictou Co.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Ragged sprucegall adelgid *Pineus similis* (Gill.)	Spruce	N.S.	In Nova Scotia, trace and light damage reported from 11 locations in eight counties; highest (12%) at Garden of Eden Barrens, Guysborough Co. No reports from New Brunswick or Prince Edward Island.
Red flag of balsam fir *Fusicoccum abietinum* (Hartig) Prill. & Delacr.	Balsam fir	N.S.	Damage increased from 1990. Several red branch tips on roadside trees were a common occurrence all over Nova Scotia. Damage was usually light but because of the striking appearance, very obvious throughout areas. No reports from New Brunswick or Prince Edward Island.
Redheaded jack pine sawfly *Neodiprion virginiana* Roh. *complex*	Jack pine Scots pine	Region	No reports in 1991.
Red pine cone beetle *Conophthorus resinosae* Hopk.	Red pine	Region	Found at one location each in Nova Scotia and Prince Edward Island with trace damage. No reports from New Brunswick.
Red spruce adelgid *Pineus floccus* (Patch)	Red spruce	Region	Trace damage at a few locations in New Brunswick. No reports from Nova Scotia or Prince Edward Island.
Roadside salt damage	Conifers	Region	Moderate and severe damage to ornamentals and roadside trees in all three provinces. Red and white pine exhibited the most damage, with less damage on other conifer species.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Red maple Sugar maple	Region	No reports in 1991.
Satin moth *Leucoma salicis* (L.)	Carolina poplar Largetooth aspen Silver poplar	Region	In New Brunswick, severe defoliation at Teague Lake, Gloucester Co. and Searsville, Kings Co., and moderate damage at Sussex, Kings Co. In Nova Scotia, found at nine locations in six defoliation on ornamental trees. In Prince Edward Island, found at five locations with moderate and severe defoliation on ornamental trees.
Seedling debarking weevil *Hylobius congener* D.T., Sch. & Marsh.	Conifer seedlings	Region	Continued to damage newly established plantations in Nova Scotia and Prince Edward Island where preventative measures (delayed planting or site preparation) were not taken. Forty-seven percent of seedlings were debarked to more than 75% of their circumference in one experimental plantation in Inverness Co. near Cleveland, Richmond Co., N.S. Trace weevil damage was

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			observed throughout New Brunswick.
Snow damage	Conifers Trembling aspen Willow	Region	Trace and light damage at a number of locations throughout New Brunswick and at one Nova Scotia location. No reports from Prince Edward Island.
Spearmarked black moth *Rheumaptera hastata* (L.)	White birch Wire birch Yellow birch	N.B. N.S.	Damage at a number of locations throughout New Brunswick, most common in the northern counties. Found at 13 locations in seven counties with 8% of leaves damaged on 62% of the trees. In Nova Scotia, trace damage at Fox Back Lake, Victoria Co.
Spittlebugs *Aphrophora* spp. *Cercopidae*	Conifers	Region	Present throughout the region, but at very low levels.
Spotted tussock moth *Lophocampa maculata* Harr.	Hardwoods	Region	No reports in 1991.
Spring cankerworm *Paleacrita vernata* (Peck)	Hardwoods	Region	No reports in 1991.
Spruce bud midge *Rhabdophaga swainei* Felt	Black spruce White spruce	Region	Trace damage at a few locations.
Spruce bud scale *Physokermes piceae* (Schr.)	Black spruce Red spruce White spruce Balsam fir	Region	Trace and light damage at locations in New Brunswick and Nova Scotia. No reports from Prince Edward Island.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Region	In Nova Scotia, one larva found at Kennington Cove, Cape Breton Co. No reports from New Brunswick or Prince Edward Island. See under: Seed Orchard Pests.
Spruce gall adelgid *Adelges lariciatus* (Patch)	Spruce	Region	No reports in 1991.
Spruce micro moth *Coleotechnites atrupictella* (Dietz)	White spruce Red spruce	N.S.	Trace damage at Economy Mountain, Colchester Co., N.S. No reports from Prince Edward Island or New Brunswick.
Spruce twig aphid *Mindarus obliquus* (Cholod)	Black spruce Red spruce White spruce	Region	Found at numerous locations throughout the region but shoot attack was generally light. In New Brunswick, found at three locations. Average shoot attack 13%, highest (21%) on red spruce at Martin Head, St. John Co. Found at 45 locations in Nova Scotia, average shoot attack was 10%; highest (45%) on red spruce at Chignecto Game Sanctuary, Cumberland Co. In Prince Edward Island,

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			found at 12 locations, average 9% of shoots; highest (45%) on white spruce at Camp Tamawaby, Prince Co.
Stillwell's syndrome	Balsam fir	Region	The incidence remained low in New Brunswick and Nova Scotia. In Prince Edward Island, incidence decreased from 1990, but tree mortality still common in southern Kings and southeastern Queens counties, where trees are under stress from spruce budworm defoliation.
Sugar maple borer *Glycobius speciosus* (Say)	Sugar maple	Region	In New Brunswick, 20% of trees affected at Wine River, Northumberland Co. In Nova Scotia, 4% of the trees affected in three counties. In Prince Edward Island, 4% of the trees affected at two locations.
Sulphur dioxide damage	Conifers Hardwoods	Region	No reports in 1991.
Tar spot of maple *Rhytisma acerinum* (Pers. ex. St. Amans) Fr.	Maple	Region	In Nova Scotia, average of 19% of leaves were spotted at eight scattered locations, highest (43%) at Liscomb, Guysborough Co. In Prince Edward Island, 5% at two locations. No reports from New Brunswick.
Uglynest caterpillar *Archips cerasivorana* (Fitch)	Alder Cherry	Region	Found at higher levels than in 1990 throughout the region, except northern New Brunswick. Areas with highest instensity included Humphrey Corner, Sunbury Co., N.B.; Debert, Colchester Co., N.S.; and Breadalbane, Queens Co., P.E.I.
Variable oak leaf caterpillar *Lochmaeus manteo* Dbly	Beech Sugar maple	N.B. N.S.	The outbreak that occurred in areas of southwestern York Co., N.B. and southwestern Nova Scotia has collapsed. Trace, light or moderate defoliation was limited to a few understory trees in some of the previously defoliated ares. In Nova Scotia, trace defoliation was found at one location each in Colchester and Halifax counties.
Wax filament scale *Xylococculus betulae* (Perg.)	Beech White birch	Region	Present throughout New Brunswick, averaging 74% of white birch infested at 14 locations; highest (100%) on white birch at St. George, Charlotte Co. In Nova Scotia, 32% of beech and white birch at 11 locations; highest (76%) on beech at Sissiboo Falls, Digby Co. and (72%) on white birch at Fox Back Lake, Victoria Co. One report from Prince Edward Island, 56% of beech infested at Freetown, Prince Co.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Weevil damage *Strophosoma melanogrammus* Forst.	Red pine Red spruce	Region	In Nova Scotia, 25% of plantation red spruce damaged at Hunters Mountain, Victoria Co. In Prince Edward Island, light damage in a red pine plantation at Mount Carmel, Prince Co. No reports from New Brunswick.
Whitemarked tussock moth *Orgyia leucostigma* (J.E. Smith)	Balsam fir Red maple White spruce	Region	In Nova Scotia, a few insects at each of eight locations; 85% of red maple foliage damaged at Manganese Mines, Colchester Co. At endemic levels in Prince Edward Island and no reports from New Brunswick.
White pine blister rust *Cronartium ribicola* J.C. Fisch.	White pine	Region	Reported from three locations in New Brunswick, no reports from Nova Scotia or Prince Edward Island.
White pine cone beetle *Conophthorus coniperda* (Sz.)	Pine	Region	See Seed Orchard Pests.
White pine sawfly *Neodiprion pinetum* Nort.	White pine	Region	Populations very low. Larvae found at Seal Cove, Grand Manan, Charlotte Co., N.B. and St. Peters, Richmond Co., N.S. No reports from Prince Edward Island.
White pine weevil *Pissodes strobi* (Peck)	Conifers	Region	Common and widespread in region. In New Brunswick, an average of 16% trees with dead terminals at 22 locations; highest (68%) on white pine at Middle Southampton, York Co. In Nova Scotia, found at several locations on the mainland; highest (40%) on Norway spruce at Mount Merrit Brook, Queens Co. In Prince Edward Island, three locations; highest (56%) on white pine at Harmony Demonstration Woodlot, Kings Co.
Whitespotted sawyer beetle *Monochamus scutellatus* (Say)	Balsam fir Red spruce White spruce Jack pine	Region	Red flagging was common in all three provinces at trace and light damage levels. In New Brunswick, an average of 10% balsam fir were infested; highest (16%) at Blue Mountain, Victoria Co. In Nova Scotia, the average was 25% balsam fir at 19 locations in 13 counties; highest (44%) at Ellershouse, Hants Co. and Upper Whitehead, Guysborough Co. In Prince Edward Island, highest (96%) at Belfast, Queens Co.
Willow blight *Venturia saliciperda* Nuesch	Willow	Region	One report of damage at Saint John, St. John Co., N.B. No reports from Nova Scotia or Prince Edward Island.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Willow flea weevil *Rhynchaenus rufipes* (Lec.)	Willow	Region	Trace damage at one location in New Brunswick. Moderate and severe leaf browning common throughout Nova Scotia and Prince Edward Island.
Wind damage	Hardwoods	Region	Foliage browning was less acute on Cape Breton Island and more widespread across mainland Nova Scotia than in 1990. The most serious damage was on hardwoods along ridge tops and north- and west-facing slopes in Inverness and Victoria counties, where areas of 1 to 50 ha of moderate to severe browning occurred. Drying by wind and drought left hardwood foliage chlorotic, on many hilltop ridges and slopes in northern and central Nova Scotia and western Cape Breton Island. In New Brunswick, light and moderate damage on small groups of trees at a few locations, mostly in Charlotte Co. In Prince Edward Island, moderate and light damage was particularly noticeable on fringe trees in north and south Queens and eastern Prince counties.
Winter drying	Conifers	Region	In New Brunswick, severe and moderate damage was found throughout the province; most severe at McKiel Brook, Carleton Co. where 250 ha of red spruce were damaged. In Nova Scotia, moderate damage was found at 10 locations in nine counties; most severe at Pubnico, Yarmouth Co., where 67% of red pine were damaged. No reports from Prince Edward Island.
WInter moth *Operophtera brumata* (L.)	Hardwoods	Region	Moderate and severe defoliation on apple at Albert, Albert Co., N.B. In Nova Scotia, severe defoliation of apple by a combination of winter moth, Bruce spanworm and/or fall cankerworm occurred at five locations in Antigonish Co. Trace and moderate damage reported throughout Prince Edward Island.
Witches' broom of balsam fir *Melampsorella caryophyllacearum* Schroet.	Balsam fir	Region	Less common than in 1990. Present at trace levels in New Brunswick and Nova Scotia. Common and widespread with 11% of trees affected at five locations in Prince Edward Island.
Witches' broom of spruce *Chrysomyxa actostaphyli* Diet.	Black spruce	Region	No reports in 1991.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Woolly alder aphid *Paraprociphilus tessellatus* (Fitch)	Speckled alder Silver maple	Region	Reported causing light and moderate damage to speckled alder throughout the region. In New Brunswick, five locations from five counties along with three locations where larvae were found on ornamental silver maple. Found at 20 locations in northern and western Nova Scotia and one report from Prince Edward Island.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce Blue spruce	Region	In New Brunswick, moderate and severe defoliation on a few trees at five locations in two counties. In Nova Scotia, a few insects found at one location in each of seven counties. In Prince Edward Island, severe defoliation was present again at St. Patrick Road, Kings Co., Conway and MacNeills Mills, Prince Co. Light and moderate defoliation found at four locations in Prince and Queens counties.