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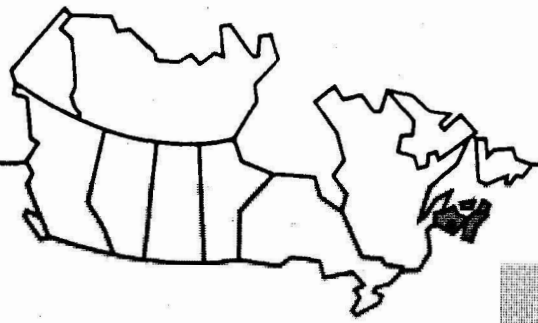
Forest pest conditions in the Maritimes 1985

Laszlo P. Magasi



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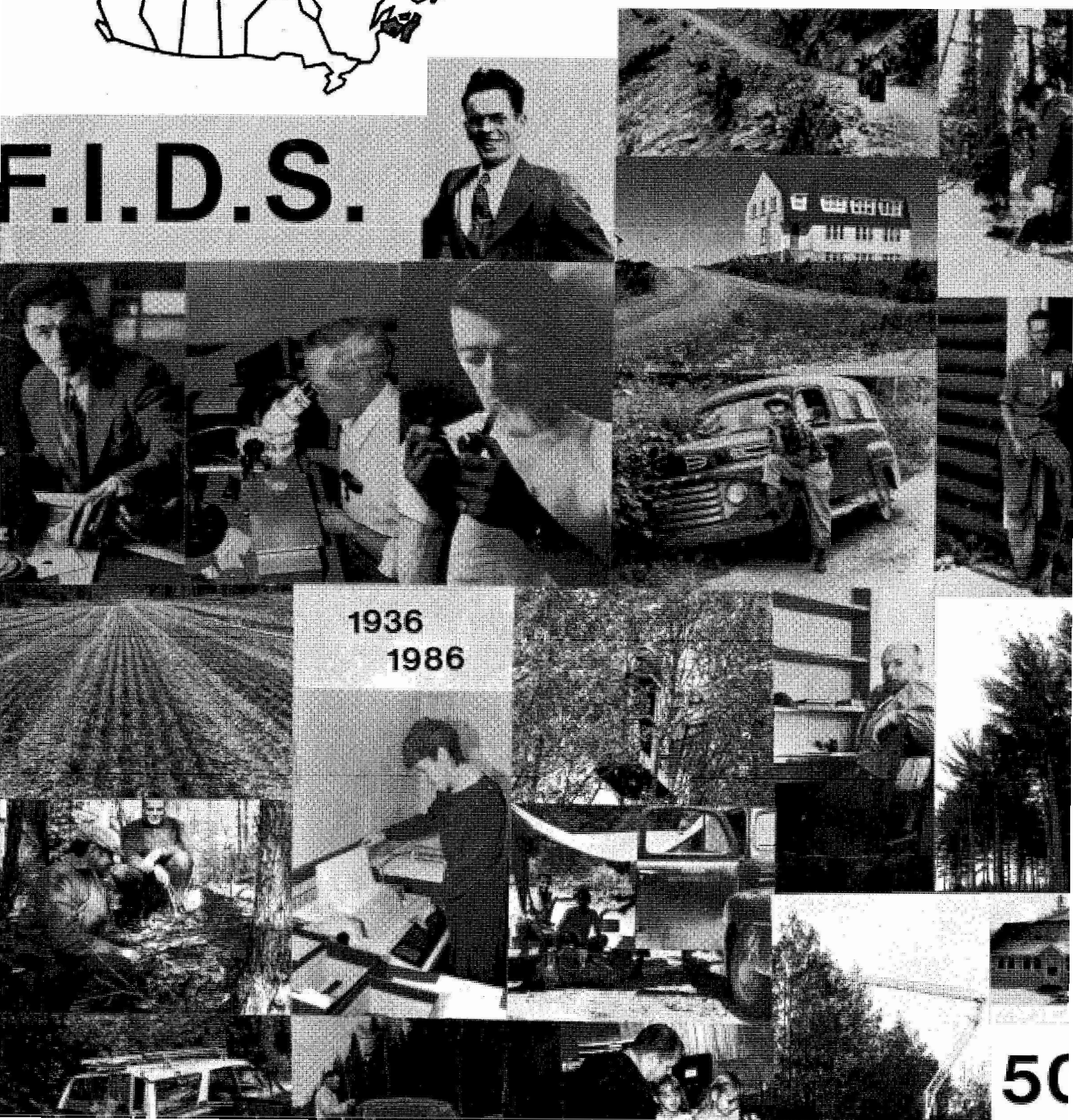
Canadian Forestry Service — Maritimes



CANADIAN FORESTRY SERVICE - MARITIMES

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

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

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

FOREST PEST CONDITIONS IN THE MARITIMES IN 1985

by

Laszlo P. Magasi

Canadian Forestry Service - Maritimes

Fredericton, New Brunswick

Information Report M-X-159

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1986

ABSTRACT

This report reviews the status of forest insects and diseases in the Maritimes Region in 1985, damage related to forest inventory data and a forecast of conditions for 1986, when appropriate. Economically important pests of current concern are discussed in some detail, other organisms are listed in tabular form. A separate chapter discusses the various special involvements with related activities such as the use of pheromones as survey tools, the Acid Rain National Early Warning System (ARNEWS) and others. A list of forest-pest related publications and reports is included. More detailed information is available from the Canadian Forestry Service - Maritimes.

RESUME

Ce rapport fait le bilan des insectes et maladies des arbres dans la région des Maritimes in 1985, cite les pertes occasionnées à l'inventaire forestier, et donne un aperçu des conditions prévues pour 1986, lorsqu'approprié. Les ravageurs d'importance courante y sont traités en détail, les autres organismes sous forme tabulaire seulement. Un chapitre en particulier explique les implications du RIMA dans des activités connexes, telles que l'usage de phéromones comme outils de relevé, le Dispostif National d'Alerte Rapide pour les Pluies Acides (DNARPA), et autres efforts. On y inclus une liste de publications et de rapports traitant de ravageurs forestiers. De plus amples renseignements sont disponibles au Service canadien des forêts - Maritimes.

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INTRODUCTION

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

In this report, pest conditions in 1985 are described and, where appropriate, related to provincial forest inventory data; operational control programs against the spruce budworm are summarized; forest pest related research programs connected with the aims of the Forest Insect and Disease Survey are briefly mentioned; and a list of reports and publications relating to forest-pest conditions is included.

The report aims to provide forest managers with information on pest conditions in the Maritime Provinces, early enough to be considered in management decisions before the start of the 1986 field season. Insects and diseases that were widespread and caused considerable concern in 1985 are discussed in detail, others are presented in tabular form. More information on these and on other specific conditions will be provided upon request from CFS-Maritimes.

Since 1982, we have presented a chapter on special surveys to report on some of our projects that have implication in forest management but did not fit our previous reporting format. In 1985 this chapter includes a summary of a plantation survey carried out in New Brunswick in cooperation with the Department of Forests, Mines and Energy; a regional survey for the pinewood nematode, a pest of importance to international commerce and great concern to plant quarantine organizations; a brief statement on the status of work on pheromones and other attractants as tools for detecting the presence and monitoring the spread and fluctuation of forest insects; and a section which deals with the Acid Rain National Early Warning System (ARNEWS).

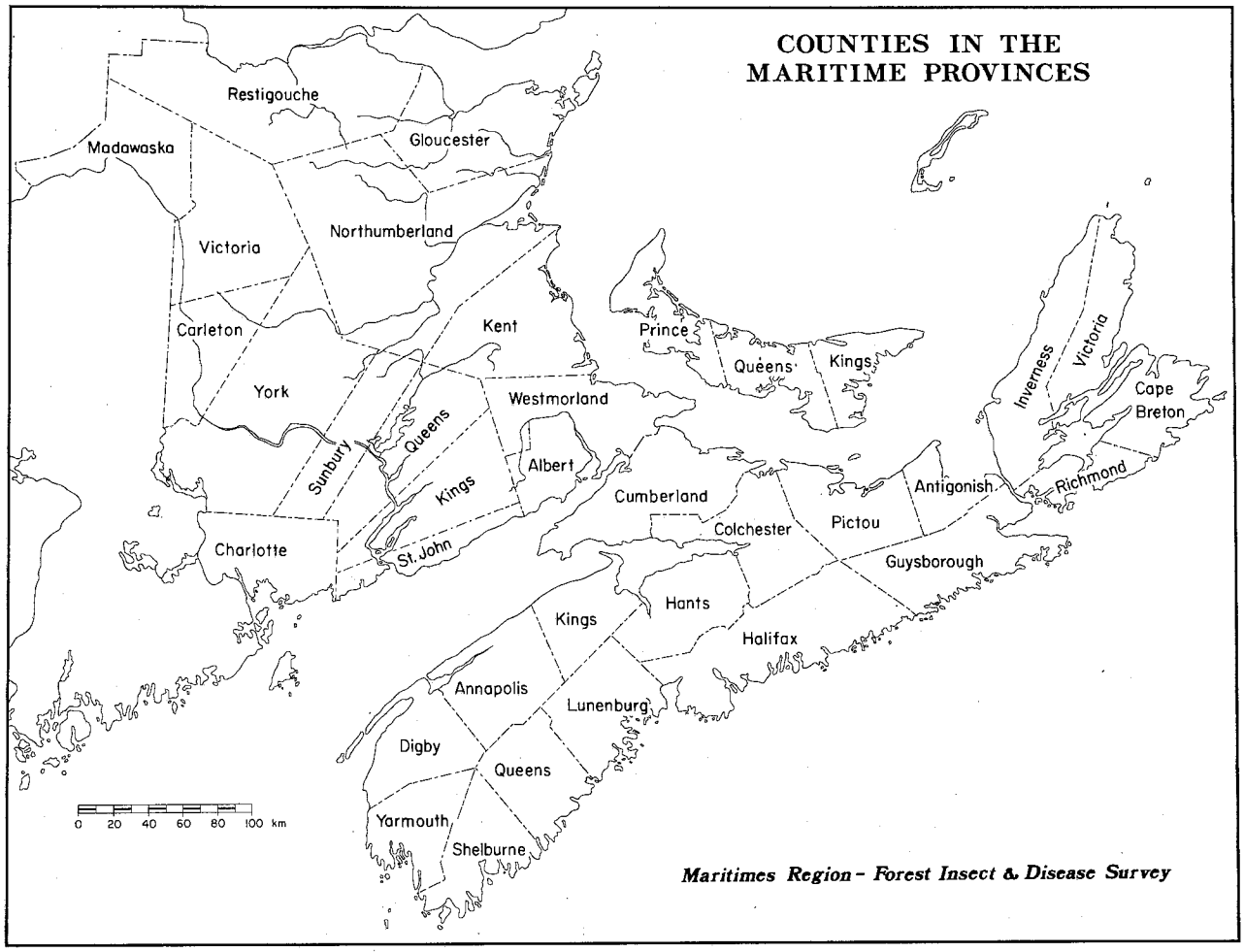
We attempt to add extra information on the pests discussed, in response to suggestions, and because requests for information indicate the need for this, now that our readership has expanded beyond our traditional clientele of the forestry community. This, we hope, will place the organisms in a better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

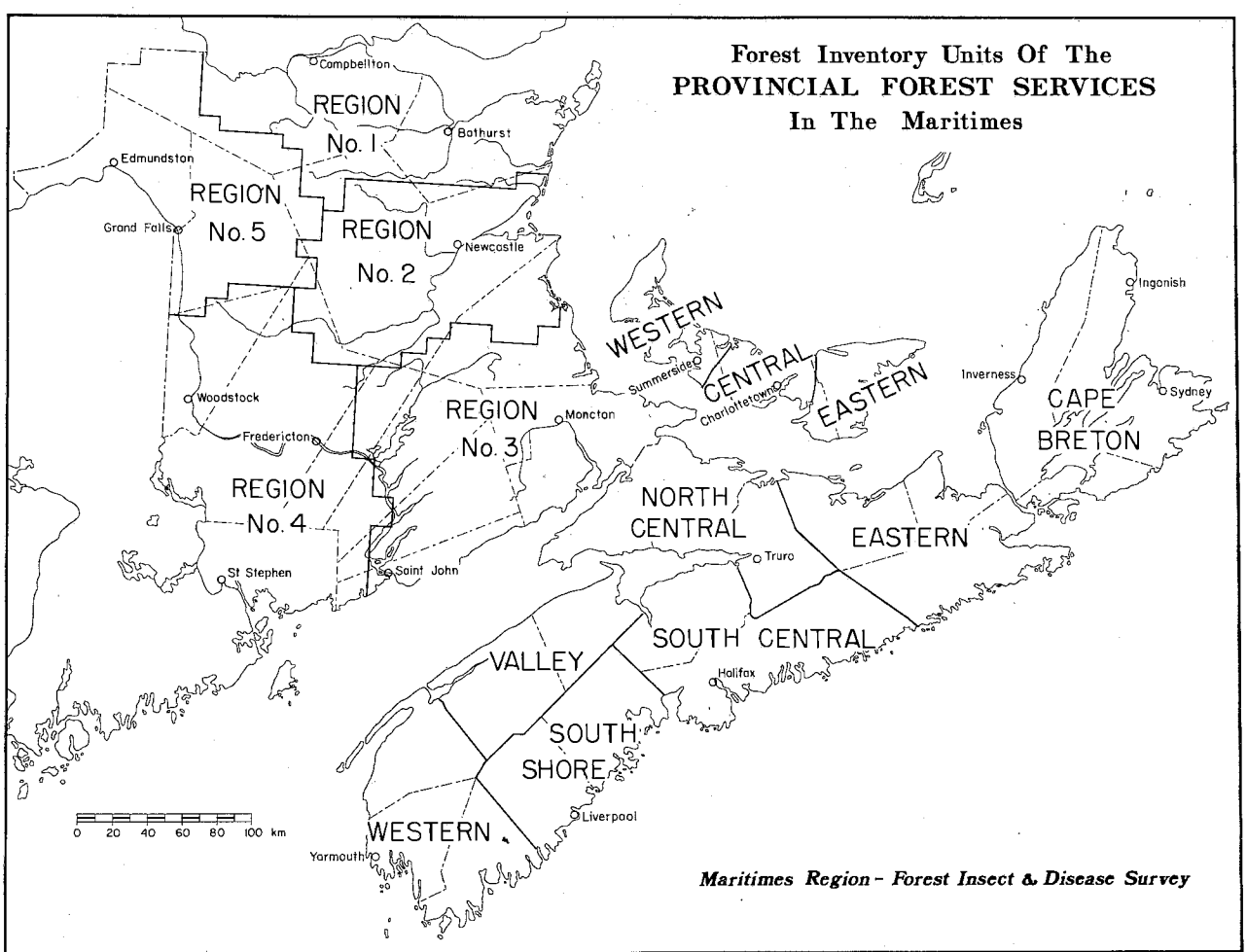
Two maps are included to help the reader locate areas mentioned. One shows the counties of the three provinces, and the other indicates the provincial forest services' forest inventory subdivisions.

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

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

In 1986, the Forest Insect and Disease Survey celebrates the 50th anniversary of its establishment. We mark the occasion on the cover of this annual report by presenting a small tribute to the Survey - as it was and as it is now. This is a departure from the usual practice of featuring a forest pest or some specific survey activity.


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


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

IMPORTANT AND CONSPICUOUS FOREST PESTS

SPRUCE BUDWORM

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

NEW BRUNSWICK

Defoliation of balsam fir and spruce stands was recorded as severe or moderate over 1 070 000 ha in the Province in 1985 (Fig. 1). Inclement weather prior to aerial surveys resulted in a considerable amount of reddened foliage being removed from the trees, necessitating the combining of moderate and severe defoliation categories and preventing accurate mapping of the light defoliation class. Consequently, the "traditional" area of total defoliation is not available for the second consecutive year.

The 1 070 000 ha severe and moderate defoliation caused by the spruce budworm in 1985 is a significant increase over the area so affected in 1984 (730 000 ha) but only half of the 2 028 000 ha recorded in those categories in 1983.

Damage There were no specific damage surveys for spruce budworm conducted by the Forest Insect and Disease Survey in 1985. However, the results of a regional assessment of the fir/spruce forest (see Special Surveys section) certainly have implications here, spruce budworm being one of the main causes of tree mortality in the fir-spruce ecosystem.

Control operations Foliage protection against the spruce budworm in New Brunswick was conducted over 725 250 ha in 1985, 701 000 ha by Forest Protection Ltd., and 24 250 ha by Forest Patrol Ltd., a subsidiary company of J.D. Irving Ltd., Saint John, N.B.

Forest Protection Ltd. treated 452 000 ha with aminocarb (Matacil 180F) in two applications at 70 g/ha dosage per application, and 168 000 ha with fenitrothion (Sumithion) at 210 g/ha per application. Most of these areas were treated twice. Both chemicals were applied in water-based formulations. In addition, the biological insecticide B.t. (Bacillus thuringiensis) was applied undiluted, at 30 BIU/ha dosage, to 81 000 ha in a single application (Dipel 132 on 78 000 ha and Thuricide 48 LV on 3000 ha). Forest Patrol Ltd. treated 24 000 ha with fenitrothion at 210 g/ha in water-based solution in two applications and 250 ha with B.t (Dipel 132) at 30 BIU/ha dosage in one application.

Thuricide HPC, the biological insecticide B.t. (Bacillus thuringiensis) was used, applied from the ground with a backpack mist blower, to treat about 2 ha at a picnic site in Kouchibouguac National Park (H. Beach 1985)[1].

Forecast The traditional egg mass surveys for predicting spruce budworm infestation levels were replaced by the overwintering larval survey (L2) in New Brunswick in 1985. The New Brunswick Department of Forests, Mines and Energy processed samples from 1521 locations. Of these, 185 locations (12%) are in the high, 503 (33%) in the moderate and 833 (55%) in the low infestation categories. These results indicate that severe or moderate infestations might be expected over 3.15 million hectares in New Brunswick in 1986 - somewhat lower than the 3.75 million hectares predicted for 1985. This follows the decreasing trend observed since 1982 when the infested area in the moderate and severe categories was predicted to be 5.30 million hectares. In terms of overall distribution much of the moderate and high populations are expected to occur in large patches across the northern part of the Province and in a large band across the south-central areas and towards the southeast.

[1]Kouchibouguac National Park, New Brunswick.

NOVA SCOTIA

Defoliation of balsam fir and spruce in softwood and mixedwood stands occurred on 345 200 ha in Nova Scotia in 1985 (Fig. 1). Defoliation was severe on 286 700 ha, moderate on 32 100 ha and light on 26 400 ha. The severe defoliation class includes 280 100 ha where moderately defoliated patches were interspersed throughout severely defoliated areas. The 318 800 ha of severe and moderate defoliation represents a five-fold increase from the 58 700 ha in these categories reported in 1984 and is also considerably higher than the 294 000 ha so affected in the Province in 1983. The previously identified outbreak areas are discussed briefly to provide historical continuity in reporting.

In Cumberland-Colchester counties defoliation was severe or moderate on 179 700 ha in 1985. This outbreak area became contiguous with the outbreak in the adjacent counties of Pictou and Antigonish on the Northumberland Strait coast where severe or moderate defoliation was recorded on 139 100 ha in 1985.

No severe or moderate defoliation occurred in either the Annapolis Valley-Hants County area or on Cape Breton Island in 1985, a situation similar to that found in 1984.

Damage There were no specific provincial-scale damage surveys for spruce budworm conducted by the Forest Insect and Disease Survey in Nova Scotia in 1985. However, the results of a regional assessment of the fir/spruce forest (see Special Surveys section) certainly have implications here, spruce budworm being one of the main causes of tree mortality in the fir-spruce ecosystem. In addition, we continued monitoring tree mortality on research plots on Cape Breton Island in the aftermath of the devastation by the spruce budworm there and conducted a special damage assessment survey in the Cumberland-Colchester area, in cooperation with the Nova Scotia Department of Lands and Forests.

Mortality of merchantable balsam fir has been followed on permanent research plots on both the Highland and Lowland areas of Cape Breton Island, since 1976. Although spruce budworm populations have decreased drastically from those at the height of the outbreak, losses continued to mount with many of the weakened trees falling victim to a complex of secondary organisms, and in recent years to blowdown.

On the Highlands, 85.7% of the original trees had been lost by the fall of 1985, an increase of 2.4% since last year. On the Lowlands, mortality and blowdown by 1985 amounted to 92.4% on the research plots, no change from 1984. The apparent slowdown in losses is a classical case of 'not much left to die' at these levels of stand destruction.

The aerial damage survey, conducted jointly with the Nova Scotia Department of Lands and Forests, in Colchester, Cumberland, and Pictou counties was concentrated in those areas where defoliation was consistently moderate or severe in recent years. Detailed analysis of the data is not yet available but preliminary results show the proportion of grey trees, indicating dead or dying softwood trees, over the area examined (Table 1).

Table 1. Softwood mortality in Cumberland, Colchester, and Pictou counties, Nova Scotia in 1985 as determined by aerial surveys

Proportion of softwood component "grey" %	Area flown so affected %
71 or more	<1
41 - 70	2
11 - 40	28
0 - 10	70

Control operations in Nova Scotia were conducted by the Nova Scotia Department of Lands and Forests on 49 720 ha and by the J.D. Irving Ltd. on 2800 ha, for a total of 52 520 ha in 1985.

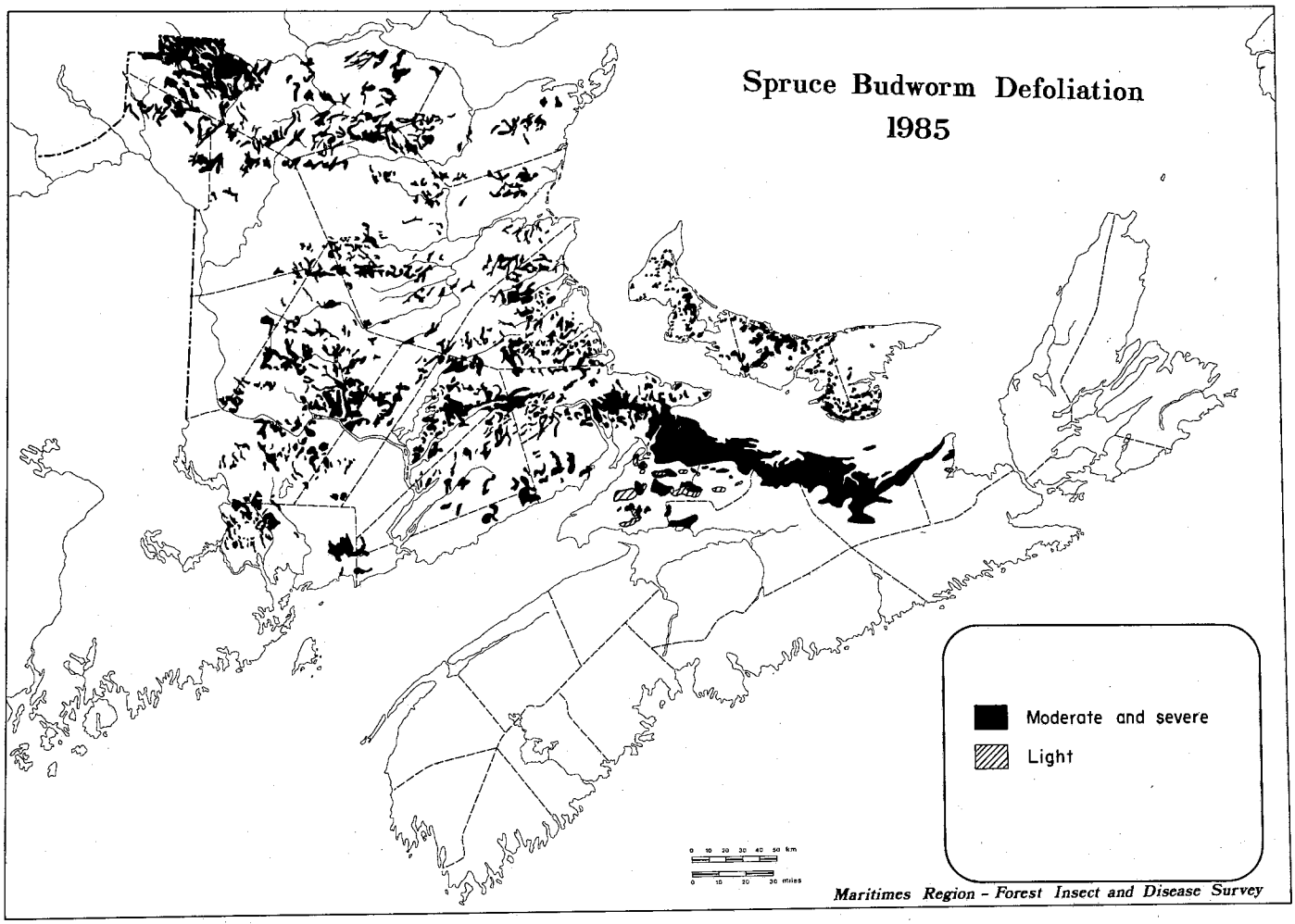


Figure 1.

The biological control agent B.t. (Dipel 132) was applied at 20 BIU/ha to 8570 ha, and at 30 BIU/ha to 41 150 ha by the provincial agency and at 30 BIU/ha to 2800 ha by J.D. Irving Ltd. All areas were treated in a single application.

Forecast - Overwintering larval surveys (L2) completely replaced the traditional egg mass surveys for the first time in Nova Scotia and results from these constitute the sole base from which predictions are made. The L2 survey was conducted by the provincial Department of Lands and Forests.

Information from 362 locations shows that infestations for 1986 are negative or low in 11 of the counties. One location in each of Digby, Inverness, and Victoria counties was found to be moderate. Of the remaining 86 locations, distributed in Cumberland, Colchester, Pictou, and Antigonish counties, infestations are moderate on 37%, high on 20% and extreme on 43%. In general, the spruce budworm outbreak is expected to remain intensified and concentrated in central Cumberland County and along the Northumberland Strait coast.

PRINCE EDWARD ISLAND

Defoliation of balsam fir and spruce stands occurred throughout Prince Edward Island and affected 70 100 ha in 1985. Defoliation was severe on 41 000 ha, moderate on 12 800 ha and light on 16 300 ha (Fig. 1). The severe defoliation class includes 40 000 ha where moderately defoliated patches were interspersed throughout severely defoliated areas. The more than fourfold

increase in the area of detectable defoliation over the 15 600 ha recorded in 1984 could be partly, but not entirely, the result of an underestimation of the affected area in 1984 due to extremely unfavorable weather conditions previous to the survey period.

Damage There were no specific damage surveys for spruce budworm conducted by the Forest Insect and Disease Survey in 1985. However, the results of a regional assessment of the fir/spruce forest and the stand mortality survey in the Province (see Special Surveys section) certainly both have implications here, spruce budworm being one of the main causes of tree mortality in the fir-spruce ecosystem.

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

Forecast The overwintering larval survey (L2) was used in Prince Edward Island to predict populations for the following year for the first time in 1984. In 1985 the L2 survey included 55 locations throughout the Province. Of these 9% are in the extreme, 33% in the high, 29% in the moderate and 29% in the low or negative infestation category. The hazard index, taking into consideration the expected spruce budworm population, previous defoliation and tree condition indicates that 12% of the locations assessed are in the high, 20% in the moderate and 68% in the low hazard categories. The high hazard areas are in southern Queens and Kings counties and in parts of Prince County where continued moderate or severe defoliation would most likely result in tree mortality.

SPRUCE BUD MOTH

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

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

In 1985, populations of the spruce bud moth were generally low and damage was light in most of the Region, with the following exceptions:

In northwestern New Brunswick repeated feeding in large areas of white spruce plantations resulted not only in shoot distortion but in some instances up to 50 cm of top mortality, involving all of the multiple leaders that developed on the affected trees as a result of repeated damage. Shoot damage at 13 locations in Madawaska, Restigouche, and Victoria counties ranged from 11 to 96% and averaged 31% in the plantations examined.

In Nova Scotia, ground surveys indicated that a portion of the 11 600 ha defoliation mapped during spruce budworm aerial surveys in Antigonish County may have been caused by the spruce bud moth (Z. canadensis) rather than the spruce budworm.

In Prince Edward Island, 30% defoliation occurred on 90% of young white spruce trees over a small area of Bayfield, Kings County.

Research to find the most appropriate combination of control methods has been conducted in white spruce plantations. In 1985, these included the release of the egg parasite Trichogramma minutum Riley. Early results indicate a significantly elevated level of egg parasitism. (Pers. comm. from E.G. Kettela).

BARK BEETLES OF CONIFERS

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

Spruce Beetle, Dendroctonus rufipennis (Kby.) attacks continued throughout the Region in 1985, although there was a further decrease in the number of white spruce trees newly affected compared with 1984 and especially with 1983 when spruce beetle activity was very high. There were further locations in New Brunswick where infested trees were found for the first time in 1985.

In Nova Scotia, Cape Breton Island constituted the major outbreak area during the early part of the 1980s and by the end of 1983 no large areas remained without severe white spruce mortality. Beetle activity decreased in 1984, and in 1985 a further reduction in newly attacked trees was observed, most new mortality having occurred in Inverness and Victoria Counties. However, more than half of the merchantable white spruce volume is now dead on Cape Breton Island as the result of the outbreak in many areas. On the mainland, the volume of dead white spruce was also much reduced from last year and was observed only in a few isolated pockets.

In Prince Edward Island, spruce beetle activity occurred in previously affected areas of Queens and Kings counties but few newly attacked trees were observed. With about a third of the Province's merchantable white spruce having succumbed to this insect in past years, the spruce beetle remains a serious threat to both forestry and agriculture, because many of the trees killed are in the hedgerows and windbreaks.

In New Brunswick, the small infestations reported in previous years remained active but, except for the area in Fundy National Park, Albert County, activity was at a very low level with few white spruce trees affected at most locations.

A special cooperative detection survey was undertaken between the Forest Insect and Disease Survey and the New Brunswick Department of Forests, Mines and Energy in New Brunswick in 1985, prompted by the discovery of infested trees at widely separated areas of the Province in previous years and by the concern over the damage potential of the insect as observed in the other Maritime provinces. A total of 68 locations was examined. These were selected on the basis of the inventory of mature white spruce and on suspicions of beetle activity. A minimum of 50 trees was assessed at each sampling point. Of the areas found to be infested only the central York County location was not previously known to harbor spruce beetle (Fig. 2). Infestation levels were generally low. In northern New Brunswick the highest level of attack was at Mount Carleton, Northumberland County where 4% of the trees were attacked. In the southern part of the Province, 12% of the trees were recently infested in Fundy National Park, Albert County. At several locations only one successfully attacked tree was found in 1985. The curently low level of infestation in most areas is of less importance than the fact that spruce beetle populations are present and the potential for significant damage is real.

Eastern Larch Beetle, Dendroctonus simplex Lec., normally attacks only weakened, damaged, or recently felled host material. However, when populations are very high, living, apparently healthy, mature, or overmature trees,

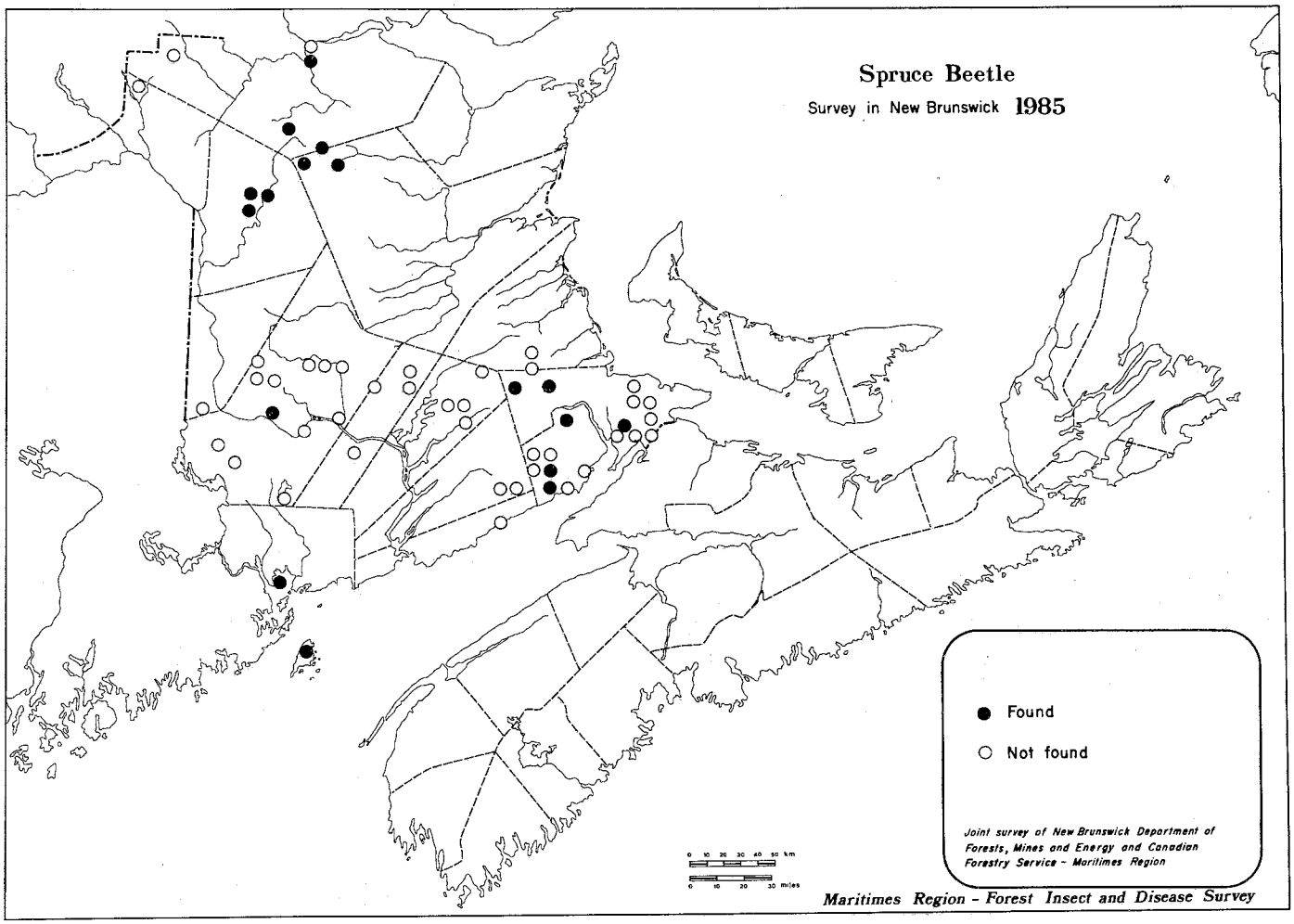


Figure 2.

and even younger, small diameter trees can also become infested.

In the Maritimes, a population build-up was first noticed in Nova Scotia in 1976. This increase in beetle populations followed several years of severe defoliation of larch by the larch sawfly, Pristiphora erichsonii (Htg.). Since then, the beetle has become widespread in all three provinces and has caused serious tree mortality. By the end of 1981, an estimated 24% of merchantable-size larch was dead in New Brunswick, 64% in Nova Scotia, and 13% in Prince Edward Island.

In 1985, eastern larch beetle was common in northwestern and eastern New Brunswick and in western Nova Scotia although a few newly infested trees were also found throughout much of the Region. The downward trend in beetle activity, observed in the last few years, continued. This was confirmed by observations at the central New Brunswick research plot, where a further 2.8% of the trees became infested in 1985, compared with 3.8% in 1984.

Surveys indicate that the eastern larch beetle, unlike the spruce beetle, does not spread quickly once established, and that there is no definite pattern to its spread into new areas (Fig. 3). Between 1979 and 1985 the beetle moved into 60% of uninfested areas in New Brunswick, 61% in Nova Scotia, and 20% in Prince Edward Island based on re-examination of 99 sampling locations established in 1978.

The damage survey conducted in 1981 was repeated in 1985. Results show that

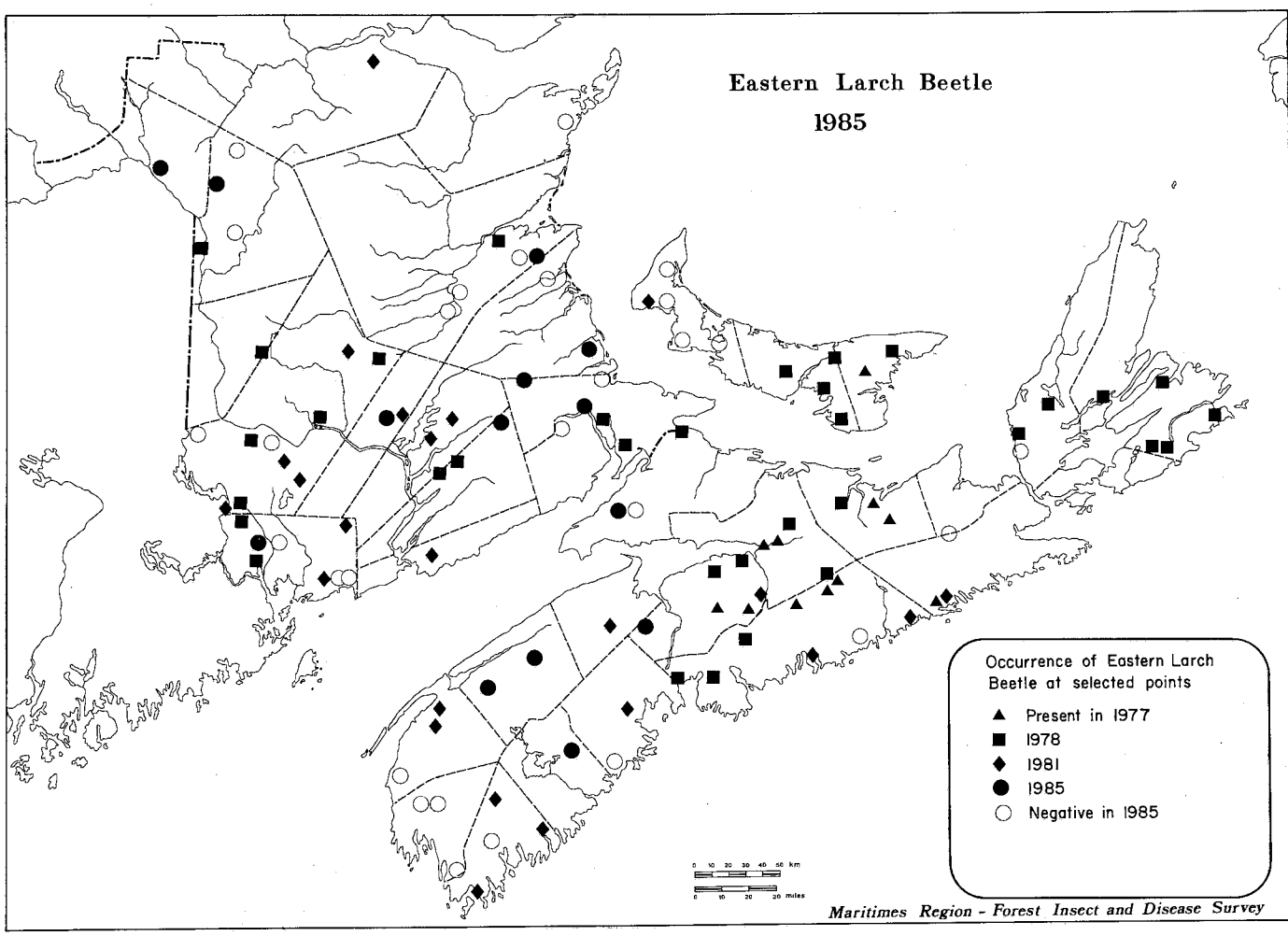


Figure 3.

there was an increase in tree mortality in New Brunswick (30% of merchantable-size larch dead from larch beetle attack) and in Prince Edward Island (23% mortality), while in Nova Scotia 49% of the larch volume is dead. The decrease of 15% in Nova Scotia since 1981 probably is a result of the disappearance of old dead trees from the stand.

CANKERS OF CONIFERS

Cankers are caused by many fungi, the attacks of which are manifested in different ways. However, all are similar in one important aspect: they damage trees. Damage varies from the loss of a few small branches or minor stem infections to the deformation of the stem to such an extent that it becomes of little or no value, or the tree may die. Damage in stands is variable. Some canker diseases eliminate only a few trees, while others may spread and infect most or all trees in a stand or plantation. Losses are direct, such as reduction in wood value, and indirect, such as low quality trees occupying valuable space, or affected trees serving as sources of infection either to other trees in the same stand or to nearby areas.

European Larch Canker, caused by the fungus, Lachnellula willkommii (Hartig) Dennis, was first discovered in the Maritimes in 1980. Surveys since then established the distribution of the disease as widespread in southeastern New Brunswick and on mainland Nova Scotia. European larch canker has been a serious disease in many parts of Europe.

The fungus is considered, by most, to be a primary pathogen (capable of infecting vigorous, healthy trees) and its presence in Europe has resulted in the exclusion of larch from plantation programs. In North America, the fungus was found in Massachusetts in the 1920s in European larch plantations. Periodic concentrated attempts to eradicate the fungus appear to have been successful as the disease was not found during surveys of the area in 1965. It was discovered in northeastern Maine in 1981.

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

In 1985, the disease was found only at one location outside the range of known distribution, south of Riversdale, Colchester County, Nova Scotia. This find represents only a minor extension. More than 50 other areas surveyed in uninfected areas in 1985 were negative (Fig. 4).

Investigation of several aspects of the behavior of the fungus under our climatic conditions has been initiated. Results will be reported as they become available. A survey to establish age and spread pattern indicates that the fungus could have been present in the Maritimes for about two decades before its discovery and may have spread from specific

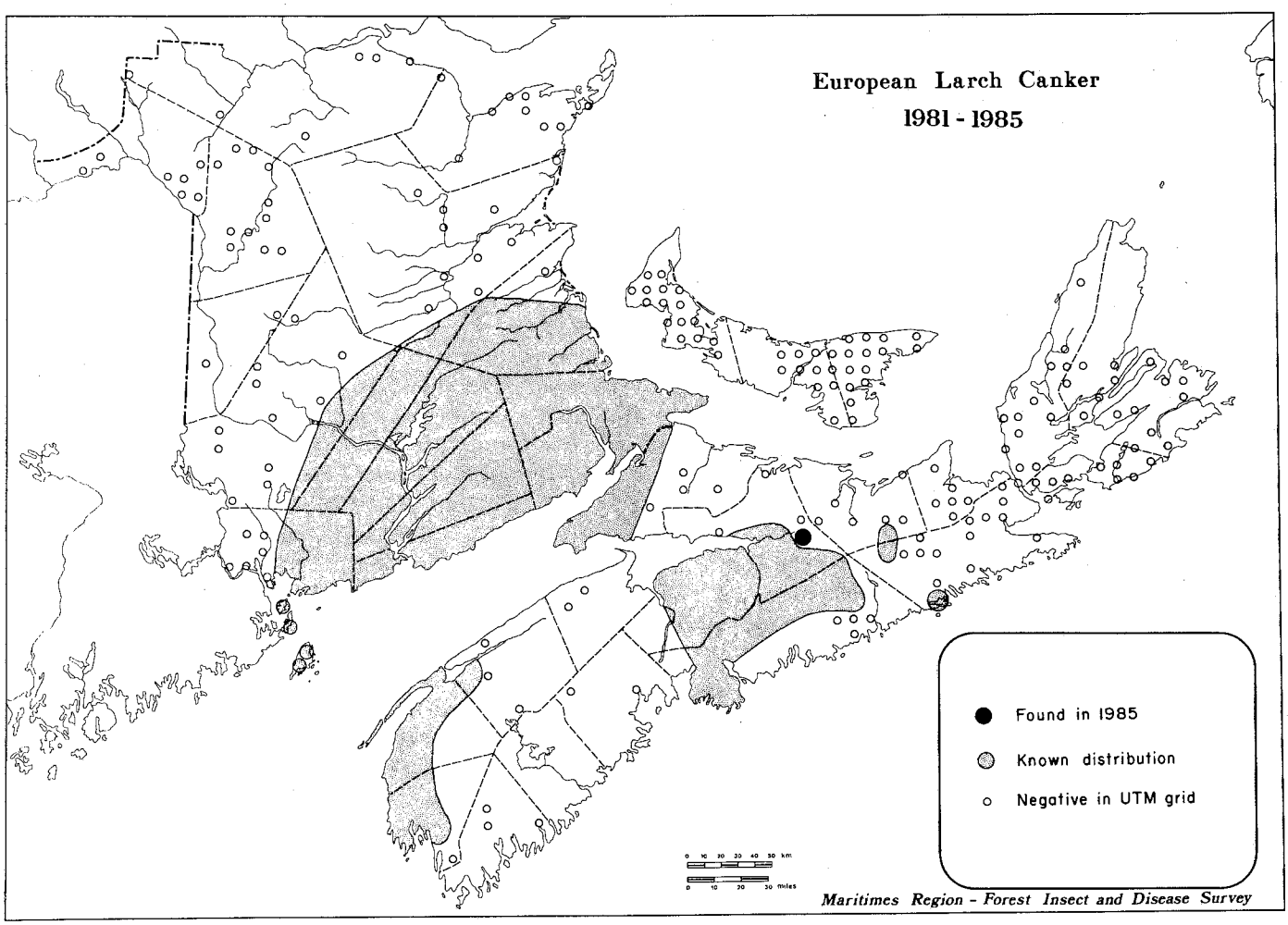


Figure 4.

areas. The study also showed a rapid decrease in incidence of infected trees with increasing distance from the southern shores of the Bay of Fundy, possibly indicating a climatic dependence.

The disease is capable of intensifying rapidly in young stands. Incidence of infected trees in a research plot increased as follows, based on fall assessments: 1982 - 7%; 1983 - 19%; 1984 - 46%; and 1985 - 88%. Both stem and branch cankers were present on 30% of the trees, 40% had only branch cankers and 16% of the trees had stem cankers only.

Greenhouse-grown seedlings of 30 populations of Larix decidua, L. leptolepis, L. eurolepis, L. laricina, and L. sibirica were planted in a heavily infected area in the early summer of 1983 to test differences in susceptibility to infection. Larix occidentalis seedlings were added to the test in 1985. Cankers, bearing fruiting bodies of Lachnellula willkommii, were found on three seedlings in the fall of 1984. By the fall of 1985, 11 of the 32 larch populations had at least one seedling infected by the disease. Details of this study are the topic of a CFS-Maritimes information report to be released shortly (in press).

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

In 1985, the disease was observed in several areas in New Brunswick in Carleton, Restigouche, Gloucester, Northumberland, and Kings counties. The highest infection level was found near Charlo, Restigouche County where more than 50 Scots pine were affected in a Christmas tree plantation.

The European race of the disease is capable of killing trees of any size (the North American race kills only small trees). This and several other "intermediate" races have been found in New Brunswick at 11 locations since 1978. Eradication attempts at a forest nursery, in a Christmas tree plantation, and in a commercial plantation appear to have been successful in eliminating the disease. The remaining 8 plantations are under close annual surveillence for changes in symptom expression, which at the current stage of disease development are indistinguishable from those of the North American race. In addition, samples from each area are serologically analyzed for race determination. The fact that none of the samples since 1983 proved to be of the European race gives rise to cautious optimism regarding the future of this race in the Maritimes.

SIROCOCCUS SHOOT BLIGHT

Sirococcus shoot blight, caused by the fungus Sirococcus conigenus (DC)P. Cannon & Minter (previously known as Sirococcus strobilinus Preuss), has been known in the Maritimes for only about a decade but has been present for much longer. The fungus infects and kills newly developed shoots. Fruiting bodies are produced on the twigs, needles, and cone scales from whence the spores disperse and cause new infection. Heavy attacks cause branch mortality, which result in crown dieback and tree mortality. In the Maritimes, the disease affects red pine and occasionally spruce, although other species of pine, larch, hemlock, Douglas fir, and true firs can also be affected. (The disease was first found on larch in the Maritimes in 1983 but because it was identified only recently this is the first report of Sirococcus shoot blight on larch in the Region.) Trees of any size, from seedlings to 15 m in height, are damaged or killed.

The disease is present in all three provinces but is most widely distributed in red pine plantations in Nova Scotia, west of the Colchester-Pictou and

Halifax-Guysborough county lines, and in natural regeneration in the south and central part of New Brunswick.

In 1985 the disease intensified in all three provinces and in many areas repeated infection has resulted in serious deterioration of red pine stands and plantations.

In New Brunswick, Sirococcus shoot blight appears to be restricted to the southern part of the Province. The northernmost occurrence was reported near Muzroll Brook along the Chipman-Doaktown road, Northumberland County, where the disease was severe on understory trees in a small area. Both understory and large trees were again infected at Shin Creek, Charlotte County where further deterioration of the stand occurred in 1985. In Fundy National Park, red pine trees along Highway 114 near the headquarters area deteriorated so much in the past years that many of them were removed in the fall of 1985. Diseased trees were also observed close to a seed orchard in Albert County.

In Nova Scotia, Sirococcus shoot blight at present is much more common and more damaging in the western part of the Province however, infected stands and plantations are also known in eastern Nova Scotia. Infection in these has been spreading. The infection continued at Squid Cove, Lunenburg County and both the number of dead trees and the affected area increased over past years in a plantation of about 1 ha. In 1985, 23% of the trees were dead and an additional 60% of the trees had more than half of their crowns dead. No trees were found in the plantation with less than 25% crown mortality.

Stands in seriously deteriorating condition were observed in the Stanley Management Area, Hants County, in the Chignecto Game Sanctuary, Cumberland County, near Debert, Colchester County and in several plantations in the Rushy Lake, Yarmouth County area. A relatively new, about 2 years old, infection centre was found near Diligent River, Cumberland County. In eastern Nova Scotia, the disease intensified in a small plantation, first found infected in 1984, in the Perch Lake road area, Pictou County. This plantation is surrounded by numerous, healthy, red pine plantations and its destruction was recommended to prevent the spread of the disease.

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

In Prince Edward Island, the infection intensified in a small 33-year-old red pine plantation at Iona, Queens County, in 1985 and on some of the fringe trees up to 30% of the shoots were infected. The fungus also caused light shoot damage to one red pine tree at Goose River, Kings County.

The browning of larch shoots and branches was reported for the first time in 1983. The condition was much reduced in incidence in Nova Scotia in 1984 and was not found in Prince Edward Island. The cause of the condition has been identified as Sirococcus conigenus (S. strobilinus). No reports were received from any of the provinces in 1985. The locations where larch was found infected in past years is as follows:

New Brunswick
Bayfield, Westmorland Co. (1983)
Meredith, Charlotte Co. (1984)
Lepreau Falls, St. John Co. (1984)

Nova Scotia
Kennetcook, Hants Co. (1983)
Maple Grove, Hants Co. (1983)
Perch Lake, Pictou Co. (1983)
Garden of Eden Barrens, Pictou Co. (1984)
Aspen, Guysborough Co. (1984)
Upper Smithfield, Guysborough Co. (1984)

Prince Edward Island
Donagh, Queens Co. (1983)
Muddy Creek, Prince Co. (1983)
Montague, Kings Co. (1983)

A larch cone, collected at Loch Katrine, Annapolis County, Nova Scotia in 1985 was found infected by S. conigenus (S. strobilinus). The collection constitutes the first record of the fungus on cones of larch in the Maritimes.

ARMILLARIA ROOT ROT

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

The disease is widely distributed in the Region and mortality of trees, both young and old, was again common in 1985. In New Brunswick, Armillaria root rot killed at least some trees in 16% of the 70 black spruce and jack pine plantations surveyed and was found in many other areas including a Christmas tree plantation in York County and a larch seed orchard in Albert County. In Nova Scotia, a Christmas tree plantation was affected in Guysborough County and up to 36% of the dead trees had Armillaria root rot on 13 of 17 plots assessed in mature stands in eastern Nova Scotia. In Prince Edward Island the disease was found at three locations, also in mature stands in Kings County.

Plots in which the spread of the disease on different hosts under different conditions can be studied, are being established as suitable areas become available. There appear to be differences in the rate of spread of Armillaria in four black spruce plantations. The plantations are of different ages and established in areas of somewhat different former cover type (Table 2). It is too early to speculate whether the differences are the result of trees in the older plantations becoming less susceptible to infection, or to differences in the amount of inoculum present depending on the composition of the former forest stand, or differences in the species planted.

The infection rate appears to be lower in jack pine than in black spruce plantations of comparable age and while the infection rate in the older black spruce plantations has remained the same, there was considerable increase in mortality in the younger ones. More plots of various species and ages are needed for observation.

SEEDLING-DEBARKING WEEVIL

The seedling-debarking weevil, Hylobius congener D.T., has been suspected as the causal agent in the mortality of newly planted coniferous seedlings in central Nova Scotia for the last four years. Its association with the problem was first reported in 1984, when seedling mortality exceeded 85% in some plantations. The insect is present on the sites as early as harvest time and debarking of the stems of seedlings occurs throughout the summer and into the fall, resulting in increasing levels of mortality.

To date, damage by the seedling-debarking weevil was found at 3 of 8 locations in New Brunswick and at 20 of 24 locations in Nova Scotia. No surveys were conducted in Prince Edward Island. The highest level of damage in 1985 was recorded in a plantation in Pictou County, Nova Scotia where 77% of the seedlings were attacked, 70% were dead. In New Brunswick 16% of the seedlings were found damaged in a plantation in

Table 2. Armillaria root rot - spread of the disease in plantations

Species	Year planted	Year plot established	Former cover type	Percent mortality 1983	1984	1985
Black spruce	1973	1983	Softwood-Hardwood	4	4	4
Black spruce	1976	1983	Softwood	8	10	10
Black spruce	1978	1983	Softwood-Hardwood	8	12	20
Black spruce	1980	1983	Hardwood-Softwood	8	16	24
Black spruce	1980	1985	Softwood-Hardwood	-	--	2
Jack pine	1978	1984	Softwood-Hardwood	-	2	2
Jack pine	1978	1984	Softwood-Hardwood	-	2	2
Jack pine	1981	1984	Softwood-Hardwood	-	2	4

York County and mortality was 13%. The level of damage varied considerably among plantations as shown in Table 3.

Table 3. Frequency of seedling mortality by seedling-debarking weevil in 24 newly established plantations in Nova Scotia in 1985

Range of mortality (%)	Percent of plantations
none	38
1-5	21
6-10	21
11-20	13
20-	8

In addition to seedling mortality, for every 100 seedlings killed there is an average of 40 seedlings that were injured but survived to the end of the first season. The long-term effects of injury on these survivors are not known.

Preliminary results of studies, initiated in 1985, indicate that the problem is associated with such factors as time elapsed between harvesting and replanting, techniques of site preparation, the size of the area replanted, and silvicultural methods applied in surrounding areas. Research into these causes and the control of the seedling-debarking weevil are underway.

RUSTS ON CONES, NEEDLES AND LEAVES

Cones and needles of conifers are infected by a group of rust fungi. Cone rusts, because of their potential to interfere with seed production, are among those forest diseases that may have a direct impact on all aspects of forestry in both the short and long term. Needle rusts cause the infected

needles to fall off the tree prematurely and, when infection levels are high, damage occurs, such as reduced grade for Christmas trees, growth loss, or in case of repeated severe defoliation, death of young trees in plantations.

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

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

The various rusts encountered in 1985 are discussed by host tree species.

Coniferous hosts

On Balsam Fir Needle rusts found on balsam fir in 1985 include Melampsora abieti-capraraearum Tub.(alternate host: willow), Milesina sp. (alternate hosts: ferns), Pucciniastrum epilobii Otth (alternate host: fireweed), Pucciniastrum goeppertianum (Kuehn.) Kleb. (alternate host: blueberry) and Uredinopsis sp. (alternate hosts: ferns). They were present alone or in various combinations throughout the Region at scattered locations but infections were generally low and rarely exceeded 5% of the needles affected. The only rust of serious economic consequence on balsam fir, the yellow witches' broom, Melampsorella caryophyllacearum, Schroet., is discussed under Christmas tree pests.

On Hemlock Melampsora sp. (alternate host: willow or poplar) was found affecting a few needles in Halifax and Lunenburg counties, Nova Scotia. The same rust or possibly a closely related species was present on 10% of cones in Kejimkujik National Park in western Nova Scotia.

On Larch Melampsora medusae Thuem. (alternate host: poplar) infected about 10% of the needles on a few trees in Prince County, Prince Edward Island.

On Pine Coleosporium asterum (Diet.) Syd. (alternate host: goldenrod) occurred on both red pine and jack pine in 1985. On red pine the rust caused light infection in plantations scattered throughout the Region. On jack pine, it was reported widely and observed to be causing various levels of infection, moderate or severe in some areas. However, because in the field this species cannot be distinguished on jack pine, from C. viburni, reports are doubtful, unless they are supported by samples for laboratory identification, and the infection is considered to have been caused by a species of Coleosporium.

Coleosporium viburni Arth. on jack pine (alternate host: Viburnum sp., wild raisin, hobblebush, highbush cranberry etc.) has been by far the most important needle rust encountered in New Brunswick in recent years. Repeated severe infection and the needle drop that follows resulted in young plantation trees being sustained only by current foliage in a number of areas in the southern half of the Province. In 1985, the rust was again common. Infection levels, closely correlated to the abundance of the alternate host, and the distance of the trees from it, varied greatly among plantations. Younger, smaller trees were more seriously affected. As much as 80% of the older needles were infected in some plantations in southern Northumberland and central Sunbury counties.

In Nova Scotia, only light infection was observed in a jack pine plantation in Guysborough County.

On Spruce Chrysomyxa ledi d By. (alternate host: Labrador tea) was severe on black spruce trees in a 1-ha area in the Stanley Management Area, Hants County, Nova Scotia. Elsewhere, infection was only trace or light at a few widely separated areas in the Region on black spruce, red spruce, white spruce, and Colorado spruce. Chrysomyxa ledicola Lagerb. (alternate host: Labrador tea) was severe on black spruce trees in an area of about 1 ha west of Head of St. Margaret's Bay, Halifax County and east of Bass River, Colchester County, Nova Scotia. Elsewhere in the Province the rust was common on black spruce on the South Shore from Halifax to Shelburne, mostly in bogs where the alternate host abounds; infected blue spruce in an ornamental nursery in Antigonish; and was reported at low levels on black spruce, red spruce, and white spruce at a few scattered locations. In New Brunswick, trace infection occurred on black spruce in a seed orchard in Albert County where about 25% of the trees were affected. The rust was found elsewhere, also at low levels, on black spruce, red spruce, white spruce and blue spruce at scattered locations. In Prince Edward Island, a few black spruce trees were infected, at trace levels, at only one location in Queens County.

Pucciniastrum americanum (Farl.) Arth., the cone rust on white spruce (alternate host: raspberry), which caused severe infection throughout New Brunswick in 1984 was largely absent on cones in 1985. The rust was abundant on the alternate host, so the lack of infected cones was likely the result of the much reduced cone crop. Infected cones were found only at a few locations in New Brunswick and at MacKenzies Point in Cape Breton Highlands National Park, Inverness County, Nova Scotia, where 9% of the white spruce cones were infected. The fungus, which also infects needles, may have been found in a seed orchard in Albert County, New Brunswick. However, because of the developmental stage of the fungus, no positive identification was possible.

Results of a study on the effect of infection on seed quantity and quality indicate that while light infection had no apparent effect on either the total number of seeds per cone or the percentage of sound seed, moderately affected cones produced fewer seeds and fewer of these were sound than in healthy cones. When infection was heavy the seeds were totally destroyed. (This work was carried out in cooperation with Ron Smith of CFS-Maritimes and will be published as a Technical Note.)

Hardwood hosts

On Ash The ash rust, Puccinia sparganioides Ell. & Barth. (alternate host: cord grass (Spartina sp.) has been one of the most serious foliage problems on ash in many parts of western Nova Scotia for the past decade. Infection causes foliage discoloration and premature leaf fall, repeated attacks cause dieback and in some cases tree mortality. In 1985, the rust was present and discoloration severe in many locations in this part of the Province but was observed, at very low levels, in only one area in eastern Nova Scotia, in Inverness County. In New Brunswick, ash rust was found in a few areas of Westmorland and Kent counties and one tree was infected in a nursery at Canterbury, York County. In Prince Edward Island, trace discoloration was observed at one location in Prince County.

On Poplar Melampsora medusae Thuem. (alternate host: larch) caused various levels of foliage discoloration, at times severe, in areas of Halifax, Hants, Kings, Colchester, Pictou, Antigonish, and Inverness counties in Nova Scotia, near Weaver Siding, Northumberland County, New Brunswick, and a trace of discoloration in Queens County, Prince Edward Island.

GYPSY MOTH

After its reappearance in the Maritimes in 1981, the gypsy moth, Lymantria dispar (L.) gained further ground in 1985, and is now at least temporarily established in both New Brunswick and Nova Scotia.

Gypsy moth has been the most destructive insect of hardwoods and to a lesser degree of conifers in the northeastern United States, for decades. The status of the outbreak in Maine in the last few years has been a special concern to us because of its proximity to our Region.

The gypsy moth monitoring committee remained active in 1985, and again coordinated all surveys. This committee was formed after the discovery of gypsy moth in 1981, in an effort to utilize available manpower more efficiently in combating this latest threat to the forests of the Region. Organizations involved in surveys include the Forest Insect and Disease Survey of the Canadian Forestry Service, Parks Canada of the federal Department of Environment, the Plant Health and Inspection Branch of Agriculture Canada, New Brunswick Department of Forests, Mines and Energy, New Brunswick Department of Agriculture, Nova Scotia Department of Lands and Forests, Nova Scotia Department of Agriculture, and Prince Edward Island Department of Energy and Forestry. Also, many volunteers, campground operators, small woodlot owners, biology teachers, students, and other interested private citizens assisted in the pheromone trapping program.

In 1985, early season egg-mass surveys, larval surveys, adult trapping program, and late-fall egg-mass surveys were conducted to determine the current status of the insect in the Region.

The adult male trapping program is aimed at defining areas where searching for egg masses should be concentrated. As a result of studies since 1980, the trap placement design was changed in 1983 to eliminate, or at least to minimize, interference from large numbers of male moths (females are flightless) brought into the Region by weather fronts from infested areas in the United States. Information was obtained from 1964 traps, 945 in New Brunswick, 824 in Nova Scotia, and 195 in Prince Edward Island. Better understanding by cooperators of the value of negative results greatly aided the planning of the fall egg-mass surveys.

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

In New Brunswick, gypsy moth was found at 11 locations in southwestern Charlotte County and, contiguous to this area, at Forest City and at St. Croix in the extreme southwestern part of York County. There are now 21 locations in this part of the Province where some life stages of the insect have been found since 1981 and this area must be considered infested. Generally, the population levels were low and the insect (larvae, pupae, egg masses) was found only as a result of diligent searching. However, in excess of 70 egg masses were found on one oak tree in St. Stephen and were it not for the timely application of control measures serious defoliation could have resulted. Elsewhere in the Province, the low level infestation continued in Fredericton and one larva was found near Peel, Carleton County. This latter location represents a considerable extension in range. However, the significance of the find is undetermined as no egg masses were recovered during fall surveys.

In Nova Scotia, gypsy moth has been found at at least one location in eight of the nine counties in the western half of the Province. To date, the insect has not been found in Queens County or anywhere east of the Windsor-Dartmouth line. Most of the infested areas were in the Annapolis Valley. The highest populations in 1985 occurred at New Minas, Kings County where in excess of 100 egg masses were counted on one apple tree in the late summer and in the town of Shelburne where larvae, and later egg masses, were numerous.

In Prince Edward Island, the gypsy moth is not known to occur to date.

The results of gypsy moth surveys, other than adult trapping programs, conducted from 1981 to 1985 are summarized in Tables 4 and 5 and in Fig. 5. In

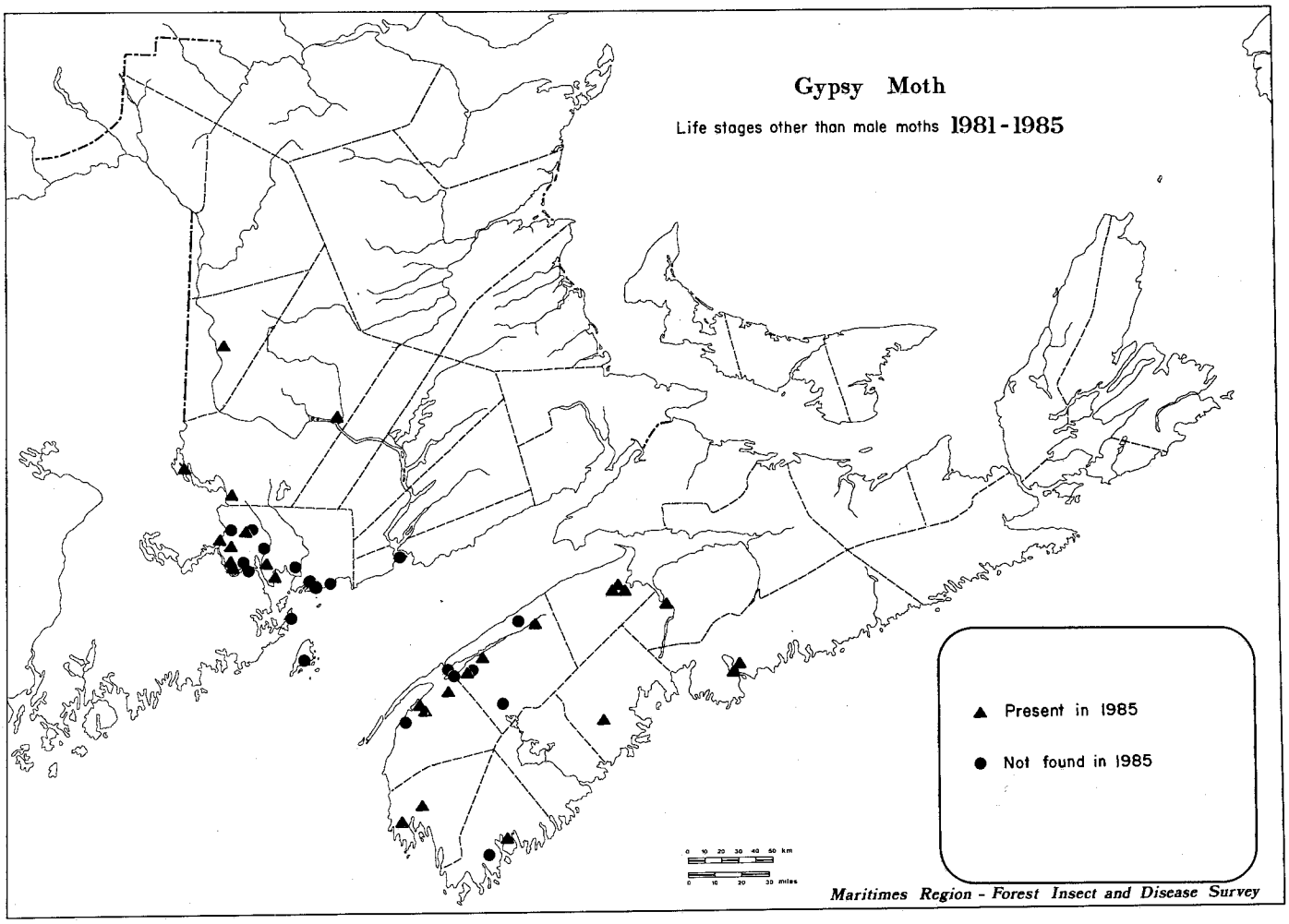


Figure 5.

New Brunswick most of the gypsy moth locations are in forested areas, away from habitation and are concentrated in a small section of the Province adjacent to an area of the United States where the insect is known to be present. In Nova Scotia, almost all of the infested spots are in inhabited areas with considerable movement of people. This suggests that while in New Brunswick the presence of gypsy moth, in most places, may be the result of natural spread, in Nova Scotia the insect was likely imported by tourists or residents travelling in gypsy moth infested areas.

Control operations against the gypsy moth in 1985 were localized and sporadic and no reliable information is available. Several communities became involved in public awareness programs emphasizing citizen participation in combatting this newly arrived pest.

Table 4. Summary of the results of detection surveys for gypsy moth in New Brunswick, 1981 - 1985

County	Location	U.T.M. Grid[1]	Gypsy moth life stage[2]														
			1981			1982			1983			1984			1985		
			L	P	E	L	P	E	L	P	E	L	P	E	L	P	E
Carleton	Peel	19-61 -513													x		
Charlotte	Mohannes	19-62(7)-500(2)			x	x	x	x	x	x		x	x	x			x
	N.W. of Oak Hill (Canoose Rd)	19-62(9)-502(3)									x	x					
	Oak Hill	19-63(1)-502(2)				x			x			x				x	
	Upper Mills	19-63(2)-500(0)							x								
	Lynnfield	19-63(3)-502(7)				x											
	St. Stephen	19-63(7)-500(4)							x		x	x	x	x	x		x
	Oak Bay area	19-64(0)-501(1)							x								
	St. Andrews	19-65(4)-499(3)							x	x	x	x	x	x		x	
	Didgequash	19-66(2)-500(2)				x											
	St. George	19-67(2)-499(9)					x		x	x	x	x					
	Beaver Harbour	19-67(7)-499(4)			x				x								
	Pennfield	19-68(9)-499(4)			x												
	Campobello Island	19-66(0)-497(2)					x										
	Grand Manan Island	19-67(3)-494(9)			x												
	Burnt Hill	19-63(0)-500(4)												x			
	Old Ridge	19-63(5)-500(9)													x		
	Bayside	19-64 -500														x	
	Little Ridge	19-62 -500															x
	Grand Falls Dam	19-61 -501															x
	Basswood Ridge	19-62 -501															x
St. John	Saint John	19-72(9)-501(5)					x										
York	Forest City	19-59(9)-505(8)															x
	Fredericton	19-68(3)-509(3)									x	x	x	x			x
	St. Croix	19-62(3)-504(6)															x

[1]U.T.M. = Universal Transverse Mercator System; [2]L = larva; P = pupa; E = egg mass

Table 5. Summary of the results of detection surveys for gypsy moth in Nova Scotia, 1981 - 1985

County	Location	U.T.M. Grid[1]	Gypsy moth life stage[2]													
			1981			1982			1983			1984			1985		
			L	P	E	L	P	E	L	P	E	L	P	E	L	P	E
Yarmouth	Yarmouth	20-24(9)-485(8)			x			x		x						x	
	Tusket	20-26(2)-486(0)									x		x	x		x	x
Digby	Grosses Coques	20-25(3)-491(6)					x	x	x								
	Digby	20-28(2)-494(4)									x						
	Smiths Cove	20-28(4)-494(3)					x	x									
	Weymouth	20-26(2)-492(2)											x	x	x	x	x
	Weymouth Falls & Tusket Road	20-26(5)-492(1)															x
	Bear River	20-28(9)-493(8)														x	
Annapolis	Clementsport	20-29(4)-494(8)					x	x						x			
	Paradise	20-32(6)-497(2)						x	x								
	Kejimkujik Nat. Park	20-31(9)-492(5)							x	x							
	Middleton	20-33(6)-497(2)										x					x
	Cornwallis	20-29(1)-494(8)														x	x
	Annapolis Royal	20-30(1)-495(7)															x
Kings	New Minas	20-38(6)-499(2)							x	x	x	x	x	x	x	x	x
	Port Williams	20-38(9)-499(4)															x
Halifax	Halifax	20-45(5)-494(3)							x		x	x		x		x	x
	Dartmouth	20-45(6)-494(6)												x		x	
Shelburne	Shelburne	20-31(4)-484(8)									x			x	x		x
	Clyde River	20-30(0)-483(4)									x						
Lunenburg	Bridgewater	20-37(8)-491(5)															x
Hants	Windsor	20-41(0)-498(2)															x

[1]U.T.M. = Universal Transverse Mercator System; [2]L = larva; P = pupa; E = egg mass

FOREST TENT CATERPILLAR

The Forest Tent Caterpillar, Malacosoma disstria Hbn., the major defoliator of hardwoods in the Maritimes since the late 1970s has been on the decline in the past few years. In 1985, the outbreak ended in New Brunswick and Prince Edward Island and the area of moderate or severe defoliation was drastically reduced in Nova Scotia (Table 6).

Table 6. Forest tent caterpillar outbreaks in the Maritimes Region (1978 - 1985)

Year	Area of severe/moderate defoliation (ha)		
	N.B.	N.S.	P.E.I.
1978	few small patches	-----	5 000
1979	37 000	-----	5 000
1980	177 000	trace	3 100
1981	775 000	small patches	13 800
1982	1 389 000	4 700	18 800
1983	1 119 000	35 000	67 000
1984	94 400	46 400	37 400
1985	-- ---	patches	-- ---

The insect feeds on a wide variety of hardwood trees with preference for trembling aspen, oak, apple, birch, and cherry. When populations are high and larvae migrate in search of food, other tree species such as sugar maple, ash, alder, elm, and ground vegetation are also readily defoliated. Feeding also occurs on some conifers, notably larch and white spruce.

In New Brunswick, no noticeable defoliation occurred in 1985 for the first time since 1978 - a total collapse.

The outbreak has been shifting to the southeast since it first started in the Woodstock, Carleton County, area in 1979. There has been a build-up of disease, parasites, and predators such as the Sarcophaga flesh fly; there was mass starvation of larvae at the height of the outbreak at many locations which resulted in fewer egg masses laid. All are factors in weakening the forest tent caterpillar population. Also, there were two consecutive years when the early summer was cool and precipitation was much above normal. A weakened forest tent caterpillar population combined with weather conditions unfavorable to its survival hastened the collapse of the New Brunswick outbreak.

In Nova Scotia, a total of 21 600 ha of defoliation occurred which was mostly light, with patches of moderate or severe defoliation in parts of Hants, Kings, and Annapolis counties (Fig. 6).

In Prince Edward Island, the outbreak which persisted in Prince County since 1973 collapsed in 1985.

Fall egg mass surveys and the results of the pheromone trapping program conducted during the moth flight period in the summer of 1985 both indicate that forest tent caterpillar populations will be generally low in 1986.

Repeated severe defoliation results in twig and branch dieback and may result in the death of trees. In 1985, a survey was conducted to assess the condition of trembling aspen in the Region in the aftermath of the current outbreak. A total of 1225 trees was assessed at 49 locations in New Brunswick, 750 trees at 30 locations in Nova Scotia, and 325 trees at 13 locations in Prince Edward Island. The results, shown in Table 7 and summarized in Fig. 7, show that less than 60% of the trembling aspen was classified as healthy in any of the three provinces and that stands with the highest degree of deterioration were generally in areas with the greatest number of successive years of severe defoliation by the forest tent caterpillar or other insects. The survey also showed that in most areas tree mortality was associated with Hypoxylon canker (Hypoxylon mammatum).

Table 7. Condition assessment survey for trembling aspen in the Maritime Provinces - 1985

Province and County	No. of plots assessed	No. of trees assessed	Percentage of trees			
			Healthy	Stressed but without dieback	Dieback present	Dead
New Brunswick						
Albert	1	25	--	24	72	4
Carleton	3	75	85	--	9	5
Charlotte	2	50	80	4	12	4
Gloucester	4	100	23	16	57	4
Kent	9	225	72	2	24	3
Kings	3	75	--	31	65	4
Madawaska	1	25	92	--	--	8
Northumberland	4	100	--	13	78	9
Queens	2	50	48	8	42	2
Restigouche	4	100	85	--	12	3
Saint John	1	25	100	--	--	-
Sunbury	3	75	81	1	13	4
Victoria	4	100	80	--	14	6
Westmorland	3	75	--	1	83	16
York	5	125	93	--	6	1
Total-N.B.	**49**	**1225**	**57**	**6**	**32**	**5**
Nova Scotia						
Annapolis	4	100	56	--	40	4
Antigonish	2	50	54	22	20	4
Colchester	3	75	80	7	12	1
Cumberland	4	100	74	--	25	1
Halifax	2	50	66	--	32	2
Hants	7	175	44	3	51	2
Kings	2	50	30	--	64	6
Pictou	5	125	59	5	26	10
Victoria	1	25	80	--	20	--
Total-N.S.	**30**	**750**	**58**	**4**	**34**	**4**
Prince Edward Island						
Kings	1	25	96	4	--	--
Prince	10	250	40	1	46	13
Queens	2	50	90	2	8	--
Total-P.E.I.	**13**	**325**	**52**	**1**	**37**	**10**

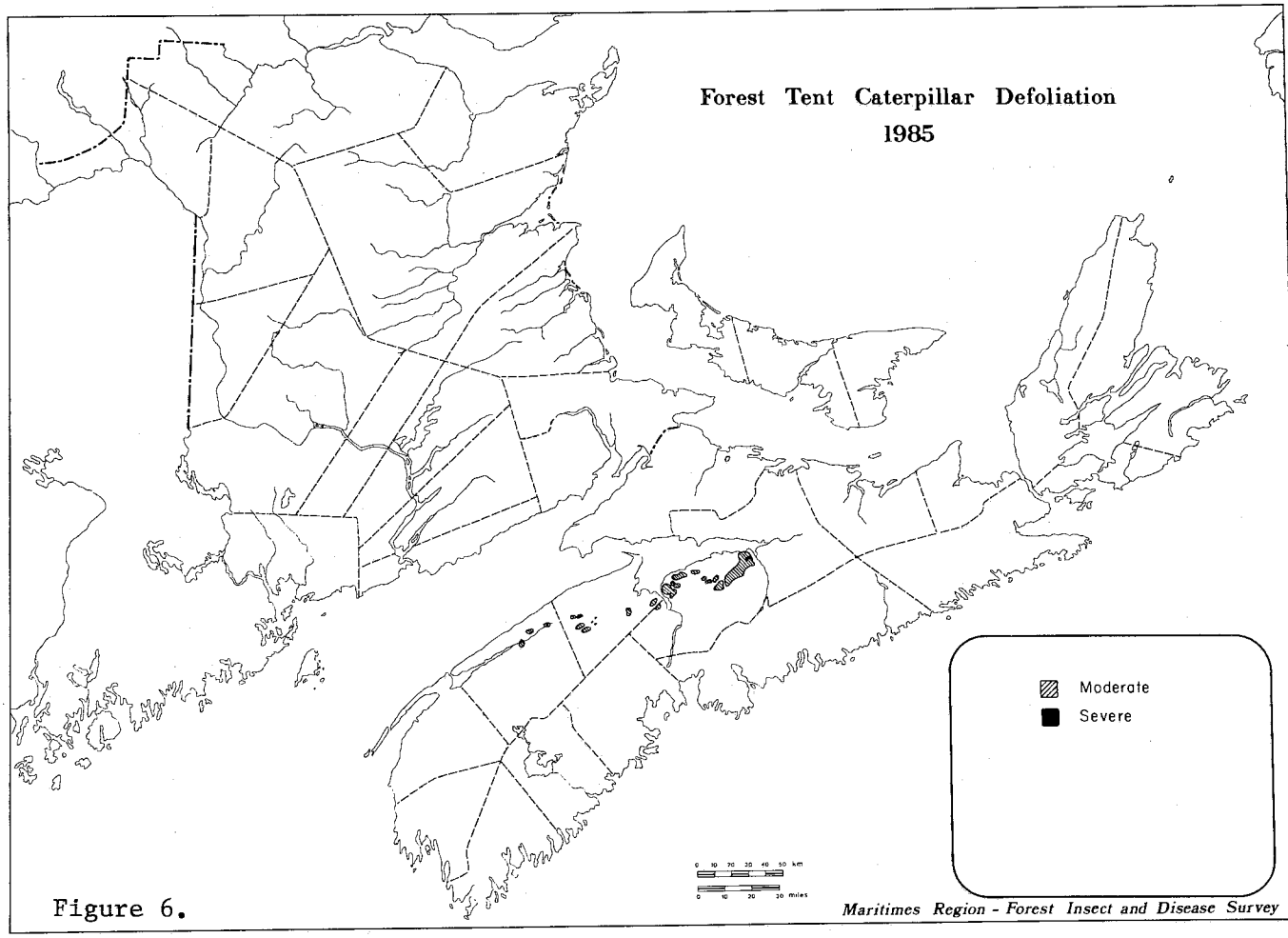


Figure 6.

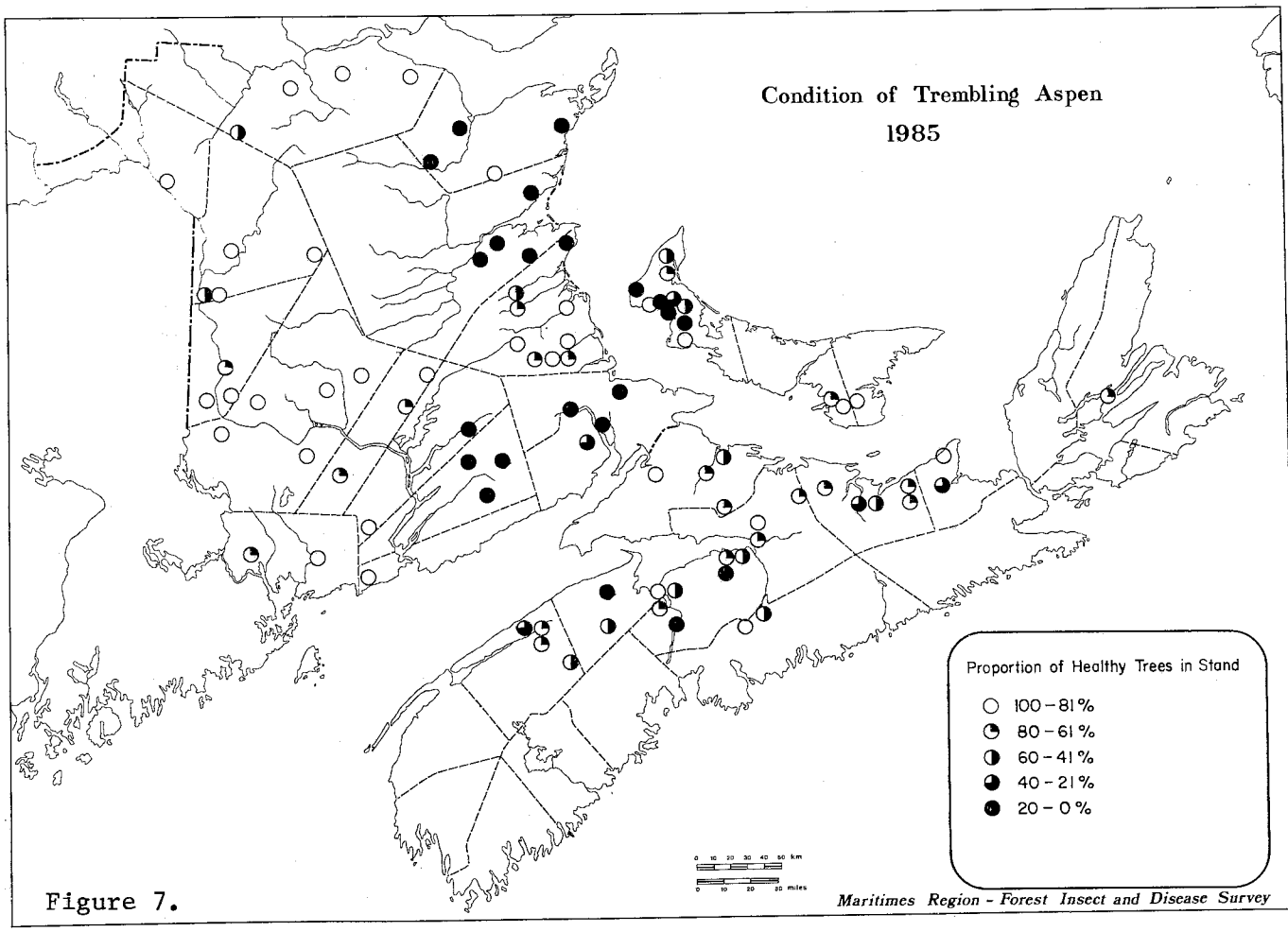


Figure 7.

OTHER HARDWOOD DEFOLIATORS

In addition to the forest tent caterpillar and the gypsy moth many other hardwood insects were active in 1985. Most are included in the Table because they occur only in localized areas. However, a few of the more prevalent species are discussed here in some detail. Hardwood defoliators may be specific to given hosts or feed on a variety of tree species. Several different insects may attack the same trees at a specific location, and often it is difficult and impractical to allocate portions of the total defoliation to the various foliage feeders.

Fall Cankerworm, Alsophila pometaria (Harr.) was the most widely reported insect of hardwoods in the Region for the third consecutive year, in 1985. It occurred throughout the Maritimes, with the exception of Cape Breton Island, alone or in combination with other defoliators. A great variety of hardwood species was affected both in forest stands and in populated areas but Manitoba maple was particularly hard hit, wherever it was present.

In 1985, fall cankerworm, at some locations mixed with winter moth, caused severe or moderate defoliation of maple and oak over approximately 15 300 ha in patches in central and western Nova Scotia. In Prince Edward Island, severe defoliation of yellow birch and red maple occurred over about 100 ha near Newton Cross, Queens County, and light defoliation of ornamental trees was observed at other scattered locations in Prince and Queens counties. In New Brunswick, fall cankerworm was widely distributed both in natural stands and on ornamental trees and caused various levels of defoliation to a variety of tree species.

Winter Moth, Operophtera brumata (L.) occurred mostly mixed with the fall cankerworm in Nova Scotia in 1985. The insect is known to occur only in a small section of southeastern New Brunswick but in 1985 it was not observed in this area or in Prince Edward Island.

Lesser Maple Spanworm, Itame pustularia Gn., is a defoliator of red maple. This insect in combination with other foliage feeders and the maple leafroller caused considerable crown dieback and some tree mortality in parts of Northumberland County, New Brunswick during the 1972-1975 infestation. After seven years of very low populations, the insect was found widespread in New Brunswick in 1983 but caused only a trace of defoliation (up to 5%). Population levels further increased in 1984, especially in the eastern part of the Province, and light defoliation (6-19%) occurred at many locations.

In 1985, moderate defoliation occurred in parts of Kent and Queens counties and defoliation was light in areas of Gloucester, Northumberland, Westmorland, and Albert counties. In some stands, this insect was found in combination with fall cankerworm. Surveys at 7 locations showed an average of 27% of the leaves damaged. Light trap records indicate that the population peaked in 1984 and a downward trend is apparent as illustrated by catches at the Ashton Hill trap in Northumberland County:

1978 -	27
1979 -	44
1980 -	157
1981 -	723
1982 -	1009
1983 -	9926
1984 -	32597
1985 -	782

Lesser maple spanworm populations remained low in Nova Scotia in 1985 and the insect was not found in Prince Edward Island.

Oak Leaf Shredder, Croesia semipurpurana (Kft.) and the Oak Leafroller, Pseudexentera cressoniana (Clem.), have been defoliating oak since the early 1970s and have been the most serious pests of oak in the Maritimes. As a result of repeated defoliation, oak trees in many areas are suffering from various degrees of twig, branch, and crown dieback. Populations started declining in 1983, the decline continued in 1984 but the insect still caused various amounts of defoliation of oak in 1985 throughout the Region.

In New Brunswick, defoliation, caused mainly by the oak leaf shredder, occurred in Kings, Queens, and York counties at various levels of intensity which at some places were severe. While twig and branch mortality is common on oak, as the result of repeated attacks, with the decline of the insect population, tree crowns were fuller in many places and the leaves covered some of the previous damage.

In Nova Scotia, the oak leafroller and, to a much lesser extent, the oak leaf shredder caused light leaf damage in oak stands throughout the western half of the Province with moderate or severe damage occurring in parts of Kings, Annapolis, Queens, Shelburne, and Lunenburg counties. Tree deterioration continued in many areas with twig, branch, and crown dieback evident in numerous stands.

In Prince Edward Island, 90% of the leaves were destroyed on a few red oak trees at Milford Station, Queens County, mostly by the oak leafroller.

Bruce Spanworm, Operophtera bruceata (Hulst) has existed at generally low population levels in the Maritimes since 1976 when the last outbreak collapsed in Nova Scotia. There was a slight population increase in northwestern New Brunswick in 1982 and 1983. In 1984, the insect was present throughout New Brunswick in a variety of hardwood trees but generally at very low populations. Defoliation was usually less than 5% and was observed at higher amounts only at a few locations.

In 1985, Bruce spanworm was again widespread in New Brunswick, often mixed with fall cankerworm and lesser maple spanworm. The heaviest defoliation occurred in the area from Bay du Vin, Northumberland County to Richibucto, Kent County and Shediac, Westmorland County, where red maple, trembling aspen, and white birch sustained moderate defoliation.

In Nova Scotia, light defoliation of sugar maple occurred at McIver Brook, Pictou County. The insect was not found in Prince Edward Island.

Spring Cankerworm, Paleacrita vernata (Peck), has been found in an area in Kings County, Nova Scotia since the early 1980s, feeding mostly on elm. In 1985, the insect in combination with fall cankerworm and possibly with winter moth caused light and moderate defoliation of a variety of ornamental trees in Windsor, McKays Section, and Hantsport, Hants County, at Kentville and near Kingston, Kings County and at Middleton, Annapolis County in the northern part of western Nova Scotia. Spring cankerworm was not observed elsewhere in the Region.

CASEBEARERS, LEAFMINERS AND SKELETONIZERS

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

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

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

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

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

In 1985, in New Brunswick, birch casebearer damage occurred at many locations, at various levels of intensity, on white birch, wire birch, and alder. It was most common and severe from Tabusintac, Northumberland County to Pokemouche, Gloucester County; from Black River to Bay du Vin in Northumberland County; and in southeastern Kings County. Foliage browning was moderate or severe in patches from Richibucto, Kent County to Shediac, Aboujagane, and Memramcook in eastern Westmorland County. Discoloration of white birch and alder was also common but patchy in some areas of Charlotte and York counties. In Nova Scotia, moderate and severe discoloration of alder occurred in the Argyle area of Yarmouth County; of birch in northcentral Cumberland County, along Route 7 from South Lochaber to Sherbrooke and from Glenelg to Caledonia in Guysborough County; in a few areas of Halifax County; and in patches on Cape Breton Island. Light leaf browning occurred elsewhere in the Province. In Prince Edward Island, moderate or severe leaf browning occurred in pockets throughout the Province. Chronic attacks by the birch casebearer resulted in mortality of alder bushes in at least seven areas in Prince County.

Fall sampling indicates high populations for many areas of New Brunswick in 1986 while in Nova Scotia and Prince Edward Island populations should be generally lower although moderate leaf browning may occur in some areas.

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

In 1985, the birch leafminer was again common throughout the Region and caused moderate or severe browning, mostly on wire birch, at numerous locations.

Birch Skeletonizer, Bucculatrix canadensisella Cham., outbreaks occur periodically in the Maritimes. The last outbreak reported in 1977, covered extensive areas in Nova Scotia and eastern Prince Edward Island. White birch is mainly affected, although other species of birch are also subject to attack.

In 1985, skeletonizing and the resulting discoloration was moderate or severe in parts of Kings, Albert, and Westmorland counties, New Brunswick; in Inverness, Victoria, and Cape Breton counties, Nova Scotia; and on a few trees at Iona, Queens County, Prince Edward Island. Light foliage discoloration was observed in parts of York, Northumberland, Kent, and Westmorland counties, New Brunswick.

On Larch Larch Casebearer, Coleophora laricella (Hbn.), is an introduced species, considered by some to be second in importance to the larch sawfly as a foliage feeder of larch. The insect is usually present but widespread, persistent outbreaks have not occurred in recent years. Populations are regulated by natural control factors including the introduced parasites Chrysocharis laricinellae (Ratz.) and Agathis pumila (Ratz.) and by certain weather conditions. In the past, populations were high in 1943, 1952, and 1959. In 1984, needle discoloration was light or moderate at locations scattered throughout mainland Nova Scotia and in Inverness County on Cape Breton Island, with populations low in New Brunswick and Prince Edward Island.

In 1985, in Nova Scotia, defoliation was moderate or severe in patches in northern Halifax, eastern Hants, southeastern Colchester, and central Lunenburg counties, with light to moderate discoloration elsewhere in the western half of the Province in most areas where larch is present. Various amounts of discoloration occurred in scattered areas throughout eastern Nova Scotia, including Cape Breton Island. In New Brunswick, populations were generally low and only trace or light browning occurred in scattered patches in Westmorland, Queens, York, Northumberland, and Gloucester counties. In Prince Edward Island, populations were also generally low with a few small pockets of moderate or severe browning in Kings and Queens counties.

Widespread needle browning at various levels of intensity is predicted for much of Nova Scotia in 1986, while generally low populations are expected for New Brunswick and Prince Edward Island.

On Poplar Poplar Serpentine Leafminer, Phyllocnistis populiella Cham., an insect, found throughout Canada, mostly on trembling aspen, has a habit of travelling inside the leaf in a wandering fashion, taking sharp turns then doubling back, hence its name. Affected leaves take on a silverish-grey hue and when populations are high the affected stand has a silvery appearance. The insect has been common in northern New Brunwick for several years. In 1985, leaf mining at 26 locations in the Province ranged from 0 to 88% of the trembling aspen leaves affected (averaged 26%). Populations were low in Nova Scotia and Prince Edward Island and discoloration was only trace to light.

DUTCH ELM DISEASE

Dutch elm disease, caused by the fungus Ceratocystis ulmi (Buism.) C. Moreau, was a major concern in all three Maritime provinces in 1985 (Fig. 8).

In New Brunswick, where the disease is present wherever elm trees are found, the resurgence of infection, reported in 1984 continued. Numerous infected and dying trees, both residual old trees and young saplings, were observed throughout the Province in 1985.

In Nova Scotia, there were 19 locations where Dutch elm disease was found for the first time in 1985, although many of these were within previously infected areas. Significant extension occurred in the range of the disease on Cape Breton Island and there was considerable "filling in" on the mainland. The intensification of the disease within outbreak areas where no sanitation is practiced was evidenced by the presence of numerous newly infected trees. On the permanent assessment plot near Newport, Hants County where 11% of the trees became infected between 1980 and 1982, the infection rate increased to 55% in 1983, to 69% in 1984, and reached 74% in 1985. This pattern agrees closely with that found in other parts of the Maritimes and indicates that most elm trees will become infected within a few years in this area.

In Prince Edward Island, an infected elm tree was found near Portage, Prince County in 1985, in essentially the same, and only, area where the disease occurred previously. The infected tree was removed and destroyed. The disease was first discovered in the Province in 1979. This discovery was followed by an immediate, vigorous sanitation cut by the provincial government. No infected trees were found in 1980 and 1981, one infected tree was identified and removed in 1982, and there were none found in 1983 or 1984.

In Fredericton, the progress of Dutch elm disease and the effect of the control program have been monitored since 1961 when the disease was first found in the City. The 41 trees killed by the disease in 1985 represented 1.2% of the current elm population within the Dutch Elm Disease Management Area. This loss is well in line with the rate of reduction since 1980 when it peaked at 7.8% followed by 5.3% in 1981, 3.0% in 1982, 2.4% in 1983, and 1.1% in 1984. Losses to date amount to 27.8% of the original urban elm stand.

No systematic survey was conducted by the Forest Insect and Disease Survey in 1985 for elm bark beetles, the carriers of Dutch elm disease, except in

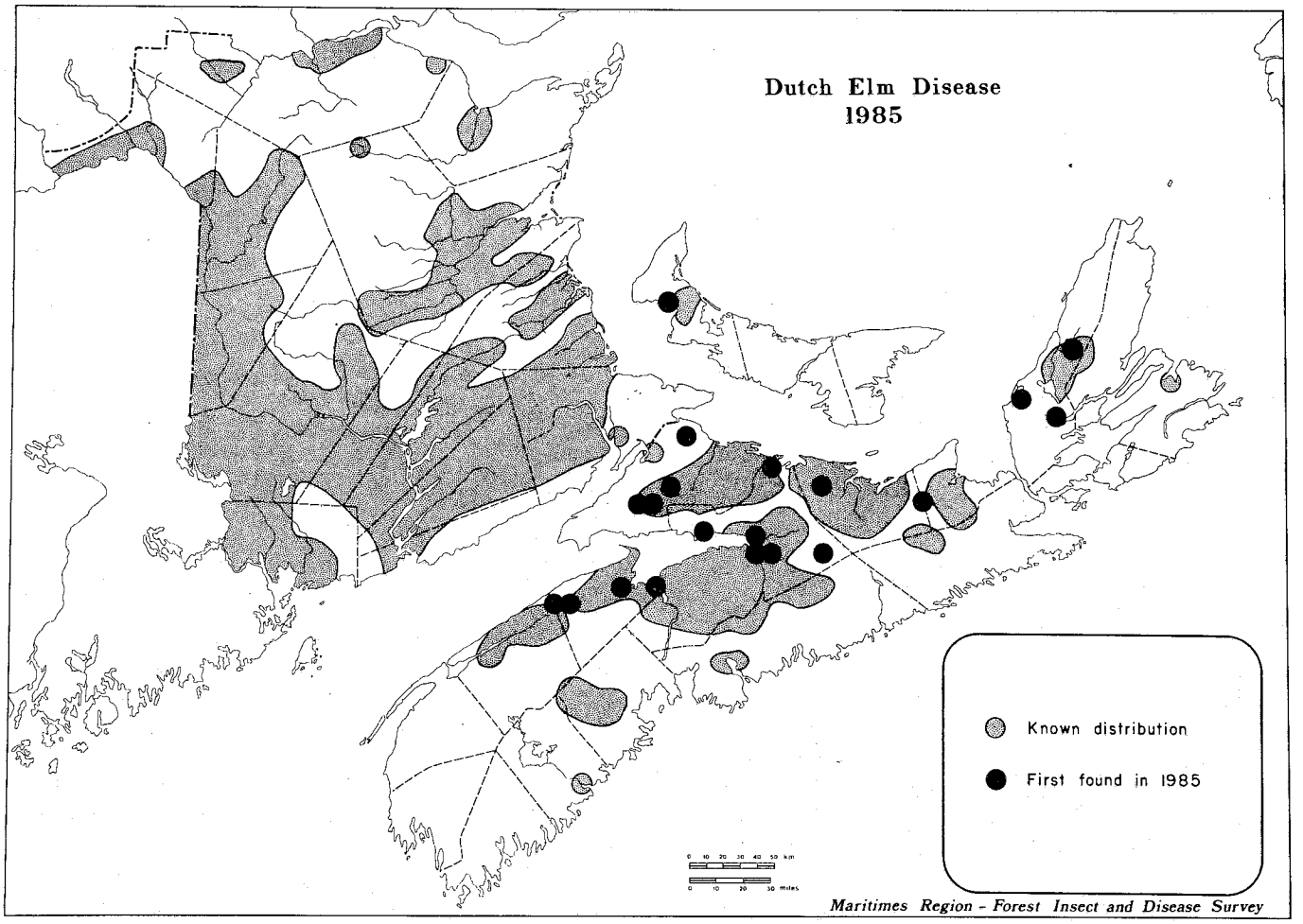


Figure 8.

Fredericton, where populations of the native elm bark beetle, Hylurgopinus rufipes (Eichh.) remained low.

DETERIORATION OF WHITE BIRCH ALONG THE BAY OF FUNDY

Since 1979, early leaf browning and premature leaf drop of white birch occurred annually in southern New Brunswick and, in some years, in Nova Scotia in western Cumberland County along the Bay of Fundy. Browning, severe every year with the exception of 1982, develops quickly and is characterized by chocolate-brown discoloration and a scorch-like appearance, which at times is restricted to leaf margins. The affected leaves curl and start dropping as early as mid-August. It was observed that some leaves that developed in the latter part of the season remained green while older leaves on the same twig turned brown. Although mainly a condition of white birch, similar symptoms were observed on other deciduous vegetation including alder, mountain ash, and mountain maple, in 1980 and 1981. The condition occurs along a coastal strip from 1 to 15 km wide and extends inland as far as 30 km, mainly along low lying areas.

In 1985, the condition was present again in essentially the same areas as in previous years (Fig. 9). Detailed weekly observations on the mainland in southern New Brunswick revealed that

1. The first evidence of leaf spotting on white birch was present at locations from Pennfield, Charlotte

County to Martin Head, St. John County by June 27.

2. Foliage discoloration was conspicuous throughout the area by August 5 and unexplained leaf discoloration occurred, in addition to that on white birch, on alder, largetooth aspen, trembling aspen and some ground vegetation at a few locations.

3. The condition was somewhat less intense and more patchy than in 1984. The unusual aspect of our observations was the presence this year of individual or groups of white birch trees that remained green within severely discolored areas.

4. Twig, branch, and tree mortality of white birch were commonly observed in the affected areas.

5. Foliage insects and diseases of birch were present throughout the area, the most common by far the leaf spot fungus Septoria betulina. July 15 was the first date on which this fungus was found fruiting at locations near the city of Saint John.

In general, light browning started near Chamcook, northwest of St. Andrews, Charlotte County and increased in intensity to the east, towards Saint John. East of the city, entire hillsides were brown near the coast between Fairfield and St. Martins and beyond to near the Westmorland County line. By late August, many trees had thin tops from premature leaf drop.

White birch foliage browning also occurred on the three islands (Campobello, Deer, Grand Manan) and at the 'tip of the Fundy funnel' in both New Brunswick and Nova Scotia.

White birch is in poor condition in some of this area. The foliage is thin even before the early browning appears, crown dieback with dead twigs and branches is evident, and many trees are dead. The cause of foliage discoloration and deterioration of white birch remains unknown. Several organisms are associated with this condition but none of them, alone or in combination, satisfactorily explains the situation.

The Leaf Spot Fungus, Septoria betulina has been consistently present on the affected trees and in 1982, when the condition was least severe, accounted for much of the leaf browning. This fungus is known to have caused severe browning elsewhere in the past but not on such a large scale and not for such an extended period of time. Its association with the condition is an inescapable fact. However, where the fungus is present on white birch in other parts of the Maritimes, the symptom expression is different from that found along the Bay of Fundy. Further, S. betulina does not account for the leaf browning observed on other vegetation.

Bronze Birch Borer, Agrilus anxius Gory, has been active in the area and was implicated in the death of many trees. The insect attacks weakened trees only and therefore cannot be considered a primary factor. However, the preponderance of infested locations in a band roughly parallel to the Bay of Fundy serves as an indication of where in the Maritimes white birch is in the worst condition.

Birch Ambrosia Beetle, Trypodendron betulae Sw., another insect normally considered secondary has a wider distribution than the bronze birch borer but the pattern of occurrence is essentially the same for both insects. Another indicator of unhealthy white birch.

Birch Scale, Xylococculus betulae (Perg.) was found infesting 21% of the still living trees on 11 plots examined in southern New Brunswick in 1985 (range 0-67%). This compares with an average of 95% on the same trees in 1984 and 34% in 1983. The impact the insect may have on the trees is unknown as is the reason for the great fluctuation in population levels (it is not a sampling problem).

The Mite species Acaphylla distata Keifer was found at high populations on white birch foliage at Martin Head, St. John County, N.B., towards the eastern edge of the severely affected area in 1985. While this organism is not normally considered a serious pest, high populations can cause bronze-brown

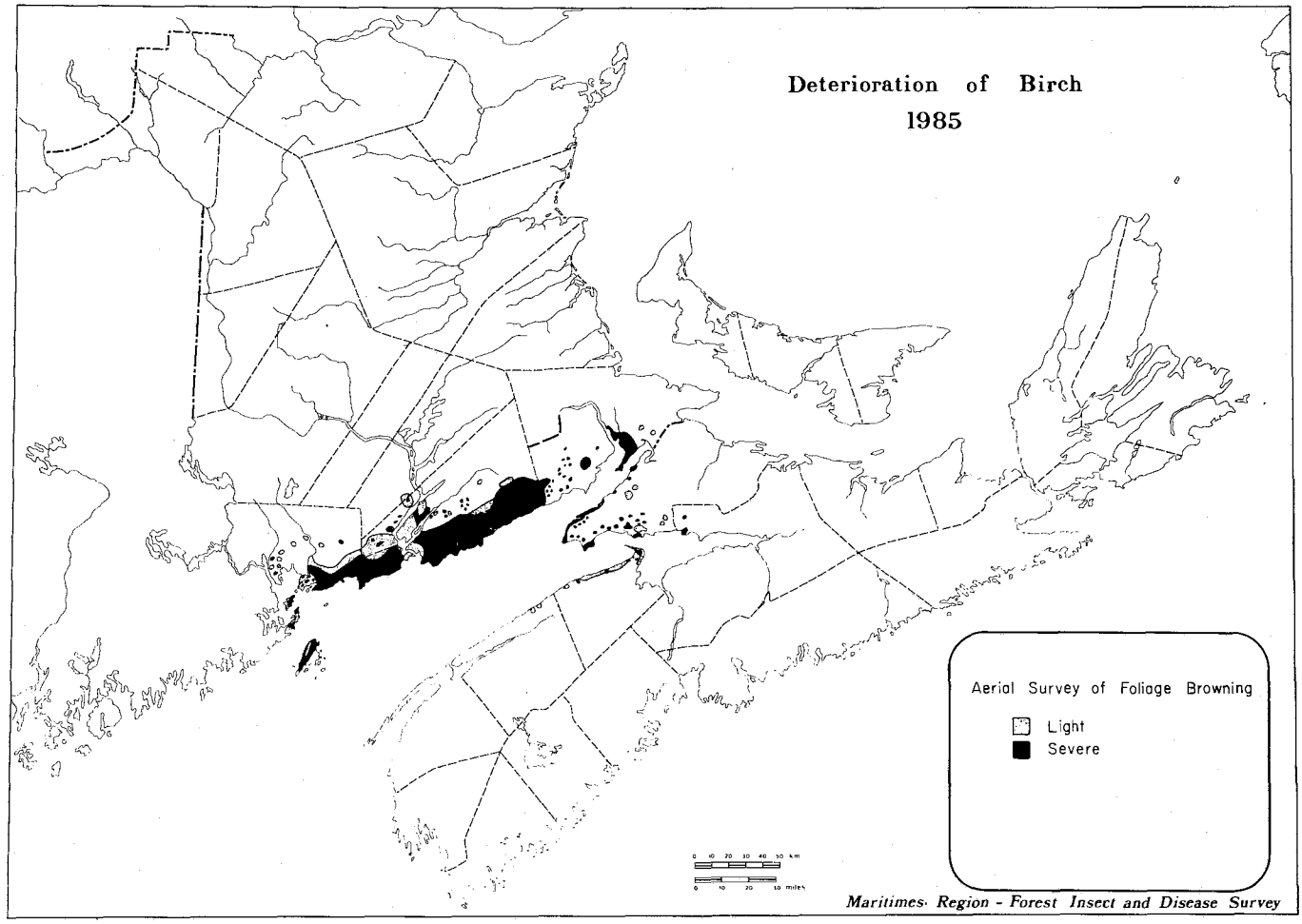


Figure 9.

discoloration and premature leaf drying. The problem usually occurs only in localized areas. Eriophyid mites, of which this species is a member, are known to thrive on hosts stressed by other factors.

Other Factors must act as predisposing agents since the organisms mentioned only provide proof that white birch is in a weakened condition.

Abiotic factors such as drought, past and present logging operations, road salting along highways and in urban areas, ocean salt spray in coastal regions including the 1976 "ground hog day storm", global climatic changes, and increased emissions from automobiles and from industrial sources, both near and far, have all been advanced as possible explanations for forest damage. Some of these do not apply to the Bay of Fundy area. Others and some additional factors may apply but proving those interactions is beyond the current mandate and capabilities of the Forest Insect and Disease Survey.

We do not often engage in speculation in our annual report on forest pest conditions. However, because concerns have been expressed regarding this condition of "unknown cause" which occurs repeatedly in the same area and because it is damaging a part of the forest (definitely a Forest Insect and Disease Survey mandate), we offer the following for consideration:

1. The area affected is one of two in the Region with high emissions of SO_2.

2. The area closely coincides with the 30 kg/ha per year wet acid sulphate deposition zone (1981 CANSAP data)

which at that level is the highest concentration and the only area so affected in the Maritimes.

3. Circumstantial evidence indicates that gypsy moth males are carried into the Maritimes by storm fronts from outbreak areas in industrial United States. In 1981, the area of leaf browning was similar to the area of the highest incidence of in-blown gypsy moth adults. Storms are also implicated in the long-range transportation of industrial impurities.

4. The affected area roughly coincides with that of the well known "Fundy fog".

5. Air pollutants were ruled out as the cause of leaf discoloration, based on foliage and soil sample analysis in 1982 - which was the year of least severity.

In addition to the Bay of Fundy area, early discoloration of white birch also occurred elsewhere. The main difference in symptom expression was the lack of scorching and leaf curling in most other areas. Yellowing was observed at numerous locations in New Brunswick, in an area of northeastern Halifax County and in two areas on Cape Breton Island in Nova Scotia. Yellowing often occurred on smaller roadside trees and was not always associated with the Septoria leaf spot. In Mt. Carleton Provincial Park, Northumberland County, New Brunswick only younger trees were affected near the base of the mountain but at higher elevations older, larger white birch trees also had yellowing foliage.

CHRISTMAS TREE PESTS

Among the many pests of balsam fir Christmas trees, the spruce budworm is by far the most significant in most areas of the Maritimes. Some of the others, usually only of localized importance, are mentioned elsewhere in this report. The balsam gall midge and the balsam twig aphid are discussed here because of their widespread occurrence and because of their effect on the quality and consequently on the value of Christmas trees. They are discussed not strictly from the point of Christmas tree production, but because their presence in natural stands has a spillover effect, the statements are relevant. Two more organisms have been added to the chapter this year: the yellow witches' broom of balsam fir because it is a relatively recent problem in Christmas tree plantations, and an unusual complex of root aphids and ants. We hope that their inclusion will create awareness among growers and in turn will result in a better understanding of the problems.

Balsam Gall Midge, Paradiplosis tumifex Gagne, populations were again low throughout the Region in 1985.

In New Brunswick, damaged needles of balsam fir were observed in most parts of the Province but the highest amount of needle damage, at Napadogan, York County was only 11%. The level of infestation by the balsam gall midge was determined at 1009 locations during the spruce budworm L2 sampling conducted by the New Brunswick Department of Forests, Mines and Energy. Of these 943 were negative (93.4%); at 65 locations (6.4%) 1-10% of the needles were affected; and only at a single location (0.2%) was the infestation in the 11-20% range. Although the above represents samples from larger trees, used to determine spruce budworm populations, the figures are comparable to our results obtained from Christmas tree plantations and are a good indication of the distribution of balsam gall midge populations in the Province in 1985.

In Nova Scotia, damage did not exceed trace levels except at a few isolated locations where it was light and moderate at one location in a thinned area on Cape Breton Island. The highest level of infestation recorded occurred at Oakfield, Halifax County where 34% of the needles were affected.

In Prince Edward Island, a few galls were found on understory trees at several scattered locations.

Balsam Twig Aphid, Mindarus abietinus Koch., was common throughout the Region but population levels were generally low in both Christmas tree plantations and in natural stands.

In New Brunswick, the presence or absence of balsam twig aphid was noted by the provincial Department of Forests, Mines and Energy during spruce budworm L2 surveys. The aphid was found at 227 of 1007 locations sampled (22.5%), almost half of these (47%) in DFME Region 1. This agrees with our results, showing that the balsam twig aphid was most common in northeastern New Brunswick and the highest level of infestation - still low - was found at Halcomb, Northumberland County where 19% of the current balsam fir shoots were affected.

In Nova Scotia, a Christmas tree plantation at Millstream, Pictou County with 10% of the shoots affected had the highest infestation observed.

In Prince Edward Island, young trees at Brockton, Prince County sustained very light shoot damage, and this constitutes the only observation in the Province.

Yellow Witches' Broom of Balsam Fir, Melampsorella caryophyllacearum Schroet., a rust fungus, which needs chickweed as an alternate host to complete its life cycle, is often found in the natural forest but it has not been a serious problem in Christmas tree plantations in the Maritimes until recently.

In 1985, witches' brooms were numerous on young Christmas trees, especially in areas where chickweed ground cover was heavy, in a plantation near Woodstock, Carleton County, and at Mouth of Keswick, York County, in New Brunswick; were common in two plantations, 3 to 8 years old, in Lunenburg County, Nova Scotia; and at Brookvale, Queens County, Prince Edward Island where a 0.5 m high young tree supported 13 witches brooms.

Balsam Fir Root Aphid, Prociphilus americanus (Walker), associated with Ants, Lasius lasius sp. Fabricius, caused mortality of scattered balsam fir trees in Christmas tree plantations in New Brunswick near Gagetown, Queens County, and Doaktown, Northumberland County, and in Nova Scotia at Monk Road, Lunenburg County.

MITES

Mites, as the name implies, are minute organisms, hardly visible to the naked eye. They cause damage by puncturing the surface of needles or young succulent shoots with their mouth parts and sucking out the sap. Affected foliage appears mottled or, when populations are high, reddish discoloration results. Seriously affected needles will fall prematurely. Some species of mites also produce a webbing that collects dust and debris giving the affected trees a dirty, unthrifty appearance. High mite populations are often associated with dry, hot weather.

Spider mites, mainly the spruce spider mite Oligonychus ununguis (Jacobi), on spruce and on pine, and a species of Eurytetranychus on spruce reached epidemic proportions in 1982 in both plantations and natural forests in southern and central New Brunswick. Although populations have declined since then, mite infested coniferous areas were observed in both New Brunswick and Nova Scotia in 1983 and 1984.

In 1985, spider mites again caused various levels of discoloration in many areas of New Brunswick and Nova Scotia occurring mainly on ornamental conifers and in a few Christmas tree plantations.

Mites on pine, Oligonychus milleri (McGregor) and to a much lesser degree Setoptus jonesi (Keifer), became a major concern in 1985 as a result of various degrees of discoloration observed in numerous jack pine plantations, especially in the southern half of New Brunswick. Many of the trees were off-color, the discoloration ranging to bronze or red, in Charlotte, York, Sunbury, Queens, Kings, St. John, Westmorland, and Kent counties. Although the condition varied from only 4% trace discoloration to 100% severe reddening, a survey of 13 plantations in southern New Brunswick showed that an average of 31.5% of the 300 shoots examined sustained heavy feeding, 10.8% moderate,

13.2% light, 14.7% trace feeding, and 29.8% were healthy. Mites were found mainly on the 1984 foliage but both 1983 and 1985 needles were affected to some degree.

It is highly probable that the mites alone did not account for all the damage; either other factors were also involved in causing the discoloration or mite population built-up to damaging levels as a result of some predisposing factor, such as drought. A study, involving 200 trees, conducted in a seriously affected area of Westmorland County, showed the following distribution of conditions:

0 - 20% of tree affected:	5.5%
21 - 40% of tree affected:	7.0%
41 - 60% of tree affected:	13.6%
61 - 80% of tree affected:	13.6%
81 - 100% of tree affected:	60.3%

The level of mite populations was determined for each rated tree. Although trees with the highest mite population were always in a severely damaged condition, not all seriously affected trees supported a high population of mites. In fact, on 20% of the severely affected trees the number of mite eggs was low or very low. This indicates that other factors cannot be discounted entirely.

The mite, O. milleri was also found in northern New Brunswick in a jack pine plantation in Gloucester County and in a red pine plantation in Yarmouth, Cumberland, and Pictou counties in Nova Scotia.

NURSERY AND GREENHOUSE PROBLEMS

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

Some of the conditions encountered in 1985 in nurseries and greenhouses are mentioned because of their importance and to demonstrate that no facet of forestry is without problems. The following, which is not intended to be all inclusive, was gathered with the cooperation of R.D. Hallett and T.W. Burns, (CFS-Maritimes).

Insects: Orthosia hibisci (Gn.), the speckled green fruitworm, was found on less than 5% of grafted white spruce trees in a New Brunswick nursery; Pristiphora erichsonii (Htg.), the larch sawfly, on japanese larch and Argyresthia laricella Kft., the larch shoot moth on tamarack were present in the same nursery; various aphids, including Cinara sp., were found on several tree species in three nurseries in New Brunswick.

Fungi: Botrytis cinerea Pers. ex Fr., a fungus favored by high humidity as a result of dense conditions, affected various tree species in numerous nurseries in the Region, requiring treatment; Armillaria mellea (Vahl ex Fr.) Kummer, the shoe-string root rot, was again found on outplanted nursery stock throughout the Region; Chrysomyxa ledicola Lagh., a spruce needle rust that alternates to Labrador tea, was noted at low intensity on black spruce in a New Brunswick nursery.

Abiotic conditions: Freezing, winter drying, salts, overwintering storage, fertilizers, quality of water supply, and handling problems were the most commonly listed conditions that affected seedlings. Being "affected" ranged from seedlings dying, to seedlings with poorly developed root systems or yellow, sickly-looking shoots or needles. In either case, culling is necessary or, if inferior seedlings are planted, they will have a less than fair chance to develop as they should in the plantations.

WHITEMARKED TUSSOCK MOTH

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

The last outbreak of whitemarked tussock moth in the Maritimes occurred in the early 1970s and collapsed by 1979, due mainly to a nuclear polyhedrosis virus. Populations were low until 1984 when the first signs of a new build-up were observed.

In 1985, although population levels were still generally low, whitemarked tussock moth was common in most of mainland Nova Scotia and in southern New Brunswick. Egg masses were easy to find, especially in Guysborough and Antigonish counties, Nova Scotia, and averaged about 1 per tree in many Christmas tree areas. At this level, the protection of these high value trees should be considered to avoid economic losses.

The populations of the whitemarked tussock moth will likely increase in 1986 and noticeable defoliation may occur in numerous areas.

HEMLOCK LOOPER

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

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

In 1985, hemlock looper, in combination with spruce budworm caused up to 50% total defoliation in a white spruce-balsam fir stand over 16 ha at Diligent River, Cumberland County, Nova Scotia. The hemlock looper was evident on old foliage of the balsam fir component. Moths were observed in the early fall at Outer Island, Shelburne County. Populations were low in the rest of the Province.

In Prince Edward Island, hemlock looper caused patchy, but in some places severe, loss of old and new needles over a 200 -ha area near Cross River, Kings County.

In New Brunswick, a few larvae were collected at scattered locations but populations were low.

SHRUBS															
Amelanchier sp.	x											x			
Amelanchier bartramiana		x													
Corylus cornuta			x												
Diervilla lonicera								x							
Ilex verticillata	x														
Kalmia angustifolia	x						x	x			x				
Ledum groenlandicum							x								
Lonicera sp.			x												
Sambucus canadensis			x												
Sambucus pubens			x												
Vaccinium sp.	x								x	x	x				
Viburnum alnifolium			x												
Viburnum cassinoides				x			x								
Viburnum lentago								x							
HERBACEOUS PLANTS															
Actaea rubra												x			
Anthoxanthum odoratum												x			
Aralia nudicaulis		x	x		x					x					
Araliaceae															x
Aster or *Solidago*								x							
Aster acuminatus						x			x	x		x		x	x
Aster macrophyllus														x	
Aster sp.							x							x	
Carex sp.											x				
Carex gracillima						x									
Carex novae-angliae							x								
Carex stricta							x								
Clintonia borealis		x	x		x		x								

SPECIAL SURVEYS

SPECIAL SURVEYS

Several forest pest surveys are carried out annually that are not necessarily related to one of the forest pests of major importance. In the past, information from these projects has either been reported elsewhere or used internally. Considering the implications this information may have in forest management, it is summarized and the results of special surveys will be included in this and future annual reports.

ACID RAIN NATIONAL EARLY WARNING SYSTEM

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

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

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

The objectives of the program are

1. To detect the possible damage to forest trees and soils caused by acid rain or to identify the damages sustained by Canadian forests (trees and soils) which are not attributable to natural causes or management practices;
2. Long-term monitoring of vegetation and soils to detect future changes attributable to acid deposition and other air pollutants in representative forest ecosystems.

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

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

a. the condition and changes in the condition of the forest stand,
b. the presence and fluctuation of biotic and abiotic factors that affect the condition of the forest (insects, diseases, stand changes, temperature, etc.),
c. the changes and symptoms that indicate factors not attributable to the above that could conceivably be early signs of acid rain damage, and
d. the effect of acid rain on the condition of the various economically important tree species.

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

In the Maritimes Region, 15 permanent ARNEWS plots, representing the important forest species and geographical areas were established in 1984 (Fig. 10). Some of the baseline information characterizing the areas is listed in Table 8. The vegetation survey was completed on the plots and the information is presented in Table 9.

In 1985, all plots were visited monthly from June to September to determine forest insect and disease conditions, detect 'acid rain' symptoms (if any), observe seed crop and/or fall discoloration, and to collect ground vegetation samples. In August, detailed assessments of all plots were carried out following the procedures established

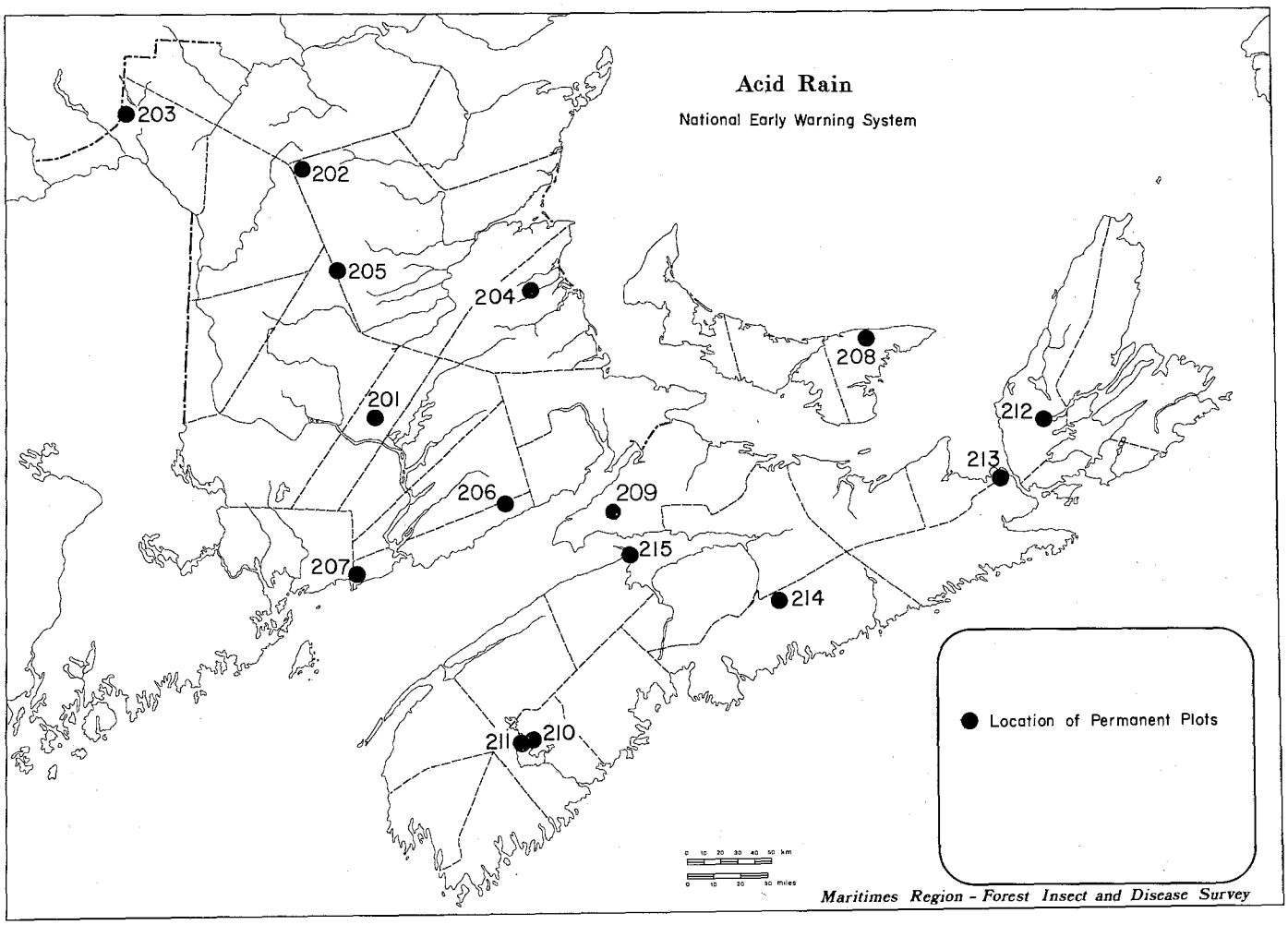


Figure 10.

for the national system, which was developed by the Maritimes FIDS unit.

Foliage and soil samples were collected for analysis from four of the ARNEWS plots (Nos. 202, 203, 205, 207). The measurement of the increment cores collected in 1984 has been completed (10 cores per species constituting at least 10% of stand per ARNEWS plot) and the collection of 20 additional cores per species per plot commenced to allow for meaningful analysis of the results.

Tree mortality on all plots increased from 8.3 to 9.3% since 1984. The problem on white birch, discussed in detail elsewhere in this report, continued at Martin Head (ARNEWS plot No. 206) but no unexplained problems were encountered on any of the other plots. Most of the data collected is awaiting analysis.

Two additional plots have been established at the request of and in cooperation with Frasers Inc. in northwestern New Brunswick. These will be monitored jointly with the Company in future years.

In addition to the work on permanent plots, the results of observations for signs of possible acid rain damage were recorded for most of the 248 locations where detailed pest condition assessments were made. Special attention was directed to the number of years of needle retention on coniferous species. A summary of some of these observations is presented in Table 10. It is apparent that the percentage of needles retained decreased with age and the rate of the decrease varied among tree species and between provinces. It is important to

Table 8. Acid Rain National Early Warning System. Some baseline characteristics of ARNEWS plots in the Maritimes established in 1984

ARNEWS Plot No.	Plot location[1]	Number of trees on plot		Species composition[2]	All trees (ave.)		Live crown (ave.)	
					Diameter[3]	Height	Width	Length
		Living	Dead	%	cm	m	m	m
201	Acadia For. Exp. Station Sunbury Co., N.B. 19-70(90)-510(0)	56	1	63 - bS 29 - rM 8 - wB	16.5	14.3	2.8	7.9
202	Mount Carleton Northumberland Co., N.B. 19-65(6)-524(7)	38	3	82 - bF 10 - wB 5 - wS 3 - yB	18.8	12.8	3.1	6.8
203	Halfway Madawaska Co., N.B. 19-55(2)-527(4)	35	1	86 - sM 14 - yB	17.2	14.4	4.3	10.3
204	St. Luc Kent Co., N.B. 20-33(7)-517(8)	60	8	90 - jP 10 - bS	15.8	14.8	2.1	5.6
205	South Dungarvon River Northumberland Co., N.B. 19-67(8)-518(8)	40	12	90 - rS 7.5 - bF 2.5 - wB	17.8	13.0	2.7	7.1
206	Martin Head St. John Co., N.B. 20-32(8)-504(9)	54	1	69 - wB 24 - rS 3.5 - rM 3.5 - yB	14.7	11.6	3.2	6.2
207	Lepreau Falls St. John Co., N.B. 19-70(0)-500(4)	46	9	56.5 - tL 32.5 - bS 11 - bF	17.5	12.5	3.5	8.4
208	Goose River Kings Co., P.E.I. 20-53(8)-514(3)	66	1	58 - S 23 - tA 9 - bF 7 - wS 1.5 - wiB 1.5 - bCh	13.2	9.6	2.3	5.4
209	Chignecto Game Sanctuary Cumberland Co., N.S. 20-39(6)-504(8)	60	2	93 - rS 3 - rM 2 - bF 2 - wB	16.8	12.1	2.6	6.5

Table 8. Continued

ARNEWS Plot No.	Plot location[1]	Number of trees on plot		Species composition[2]	All trees (ave.)		Live crown (ave.)	
		Living	Dead	%	Diameter[3] cm	Height m	Width m	Length m
210	Hemlock Hill Queens Co., N.S. 20-33(0)-490(5)	53	1	38 - rS 30 - bF 15 - wP 7.5 - wB 5.5 - As 4 - rM	16.4	12.2	3.5	7.5
211	Rossignol Lake Queens Co., N.S. 20-32(7)-490(5)	29	0	100 - wP	20.0	13.6	4.3	8.3
212	Whycocomagh Inverness Co., N.S. 20-64(6)-509(2)	51	12	43 - bF 25.5 - wB 21.5 - wS 10 - rM	13.9	9.9	2.6	6.6
213	Frankville Guysborough Co., N.S. 20-61(2)-505(5)	75	11	57 - bF 25 - wS 11 - rM 4 - eH 3 - yB	14.4	11.8	2.2	4.9
214	Middle Musquodoboit Halifax Co., N.S. 20-48(6)-498(9)	71	0	48 - bF 41 - rM 7 - wS 3 - ltA 1 - rS	13.0	11.8	3.1	6.2
215	Blomidon Prov. Park Kings Co., N.S. 20-39(4)-501(3)	52	0	48 - wS 33 - bF 19 - rS	17.8	10.5	3.5	7.3

[1]Includes U.T.M. grid to nearest kilometre.
[2]Percent based on total living trees on plot; standard FIDS tree abbreviation.
[3]Diameter measured at breast height.

Table 9. Acid Rain National Early Warning System Vegetation Survey on the ARNEWS Plots in the Maritimes - 1985

Name of Plant	ARNEWS Plot Number														
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
TREES															
Abies balsamea		x			x		x	x	x	x	x	x	x	x	x
Acer rubrum	x					x		x	x	x	x	x	x	x	
Acer pensylvanicum			x												
Acer saccharum			x												
Acer spicatum		x	x												
Betula alleghaniensis		x	x			x							x		
Betula papyrifera	x	x			x	x			x	x		x	x		
Betula populifolia								x							
Fraxinus sp.			x							x					
Larix laricina							x								
Picea sp.								x							
Picea glauca		x						x				x	x	x	x
Picea mariana	x			x			x								
Picea rubens					x	x			x	x				x	x
Pinus banksiana				x											
Pinus strobus										x	x				
Populus grandidentata														x	
Populus tremuloides								x							
Prunus serotina								x							
Quercus rubra											x				
Sorbus sp.		x													
Tsuga canadensis													x		

Table 9. Continued.

Name of Plant	ARNEWS Plot Number														
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
HERBACEOUS PLANTS (continued)															
Coptis groenlandica		x					x								
Coptis trifolia	x	x				x	x							x	
Cornus canadensis	x	x		x	x	x	x	x			x				x
Cypripedium acaule				x											
Dalibarda repens	x														
Epigaea repens				x											
Erythronium americanum					x										
Equisetum sylvaticum							x								
Gaultheria hispidula	x			x											
Linnaea borealis				x											
Maianthemum canadense			x	x		x				x		x	x	x	
Medeola virginiana											x			x	
Monotropa unifolora											x			x	
Oxalis montana		x	x			x								x	
Panax trifolius						x									
Pyrola sp.	x														
Ranunculus acris												x			
Ribes sp.						x									
Ribes lacustre					x										
Rubus sp.			x												
Rubus strigosus			x									x			
Smilacina trifolia						x				x					
Solidago sp.						x									

HERBACEOUS PLANTS (continued)															
Spiraea latifolia							x								
Streptopus roseus			x												x
Taraxacum officinale												x			
Trientalis borealis	x	x	x			x	x			x	x			x	
Trillium erectum			x												
Trillium undulatum	x	x		x	x			x	x						
Veronica officinalis												x			
Viola cucullata												x		x	
Viola pallens						x									x
Viola sp.			x			x								x	
FERNS															
Dennstaedtia punctilobula										x		x			
Dryopteris campyloptera		x					x								
Dryopteris carthusiana					x										
Dryopteris sp. possibly D. carthusiana															x
Dryopteris intermedia			x			x						x	x		x
Dryopteris noveboracensis														x	
Onoclea sensibilis														x	
Osmunda cinnamomea										x				x	
Pteridium aquilinum var. latiusculum	x			x				x	x		x				
Thelypteris palustris var. pubescens														x	
MOSSES															
Brachythecium reflexum			x												
Brachythecium starkei						x									

Table 9. Continued.

Name of Plant	ARNEWS Plot Number														
	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
MOSSES (continued)															
Brotherella recurvans						x									
Callicladium haldanianum						x		x							
Dicranella heteromalla															x
Dicranum sp.	x					x				x					
Dicranum flagellare	x			x					x		x				
Dicranum fuscescens		x			x	x	x								x
Dicranum ontariense											x				
Dicranum polysetum	x								x	x				x	
Dicranum scoparium		x					x					x	x	x	
Drepanocladus uncinatus		x													
Hylocomium splendens	x	x			x					x			x	x	x
Hylocomium umbratum		x													
Hypnum imponens						x				x		x			
Hypnum pallescens			x												
Hypnum sp.	x														
Leucobryum glaucum													x	x	
Pleurozium schreberi	x	x		x	x	x	x	x	x		x	x		x	x
Polytrichum commune				x			x			x					x
Polytrichum formosum						x									
Polytrichum ohioense						x									
Polytrichum strictum							x								
Sphagnum fallax	x						x								
Sphagnum girgensohnii						x			x						

Sphagnum sp.														x	
Tetraphis pellucida						x									
CLUB MOSSES															
Lycopodium clavatum														x	
Lycopodium digitatum															x
Lycopodium lucidulum		x	x			x	x								
Lycopodium obscurum	x			x				x							x
Lycopodium annotinum		x	x				x								
LIVERWORTS															
Bazzania trilobata					x	x			x				x	x	
Calypogeia muelleriana															x
Ptilidium ciliare						x									
LICHENS															
Cladina rangiferina		x			x										x
Cladina subtenuis									x					x	
Cladonia bacillaris			x												
Cladonia coniocraea	x	x	x		x		x								
Cladonia cornuta						x									x
Cladonia crispata					x										
Cladonia deformis					x										
Cladonia gracilis turbinata		x			x										
Cladonia grayi							x								
Cladonia maxima														x	
Cladonia merochlorophaea							x								
Cladonia dquamosa									x					x	
Cladonia sp.										x					
Hypogymnia physodes					x										

Table 10. Retention of needles produced in different years by various coniferous trees in the Maritimes Region - 1985

Tree species	Province	No. of observations	Percentage of needles retained of the needles produced in the year indicated							
			1985	1984	1983	1982	1981	1980	1979	1978
Balsam fir	New Brunswick	57	88	73	43	38	37	32	21	16
	Nova Scotia	51	98	96	90	87	81	65	43	14
	Prince Edward Island	11	89	64	58	68	71	46	11	?
White spruce	New Brunswick	26	89	75	65	66	53	45	26	20
	Nova Scotia	34	99	98	95	90	80	68	52	18
	Prince Edward Island	17	87	86	84	81	71	31	6	?
Black spruce	New Brunswick	5	97	84	76	64	50	48	44	32
	Nova Scotia	3	100	100	97	93	93	70	27	?
	Prince Edward Island	3	97	87	93	90	90	20	?	?
Red spruce	New Brunswick	34	92	93	75	65	50	37	19	13
	Nova Scotia	19	99	96	92	89	82	77	54	25
Spruces (combined)	New Brunswick	65	91	85	71	65	51	41	24	17
	Nova Scotia	56	99	97	94	90	81	72	53	20
	Prince Edward Island	20	88	86	85	82	74	29	6	?
Red pine	New Brunswick	2	100	100	95	45	--	--	--	--
	Nova Scotia	3	100	97	87	30	--	--	--	--
White pine	New Brunswick	9	92	87	51	9	--	--	--	--
	Nova Scotia	22	90	78	53	4	1	--	--	--
Jack pine	New Brunswick	5	95	98	76	18	--	--	--	--
	Nova Scotia	6	98	92	63	10	--	--	--	--
Pines (combined)	New Brunswick	16	94	92	64	16	--	--	--	--
	Nova Scotia	31	92	82	58	7	1	--	--	--
Hemlock	New Brunswick	4	100	72	52	25	25	15	15	12
	Nova Scotia	4	100	97	87	55	12	--	--	--

realize that the figures represent provincial averages and, more important, that at least some of the loss is definitely contributable to feeding by defoliating insects.

Forest Insect and Disease Survey personnel are always on the lookout for the unusual or unexplained forest conditions, some of these conceivably suspect for acid rain damage. In 1985, in the course of general surveillance, an unexplained deterioration of white spruce was observed in northern New Brunswick. The condition involved areas of several hundred hectares in the vicinity of Squaw Cap (elevation 483 m), Slate Mountain, and Mann Mountain in Restigouche County. Mainly mature trees are affected but other age classes are also deteriorating to some extent. In the southern part of the Province, red spruce was found in a deteriorating condition at many locations on Deer Island, Charlotte County. Although trees in many of these areas have been defoliated by the spruce budworm in the past, this does not adequately explain the conditions observed. Both of these problem areas require further investigation.

The deterioration of white birch along the Bay of Fundy (see page 29 in this report) was first noticed in 1978. The condition has been under surveillance and has been reported annually since 1979. Plans in 1986 call for a further, detailed examination by researchers to determine if "acid rain" is a causal factor in the annually occurring foliage browning and early leaf fall in this area.

FOREST PEST ASSESSMENT IN PLANTATIONS

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

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

Other work priorities resulted in the cancellation of specific regional surveys in 1984 and 1985 although numerous observations were made in plantations in both years. The results of these are reported under the appropriate pests.

The realization of the importance of forest pests to the future wood supply in New Brunswick resulted in the first large-scale joint plantation survey between the provincial Department of Forests, Mines and Energy and the Forest Insect and Disease Survey of the Canadian Forestry Service - Maritimes in

1985, to assess the general state of health of plantations and of silviculturally treated (thinned) areas. There were large-scale joint surveys conducted in the past. However, all previous surveys were pest specific in response to crisis situations, such as the Scleroderris survey in 1979, in the wake of the discovery of the European race of that disease in the Province. The survey in 1985 was conducted as a pilot project in anticipation of regular, continuing surveys in future years.

Most of the plantations assessed in 1985 were jack pine and black spruce of 5-15 years of age. Sixty-three percent of the areas selected were visited twice. Observations were made on the type and occasionally the level of forest pest caused disturbances or damage. Field assessments and sampling were carried out by the provincial Pest Detection Officers. Identification and data analysis were done by the Forest Insect and Disease Survey.

There were 141 assessments made in the 70 plantations and 15 silviculturally treated areas (Fig. 11). A total of 7 218 trees was examined in the course of the survey.

The most remarkable - and comforting - observation drawn from the results is that, in spite of a long list of organisms encountered, spruce plantations and, with the exception of DFME Region 3, jack pine plantations were found to be generally in very good condition in New Brunswick in 1985. A brief summary of the plantation assessments is presented in Table 11. In Table 12 the

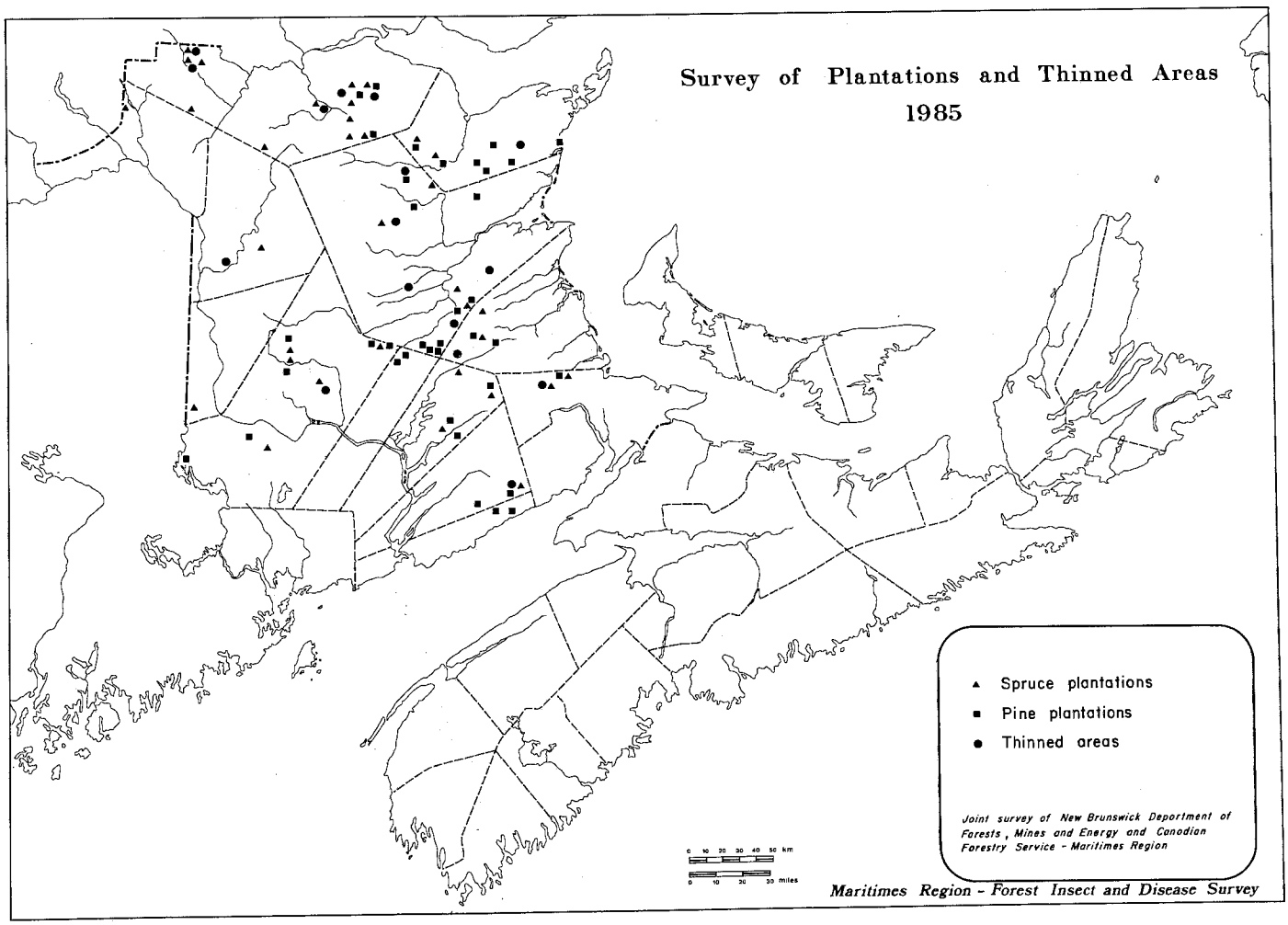


Figure 11.

Table 11. Summary of the plantation assessment survey in New Brunswick in 1985

DFME Region	Tree species	No. of plantations assessed	Percent of trees assessed as healthy		Tree mortality	
			Average	Range	No. of plantations with mortality	Mortality range %
1	Black spruce	16	92.9	66 - 100	2	2 - 6
	Jack pine	13	95.3	86 - 100	3	1 - 4
2	Black spruce	6	96.0	88 - 99	1	2
	Jack pine	7	90.3	84 - 100	5	2 - 6
3	Black spruce	6	86.2	64 - 100	4	2 - 16
	Jack pine	7	29.3	0 - 55	2	2
4	Black spruce	5	93.8	91 - 98	2	2
	Other spruce	2	99.0	98 - 100	0	0
	Jack pine	5	93.8	90 - 100	1	2
5	Black spruce	1	92.0	92	0	0
	White spruce	2	86.0	86 - 92	0	0

plantation problems and the frequency of their occurrence in the various DFME regions are summarized.

Less than a third (29.3%) of the jack pine trees in plantations in DFME region 3 were classified as healthy. A special survey of 17 plantations revealed the presence of very high levels of infection by the needle rust Coleosporium viburni in 15 plantation and damaging levels of populations of the mite Oligonychus milleri in 14 plantations. The needle rust has been reported to have caused severe foliage discoloration and premature needle drop in much of southcentral New Brunswick in the last three years and a similar level of infection continued in 1985 in many of the same areas. These two organisms account for the unthrifty appearance of jack pine in this region.

Tree mortality was reported in 20 of the 70 plantations and Armillaria root rot (Armillaria mellea) was implicated in more than half of these (11 plantations). Although the highest level of mortality in any one location was only 6%, the disease occurred in all areas of the Province thus confirming earlier suggestions that Armillaria root rot could become one of the major problems in young plantations.

There were 15 thinned stands examined in the Province: 4 balsam fir, 3 jack pine, 2 black spruce, 1 yellow birch, and 5 with various mixes of balsam fir and spruce. In stands with fir and/or spruce component, 78% of the trees were classified as healthy. Tree mortality was observed in two of these stands; 18% of the trees were dead near Castaway, Kent County due to a combination of defoliation by spruce budworm and animal damage, and 2% of the trees were dead in a black spruce stand near States Brook, Restigouche County, probably a result of animal damage. Spruce budworm was the most commonly encounterd forest pest. Other foliage-affecting pests included balsam gall midge, cone worms, mites, needle rust and yellow witches' broom of balsam fir, found in two areas. Of the

Table 12. Plantation problems observed during the plantation assessment survey in New Brunswick in 1985

Plantation problems	Number and frequency of problems in the various DFME Regions																	
	Spruce										Jack pine							
	1		2		3		4		5		1		2		3		4		5	
	No.[1]	%[2]	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Abiotic injuries	8	50	2	33	1	17	5	71	1	33	6	46	2	28	2	28	4	80	–	
Animal damage	1	6	1	17			3	43	1	33	2	15	3	43	–		4	80	–	
Armillaria root rot	1	6	1	17	1	17	2	28	–		3	23	3	43	3	43	1	20	–	
Bark beetles	–		–		–		–		–		–		1	14	–		–		–	
Bud moth(s)	4	25	–		–		–		–		–		–		–		–		–	
Budworm(s)	3	19	3	50	3	50	5	71	–		2	15	–		4	57	–		–	
Coneworm(s)	–		–		1	17	1	14	–		1	8	–		1	14	1	20	–	
Conifer aphid(s)	2	12	–		–		1	14	–		–		2	28	1	14	2	40	–	
Frost damage	3	19	1	17	–		1	14	2	66	–		–		–		–		–	
Frost heaving	–		–		1	17	–		–		–		–		–		–		–	
Globose gall rust	–		–		–		–		–		1	8	–		2	28	–		–	
Mites	–		–		–		1	14	1	33	–		–		3	43	1	20	–	
Needle rust(s)	2	12	2	33	–		–		1	33	2	15	4	57	6	86	2	40	–	
Northern pitch twig moth	–		–		–		–		–		2	15	1	14	3	43	–		–	
Snow damage	–		–		–		–		–		3	23	2	28	–		2	40	–	
Spruce bud scale	1	6	–		–		1	14	–		–		–		–		–		–	
Spruce gall adelgid	4	25	–		–		2	28	1	33	–		–		–		–		–	
Spruce spittle bug	–		1	17	–		–		–		–		3	43	–		–		–	
Sweetfern blister rust	–		–		–		–		–		1	8	–		–		–		–	
Weevils	–		2	33	–		4	57	–		2	15	1	14	2	28	1	20	–	
Whitemarked tussock moth	–		–		1	17	–		–		–		–		–		–		–	
Undetermined problems	2	12	2	33	1	17	–		–		3	23	–		–		–		–	

[1] Number of plantations with the problem.
[2] Percentage in terms of total plantations assessed.

three jack pine stands, one was free of problems, the other two were affected by both the globose gall rust and jack pine budworm. The stand near Downer Siding, Westmorland County was also affected by the northern pitch twig moth. In DFME region 4 the yellow birch stand appeared in good condition except for an unexplained swelling on the stem of some of the trees.

CYCLICAL REVIEWS FOR SPECIFIC PESTS

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

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

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

In 1985, other priorities did not allow for special assessments of this type but we plan to continue with cyclical reviews in the future, especially when supporting evidence is required to explain certain forest conditions.

PINE WOOD NEMATODE

The Pine Wood Nematode, Bursaphelenchus lignicolus (Steiner and Buhrer) Nickle has gained worldwide attention in recent years, mostly because of its implications to international trade of forestry products.

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

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

In the Maritimes, the pine wood nematode (referred to earlier as the Japanese wood nematode) has been a

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

In the fall of 1985 a special survey was conducted as part of a national effort to establish the presence or absence of pine wood nematode in Canada. The 14 locations sampled in New Brunswick were concentrated along the area bordering Quebec, where apparently there were some suspected pine wood nematode samples obtained, and Maine, because of the reports of the widespread occurrence of this species in the United States. In Nova Scotia the 14 sample areas were distributed over the central mainland to provide for wide coverage (Fig. 12). Recently dead, old dead and living trees of balsam fir, white spruce, black spruce and red spruce were sampled. The nematodes extracted were submitted for expert identification. Results are not yet available.

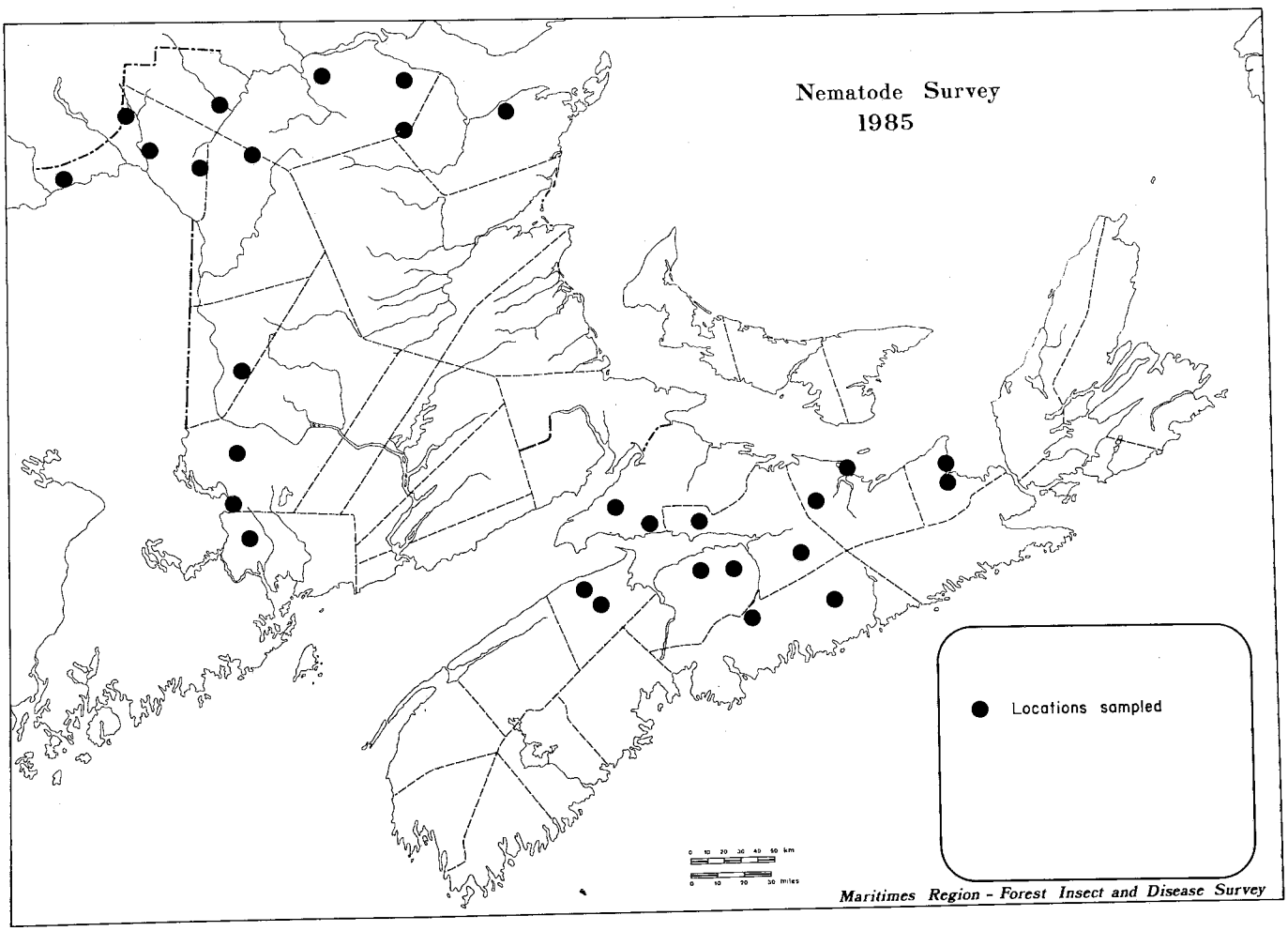


Figure 12.

TREE MORTALITY IN THE FIR-SPRUCE FOREST

The forest is constantly under attack by a multitude of enemies; insects, diseases, environmental conditions, man's interference, and others. These, of course, vary in importance of their effects but each contributes to the weakening of trees. Each comes into the process at different times when a tree reaches the stage of deterioration most appropriate to their mode of action. Consequently, it is possible to speak of primary pests and predisposing factors or of secondary organisms and the succession of damaging agents. The tree, unless it is able to withstand the effects of the primary intruder, is pushed further along the line and may succumb to an organism which, under vigorous conditions, would not have been able to affect it. What killed the tree? Was it the spruce budworm, which caused the initial loss of vigor or was it the shoestring root rot which finally cut off the water flow by girdling the root collar? Although it is customary to deal with forest pests on an individual basis, it must be realized that usually it is a complex of factors that leads to the ultimate death of a tree.

The forester, to be able to forestall losses, should know what the primary agents are. However, when faced with losses, he or she must know how much they are regardless of the chain of events which preceded tree mortality in the stand.

In 1985, a survey was conducted to provide information on the level of tree mortality in the fir-spruce forest regardless of the cause of tree death. Twenty-five balsam fir and spruce trees were classified as dead or alive at each of 96 randomly selected locations in the Region and the presence of the commonly occurring "secondary organisms" on dead trees was recorded.

Tree mortality in fir-spruce stands was 13% in New Brunswick, 22% in Nova Scotia (13% on the mainland and 42% on Cape Breton Island) and 20% in Prince Edward Island. It must be emphasized that these figures represent mortality which occurred in the past few years in the stands examined. Old dead trees which had broken or fallen down were not considered. Also, it must be obvious that only existing stands were examined. Forests harvested after the ravages of some forest pest, such as the spruce budworm, were no longer there to be surveyed. Consequently, these figures should be taken for what they are, mortality observed in 1985 in the residual fir-spruce forest.

The information is detailed in Tables 13, 14 and 15 and Figures 13, 14, 15 and 16.

Among the dead trees were a number of recently dead balsam fir, usually with a fair complement of bright red foliage. This sudden death of balsam fir has been reported since 1980 as the Stillwell's syndrome. In 1985 the condition was again observed throughout New Brunswick but was more common in the western half of the Province. It also occurred in eastern Nova Scotia.

A special mortality survey was conducted in Prince Edward Island involving prism point assessments at 47 locations in the Province in 1985. A summary of the results is presented in Table 16, details will be reported elsewhere.

Table 16. Summary of stand mortality survey in Prince Edward Island in 1985

County	Locations assessed	Average merchantable volume m^3/ha	Average stand mortality %*
Prince	18	192.3	4.2
Queens	18	153.2	9.3
Kings	17	189.8	16.4

*Based on m^3/ha

Table 13. Tree mortality in the fir-spruce forests in New Brunswick in 1985

Provincial inventory unit	Tree species	No. of locations sampled	Percent tree mortality	Presence of secondary organisms									
				Armillaria root rot	Balsam bark weevil	Balsam fir bark beetle	False darkling beetles	Flatheaded wood borers	Foureyed bark beetles	Horntails	Sawyer beetles	Spruce beetle	Striped ambrosia beetle
Region 1	Balsam fir	11	11.5	x	x	x	x			x	x		x
	Black spruce	1	16.5						x				
	Red Spruce	6	5	x					x	x	x		
	Tamarack	1	0										
	White spruce	5	32	x	x			x	x	x	x		x
Region 2	Balsam fir	6	18	x	x	x	x			x	x		x
	Black spruce	2	0										
	Red spruce	4	4						x				
	White spruce	1	0										
Region 3	Balsam fir	11	20	x	x	x	x	x		x	x		x
	Black spruce	1	13	x	x				x		x		x
	Red spruce	6	3	x					x		x		x
	White spruce	5	9	x	x			x	x		x		
Region 4	Balsam fir	17	15.5	x	x	x	x			x	x		x
	Black spruce	1	27	x	x				x		x		x
	Red spruce	10	6	x	x				x		x		x
	White spruce	4	10.5		x				x		x		
Region 5	Balsam fir	8	14.5	x	x	x					x		
	Red spruce	4	0										
	White spruce	2	0										

Table 14. Tree mortality in the fir-spruce forests in Nova Scotia in 1985

Provincial inventory unit	Tree species	No. of locations sampled	Percent tree mortality	Presence of secondary organisms									
				Armillaria root rot	Balsam bark weevil	Balsam fir bark beetle	False darkling beetles	Flatheaded wood borers	Foureyed bark beetles	Horntails	Sawyer beetles	Spruce beetle	Striped ambrosia beetle
Cape Breton	Balsam fir	8	50	x	x	x	x			x	x		
	Black spruce	1	0										
	Red Spruce	2	0										
	White spruce	4	18.5	x							x	x	
North Central	Balsam fir	4	20	x	x	x				x	x		
	Red spruce	3	0										
South Central	Balsam fir	3	21		x	x	x			x	x		
	Red spruce	2	0										
	White spruce	1	0										
Valley	Balsam fir	3	6.5				x			x			
	Red spruce	4	4									x	
	White spruce	2	13.5									x	
Eastern	Balsam fir	4	30	x	x	x	x			x	x		
	Red spruce	1	0										
	White spruce	1	0										
Western	Balsam fir	1	33										
	Red spruce	2	6.5										
South Shore	Balsam fir	2	7.5							x			
	Red spruce	3	4								x		
	White pine	1	0										

Table 15. Tree mortality in the fir-spruce forests in Prince Edward Island in 1985

Provincial inventory unit	Tree species	No. of locations sampled	Percent tree mortality	Presence of secondary organisms									
				Armillaria root rot	Balsam bark weevil	Balsam fir bark beetle	False darkling beetles	Flatheaded wood borers	Foureyed bark beetles	Horntails	Sawyer beetles	Spruce beetle	Striped ambrosia beetle
Western	Balsam fir	2	12							x			
	Black spruce	2	17		x		x				x		x
	White spruce	1	0										
Central	Balsam fir	3	28	x	x	x				x	x		x
	Black spruce	1	25		x		x		x	x			x
	White spruce	1	0										
Eastern	Balsam fir	1	17			x							x
	Black spruce	1	7		x						x		
	White spruce	1	0										

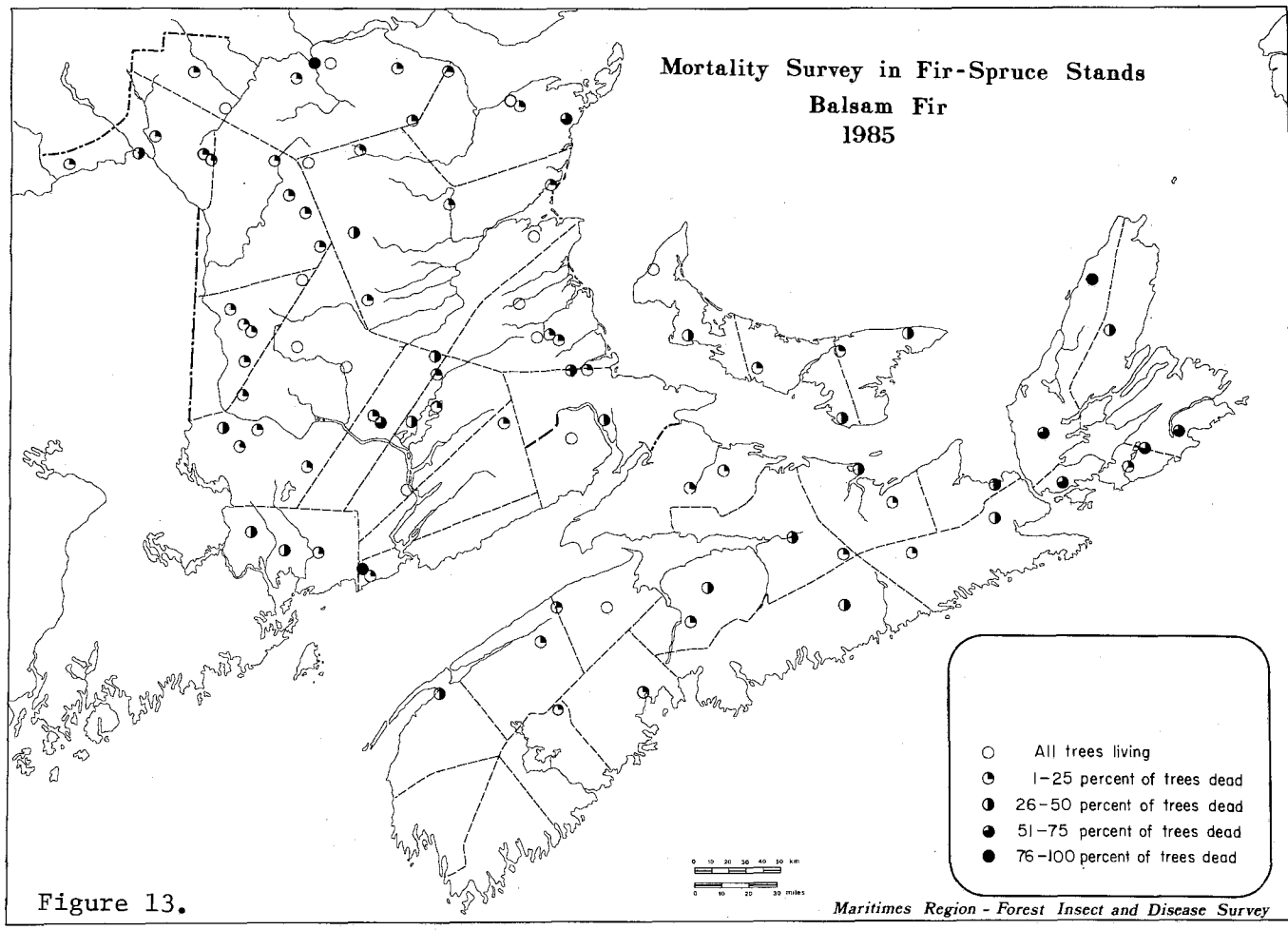


Figure 13.

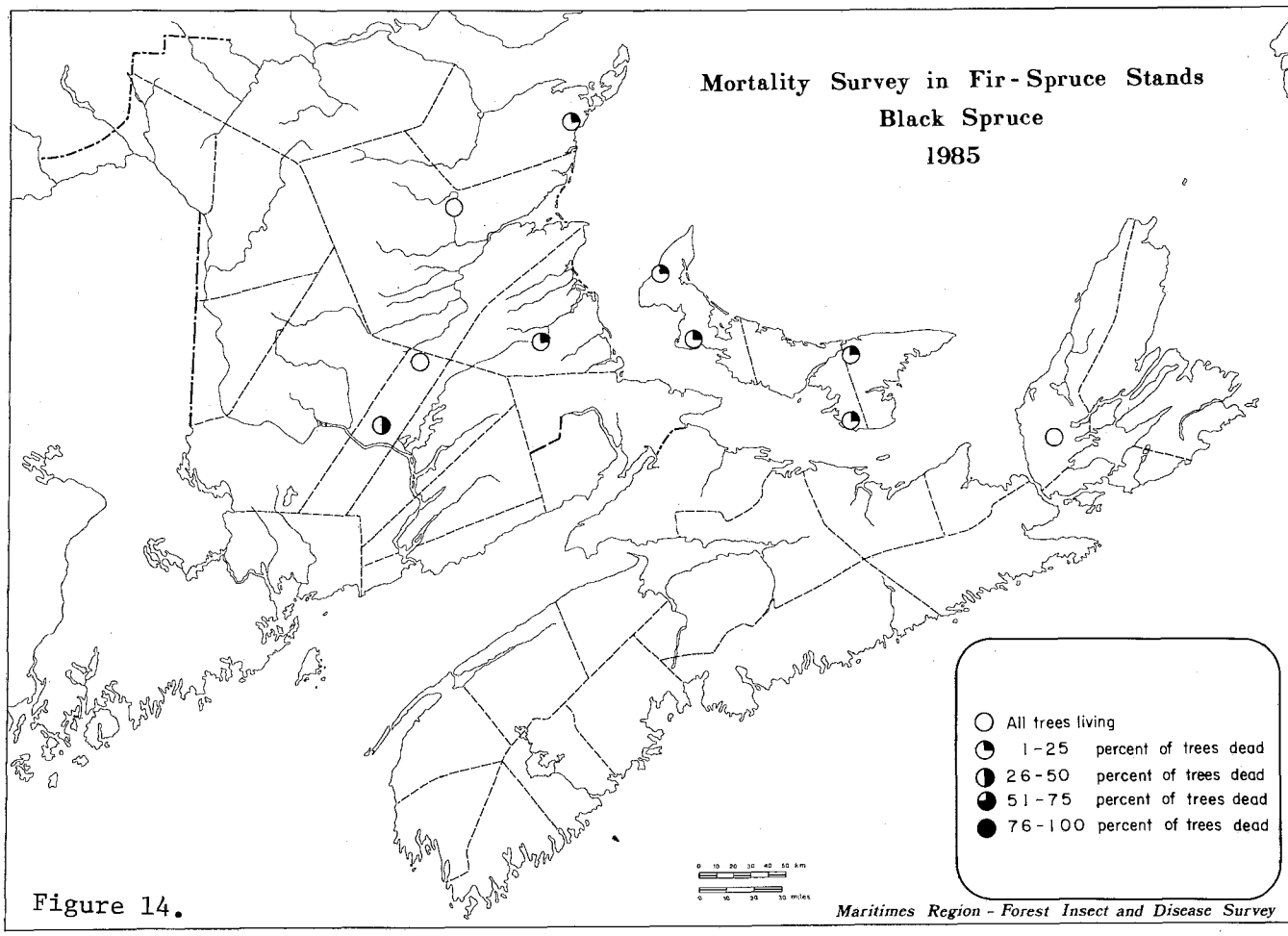


Figure 14.

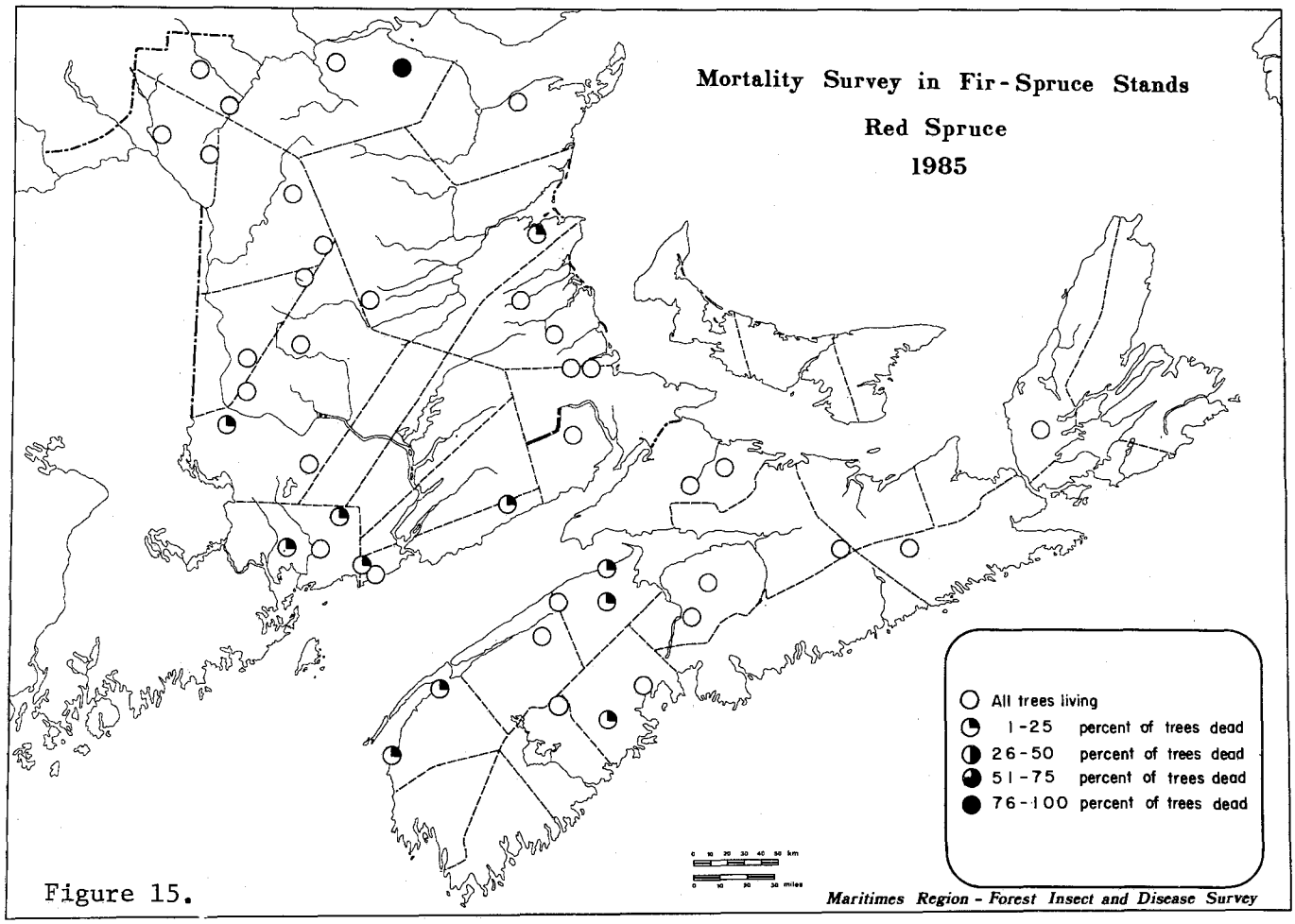


Figure 15.

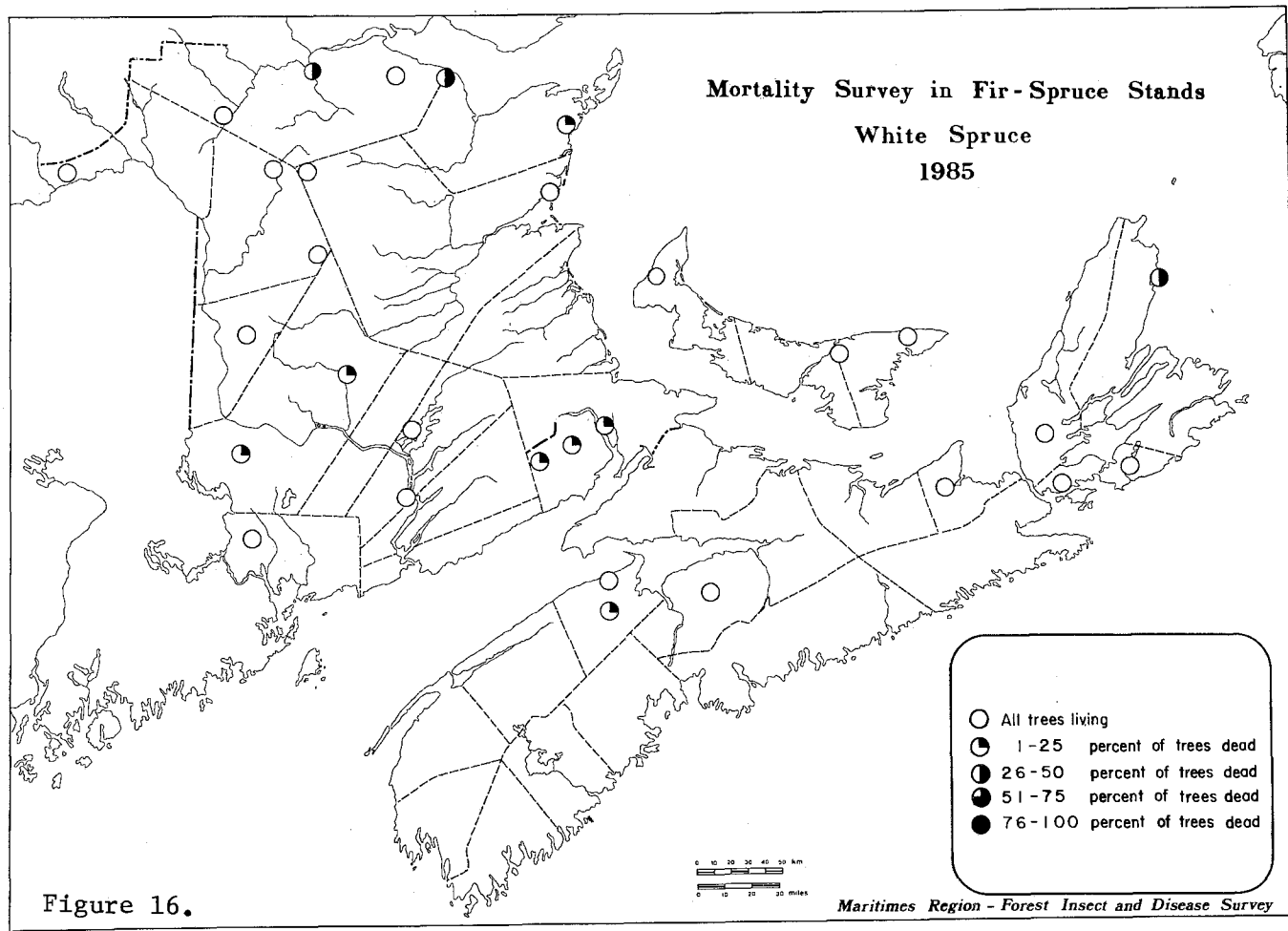


Figure 16.

PHEROMONE SURVEYS

Organizations, involved with the detection or monitoring of insect population fluctuations, in order to predict infestations or to organize control measures, strive for more reliable, economical and effective operational tools. Chemical communication is important in the behavior of insects. They are attracted to various stimulants and this behavioral characteristic is utilized in several ways.

Females send a chemical message by releasing a pheromone that stimulates the male to search for the female for the purpose of mating. In other cases the insect, male or female, may be attracted to odors given off by a tree signalling a suitable condition for the insect to attack the tree, usually in connection with propogation.

Attractants can be used to lure insects to traps where they are caught in rough proportion to the adult population present in the immediate area. These catches, when correlated to other life stages or more importantly to the defoliation or damage caused by the insect the following year, then become predictive tools that can replace or complement other survey methods. Pheromones can also be used in control either by causing mating disruption or by capturing significant numbers of the insect.

In the Maritimes, the Forest Insect and Disease Survey, often in cooperation with other organizations, has been in the "pheromone business" since 1971, when traps were first used in detection surveys for the gypsy moth, ten years before the first egg mass was found. Since then our efforts have gradually increased, first with opportunities to cooperate in testing various compounds for researchers, then by including testing in our program to develop pheromones as survey tools. Depending on the level of available precision, pheromones are used for:
1. detection surveys to establish the presence of an insect; 2. monitoring surveys to indicate a threshold of concern for the initiation of further action, such as other, more precise surveys or issuing an early warning of an impending population build-up; 3. monitoring surveys to predict the level of injury such as defoliation and subsequent damage, such as growth loss.

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

In 1985, pheromones or attractants were used for a number of insects and comments on these follow.

Spruce budworm As part of an interregional and international testing program to determine the reliability of traps and pheromones in monitoring annual population changes of the spruce budworm, the system was tested at 35 locations in the Maritimes in 1985. Cooperating in the program were the New Brunswick Department of Forests, Mines and Energy (10 locations), the Nova Scotia Department of Lands and Forests (5 locations), E.G. Kettela of CFS-Maritimes (10 locations) and the regional Forest Insect and Disease Survey (10 locations).

Multipher traps baited with PVC pellets (pheromone concentration 0.03% by weight) were used in a cluster of three traps deployed at each location (Fig. 17). Trees at each location were sampled in the early summer to determine spruce budworm larval populations at the L3-L4 stage, adult males captured by the traps were counted at the end of the flight period, defoliation levels on the sample trees were determined and L2 counts, an indicator for next year's expected population levels, were obtained. The results of the various counts are summarized in Table 17.

No detailed analysis of the results is available but a quick glance at the table indicates that the correlations are not good. There were start-up problems with the project and it is suspected that further laboratory testing with the lure and possibly a change of the killing agent (dog flea collars were used in 1985) is necessary before the 1986 season. However, since all the

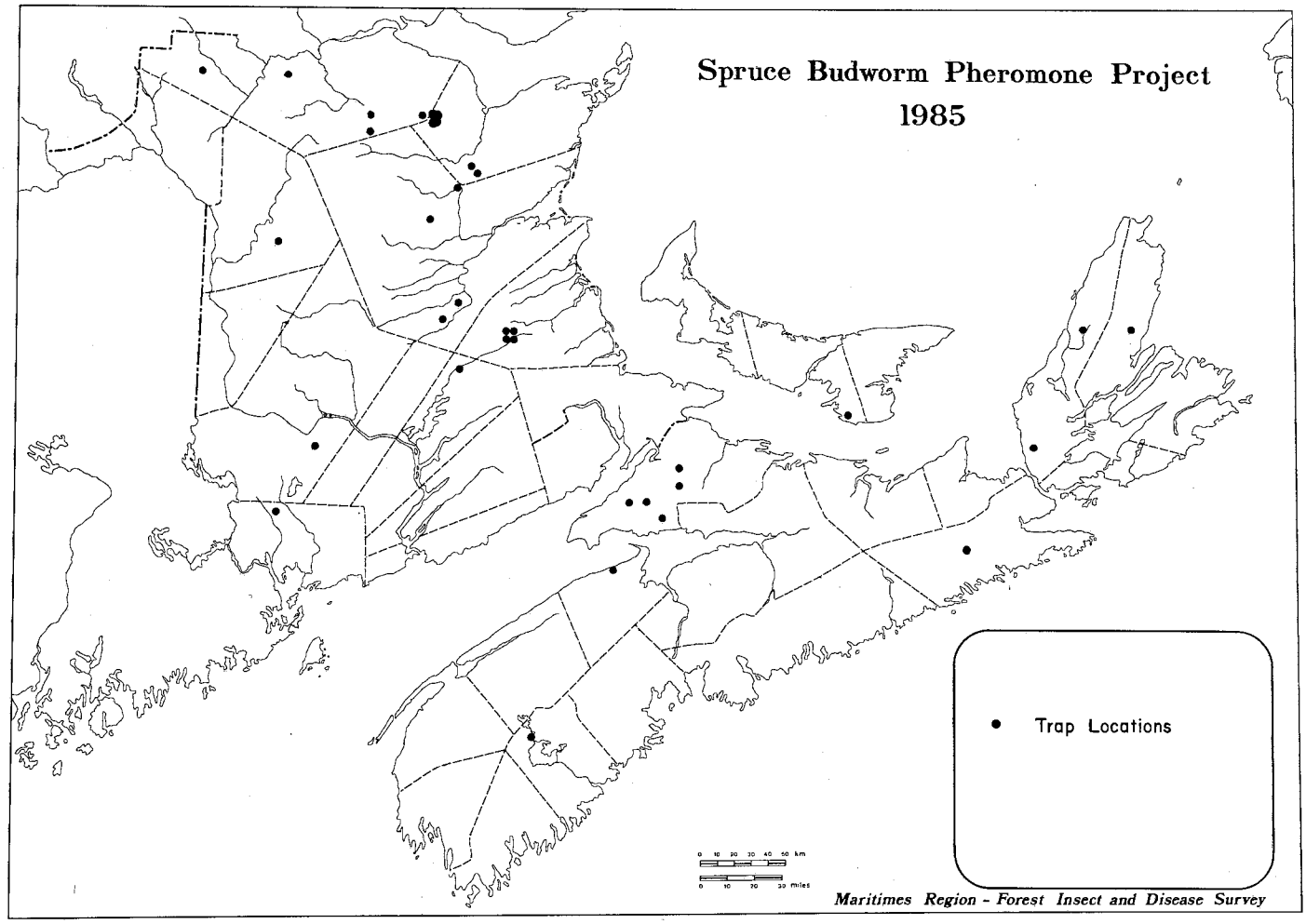


Figure 17.

permanent sampling stations are selected and a population fix, through the L2 sampling, is available, the project is on the way and should yield results in future years.

Forest tent caterpillar Trap catches correspond to areas of defoliation and, more importantly, with the results of late fall egg mass surveys during the last two years. Pheromone catches appear more sensitive for detecting low populations of the insect than the traditional and expensive egg-mass surveys. Consideration is being given to the adoption of pheromone surveys as operational.

Jack pine budworm Work on this pheromone coincided with a small and short lived population rise in central New Brunswick in 1983, allowing for a determination of a gradient in catch numbers correlated to population differences in various areas. Although no meaningful concern-threshold is yet available, with the baseline information at our disposal we can monitor fluctuation of jack pine budworm populations. It appears that this pheromone is ready to aid in planning other surveys when numbers of moths captured warrant.

European pine shoot moth Preliminary results were encouraging, however because the insect is currently at very low population levels in the Region no reliable data have been developed. Continued use of the pheromone is expected to indicate when an increase in the population occurs, then further work on trap calibration will be done.

Oak leaf roller Attractants, were tested in a study to determine the most appropriate lure for a monitoring program and the Oak leaf shredder pheromone was used in Nova Scotia to monitor insect populations at relatively low

Table 17. Spruce budworm pheromone survey - Maritimes Region - 1985

Location	UTM Grid	Larvae L3 - L4 (Ave. of three trees)	Multi-pher trap catches 1	2	3	Ave.	Defoliation %	L2 larvae (Ave. of three trees)
New Brunswick								
1 Lawrence Station (Brockway) Charlotte County	19 64(7) 503(7)	19	0	1	2	1.0	70	20
2 *Mazerolle Settlement 2.8 km on Mountain Rd York County	19 66(4) 507(9)	60	10	4	2	5.0	5	11
3 Gaspereau Forks, Queens County	20 28(1) 512(5)	7	1	-	-	?	20	18
4 Trout Brook, Airstrip #2, Kent County	20 31 514	11	32	6	13	17.0	50	21
5 Trout Brook Airstrip #1, Kent County	20 31 514	18	12	3	10	8.3	20	24
6 Trout Brook Airstrip Block 234A, Kent Co.	20 31(4) 514(8)	8	31	11	5	15.7	20	31
7 Trout Brook Airstrip Block 234B, Kent Co.	20 31(5) 514(8)	12	9	13	11	11.0	30	8
8 South of Dunphy Airstrip, Northumberland County	20 27(7) 515(9)	33	3	5	4	4.0	60	3(8)
9 Mouth of Cains River, Northumberland County	20 28(9) 516(8)	8	20	13	8	13.7	50	16(15)

Table 17. (Continued)

Location	UTM Grid	Larvae L3 - L4 (Ave. of three trees)	Multi-pher trap catches 1	2	3	Ave.	Defoliation %	L2 larvae (Ave. of three trees)
New Brunswick (continued)								
10 Mullin Stream Road, Northumberland County	19 72 521	13	4	3	5	4.0	60	6
11 Tomogonops River Road Northumberland County	20 28 523	6	1	2	4	2.3	10	11
12 *Plaster Rock-Renous Hwy, Little Wapske Road, Victoria County	19 63(7) 519(6)	7	0	0	1	0.3	5	15
13 *South Tetagouche 18.7 km W. Restigouche County	19 71(7) 527(4)	9	0	0	0	0.0	10	9
14 Clearwater Brook, Restigouche County	19 58 529	33	74	43	59	58.7	50	16
15 Two Brooks, Restigouche County	19 63 529	15	11	0	4	5.0	10	9
16 Simpsons Field, Restigouche County	19 68(8) 527(0)	2	1	3	1	1.7	10	5(1)
17 Simpsons Field, Restigouche County	19 68(9) 526(9)	4	2	1	3	2.0	10	11
18 Taylor Brook Road, (Bathurst), Glou. Co.	20 29 524	15	3	8	4	5.0	5	6
19 Taylor Brook Road, (Bathurst, Glou. Co.	20 29 524	6	0	2	2	1.3	5	3

Table 17. (Continued)

Location	UTM Grid	Larvae L3 - L4 (Ave. of three trees)	Multi-pher trap catches 1	2	3	Ave.	Defoliation %	L2 larvae (Ave. of three trees)
New Brunswick (continued)								
20 Rose Hill, Glou. Co.	19 72(0) 527(4)	23	40	28	37	35.0	60	29
21 Rose Hill, Glou. Co.	19 72(1) 527(4)	27	77	33	13	41.0	70	11(14)
22 Rose Hill, Glou. Co.	19 72(2) 527(4)	17	16	48	19	27.7	50	12(12)
23 Rose Hill, Glou. Co.	19 72(3) 527(4)	44	43	59	24	42.0	80	11
Nova Scotia								
24 Chignecto Game Sanctuary, Cumberland County (P-5)	20 38 504	3	0	1	1	0.7	10	(2)
25 Moose River, Cumberland County (P-3)	20 40 503	2	0	0	@	0.0	10	(1)
26 Springhill, Cumberland County (P-4)	20 41 505	33	3	3	3	3.0	50	(15)
27 Leicester, Cumberland County (P-4)	20 41 506	66	1	4	0	1.7	60	(30)
28 Hampton, Cumberland County (P-3)	20 39 504	44	5	0	2	2.3	20	(122)
29 *Sand Lake, Queens County	20 32 490	0	0	0	0	0.0	0	?
30 *E. of Ross Corner, Kings County	20 37(0) 500(1)	4	0	0	0	0.0	15	0

Table 17. (Continued)

Location	UTM Grid	Larvae L3 - L4 (Ave. of three trees)	Multi-pher trap catches 1	2	3	Ave.	Defoliation %	L2 larvae (Ave. of three trees)
Nova Scotia (continued)								
31 *100 m W of Twin Lake road on Third Lake Road (2.5 km from Cross County Harbour-Melrose Road, Guysborough County	20 58(1) 501(0)	?	0	0	0	0.0	5	?
32 *Sterner Plot #21, Loch Lomond (Enon), Inverness County	20 62(2) 507(7)	?	0	0	0	0.0	5	?
33 *Sterner Plot 3, Belle Cote, 11.6 km W. on Pembrooke Lake Road, Inverness County	20 65(4) 514(7)	?	0	0	0	0.0	5	?
34 *Sterner Plot 7, Barachois Brook, 6.4 km S. on Mariana Road, Victoria County	20 68(8) 514(6)	?	0	0	0	0.0	5	?
Prince Edward Island								
35 *Mount Vernon, Queens County	20 51(9) 509(4)	3	2	6	1	3.0	50	12

* Indicates traps placed by FIDS.
()Indicate overwintering larvae (L2)/branch on spruce.
@ Traps destroyed by cutting in the area.

levels at most of the selected locations. Catches for both of these insects are being correlated to egg numbers and to defoliation. This work is carried out in cooperation with the Canadian Forestry Service - Forest Pest Management Institute.

Spruce beetle Both sex and host attractants were used in plastic multi-funnel traps simulating the silhouettes of trees in an experimental trial in cooperation with the New Brunswick Department of Forests, Mines and Energy. No results are available.

Spruce bud moth Pheromones developed by other agencies and used in 1985 in the northwestern New Brunswick outbreak area will be tested as a survey tool in the Maritimes in 1986.

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

Seedling-debarking weevil Preliminary work has been done with freshly cut split bolts of spruce, which attract the insect, adopting experience elsewhere with this technique and with host-attractant compounds used in pit-fall traps. Further development is necessary for quantitative monitoring.

THE LIGHT TRAP MONITORING SYSTEM

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

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

Light trap locations in the Maritimes region are as follows:

NEW BRUNSWICK

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

NOVA SCOTIA

Big Intervale, Inverness Co.
Georgeville, Antigonish Co.
Kejimkujik National Park, Annapolis Co.
Lawrencetown, Annapolis Co.
Liverpool, Colchester Co.
Londonderry, Colchester Co.

PRINCE EDWARD ISLAND

Breadalbane, Queens Co.
Coleman, Prince Co.
Montague, Kings Co.

OTHER INSECTS AND DISEASES

OTHER INSECTS AND DISEASES

This table lists, alphabetically by common name, most insects and diseases encountered in the Maritimes in 1985 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 1985 to warrant detailed discussion. It may be that although "severe", an organism, e.g., Douglas fir needle blight, was only of localized importance in 1985.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Abiotic conditions Flooding	Ash Balsam fir Cedar Red Maple Spruce	N.B. N.S.	Small areas of flooding due to such activities as dam building by beavers or road construction caused decline and mortality of a variety of tree species at a number of locations in western New Brunswick and in Nova Scotia.
Roadside salt damage	Conifers	N.B. N.S.	Various degrees of foliage reddening mainly of white pine and red pine present on roadside trees throughout New Brunswick and Nova Scotia. Other hosts affected but to a lesser extent were Scots pine, eastern hemlock, and balsam fir.
Blowdown	Conifers Hardwoods	N.B.	Approximately 100 ha of mixedwood with extensive blowdown at Veneer, Victoria County; 16% of balsam fir and 12% of spruce at McLean Brook; 16% of the balsam fir at Pokiok, York County; and 16% of balsam fir between Dungarvon River and Holtville, Northumberland County.
Winter drying	Balsam fir Black spruce Red pine Scots pine White pine	P.E.I. N.S.	Moderate and severe injury on young open-grown red pine and white pine at St. Peters and Morell, Kings County, Hunter River, Queens County, and on Scots pine at Kensington and Miscouche, Prince County, and Mansfield, Queens County, Prince Edward Island. Found at a few locations in Nova Scotia.

Alder flea beetle *Altica ambiens alni* Harr.	Alder	Region	Populations increased greatly in southwestern New Brunswick with pockets of moderate and severe browning common in much of Charlotte County, also causing varying levels of browning at locations in Queens, St. John, York, and Carleton counties. Moderate and severe browning along roadsides and in old fields throughout western Nova Scotia with a few scattered patches at locations in Pictou, Antigonish, and Halifax counties. Light browning at Brackley Beach and St. Ann, Queens County, Prince Edward Island.
Animal damage Porcupine	Balsam fir Jack pine Red pine Red spruce Scots pine Tamarack White pine White spruce	N.B. N.S.	Common throughout New Brunswick and Nova Scotia. In damaged areas 18% of trees dead at 8 locations in Nova Scotia and 14% at 6 locations in New Brunswick.
Aphids *Asiphum* sp. *Cinara abieticola* (Cholod.) *Cinara banksiana* P. & T. *Cinara fornacula* Hottes *Pemphigus* sp. *Pterocomma smithiae* (Monell) and others	Balsam fir Balm of gilead Balsam poplar Beech Black spruce Cedar Cherry Jack pine Red maple Red pine Sugar maple Trembling aspen White birch White pine Willow	Region	Aphids present on a wide variety of hosts, at various levels of intensity at many locations throughout the Region. One of the heaviest infestations found in a jack pine plantation near Port Elgin, Westmorland County, New Brunswick.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Aspen leafrollers *Pseudexentera oregonana* (Wlshm.) and *Epinotia criddleana* (Kft.) Birch-aspen leafroller *Epinotia solandriana* (L.) Darkheaded aspen leafroller *Anacampsis innocuella* (Zell.) Large aspen tortrix *Choristoneura conflictana* (Wlk.) Lightheaded aspen leafroller *Anacampsis niveopulvella* (Cham.) Spotted aspen leafroller *Pseudosciaphila duplex* (Wlshm.)	Largetooth aspen Trembling aspen	Region	Leafrolling, mostly of trembling aspen, common at locations scattered throughout much of the Region. Injury usually trace or light but occasionally moderate. More than one species of leafroller often involved.
Aspen webworm *Tetralopha aplastella* (Hlst.) Lesser aspen webworm *Meroptera pravella* (Grt.)	Trembling aspen	N.S. P.E.I.	Present in forest tent caterpillar infested area in Hants County, Nova Scotia at various levels of incidence and intensity. In Prince Edward Island, a few larvae found at Goose River, Kings County.
Balsam woolly aphid *Adelges piceae* (Ratz.)	Balsam fir	Region	Populations continue to be low. In New Brunswick, a slight increase evident at Canoose Lake in Charlotte County where one tree was severely infested, and a few others had trace and light stem attack. Stem wool present in parts of Nova Scotia but did not exceed light, umbrella tops and gouty twigs present in coastal areas. In Prince Edward Island, very light stem attack at scattered locations.

Beech bark disease *Nectria coccinea* var. *faginata* Lohm., Wats. & Ayers Beech scale *Cryptococcus fagisuga* Lind.	Beech	Region	Cankered trees common in beech stands throughout the Region. In New Brunswick, 100% of trees affected near Brockway, York County, Dawson Settlement, Albert County, Acadia Station, Sunbury County, 80% at Mt. Pleasant, Charlotte County, and Rocky Brook area of Northumberland County, 40% in the Cains River area of northern Sunbury County, and 8% at Johnville, Carleton County; in Nova Scotia, 100% at Acadiaville and Wentworth Lake, Digby County, 80% at Marinette, Halifax County, 68% near Melford and northeast of Petit Etang, Inverness County; in Prince Edward Island, 100% at Cross River, Kings County and Brookvale, Queens County.
Cedar leafminers *Argyresthia aureoargentella* Brower *Argyresthia freyella* Wlshm. *Argyrestha thuiella* (Pack.) *Coleotechnites thujaella* (Kft.)	Cedar	N.B. P.E.I.	Browning in New Brunswick severe from Grand Bay, Kings County to Saint John, St. John County, light and moderate Saint John to Rothesay, and Saint John to St. Martins, St. John County, light at Pole Hill Settlement, Carleton County; in Prince Edward Island severe over about 2 km between Sandy Cove and Sunbury Cove, light at St. Eleanors, Miscouche and Freeland, Prince County.
Cedar tree borer *Semanotus ligneus* (F.)	Cedar	N.B.	Cedars continue to deteriorate in the Portage Lake area of Northumberland and Restigouche counties, and along the Martinon by-pass, St. John County, with tree mortality at Dalhousie Jct., Restigouche County.
Cherry casebearer *Coleophora pruniella* Clem.	Pin cherry Trembling aspen	N.B. P.E.I.	In New Brunswick scattered roadside pin cherry bushes moderately browned at Goshen, Albert County. Population levels increased in Prince Edward Island with moderate and severe browning of trembling aspen in areas as large as 3 ha at 26 locations.
Dieback of ash	Ash	N.B.	Branch dieback and top mortality, sometimes associated with armillaria root rot, in a stand of semimature trees, about 1.5 ha, near the Tetagouche River, Gloucester County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Douglas fir needle blight *Rhabdocline* sp. and Douglas fir needle cast *Phaeocryptopus gaeumannii* (Rohde) Petr.	Douglas fir	N.S.	Severe browning of numerous trees at West Leicester, Cumberland County. Negative at Barss Corner, Lunenburg County where light and moderate damage occurred in a 1.2-ha plantation in 1984.
Eastern blackheaded budworm *Acleris variana* (Fern.)	Balsam fir Spruce	Region	Populations continued low.
Eastern tent caterpillar *Malacosoma americanum* (F.)	Apple Cherry	Region	Populations low at locations in eastern New Brunswick where counts were as high as 13/100 m^2 in 1984. Nests present in low numbers in Prince Edward Island and most of Nova Scotia except Hants and Annapolis counties where they were common.
Elm leaf beetle *Pyrrhalta luteola* (Mull.)	Elm	N.B.	Browning of shade trees severe in Fredericton for the third consecutive year.
Elm leafminer *Fenusa ulmi* Sund.	English elm	Region	Leaf browning of varying intensity, often severe in communities in Cape Breton, Colchester, Pictou, Kings, Queens, Lunenburg, Hants, and Halifax counties, Nova Scotia, in all counties of Prince Edward Island; and in Westmorland County, New Brunswick. A reduction from 1984 in intensity of browning occurred at Truro, Colchester County, Nova Scotia and the insect was not found at Montague, Kings County, Prince Edward Island where moderate and severe damage occurred in 1984.
European pine sawfly *Neodiprion sertifer* (Geoff.)	Red pine	N.B. N.S.	Found on an ornamental tree at Moncton, Westmorland County, New Brunswick; present in a plantation at Lunenburg, Lunenburg County, and MacBain's Corner, Colchester County, Nova Scotia.

European pine shoot moth *Rhyacionia buoliana* (D.& S.)	Red pine Scots pine	Region	Populations remained at about the same level as 1984. Intensity of attack varied greatly between locations. In a red pine plantation at Stanley, Hants County, 87% of the trees and 7% of the branch tips were infested, at West Hansford, Cumberland County, 67 and 10%, and at Margaree, Inverness County, 100 and 44%, respectively. In Prince Edward Island, a slight increase occurred in some plantations but, in general, populations remained at about the same level. Found on ornamental red pine at Riverview and Dorchester, Westmorland County, New Brunswick.
European spruce sawfly *Gilpinia hercyniae* (Htg.)	Black spruce Red spruce White spruce	Region	Populations low, distributed widely throughout the Region.
Fall webworm *Hyphantria cunea* (Dru.)	Deciduous	N.S. P.E.I.	Nests very common on roadside bushes in Yarmouth and Shelburne counties, populations increase in all other areas of Nova Scotia, and in Prince Edward Island.
False hornworm *Pheosia rimosa* Pack. Rustylined leaftier *Clostera albosigma* Fitch Pepper-and-salt moth *Biston betularia cognataria* (Gn.)	Trembling aspen	N.S.	False hornworm, in association with the rustylined leaftier and larvae of the pepper-and-salt moth caused moderate and severe defoliation of a few trees northeast of Salem Road, Cape Breton County.
Globose gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Jack pine Scots pine	Region	Common in some areas of New Brunswick, tree counts at four locations showed a range of infection from 1 to 60%. In Prince Edward Island, infection levels remained the same on jack pine at Park Corner, Queens County and found on a few Scots pine ornamental trees at St. Timothye, Prince County; in Nova Scotia 14% of Scots pine affected at West Leicester, Cumberland County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Jack pine budworm *Choristoneura pinus pinus* Free.	Jack pine Scots pine	N.B. N.S.	In New Brunswick populations remained low to trace, however, indications from pheromone trapping and larval sampling plots suggest a slight increase over 1984 levels. Trace defoliation detected at some Northumberland and Kent county locations but feeding on staminate flowers was heavier with most of the flower crop being destroyed at some locations. In Nova Scotia, a small population present in the Oxford area of Cumberland County, but no noticeable defoliation observed.
June beetles *Phyllophaga* sp.	Pines	N.S.	Not causing damage at Middle Musquodoit, Halifax County, where plantation trees were in a state of deterioration in 1984.
Larch needleworm *Zeiraphera improbana* (Wlk.)	Tamarack	N.S.	Populations remain low except at Garden of Eden Barrens, Pictou County, where trees in an area of about 0.25 ha sustained light and moderate defoliation. Trace defoliation on a few trees near Big Pond, Cape Breton County.
Larch sawfly *Pristiphora erichsonii* (Htg.)	Tamarack	Region	Populations remained low throughout the Region, the insect was found at one location in New Brunswick and one in Prince Edward Island.
Leaf blotch of horsechestnut *Guignardia aesculi* (Peck) V.B. Stew.	Horsechestnut	Region	In New Brunswick, moderate and severe leaf browning at Saint John and Tynemouth Creek, St. John County, Westfield, Kings County, Chamcook, St. Stephen, and Welshpool, Charlotte County. In Nova Scotia, leaf browning light at Middle Sackville, Halifax County, and present at various locations in Hants, Kings, Annapolis, Digby, Yarmouth, and Pictou counties, and on Cape Breton Island. In Prince Edward Island, leaf browning severe again at Souris, moderate or severe at Sturgeon and Montague, Kings County, Summerside, Prince County; Belfast and Marshfield, Queens County.

Leafrollers on birch *Caloptilia* sp.	White birch Yellow birch	N.B.	Populations increased significantly in the past 2-3 years resulting in moderate leaf rolling of white birch foliage and to a lesser extent yellow birch in much of the northern half of the Province and at scattered locations in Sunbury, Carleton, and Kent counties.
Leaf spot of oak *Actinopelte dryina* (Sacc.) Hoehn.	Red oak	N.B.	Foliage browning did not occur at Mohannes, Charlotte County, where 50-70% of foliage was affected in 1984.
Leaf spot of poplar *Drepanopeziza tremulae* Rimpau	Trembling aspen	N.S. P.E.I.	Leaf browning moderate and severe at St. Peters, Johnstown, Soldiers Cove, Lennox and Arichat, Richmond County, Nova Scotia, and at Brooklyn, Kings County, Prince Edward Island.
Leaf and twig blight of aspen *Venturia macularis* (Fr.) E. Muell. & Arx.	Trembling aspen	Region	Common throughout New Brunswick causing mostly light damage, with the exception of roadside trees at Crawford Lake, Kings County, that sustained severe loss of new shoots. Damage light at scattered locations in Nova Scotia. Light damage at Mount Pleasant and Piusville, Prince County, Prince Edward Island.
Lichens *Xanthoria* and *Hypogymnia physoides*	Conifers Hardwoods	N.B. N.S.	Common near cement plant and lime works at Havelock, Westmorland County, New Brunswick, and near the cement plant at Brookfield, Colchester County, Nova Scotia, covering stems and branches of many tree species but does not appear to be causing damage.
Maple leafroller *Sparganothis acerivorana* MacK.	Red maple Sugar maple	Region	Populations low throughout Nova Scotia and common but light in New Brunswick. In Prince Edward Island, an area in Kings County with light leafrolling in 1984 increased to moderate. Elsewhere in the Province, leafrolling on red maple moderate and severe.
Maple tar spot *Rhytisma acerinum* (Pers. ex St. Amans) Fr.	Red maple Sugar maple	N.S. P.E.I.	In Nova Scotia, light damage on red maple in Colchester, Kings, and Queens counties, also noted at various locations in the eastern part of the Province with up to 45% of the leaves affected but usually less than 5% of the leaf area injured. In Prince Edward Island, moderate on red maple at Goose River, Kings County, Wellington, Prince County, Wood Islands, Queens County, and on sugar maple at Emyvale, Queens County.

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
Mountain ash sawfly *Pristiphora geniculata* (Htg.)	Mountain-ash	Region.	Various levels of defoliation throughout the Region.
Needle cast *Lirula nervata* (Darker) Darker	Balsam fir	N.B. N.S.	At various levels of intensity at a few locations in natural forests in New Brunswick and in Christmas tree areas and natural forests in Nova Scotia.
Northern pitch twig moth *Petrova albicapitana* (Busck)	Jack pine	N.B. N.S.	Present in a few jack pine stands and plantations in New Brunswick, insect populations and tree damage low. In Nova Scotia, plantations at some locations in Lunenburg, Cumberland, and Colchester counties were infested at various levels of intensity.
Orangehumped mapleworm *Symmerista leucitys* Francl.	Beech Sugar maple	N.S.	Populations declined dramatically from 1984 levels. Light and moderate defoliation in the lower crowns of beech and sugar maple trees in a few stands at College Lake, Halifax County. At Riversdale, Colchester County where about 250 ha were defoliated in 1984 only one small colony of larvae found and defoliation was negligible.
Pine leaf adelgid *Pineus pinifoliae* (Fitch)	Red spruce White pine	N.S.	Common throughout Nova Scotia on red spruce and white pine at various levels of intensity.
Saddled prominent *Heterocampa guttivitta* (Wlk.)	Beech Sugar maple	N.S. P.E.I.	Present in low numbers at scattered locations in Nova Scotia. No defoliation occurred south of Riversdale, Colchester County, where the insect in combination with the orangehumped mapleworm caused considerable defoliation in 1984. Found on beech at Cross River, Kings County, Prince Edward Island.
Satin moth *Leucoma salicis* (L.)	Balsam poplar Carolina poplar Lombardy poplar Silver poplar	Region	In New Brunswick, moderate and severe defoliation of ornamental trees at New Maryland and Harvey, York County. No defoliation at Popple Depot, Northumberland County where moderate and severe foliage loss over about 10 ha of aspen occurred in 1984. In Nova Scotia, moderate defoliation at one location in Hants County. In Prince Edward Island, severe defoliation of ornamental silver poplar trees at Hunter River, Queens

			County and St. Anthony, Prince County. The infestation at Freeland and O'Leary, Prince County and Bedford, Queens County, subsided from 1984 levels.
Scale insects Eriococcidae	Beech	N.B.	Beech trees in an area of about 4 ha at Val-Doucet, Gloucester County supported high populations and were often black in appearance from a cover of sooty mold which developed on the honeydew secreted by the insect.
Spruce coneworm *Dioryctria reniculelloides* Mut. & Mun.	Spruce	Region	Populations remained generally low.
Spruce gall adelgid *Adelges lariciatus* (Patch)	Tamarack	N.B.	Found associated with young seed orchard trees, the insect alternates to spruce.
Striped alder sawfly *Hemichroa crocea* (Geoff.)	Alder	Region	Populations, which were high at Morell East, Queens County, Prince Edward Island and Petit Paquetville, Gloucester County, New Brunswick in 1984, collapsed and no defoliation occurred in the Region.
Tip blight of balsam fir *Delphinella balsameae* (Waterm.) E. Muell.	Balsam fir	N.B. N.S.	Common in the Fundy National Park area, Albert County with up to 75% of current shoots affected on scattered trees. Present also at Peel, Carleton County, Stanley, York County, St. Paul de Kent, Kent County, Sussex, Kings County, New Brunswick. Also found on one tree at Sutherlands Lake, Pictou County, Nova Scotia.
Wax filament scale *Xylococculus betulae* (Perg.)	Willow	N.B.	Found on willow at Calder Head, Charlotte County. This organism is commonly found on birch and beech but willow is a new host record for the Region. See also Deterioration of Birch.
White pine needle blight	White pine	Region	The condition results in browning of needles, often affecting just the tips. It may occur on single or small groups of trees. Mature or semimature trees are most frequently affected but may be found on younger trees; the cause is unknown. Needle browning in 1985 occurred at scattered locations in southern New Brunswick at various levels of intensity in Kings, Queens, Sunbury

INSECT OR DISEASE	HOST(S)	LOCALITY	REMARKS
			St. John, York and Northumberland counties; in Nova Scotia light and moderate browning of individual trees and stands was present at locations in Cumberland, Kings, Queens, Lunenburg, Hants, and Shelburne counties, and at Queensville, Inverness County. It was not found in Prince Edward Island.
White pine weevil *Pissodes strobi* (Peck)	Jack pine Norway spruce Red spruce White pine White spruce	Region	Continued to cause leader mortality to a variety of hosts throughout much of the Region. White pine was the preferred host in nearly all areas.
Willow blight *Venturia saliciperda* Nuesch	Willow	Region	Severe on ornamentals in Queens and St. John counties, New Brunswick; present at various levels of intensity in Colchester, Hants, Kings, Annapolis and Digby counties, Nova Scotia; not found in Prince Edward Island.
Willow flea weevil *Rhynchaenus rufipes* (Lec.)	Poplar Willow	Region	In New Brunswick, severe and moderate browning of ornamental willows at various locations in Gloucester, Restigouche, Northumberland, York, Charlotte, Kings, and Queens counties; in Nova Scotia, widespread at various levels of intensity in Annapolis, Hants, Kings, Halifax, Cumberland, Pictou, Antigonish, Guysborough, Colchester, Inverness, Cape Breton, Richmond, and Victoria counties; in Prince Edward Island, severe browning of bayleaf willow in many areas of Prince and Queens counties, and for the first time in Kings County, at St. Peters.
Yellowheaded spruce sawfly *Pikonema alaskensis* (Roh.)	Black spruce Red spruce White spruce	Region	In Prince Edward Island, many black spruce severely defoliated in a 1.5-ha plantation at Dromore, Queens County where 7% mortality occurred as a result of repeated defoliation; light and moderate defoliation of a few black spruce at Wood Islands, and Brookvale, red spruce at Oyster Bed Bridge, and white spruce at Covehead Harbour, Queens County, and in a 5 ha black spruce plantation near Peaks, Kings County. A few larvae collected in New Brunswick and Nova Scotia but no defoliation observed.

Yellow underwing *Noctua pronuba* L.	N.S.	This newly imported species was found at Tangier, Halifax County. Not found at Middle Musquodoboit, Halifax County, or Hantsport, Hants County where it was collected in 1984. The implication of this newly introduced species to forestry is not yet known.

ACKNOWLEDGEMENTS

This report is the result of the combined effort of all members of the Forest Insect and Disease Survey; L.J. Coady, J.R. Cormier, C.M. Dobson, K.J. Harrison, J.E. Hurley, A.M. Jones, C.D. MacCall, A.W. MacKay, L.P. Magasi, O.A. Meikle, W.R. Newell, D.P. Ostaff, B.A. Pendrel, S.E. Pond and F.A. Titus. We wish to thank our summer students and the numerous staff members at MFRC who contributed in many ways. Some are mentioned in the appropriate sections of the report but special thanks go to Marg Cameron, Ed Kettela, Don Marks and Thaddee Renault. Mike Oudemans was responsible for the preparation of the final versions of all the maps included in this report. Much of the information on the control of the spruce budworm is based on data provided by other organizations as listed in the appropriate chapter. A special thanks from me to Fred Titus who contributed much more than his share to the preparation of this report.

Information contributed by the Pest Detection Officers of the New Brunswick Department of Forests, Mines and Energy, the Nova Scotia Department of Lands and Forests, and the Prince Edward Island Department of Energy and Forestry is acknowledged and appreciated. Special thanks go to those who participated in the gypsy moth surveys.

Parks Canada, the Department of Forests, Mines and Energy of New Brunswick, the Department of Lands and Forests of Nova Scotia, the Bowater-Mersey Ltd., and private individuals operated light traps during the summer months.

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 effort on our behalf in so many ways not only makes our work easier but also makes us a more effective unit. I would like to express my personal thanks to all my staff who made me 'look good' on many occasions through their hard work and dedication. They carried the load on my behalf in my absence through a considerable part of the field season, which I much appreciate.

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Note: The USDA Agriculture Handbook No. 620 on "Managing the Spruce Budworm in Eastern North America" was published in 1984 but because it was not available until after our 1984 report went to press, chapters with MFRC contribution are listed here.