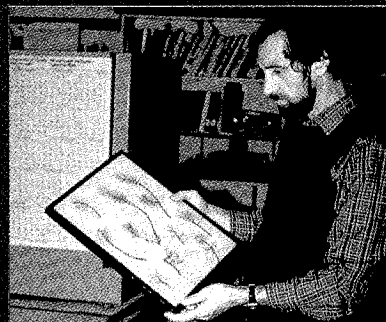
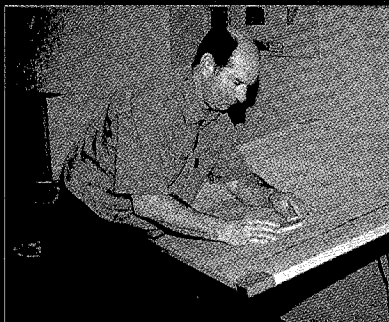
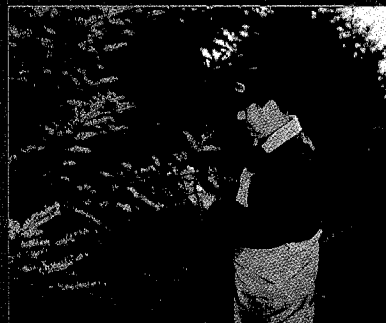
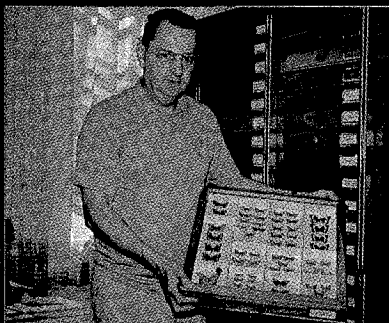




Forest Insect and Disease Conditions in Newfoundland and Labrador in 1994 and 1995

J. Hudak, D.S. O'Brien, D.M. Stone, W.J. Sutton,
L. Oldford, K.E. Pardy and G.C. Carew
Newfoundland and Labrador Region - Information Report N-X-299



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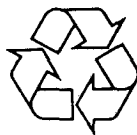
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by

J. Hudak, D.S. O'Brien, D.M. Stone, W.J. Sutton, L. Oldford, K.E. Pardy and G.C. Carew

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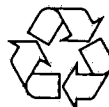
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ABSTRACT

This report summarizes forest pest conditions in Newfoundland and Labrador in 1994 and 1995 and includes a forecast of infestations of major defoliators. Summaries were compiled from information collected by Forest Insect and Disease Survey staff in 12 districts of the Province.

The total area of infestations of **hemlock looper** increased to 58 400 ha in 1995 from 14 400 ha in 1994. Moderate and severe defoliation for the Island in 1995 totalled 22 800 ha an increase from the 1994 total of 11 600 ha. The area of infestation is forecast to cover a total of 149 700 ha of moderate and severe defoliation in productive forest in 1996.

The **balsam fir sawfly** outbreak increased dramatically in Management District 14, to cover a total area of 12 600 ha in 1995. Moderate and severe defoliation was recorded on 4300 ha, an increase from 1200 ha in 1994. This outbreak is forecast to continue and increase in 1996.

The **blackheaded budworm** caused severe defoliation to 300 ha in Management District 17 in 1994. In 1995 the total infested area increased to 1420 ha including 950 ha of light, 270 ha of moderate and 200 ha of severe defoliation. This infestation is forecast to continue in 1996. Population levels of the **spruce budworm** were at endemic levels and no defoliation was recorded in 1994, 1995 or forecasted for 1996.

The **balsam woolly adelgid** continued to cause damage particularly in young thinned balsam fir forest of western Newfoundland. Increased surveys and research are centered on the development of a comprehensive decision support system for the improved management of this important forest pest.

The **European pine sawfly** extended its range by infesting ornamental pines in Gander, Grand Falls and Corner Brook in 1994. The **pine false webworm**, a sawfly, continued to cause light defoliation of ornamental pines in St. John's. These accidentally introduced sawfly species represent a serious threat to native red pine stands.

Armillaria root rot continued to cause varying levels of damage in plantations and natural stands. Enhanced research emphasizes the development of a hazard rating system and management guidelines to minimize damage particularly in plantations.

White pine blister rust infected over 30% of the white pine in areas of western and central Newfoundland where over 20% of the trees had lethal stem cankers. Enhanced cooperation research using biotechnology and biological control is aimed at the re-establishment of white pine stands.

Scleroderris canker continued to affect Austrian pines on the Avalon Peninsula. Experimental results on the susceptibility of various conifers provided guidelines to prevent the possible spread of the disease to highly susceptible native red pine stands in central Newfoundland.

All **Acid Rain National Early Warning System** permanent plots were inspected for pest conditions and sampled for chemical analysis of soil and vegetation in 1995 as part of the 5-year-remeasurement program.

RÉSUMÉ

Le rapport résume la situation des insectes ravageurs des forêts à Terre-Neuve et au Labrador en 1994 et en 1995 et présente les prévisions d'infestations par les principaux défoliateurs. Des résumés ont été établis à partir des données recueillies dans 12 districts de la province par le personnel du Relevé des insectes et des maladies des arbres.

En 1995, les secteurs infestés par l'**arpenreuse de la pruche** ont augmenté par rapport aux 14 400 ha de 1994 pour atteindre 58 400 ha, dont 22 800 ha modérément et gravement défoliés dans l'île, en hausse par rapport aux 11 600 ha de 1994. En 1996, on prévoit que 149 700 ha de forêt productive devraient être modérément et gravement défoliés par ce ravageur.

L'infestation par le **diprion du sapin** a connu une aggravation spectaculaire dans le district d'aménagement 14, pour affecter un total de 12 600 ha en 1995. On a observé une défoliation modérée et grave sur 4 300 ha, en hausse par rapport aux 1 200 ha relevés en 1994. On prévoit que la présente infestation se poursuivra et s'aggravera encore en 1996.

La **tordeuse à tête noire** a causé une défoliation grave dans 300 ha du district d'aménagement 17 en 1994. La zone totale d'infestation en 1995 s'est étendue à 1 420 ha défoliés, dont 950 ha légèrement, 270 ha modérément et 200 ha gravement. On prévoit que cette infestation se poursuivra en 1996.

Les populations de la **tordeuse des bourgeons de l'épinette** se sont maintenues à leur niveau naturel et n'ont causé aucune défoliation en 1994 et en 1995; cette situation devrait se maintenir en 1996.

Le **puceron lanigère du sapin** a continué de causer des dommages, en particulier dans les jeunes forêts éclaircies de sapin baumier de l'ouest de Terre-Neuve. Une augmentation des relevés et des recherches portant sur l'élaboration d'un système complet d'aide à la décision devrait permettre d'améliorer la lutte contre cet important ravageur des forêts.

En 1994, la **tenthrede du pin d'Écosse** a agrandi son territoire en infestant des pins ornementaux à Gander, Grand Falls et Corner Brook. Le **pamphile à tête rouge**, une autre espèce de tenthrede, a continué de causer une légère défoliation des pins ornementaux à St. John's. Ces espèces de tenthredes accidentellement introduites présentent une sérieuse menace pour les peuplements de pins rouges

indigènes.

Le **pourridié-agaric** provoque toujours des dommages plus ou moins graves dans les plantations et dans les peuplements naturels. Des recherches plus poussées soulignent l'importance d'élaborer un système d'échelle de risques et des lignes directrices propres à réduire les dommages, en particulier dans les plantations.

La **rouille vésiculeuse du pin blanc** a infecté plus de 30 % des pins blancs dans les zones de l'ouest et du centre de Terre-Neuve, où plus de 20 % des arbres portaient des chancres mortels sur leurs branches. Une coopération accrue des efforts de recherche, faisant appel à la biotechnologie et à la lutte biologique, vise à restaurer les peuplements de pins blancs.

Le **chancre scléroderrien** a continué de s'attaquer aux pins noirs d'Autriche de la presqu'île Avalon. Des résultats expérimentaux sur la sensibilité de divers conifères ont permis d'élaborer des directives pour prévenir la contagion de cette maladie aux peuplements très vulnérables de pins rouges indigènes du centre de Terre-Neuve.

En 1995, dans le cadre du programme quinquennal de réévaluation, toutes les placettes permanentes du Dispositif national d'alerte rapide pour les pluies acides ont fait l'objet d'inspections et d'échantillonnages, pour y évaluer la situation des ravageurs et y analyser la composition chimique du sol et de la végétation.

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FOREST INSECT AND DISEASE CONDITIONS IN NEWFOUNDLAND AND LABRADOR IN 1994 AND 1995

by

J. Hudak, D.S. O'Brien, D.M. Stone, W.J. Sutton, L. Oldford
K.E. Pardy and G.C. Carew

INTRODUCTION

The mandate of the Forest Insect and Disease Survey is to annually assess forest health conditions by detecting, identifying, evaluation and forecasting forest pest populations, to support research and development programs including regional, national and international plant quarantine activities and to disseminate forest pest information useful for ecosystem management decisions by client agencies. Information on forest health, in the form of describing pest populations and other conditions, were disseminated through seasonal highlights, special reports, information reports and the Annual Report of the Forest Insect and Disease Survey.

This report provides forest managers and the general public with information on pest conditions, forest statistics with regional information for national summaries and forms a part of the historical record for Newfoundland and Labrador. Insects, diseases and conditions that were widespread in 1994 and 1995 or caused considerable concern are discussed in detail in the text, whereas those of lesser importance are presented in tabular form.

The Forest Insect and Disease Survey monitored the abundance of forest pests and related damage in areas throughout the Island and Labrador. The extent of major pest infestation was mapped, population levels sampled and the distribution of damage surveyed intensively to provide their status in 1994. However, due to program changes in the Canadian Forest Service, a less intensive survey was conducted in 1995. In 1994, survey personnel collected 417 insect and 109 disease samples in the 12 ranger districts (Fig. 1) and 19 Forest Management Districts (MD) (Fig. 2) in the Province. A limited number of samples were collected in 1995. Furthermore, the primary responsibility for forecasting infestations of major defoliators was transferred to the Newfoundland Forest Service in 1995 while the Forest Insect and Disease Survey provided advice and assistance where necessary. A forecast of infestations of major defoliators is provided for 1996.

In 1994, helicopters were used to sample inaccessible areas, to map insect defoliation and damage and to sample egg and overwintering larval populations to forecast possible infestations of major forest pests. During the fall forecast survey approximately 160 hours of flying time were used while approximately 90 hours were used for the annual defoliation and damage assessment surveys of the Island. An additional 16 hours were used to complete the aerial survey in Labrador. The actual amount of flying time in 1995 is unavailable because the Newfoundland Forest Service assumed the major responsibility for these surveys.

Quantitative and qualitative estimates of pest conditions were obtained throughout the Province. Damage was expressed using the following ranges:

Trace	1% to 5%
Light	6% to 25%
Moderate	26% to 75%
Severe	76% to 100%
Extreme	100% plus additional damage

The damage assessment surveys of the Island were conducted in the fall of 1994 and 1995 as a coordinated project by the Provincial Department of Forestry and Agriculture and the Forest Insect and Disease Survey.

The Forest Insect and Disease Survey has provided, on request, special collections of insect or disease samples to support various projects conducted by research scientists of the Canadian Forest Service or Universities throughout Canada. During 1994, mass collections of hemlock looper were forwarded to Dr. I. Otvos (Pacific Forestry Centre), balsam fir sawfly to Mr. Blair Helson (Forest Pest Management Institute), Sault Ste. Marie, Ontario, and birch leafminer to Mr. Scott Digweed (University of Alberta). In addition, lichen samples were collected from many locations throughout the Island and Labrador and analyzed by the Department of Earth Sciences, (Memorial University of Newfoundland) to detect any evidence of airborne pollutants.

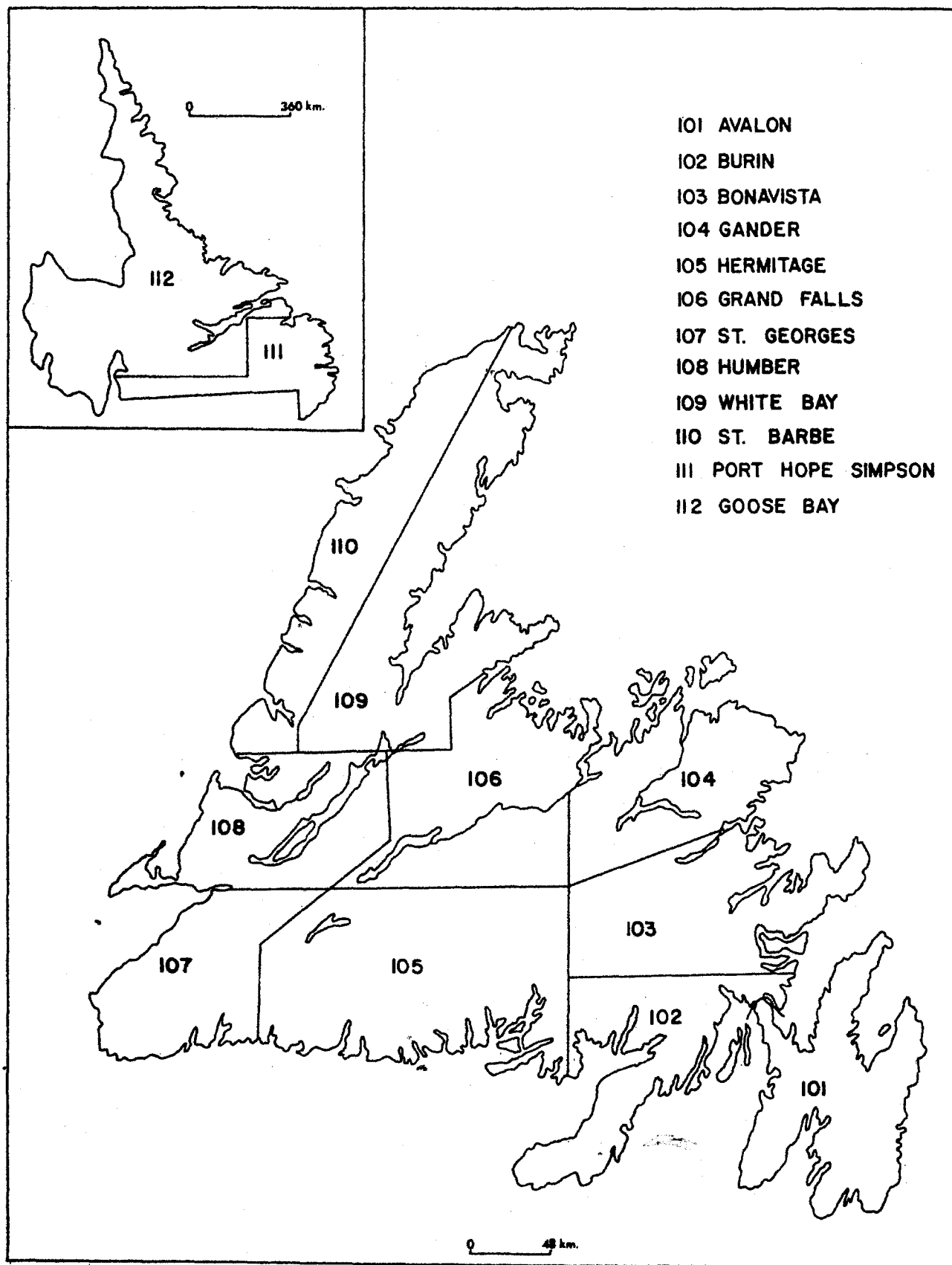


Figure 1. Forest Insect and Disease Survey Districts.

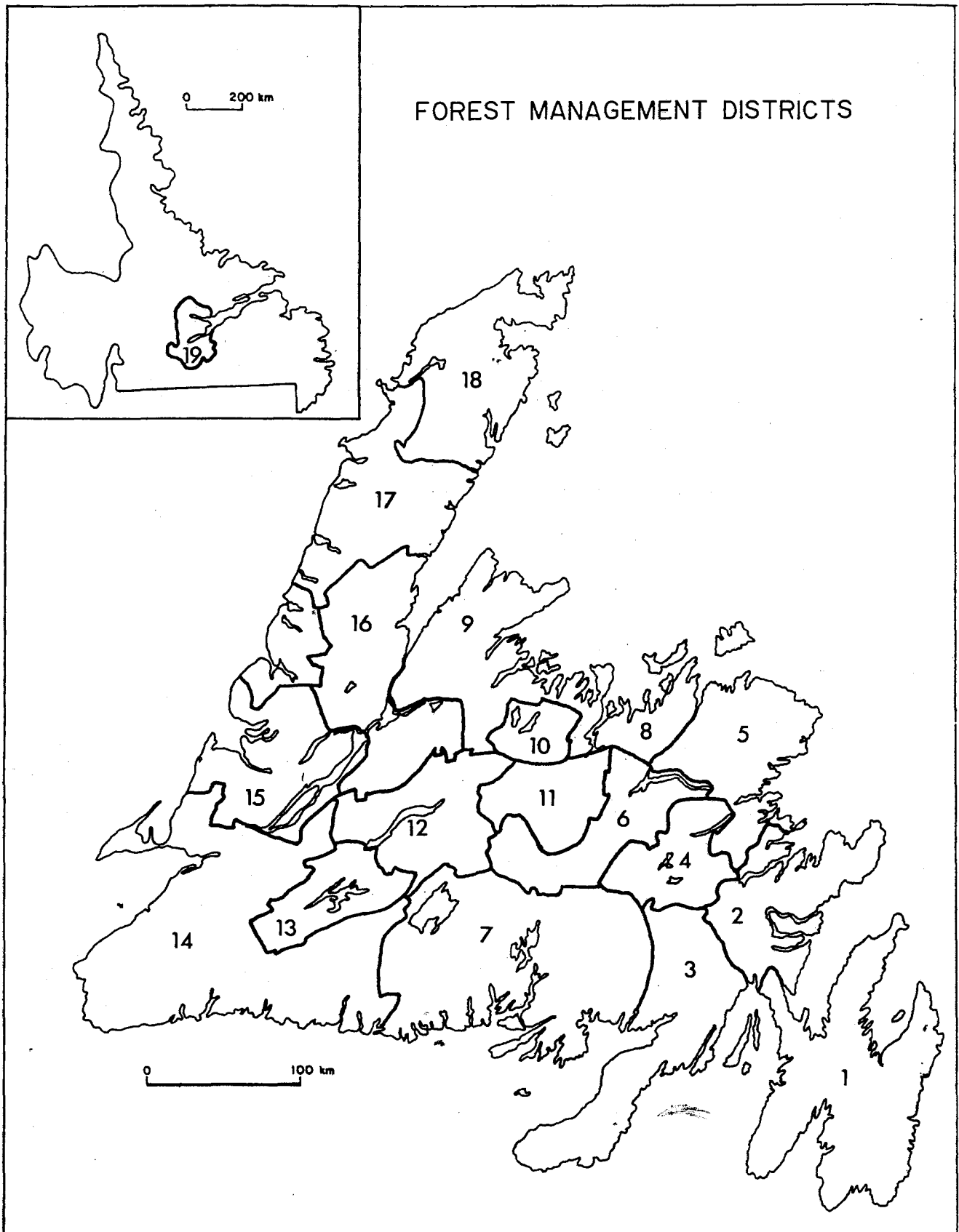


Figure 2. Newfoundland Forest Management Districts.

Staff changes during 1994 resulted in J. Hudak replacing W.W. Bowers as Forest Insect and Disease Survey Head and L. Oldford was assigned to the Central Newfoundland ranger districts due to the retirement of E.C. Banfield. D.M. Stone was responsible for the Labrador districts during 1994.

Following the Program Review culminating in the 1995 Federal Budget, major changes were implemented affecting the overall structure of the Canadian Forest Service and its method of conducting business. It was decided that the Forest Insect and Disease Survey will cease to function after 1995 and most of its duties will be transferred to the Newfoundland Forest Service, with the notable exception of the Forest Health Monitoring including the Acid Rain National Early Warning System. Consequently, all Forest Insect and Disease Survey positions in Newfoundland were eliminated during this downsizing and resulted in the early retirement of W.J. Sutton and L. Oldford. D.M. Stone and D.S. O'Brien later acquired alternate positions within the Forest Health Monitoring Network Program of the Canadian Forest Service.

Weather throughout insular Newfoundland and eastern Labrador was unseasonably cool and wet during early spring in 1994. Temperatures turned warmer than the long-term average after mid-June and continued to remain warm throughout 1994. Precipitation was unusually low in eastern and central Newfoundland stressing trees on shallow soils. In 1995, temperatures were below average throughout the Island in late spring and early summer with less than normal precipitation. A late frost occurred in areas of western and central Newfoundland on June 29 and July 2. Temperatures and precipitation reached normal levels as the season progressed with the exception of heavy rains experienced throughout western Newfoundland on July 2 and 24. In eastern Labrador weather conditions were generally normal in both 1994 and 1995.

IMPORTANT PESTS

FOREST INSECTS

Eastern Hemlock Looper

Lambdina fiscellaria fiscellaria (Guen.)

Larval Development and Defoliation in 1994 -

Moderate and severe defoliation by the eastern hemlock looper (EHL) were forecast to occur in several areas in central Newfoundland in 1994, but in western Newfoundland egg densities had been relatively low in samples collected in the fall of 1993. However high numbers of moths were caught in pheromone traps in the fall and these areas in western Newfoundland were closely monitored for larval populations in 1994. High larval numbers and severe defoliation were recorded in several areas in western Newfoundland including near Hinds Lake, Lomond, Bonne Bay Little Pond, Goose Arm Brook and the South Brook Valley between Pasadena and North Harbour of Grand Lake (Fig. 3). In central Newfoundland high larval numbers and severe defoliation occurred in many scattered locations from Victoria Lake in the south to the Exploits River in the north. In eastern areas of the Island, looper populations remained at outbreak levels in several areas occurring from Clarendville to the Bonavista Peninsula and near Lake St. John. Larval development and survival were good in most of the infestations and resulted in severe defoliation. Generally the looper infestations continued to increase in distribution and severity. The total area of defoliation was about 14 400 ha including 11 600 ha in the moderate and severe category and 2 800 ha in the light category (Table 1). This represented an increase from the 11 200 ha overall defoliation in 1993. The total area in productive forests increased from 9 500 ha in 1993 to 11 500 ha in 1994 encompassing 326 500 m³ of timber in all defoliation categories.

Forecast for 1995 - Overwintering eggs were sampled at 1100 locations in late October of 1994 to forecast larval population levels and subsequent defoliation for 1995. Numerous locations had very high egg numbers (> 100 eggs/branch sample), signifying severe defoliation for 1995. The total area of defoliation was forecast to cover about 209 000 ha, including 90 000 ha in the light and 119 000 ha in the moderate and severe category (Table 2, Fig. 4). Some infestation was forecast to occur in MD 1-4 in eastern Newfoundland, however, most of the outbreak was expected

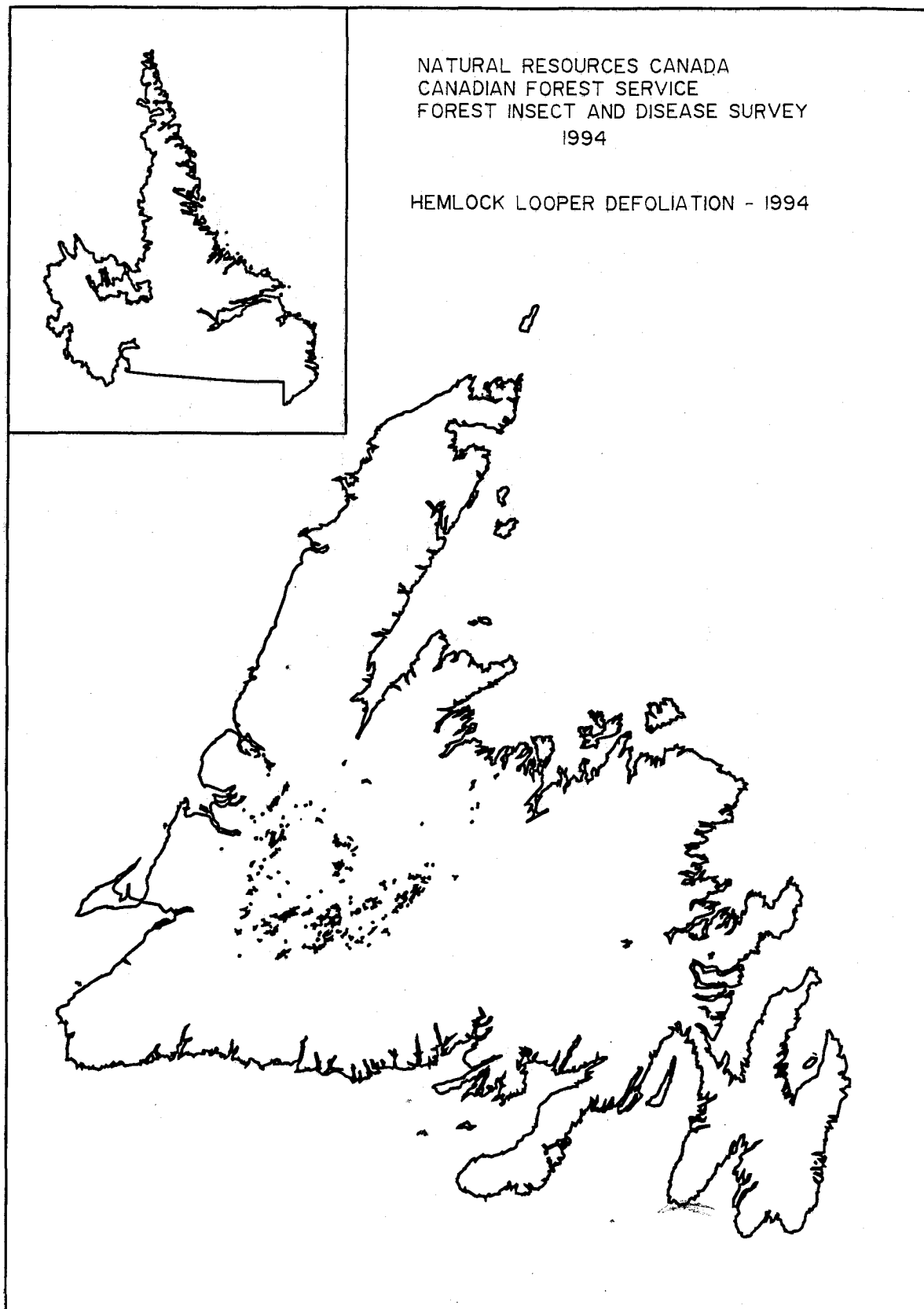


Figure 3. Areas of defoliation by the hemlock looper in forested areas of Newfoundland in 1994.

Table 1. Areas (ha) and gross merchantable volume (m³) of stands defoliated by the hemlock looper in productive forests and total area of infestations in Newfoundland in 1994.

Mgmt. Distr.	Productive Forest*								Productive and Non-Productive Forest (ha) (Total Infestation)			
	Light**		Moderate		Severe		Total		Light	Mod.	Sev.	Total
	Area	Vol.	Area	Vol.	Area	Vol.	Area	Vol.				
1									0	0	18	18
2					587		587		0	20	799	819
4					32	1 966	32	1 966	0	0	32	32
7	28	2 723	51	5 100			79	7 823	28	72	0	100
9									0	0	19	19
10	109		36		16		161		246	55	24	325
11	85	1 826	176	6 853	64	2 951	325	1 163	121	218	60	399
12	483	14 659	900	24 259	1514	59 724	2 897	98 642	640	847	1 600	3 087
13	77	3 494	285	9 788	2377	79 537	2 739	92 819	511	359	3 056	3 926
14	33	1 527	149	6 538	166	6 392	348	14 457	61	208	293	562
15	873	14 603	2 712	75 360	347	9 193	3 932	99 156	924	2 785	437	4 146
16	163		152		109		424		272	327	280	879
GMNP									12	79	0	91
Total	1 851	38 832	4 461	127 898	5 212	159 763	11 524	326 493	2 815	4 970	6 618	14 403

*Productive forest = Capable of producing ≥ 35 m³/ha. Data provided by NFS.

**Light = 6% - 25%
 Moderate = 26% - 75%
 Severe = 76% - 100%

Table 2. Areas (ha) of defoliation by the hemlock looper forecast in forested areas of Newfoundland for 1995.

Management District	Defoliation (ha)*			
	Light	Moderate	Severe	Total
1	5 542	834	0	6 376
2	4 869	3 989	3008	11 866
4	2 553	1 517	1 985	6 055
6	273	456	1 136	1 865
7	2 279	478	0	2 757
9	512	0	0	512
10	3 656	988	1 449	6 093
11	1 117	872	3 193	5 182
12	17 076	7 101	11 311	35 488
13	3 728	5 279	15 415	24 422
14	17 124	11 718	6 981	35 823
15	20 604	5 423	29 191	55 218
16	2 362	423	724	3 509
17	3 263	2 157	876	6 296
GMNP	3 757	808	606	5 171
TNNP	1 564	318	857	2 739
Total	90 279	42 361	76 732	209 372

*Light = 6% - 25%

Moderate = 26% - 75%

Severe = 76% - 100%

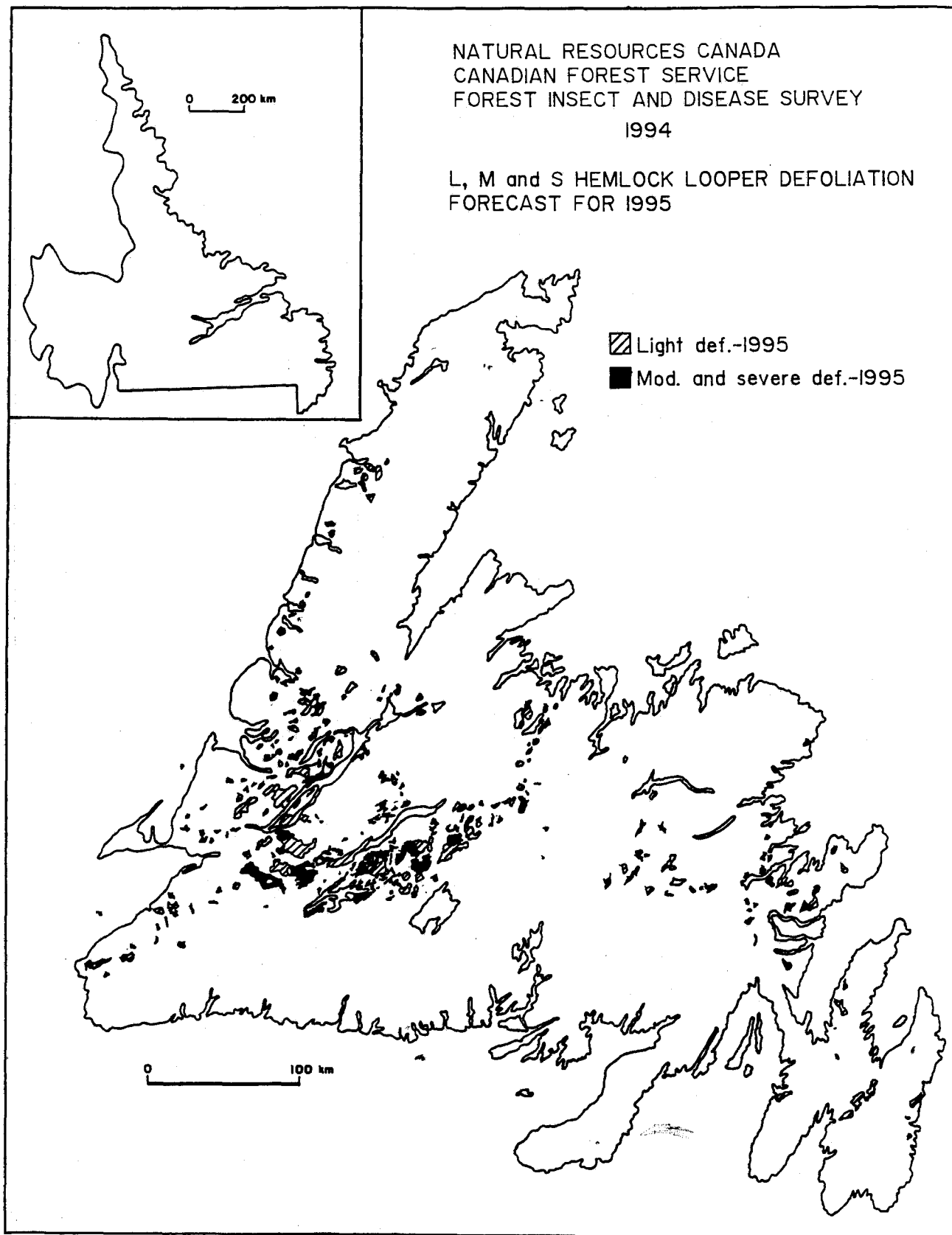


Figure 4. Areas of defoliation by the hemlock looper forecast in forested areas of Newfoundland for 1995.

to be distributed throughout MD 10-17 in central and western Newfoundland.

Larval development and defoliation in 1995 - In 1995, defoliation occurred in most of the forecast areas except in central Newfoundland from Redcross Lake to Diversion Lake in the Bay d'Espoir area and in several locations on the Bonavista Peninsula. A severe late frost on June 29 may have been the cause of the collapse of looper populations in these areas.

In 1995, the total area of defoliation was 58 400 ha including 22 800 ha in the moderate and severe classes (Table 3, Fig. 5). Most of the defoliation caused by the hemlock looper occurred on the west coast of the Province, in MD 15. Areas east and north of Corner Brook and around Pasadena, Deer Lake, Grand Lake and Goose Arm were the most severely infested. Moderate and severe defoliation were also mapped near Cormack, Hinds Lake, Victoria Lake and Terra Nova National Park. Many of the areas around Hinds Lake and Victoria Lake had been defoliated in 1994. Smaller areas of defoliation were recorded around Gander Lake, Diversion Lake and Lake St. John. New, relatively small infestations occurred on the Northern Peninsula, as far north as Hawkes Bay.

Biological Mortality Factors - In 1994 and 1995, EHL larvae were collected from eastern, central and western Newfoundland to determine natural mortality factors. Parasitism caused mainly by tachinid species affected less than 1% of the larvae in 1994 and less than 5% in 1995. Disease organisms were present in all areas in various degrees of incidence and were tentatively identified as bacteria, yeast-like organisms and fungi, including *Entomophaga aulicae* and *Erynia radicans*. Contract research with Memorial University on the mass fermentation of *E. aulicae* has been successful in producing hyphal bodies capable of forming conidia on completely defined medium. Patenting this medium is in progress. The ultimate goal of this work is to initiate epizootics using artificially produced spores at the beginning of impending outbreaks to minimize forest damage. Research on the use of exotic parasitoids for improved biological control of the EHL produced negative results. These parasitoids did not develop well on EHL and are not suitable for release as control agents.

Pheromone Trapping - A pheromone trap grid was established in the summer of 1994 and 1995 using 50 permanent sample locations throughout the Island (Fig. 6). Multi-pher traps baited with a hemlock looper pheromone

were used at all locations. In 1994, traps at numerous locations in western and central Newfoundland became saturated signifying increased population levels. The mean number of moths per trap collected in western central and eastern Newfoundland was 801, 292 and 179 respectively. In 1995, the number of moths per trap was significantly higher in western and eastern Newfoundland while population levels in central regions were slightly lower than in 1994. In comparison the 1995 catches were 1184, 237 and 638 respectively (Appendix 1).

Control Program - The Newfoundland Forest Service, Department of Natural Resources conducted an operational control program against the EHL. The biological insecticide, *Bacillus thuringiensis* (*B.t.*) was applied to about 11 000 ha of balsam fir forest in central Newfoundland in 1994 and to about 48 000 ha of balsam fir forest in central and western Newfoundland in 1995.

The Canadian Forest Service (CFS) conducted an experimental program in 1995 testing the efficacy of two aqueous formulations of *B.t.* and the growth regulator tebufenozide, MIMIC 240 LV. Both insecticides were effective in reducing larval numbers and preventing defoliation from low to moderate populations of EHL. Additional testing in stands with high populations is warranted. Early application of MIMIC at the beginning of larval hatching should also be evaluated to determine if deposits persist long enough to kill late hatching larvae.

Damage Assessment - The EHL was the major cause of forest depletion in Newfoundland and Labrador from 1988 to 1995. The CFS cooperated with the NFS to assess the damage. The total volume of stand mortality in these defoliated areas during this 5-year period from 1988 to 1992 was 3 299 000 m³. Approximately 353 000 m³ was salvaged. In addition to tree mortality, an estimated 343 000 m³ were lost as a result of reduced growth. Damage assessment of more recently defoliated stands is in progress.

Eastern Hemlock Looper Decision Support System (EHL DSS) - A project was initiated in 1988 to develop a decision support system to facilitate integrated management of EHL populations across insular Newfoundland. Individual models were developed to predict probabilities of defoliation, timber mortality and decay, risk of impending outbreaks and larval phenology. Models and data were embedded in a geographic information system (ARC/INFO®) and linked to a menu-driven, graphical user interface FOKIS (Forest Knowledge Information Systems).

Table 3. Total area of hemlock looper defoliation by Management District and severity class in Newfoundland in 1995.

Management District	Total Area (ha) by Defoliation Class			
	Light**	Moderate	Severe	Total
2	59			59
4	3	44	7	54
5	47		5	52
6	60	246	237	543
7			21	21
8	65	10	2	77
10	208	66	40	314
11	84	33		117
12	348	149	398	895
13	987	1 897	1 306	4 190
14	3 620	1 430	138	5 188
15	24 350	9 079	4 401	37 830
16	1 593	717	963	3 273
17	3 617	205	224	4 046
GMNP	279	388	298	965
TNNP	235	407	102	744
TOTAL	35 555	14 671	8 142	58 368

*Total area includes productive and non-productive forests. Productive forest = Capable of producing $\geq 35 \text{ m}^3/\text{ha}$.

**Light = 6% - 25%

Moderate = 26% - 75%

Severe = 76% - 100%

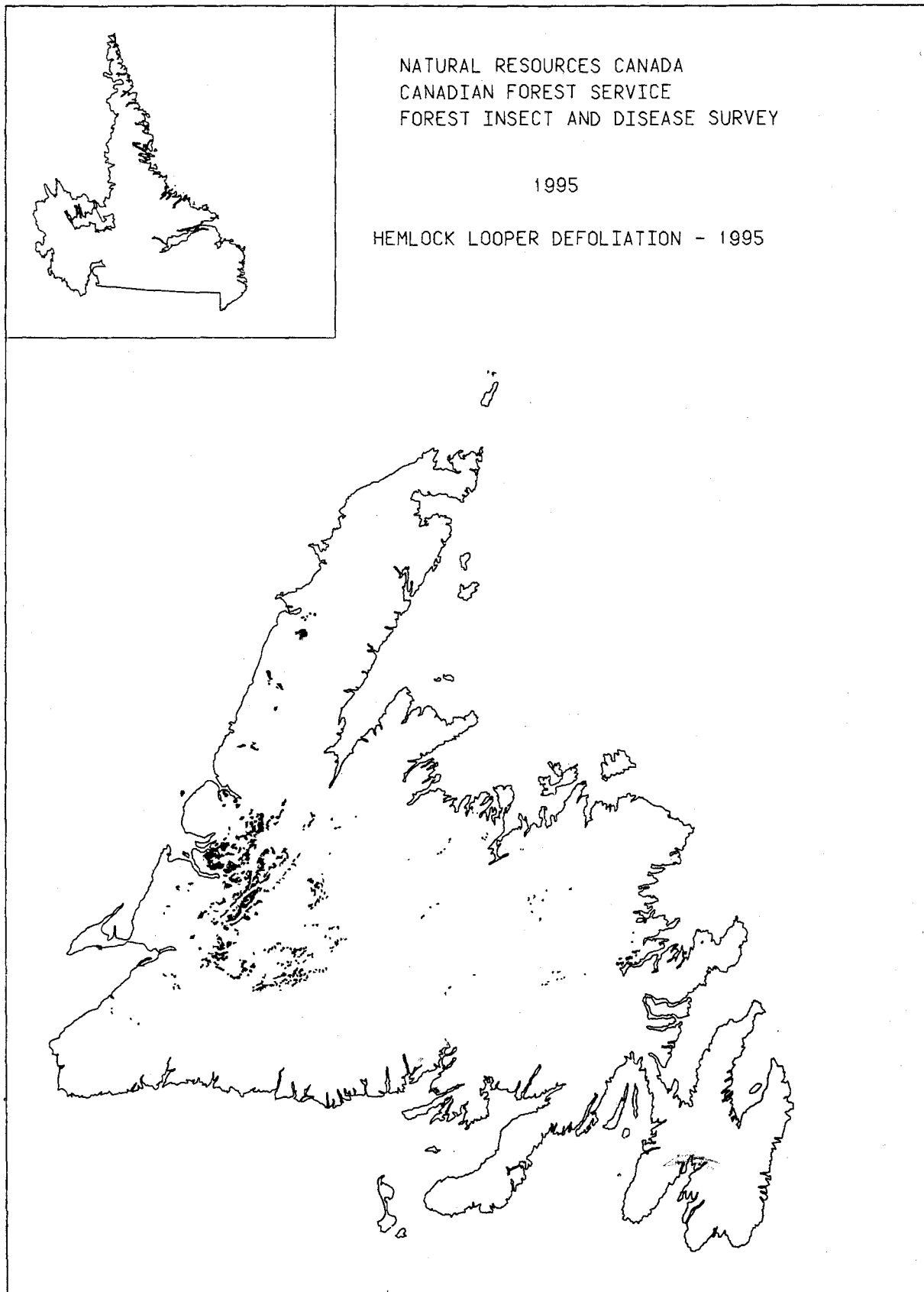


Figure 5. Areas of defoliation by the hemlock looper in forested areas of Newfoundland in 1995.

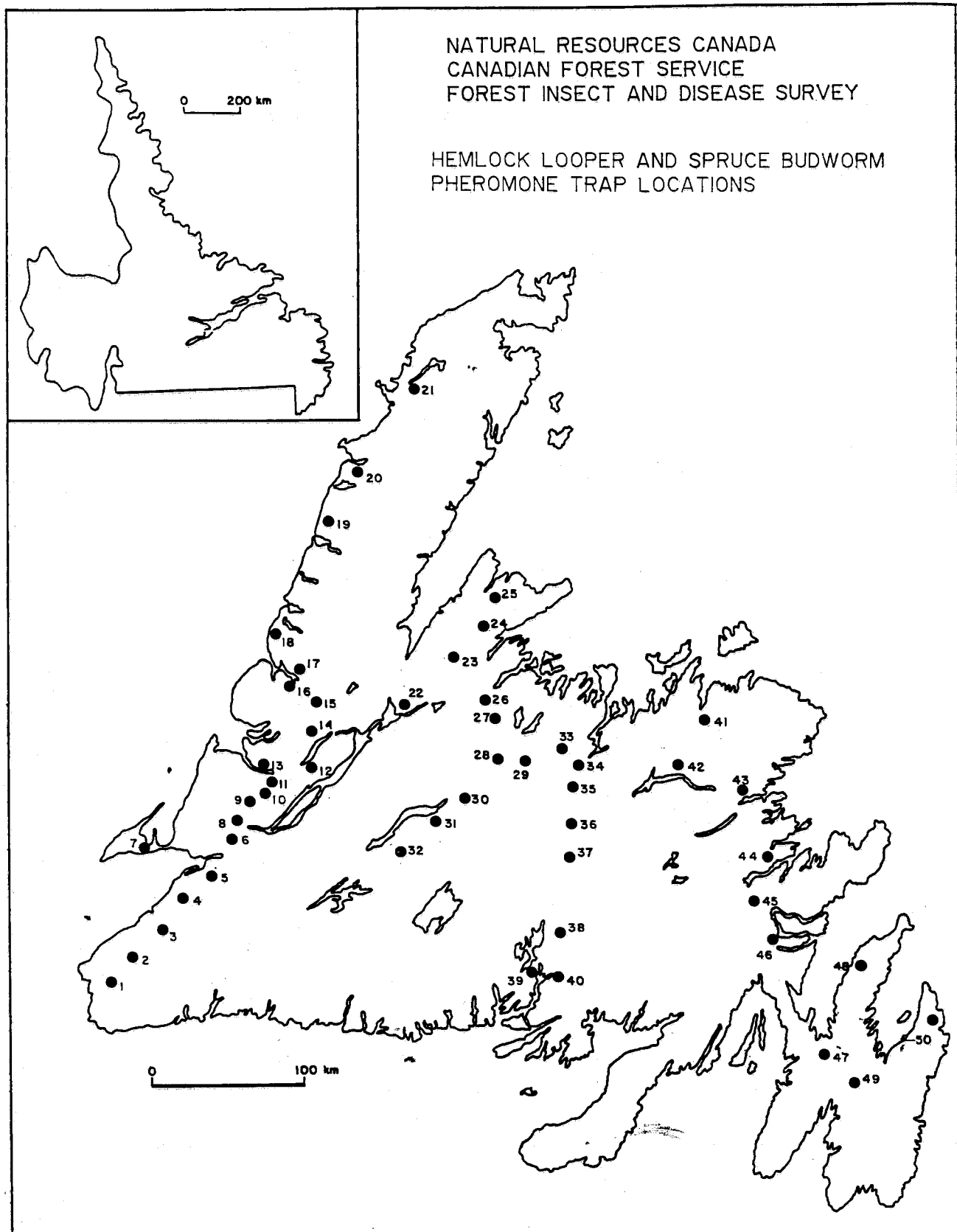


Figure 6. Hemlock looper and spruce budworm pheromone trap locations in Newfoundland.

The EHL DSS generates predictions of probabilities of initial and continued defoliation, timber mortality and decay based on forest stand characteristics and past and present EHL population levels. To support management decisions, each prediction run can be modified based on stand eligibility for control tactics, expected efficacies of various control measures and acceptable mortality and decay volume resolution. Future versions of EHL DSS will include links to timber supply projection models and incorporate economic analyses and indicators.

Forecast for 1996 - In 1995, the primary responsibility for the forecast survey was transferred to the Newfoundland Forest Service, Department of Natural Resources. However, the Forest Insect and Disease Survey cooperated and provided advice and assistance in the planning of the survey, the collection and processing of branch samples and in the formulation of the forecast.

Overwintering eggs were sampled at over 1 000 locations throughout the Island in the fall of 1995 to forecast larval populations and subsequent defoliation for 1996. Moderate to severe hemlock looper defoliation is expected to occur on 149 700 ha of productive forests located primarily from George's Lake to Bonne Bay and in the River of Ponds to Hawkes Bay area. Smaller, isolated pockets of moderate to severe defoliation are also forecast near Crabbes River, Birchy Lake, Hodges Hill, Grand Falls, Gander, Star Lake and on the Bonavista Peninsula. The amount of light defoliation expected for 1996 was not calculated.

Eastern Spruce Budworm *Choristoneura fumiferana* (Clem.)

Larval Development and Defoliation - Populations of the eastern spruce budworm (ESB) were at endemic levels throughout the Island and no areas of defoliation were detected in 1994 or 1995. The infestation near Codroy Pond collapsed in 1993. Pheromone traps were placed at 50 permanent plots throughout the Island (Fig. 7). Twelve of those locations in western Newfoundland were checked in July of 1994 and 1995 for possible moth invasion from the Maritime Provinces. In 1994, traps at five locations were without moths, four locations had 1 moth, and three locations had 2, 4, and 12 moths respectively. These moths were caught before local emergence had commenced, and such low numbers indicate that moth invasion was relatively light in 1994. The overall mean catch in the fall of 1994 remained low and averaged 1 moth per location as compared to approximately 5 moths per location in 1993. The highest

number of moths trapped were on the west coast of the Island at Campbells Creek and Bay of Islands (average 5 per trap) and at Sallys Cove (average 3 per trap). All trap catches in 1994 from central and eastern Newfoundland were negative (Appendix I). In 1995, the results of traps that were checked before local emergence commenced were negative, with the exception of one near Barachois Pond Park where only two moths were caught. Trap catches from local populations were also low in all areas in 1995 with the highest mean trap catch being 10 moths caught near Corner Brook. The overall mean catch per location in 1995 was 2 moths.

Damage Assessment - Several small infestations were recorded from 1987 to 1993 in western Newfoundland, but these did not cause tree mortality. However, volume loss from reduced growth was estimated at 2 800 m³.

Spruce Budworm Decision Support System - Quantification of the impact of the ESB involved derivation of predictive equations relating stem-wood growth reduction to defoliation intensity and stand and site parameters. This work is a contribution towards a spruce budworm decision support system jointly developed for eastern Canada under the Green Plan.

Forecasts for 1995 and 1996 - Overwintering larvae are sampled at the 50 ESB pheromone trap sites throughout the Island in the fall. Resulting larval counts were very low in both years. No appreciable defoliation by the spruce budworm was recorded in 1995 or is expected in 1996.

Blackheaded Budworm *Accleris variiana* (Fern.)

Population levels of the blackheaded budworm (BHB) have decreased in recent years but a small infestation near Hawkes Bay on the Northern Peninsula persisted in 1994 and caused overall severe defoliation in about 330 ha of overmature balsam fir stands of which 240 ha was in productive forest resulting in 30 000 m³ of tree mortality and 3 000 m³ of growth reduction. Population levels were high again in 1995, and the area of infestation increased to 1420 ha of which 200 ha was severe while 270 ha and 950 ha were in the moderate and light categories respectively (Table 4). Some additional tree mortality and growth reduction is expected in these stands. This infestation is forecast to continue in 1996.

The BHB characteristically defoliates trees by

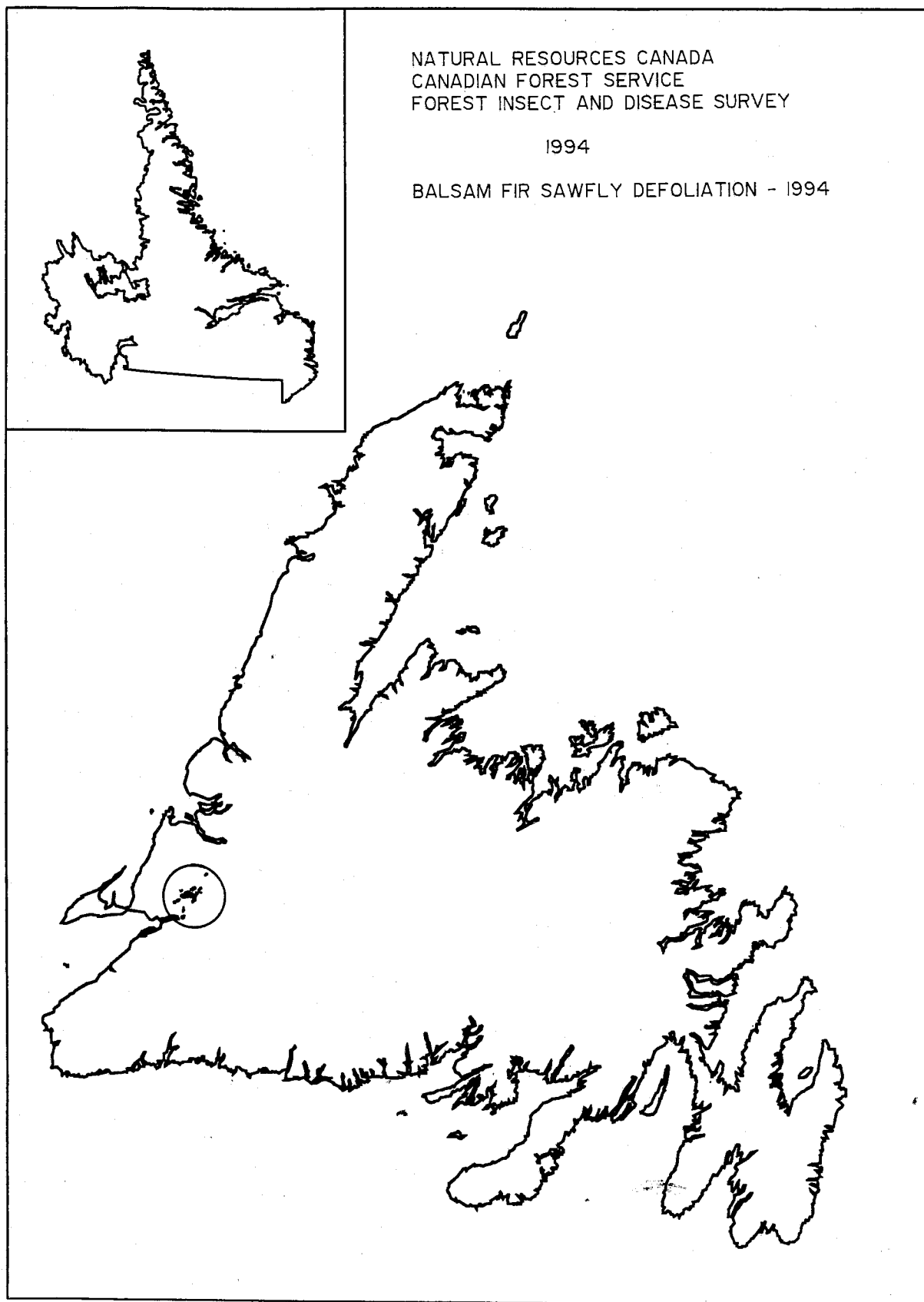


Figure 7. Areas of defoliation by the balsam fir sawfly in forested areas of Newfoundland in 1994.

Table 4. Areas (ha) and gross merchantable volume (m³) of stands defoliated by the blackheaded budworm in productive forests and total area of infestations in Newfoundland in 1994 and 1995.

Year	Productive Forest*				Productive and Non-Productive Forest (ha) (Total Infestation)			
	Severe		Total		Light**	Mod.	Sev.	Total
	Area	Vol.	Area	Vol.				
1994	243	25273	243	25273	0	0	328	328
1995					950	270	200	1420

* Production forest = Capable of producing ≥ 35 m³/ha. Data provided by NFS.

**Light = 6% - 25%

Moderate = 26% - 75%

Severe = 76% - 100%

causing damage to the current year needles, mostly in the upper portion of the crowns. An investigation to determine the potential of remote sensing to forecast the susceptibility (likelihood of defoliation) and vulnerability (likelihood of volume loss or mortality) of balsam fir stands to BHB damage has been successful. Optimal logistics models were derived that integrate selected spectral measurements and forest inventory data to produce classification accuracies of 81%, 67% and 78% for susceptibility, pre-, and post-outbreak vulnerability respectively.

Balsam Fir Sawfly

Neodiprion abietis complex

The balsam fir sawfly (BFS) has defoliated young and semi-mature balsam fir in the Bottom Brook - Trout Brook - White's Road area of MD 14 since 1991. In 1994 an overall area of moderate and severe defoliation covered 1216 ha of which 727 ha was in productive forests affecting 9 800 m³ of timber (Table 5). This infestation was concentrated mainly along White's Road and the Trans Canada Highway (TCH), near Trout Brook, with smaller patches of defoliation occurring near Wheelers Brook and Little Grand Lake Road (Fig. 7). Thinned stands along the TCH near Trout Brook were severely defoliated for the first time in 1994. About 10% tree mortality resulting from previous severe defoliation occurred in young thinned stands along the Caribou Lake Road. Egg parasitism was estimated at only 2% in 1994 indicating high early instar larval

populations in 1995.

In 1995 there was a tenfold increase in the overall outbreak area (Table 5), extending from Southwest Brook, north to Gallants road and west to Harry's River (Fig. 8). Defoliation was most severe along the TCH from Caribou Lake road north to Gallants Hill and along Harry's River. Light to moderate defoliation was widespread from the north side of George's River west to Bottom Brook and Southwest Brook. Light defoliation was extensive along the TCH and White's Road. Severe defoliation was also reported near Burin.

The results of the 1995 egg survey indicate that moderate to severe defoliation is expected to continue in 1996 in the same general location, with an expansion in the Hare Hill area.

Balsam Woolly Adelgid

Adelges piceae (Ratz.)

The balsam woolly adelgid (BWA) is prevalent in most areas of Newfoundland particularly in central and western regions where nearly 200 000 ha of balsam fir, the majority of which is less than 40 years old, has been infested. Major silvicultural activities using precommercial thinning designed to reduce a serious wood supply deficit are threatened, making the sustainable supply of balsam fir questionable. Increased survey and research efforts, including

Table 5. Areas (ha) and gross merchantable volume (m³) of stands defoliated by the balsam fir sawfly in productive forests and total area of infestations in Newfoundland in 1994 and 1995.

Year		Defoliation**							
		Light		Moderate		Severe		Total	
		Area	Vol.	Area	Vol.	Area	Vol.	Area	Vol.
1994	Prod.*	0	0	536	6750	191	3017	727	9767
	Total	2	-	816	-	400	-	1218	-
1995 (Total)		8300	-	1200	-	3100	-	12600	-

* Productive forest = Capable of producing ≥ 35 m³/ha. Data provided by NFS.

**Light = 6% - 25%
 Moderate = 26% - 75%
 Severe = 76% - 100%

an innovative remote sensing technology, site-specific surveys and chemical characterization of foliage are being used to develop a hazard rating system as an integral part of a comprehensive decision support system for the improved management of this important forest pest.

European Pine Sawfly *Neodiprion sertifer* (Geoff.)

Pines were severely defoliated in many communities along Conception Bay of the Avalon Peninsula from Portugal Cove to north of Harbour Grace. In addition, new infestations were detected in 1994 on ornamental pines in Gander, Grand Falls and Corner Brook and are significant range extensions from known areas of occurrence on the Avalon Peninsula. These were probably caused by human transport of infested pines. These new infestations represent a direct threat to native red pine stands. A cooperative effort involving the Newfoundland Forest Service, Agriculture-Agrifood Canada and Memorial University of Newfoundland initiated in the early spring of 1994 to improve the detection and enhance the application of quarantine measures and domestic insecticides to prevent further spread of this important pine defoliator was well received and supported by the public.

Pine False Webworm *Acantholyda erythrocephala* (Linn.)

Defoliation by this false webworm, a sawfly, continued for a third year in and near St. John's, however most trees were only lightly defoliated. The adult is a striking insect with metallic blue body and bright orange head. This insect was not collected in Newfoundland before 1990, and probably was accidentally introduced into the St. John's area. The pine false webworm is potentially a more serious defoliator of pines, including red pine, than the European pine sawfly, because the false webworm will also feed on new-growth needles after the old foliage has been consumed. In the St. John's area Austrian pine seems to be the preferred host followed by mugho pine, Scots pine and jack pine in decreasing order. The distribution of this false webworm will be closely monitored and this insect, together with the European pine sawfly, will be treated as serious threats to native red pine stands.

Larch Sawfly *Pristiphora erichsonii* (Htg.)

In 1994 high population levels of this sawfly were detected in many scattered areas in western Newfoundland from the Baie Verte Peninsula to Sheffield Brook, Howley, Deer Lake, Goose Arm Road and south to the Pinchgut Lake area. High populations also occurred in many areas in central

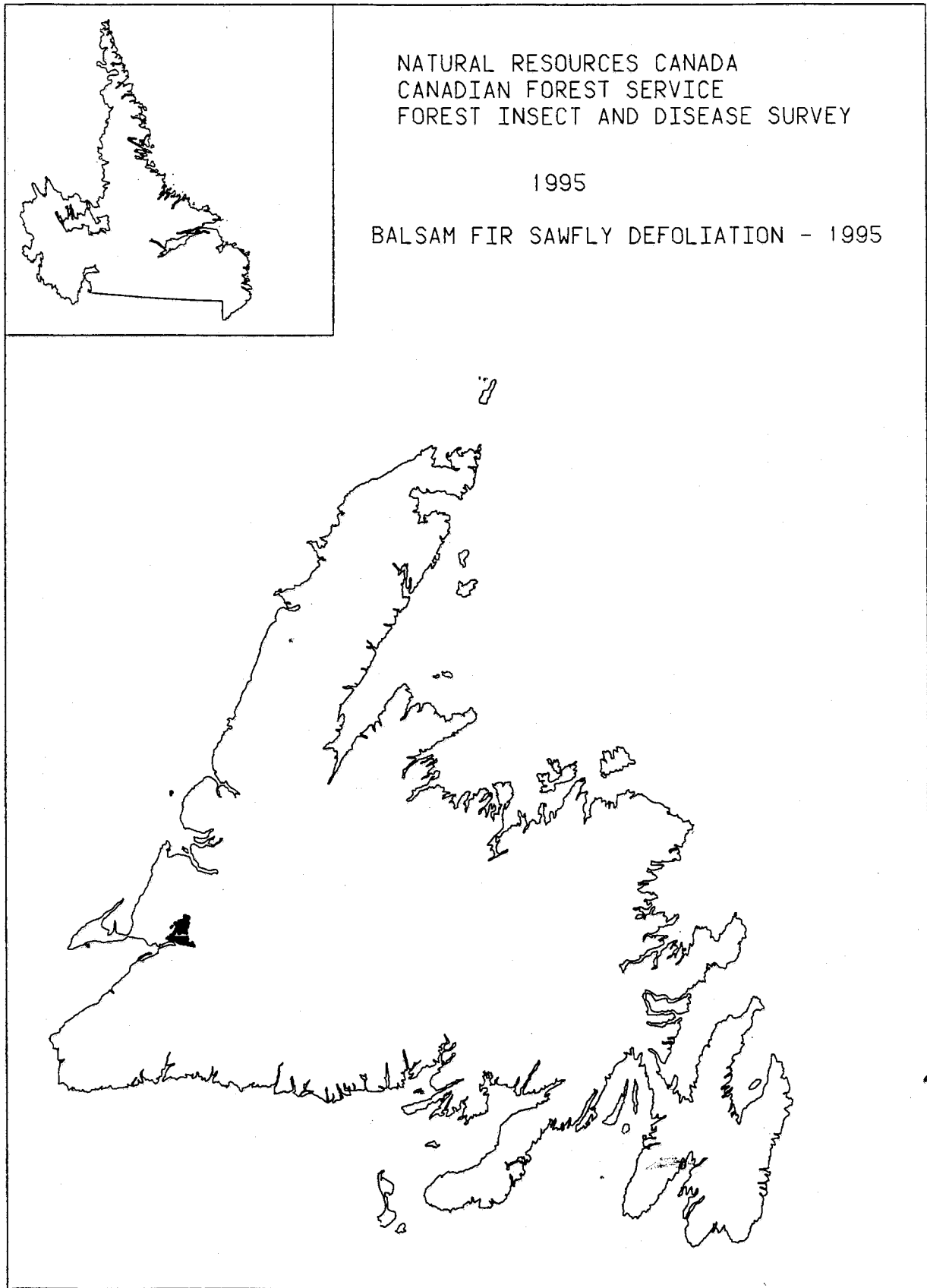


Figure 8. Areas of defoliation by the balsam fir sawfly in forested areas of Newfoundland in 1995.

Newfoundland from Bishops Falls, Grand Falls, Botwood and west to Buchans Junction. Moderate to severe defoliation was experienced in many of those areas. In Labrador light defoliation of 10% to 20% occurred in scattered larch stands in the Goose Bay area and along the Goose River and Grand Lake roads. Department of Forestry and Agriculture staff report that the outbreak in western Labrador had collapsed.

This outbreak continued in 1995, causing extensive defoliation in larch stands throughout the Island. Defoliation was particularly severe in central and eastern areas with varying degrees of defoliation also occurring in western and northern Newfoundland. Light defoliation was recorded again in eastern Labrador, near Goose Bay.

Results of the annual fall shrew trapping program in the four permanent plots across the Island showed a significant increase in the number of shrews over the last 2 years (Table 6). The larch sawfly is a food source of the masked shrew and the high sawfly numbers may have contributed to the increase in shrew populations.

Balsam Gall Midge *Paradiplosis tumifex* Gagne

Surveys in 1994 indicated a significant decrease in population levels of this insect in the Goose Arm to Bonne Bay Big Pond area. However, the continual loss of new foliage with simultaneous damage caused by *Sirococcus* shoot blight, has seriously decreased the vigor of infested stands. Little additional damage was detected in this area in 1995. Varying degrees of damage by the balsam gall midge was observed throughout northern and western Newfoundland in 1994 particularly in MD 15, 16 and 17. Severe defoliation was most evident from Georges Lake to Lady Slipper Road, also in conjunction with damage by *Sirococcus* shoot blight. High populations were also observed in many locations throughout central and eastern Newfoundland.

Table 6. Estimated number of shrews per hectare from 1990 to 1995 in Newfoundland.

Location	1990	1991	1992	1993	1994	1995
St. Georges	1.09	14.01	4.3	2.14	7.54	19.37
Hall's Bay	0.97	8.6	4.3	4.3	9.69	15.07
Terra Nova National Park	0.97	8.6	4.3	4.3	6.45	17.22
Paddy's Pond	0	5.36	5.36	2.14	3.24	7.54

In 1995, high larval numbers were recorded in young balsam fir near Eastern Blue Pond and along the Daniels Harbour Zinc Mine road on the Northern Peninsula and also in a semi-mature thinned stand along the La Scie road on the Baie Verte Peninsula. Severe damage from previous infestations was evident along the Nelsons Pond road near Pasadena.

Black Army Cutworm *Actebia fennica* (Tausch.)

A 1993 prescribed burn at the experimental area near Glide Lake was closely monitored in 1994 for adult and larval populations of the black army cutworm (BAC). Trap catches of adults were low in the fall of 1993 and larval numbers were also low in 1994, averaging 0.2 per square metre, and causing only light defoliation to herbaceous vegetation. Trap catches were low from pheromone traps deployed in this area and also from traps deployed in a

prescribed burn area southwest of Glide Lake. This indicated that larval populations would likely be low in 1995.

Black army cutworm activity was also monitored on four other prescribed burn sites in MD 14 in western Newfoundland and on a wildfire burn near Goose Bay, Labrador. Mean larval numbers per square metre were 0.2 and 1.0 respectively at Flat Bay Brook and Tom Diamonds Pond with only light defoliation recorded on herbaceous vegetation. Relatively low larval numbers were reported at St. Fintans causing severe defoliation to scattered pin cherry. No larvae or defoliation were observed on a prescribed burn at South Branch. Larval monitoring was not undertaken at Goose Bay in 1994. Pheromone traps deployed at all locations, resulted in low moth counts with the exception of St. Fintans where an average of 408 moths per trap indicated that some light defoliation might occur in 1995. In central Newfoundland pheromone traps were deployed in a 1994 wildfire area near Tote Brook along the Bay d'Espoir highway. Trap catches were also low in this area indicating low larval populations for 1995.

The only location monitored for BAC activity in 1995 was on the experimental prescribed burn site near Glide Lake with no significant defoliation being recorded.

Spruce Bud Moth

Zeiraphera canadensis Mut. & Free.

The infestation of the spruce budmoth in white spruce at Arches Provincial Park has collapsed and only traces of damage occurred in 1994 and 1995. Throughout Newfoundland the insect was common wherever the host tree occurred although populations remained low with the exception of an area of young white spruce along Pitts Memorial Drive near Kilbride where severe defoliation occurred in 1995.

Spruce Bud Midge

Rhabdophaga swainei Felt

This insect was identified as the cause of multi-leadered tops that affected 70% of the young black spruce in a stand in the South Brook Valley, and 10%-20% of young black spruce along the Loggers School Road in 1994.

Yellowheaded Spruce Sawfly

Pikonema alaskensis (Roh.)

In 1994 larvae of this sawfly caused up to 40%

defoliation of young black spruce in plantations along the South Branch road in Labrador. Up to 30% defoliation occurred on natural black spruce regeneration in the Goose Bay area, and at several locations along the Grand Lake road. Most defoliation occurred on single trees or on small clusters of trees.

In 1995, 10-30% defoliation was caused to 20% of black spruce in a plantation near Sunday Lake and at Johnson's Lookout near West Pond in central Newfoundland. This insect also caused varying degrees of damage to ornamental spruce throughout eastern Newfoundland.

Spruce Bark Beetle

Dendroctonus rufipennis (Kby.)

Small pockets of white spruce were killed by spruce bark beetle attack near Wiltondale and Glenburnie. Most trees successfully attacked were overmature and of poor vigour. The rate of tree mortality by this bark beetle in the Lower Humber River Valley decreased in 1994, and only a few recently dead trees occurred between Little Harbour and Little Rapids. No additional mortality was observed in 1995.

Larch Bark Beetle

Dendroctonus simplex (Lec.)

High population levels continued in several areas of the Avalon Peninsula. Damage by this insect was most obvious in early fall particularly along the TCH from Paddys Pond to the Salmonier Line.

Bruce Spanworm

Operophtera bruceata (Hulst)

The outbreak of this insect in Labrador that existed in 1993 along the north shore of the Churchill River has collapsed. However defoliation of white birch was estimated at 50% in a 400 ha area near Paradise River in 1994. This outbreak has also collapsed as no defoliation was observed in this area in 1995.

Poplar Serpentine Leafminer

Phyllocnistis populiella (Cham.)

The poplar serpentine leafminer outbreak in Labrador continued in 1994 and 1995 with light to moderate defoliation of trembling aspen stands along the Churchill River from Goose Bay west to the Minipi River, along the Pena's River, Goose River and the west end of Grand Lake.

This is the twelfth consecutive year of infestation by this insect in the same area.

Birch Casebearer

Coleophora serratella (Linn.)

Surveys in 1994 revealed small patches of light defoliation of white birch in western Newfoundland along the Goose Arm Road from Nicholsville to Goose Arm, along sections of the Loggers School Road, and near Blue Ponds Park. This casebearer also caused light defoliation in many areas in central Newfoundland.

In 1995, defoliation was generally light throughout western Newfoundland with the most noticeable damage occurring along Goose Arm road and from Cormack to Big Falls. An area of light defoliation was also recorded near River of Ponds on the Northern Peninsula. In central Newfoundland, moderate to severe defoliation was observed on young white birch along the TCH from West Brook to Badger.

Poplar and Willow Leaf Beetle

Chrysomela falsa Brown

In 1994 this beetle caused up to 90% defoliation of roadside willows along Birchy Ridge, in areas on the Baie Verte Peninsula, near Deer Lake and near Bonne Bay Big Pond. In Labrador moderate and severe defoliation of willows occurred along the Northwest River road. Light defoliation was observed throughout the Upper Lake Melville area. An average of 50% defoliation was recorded in semi-mature stands of balsam poplar near the mouth of the Red Wine River and near Mud Lake. No significant defoliation was recorded in 1995.

Birch Leafminer

Fenusa pusilla (Lep.)

In 1995, a late summer infestation of leaf miner caused severe browning in many young to semi-mature white birch stands on the Northern Peninsula. Damage was particularly noticeable in roadside stands near River of Ponds, from Castors River to 3-Mile Lake and near Roddickton. This insect also caused severe defoliation of white birch in Labrador near Happy Valley - Goose Bay for the third consecutive year. The last outbreak in this area terminated in 1987.

Birch Skeletonizer

Bucculatrix canadensisella Cham.

This insect caused up to 80% defoliation of yellow and white birch near St. Josephs Cove and along the Upper Salmon River road near Bay d'Espoir in MD 7 in 1994 and 1995.

Striped Alder Sawfly

Hemichroa crocea (Geoff.)

In 1994, moderate to severe defoliation of speckled alder was evident along the Caribou Lake road and to a lesser degree in the Trout Brook area of MD 14. The last major outbreak of this insect in western Newfoundland collapsed in 1988. An outbreak also occurred near Lake Ambrose in central Newfoundland (MD 12), where up to 100% defoliation was recorded on roadside alder.

In 1995, an infestation of this sawfly caused severe damage to roadside speckled alder near Rocky Harbour and in patches along the access road to Berry Hill Campsite in Gros Morne National Park. Although the preferred host is alder, damage was also recorded on white birch growing near the campsites at Berry Hill.

Gypsy Moth *Lymantria dispar* (Linn.) and

Forest Tent Caterpillar *Malacosoma disstria* Hbn.

These two major defoliators do not occur in Newfoundland but pheromone traps set out in cooperation with Agriculture-Agrifood Canada are maintained annually to detect any accidental introductions (Figs. 9 & 10).

No gypsy moth or forest tent caterpillar adults were captured in any of the pheromone-baited delta traps set out throughout Newfoundland in 1994 or 1995.

FOREST DISEASES

Armillaria Root Rot

Armillaria species

During 1994 and 1995 about 10% dead or chlorotic black spruce occurring in a 10 year old plantation in the Great Rattling Brook area, and about 20% of the black spruce in a plantation near Springdale were infected with this fungus. Most of the affected trees had distinctly deformed roots caused by improper planting. Along the Caribou Lake Road in western Newfoundland, about 10% of the trees

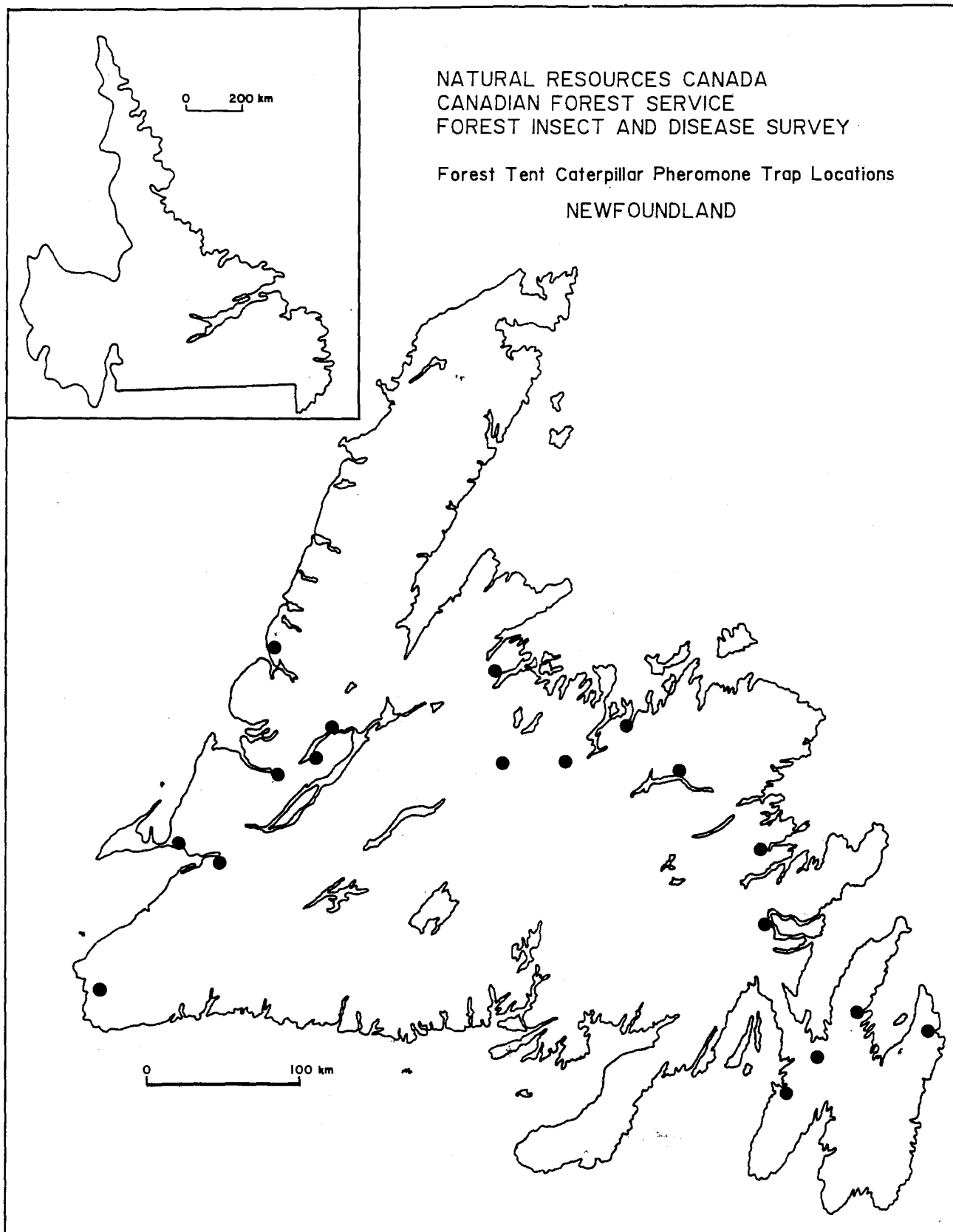


Figure 10. Forest tent caterpillar pheromone trap locations in Newfoundland.

damaged by the balsam fir sawfly were also infected with the root rot fungus. In 1995, nearly all the spruce, fir and birch stumps at Glide Lake were infected with *Armillaria* root rot. This is an increased incidence from two years ago when the trees were first inspected.

Research on *Armillaria* root rot forms an integral part of the Root Rot Network under the Green Plan and includes early detection of damage using remote sensing techniques, the identification of *Armillaria* species using biotechnology and the development of a hazard rating system and management guidelines to minimize damage particularly in plantations.

White Pine Blister Rust *Cronartium ribicola* J.C.

This disease continues to infect white pines throughout the Island. In 1994, stem and branch infections by this rust continued to spread to young and old white pine in the Little Grand Lake road area and near Howley and Sheffield Lake in western Newfoundland. The disease was also recorded along the road to the village of Terra Nova and near Gambo Pond in eastern Newfoundland. Surveys in 1995 for the incidence of white pine blister rust were carried out in two localities, one on the Burgeo road in southwestern Newfoundland and the other near Glenwood in central Newfoundland. Over 30% of the white pine were infected and over 20% had lethal cankers on the stem in both localities.

Research on white pine blister rust forms an integral part of the Stem Cankers of Forest Trees Network under the Green Plan and concentrates on biotechnology, biological and silvicultural control. The goal is the development of management practices to minimize damage and promote the re-establishment of white pine stands in eastern Canada.

Scleroderris Canker *Gremmeniella abietina* (Lagerb.) Morelet & *Gremmeniella abietina* var. *balsamea* O. Petrini *et al.*

The European strain of the fungus causing Scleroderris canker was accidentally introduced into Newfoundland in the vicinity of St. John's and continued to infect Austrian pine at different areas in St. John's and near Portugal Cove on the Avalon Peninsula in 1994. In 1995, approximately 300 Austrian pine were examined for incidence of Scleroderris canker on the grounds of Memorial University in St. John's. Canker was present on 6 trees and

all infected branches were pruned and burnt. As part of the public awareness program concerning Scleroderris canker, nurseries and garden centres were visited, pines were examined for possible disease symptoms and pamphlets were distributed. All pines near the Provincial Tree Nursery on Brookfield road were cut and burned as part of the quarantine measures. The possible spread of the disease from the Avalon Peninsula to the highly susceptible red pine stands in central and western Newfoundland is a major concern of forest managers.

Experimental results on the susceptibility of various conifers to this disease provided guidelines for a cooperative effort to enhance the application of quarantine measures to prevent further spread of this disease. Additional research using biotechnology to improve the management of the disease is in progress and forms part of the Stem Cankers of Forest Trees Network under the Green Plan.

Sirococcus Shoot Blight *Sirococcus strobilinus* Preuss

A new host record for this disease was recorded in 1993 when severe damage was observed in young to semi-mature balsam fir stands in the Goose Arm to Big Bonne Bay Pond area in MD 15. In 1994 the incidence of the disease decreased, however, because of simultaneous damage to the new foliage caused by the balsam gall midge, tree vigour has been severely affected. This shoot blight also affected up to 90% of the current shoots of young to semi-mature balsam fir at frequent intervals along the TCH between Lady Slipper road and Whites road in MD 15. Again damage was in conjunction with the balsam gall midge which has been present in this area for the past 3-4 years and tree vigour was reduced.

Shoot Blight of Jack Pine *Hormonema species*

This shoot blight affected two Jack pine plantations near Peters River in Labrador in MD 19 since 1991 but decreased in intensity in 1994. Little or no new infection was observed as evidenced by new healthy lateral growth. The disease was also present in a Jack pine plantation near Muskrat Lake near Goose Bay with less than 5% of the seedlings affected.

Bacterial Blight (Fire Blight)

Xanthomonas campestris var. *Pruni*

Symptoms of this disease including red and wilting foliage of pin cherry was common in several areas of western Newfoundland in 1994. Affected trees were most evident between Southwest Brook and Little Barachois Brook in MD 14 where damage ranged from 10% to 60%. Top and branch dieback was recorded in Deer Lake in MD 15. Pin cherry were severely damaged with some mortality occurring in the LaScie road area near Southwest Brook in MD 9. The blight remained common in central and eastern Newfoundland but was less prevalent in the St. John's area.

Needle Rust of Conifers

Chrysomyxa ledicola Lagerh.

Milesia fructuosa Faull

Needle rust affected young spruce trees at the Wooddale tree nursery in central Newfoundland in 1994. It was common on blue spruce throughout Old Shop, Spaniards Bay, Paradise, Portugal Cove, Bauline Line, St. Phillips, Shoe Cove, Flat Rock, Logy Bay and St. John's on the Avalon Peninsula. Rust disease was also common in balsam fir stands along the Goose Arm road and affected tamarack larch along the Grand Lake road in Labrador where 50% of the foliage on 30% of the trees in a small stand were infected. In 1995, a high incidence of this disease was recorded in black spruce plantations along the Bay d'Espoir Highway, near Conne River. Numerous other occurrences were observed on roadside black spruce regeneration and ornamentals in central and eastern Newfoundland.

Inland Spruce Cone Rust

Chrysomyxa pirolata Wint.

Cone rust of black and white spruce was observed in the New Bay Pond area in central Newfoundland with up to 100% of the cones affected on some trees. In Hall's Bay about 5% of the cones on regenerating black spruce were infected.

Winter Drying

A high incidence of winter drying occurred in balsam fir at Parsons Pond on the Northern Peninsula in 1994. A low to moderate incidence occurred in exposed areas north of Sallys Cove. Light damage was observed at the Arches Provincial Park. Severe damage was recorded on Sitka

spruce in a plantation near Pynn's Brook and on Jack pine at Catalina. A moderate incidence occurred to pine near St. Fintans as 30% of the foliage on 80% of the trees was affected. Approximately 200 balsam fir trees near Flatrock were affected by winter drying. Winter drying has been identified as the probable cause of top mortality and multiple leadering of young black spruce in the Goose Bay area, MD 19. About 10% to 15% of the trees were affected in a forest improvement area near the Goose River. Damage also occurred along the Grand Lake road near the Cape Caribou River and at several locations along the Churchill road to Muskrat Falls.

In 1995, light damage was observed along the coastline of the Northern Peninsula from Sally's Cove to Belburns with a few moderate patches near Parson's Pond. Winter drying also affected exposed ornamental Scots, jack and Austrian pines throughout St. John's.

Drought

Drought was common on the eastern part of the Island particularly on the Avalon Peninsula in 1994. Hardwoods and softwoods were affected with leaves wilting and needles turning brown. Mortality occurred to some younger shallow rooted trees. In 1995 drought damaged many hardwood and softwood trees throughout the Avalon Peninsula in early to mid summer when very low precipitation occurred. Premature leaf and needle fall was common with some shoot dieback.

Frost

Frost damage occurred to 100% of Japanese larch in a plantation at Muskrat Lake in Labrador in 1994. About 5% of young Jack pine trees along the Churchill River road were also affected.

Acid Rain National Early Warning System (ARNEWS)

All permanent ARNEWS plots were precisely located with global positioning system and were inspected for pest conditions and sampled for chemical analysis of soil and vegetation as part of the 5-year remeasurement program. The abundance and diversity of soil arthropods were monitored in three ARNEWS plots in western Newfoundland. Analysis of data is in progress.

OTHER INSECTS, DISEASES OR DAMAGE

Insect, Disease or Damage	Host(s)	Location	Remarks
Alder leaf beetle <i>Chrysomela mainensis</i> <i>mainensis</i> Bech	Speckled alder	Western and Central Newfoundland	Severe defoliation on roadside alder near Gallants Jct. and Mint Brook
Anthrachnose <i>Kabatiella apocrypta</i> (Ell. & Ev.) Arx	Red maple	Eastern Newfoundland	High incidence on a few trees in Mount Pearl
Antler moth <i>Cerapteryx graminis</i> (Linn)	Grass	Central Newfoundland	High population at Gander
Aspen leaf roller <i>Pseudexentera oregonana</i> Wlshm.	Trembling aspen	Central Newfoundland	Low population
Birch-aspen leafroller <i>Epinotia solandriana</i> (Linn.)	White birch	Western Newfoundland	Low numbers in Sops Arm area
Black cheeked aspen caterpillar <i>Ipimorpha pleonectusa</i> Grt.	Trembling aspen	Eastern Newfoundland	Low numbers
Black knot <i>Apiosporina morbosa</i> (Schw.) Arx	Pin cherry	Throughout Newfoundland	High incidence on Baie Verte Peninsula and Springdale area
Blight <i>Phomopsis juniperovora</i> Hahn.	Juniper	Avalon Peninsula	Low incidence
Broom rust <i>Melampsorella carophyllacearum</i> Schroet.	Balsam fir	Avalon Peninsula	Low incidence

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Canker and dieback			
<i>Cytospora</i>	Willow	Eastern Labrador	
<i>Nectria galligena</i> Bres.	Norway maple "	Eastern Newfoundland	
<i>Potebniamyces coniferarum</i> (Hahn) Smerlis	Larch	Western Newfoundland	Exotic larch at pasadena affected
Dotted line looper <i>Protoboarmia porcelaria indicataria</i> (Wlk.)	Balsam fir	Bay d'Espoir	Low population
Early brown looper <i>Eupithecia</i> spp.	Balsam fir	Throughout Newfoundland	Low numbers
European spruce sawfly <i>Gilpinia hercyniae</i> (Htg.)	Black spruce	Western and Central Newfoundland	Low numbers
False hornworm <i>Pheosia rimosa</i> Pack.	Balsam poplar	Eastern Labrador	Low population near Red Wine River
Fringed birch sawfly <i>Dimorphopteryx melanognathus</i> Roh.	Speckled alder	Central Newfoundland	Low population near Quinn Lake
Fringed looper <i>Campaea perlata</i> (Gn.)	Greenhouse stock	Eastern Labrador	Collected at Goose Bay Greenhouse
Gall insects <i>Acotyledon</i> spp.	Trembling aspen	Western Newfoundland	Severe damage on a few trees - Bonne Bay Pond area

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Gall rust <i>Gymnosporangium cornutum</i> Arth. & Kern	American Mountain-ash Red maple	Eastern Newfoundland	Low incidence at Port Rexton and St. John's
Gray spruce cutworm <i>Zestia perquiritata</i> (Wlk.)	Balsam fir	Western Newfoundland	Low numbers near Deadwater Brook
Gray spruce tussock moth <i>Dasychira plagiata</i> (Wlk.)	Balsam fir	Northern Newfoundland	Low numbers near Angle Pond
Green larch looper <i>Semiothisa sexmaculata</i> (Pack.)	Larch	Eastern Labrador	Low numbers along Grand Lake road
Herbicide damage	Balsam fir Red pine	Western and Central Newfoundland	Moderate damage common on balsam fir in Wiltendale Christmas Tree plantation in 1994
Imported currant worm <i>Nematus ribesii</i> (Scopoli)	Currant	Avalon Peninsula	High population on few domestic currant .
Larch needleworm <i>Zeiraphera improbana</i> (Wlk.)	Tamarack-larch	Avalon Peninsula	20%-90% defoliation near Mt. Pearl and Goulds

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Leaf and shoot blight <i>Venturia macularis</i> (Fr.) Mull & Arx	Trembling aspen	Western Newfoundland	Moderate damage on regeneration in Pynns Brook area
<i>Venturia populina</i> (Vuill.) Fabricius	Balsam poplar	Northern Newfoundland	Moderate on ornamentals - Roddickton area
Leaf spot <i>Septoria betulae</i> (Lib.) West.	White birch	Western Newfoundland	Severe damage on regeneration near Georges Lake and Blue Pond Park in 1994
Lilac leafminer <i>Gracillaria syringella</i> (Fabr.)	Lilac	Central Newfoundland	High population on few oramentals at Bishops falls
Little spruce sawfly <i>Prisiphora lena</i> Kincaid	Black spruce, White spruce	Western Newfoundland	Low numbers
Mites <i>Phytopus laevis</i> Natepa	Speckled alder	Northern Newfoundland	Common near Ten Mile Lake
Nectria dieback <i>Nectria cinnabarina</i> Tode ex Fr.	Norway maple	Avalon and Western Newfoundland	Common on ornamentals at the Goulds and Pasadena

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Needle cast <i>Hypodermellea laricis</i> Tub	Tamarack-larch	Western and Central Newfoundland	Moderate damage in larch stands near Cormack and Buchans
<i>Isthmiella faullii</i> (Darker)	Balsam fir	Western Newfoundland	Low incidence
Needle rust <i>Chrysomyxa ledicola</i> Lagerh	Blue spruce	Avalon	Light to moderate incidence (ornamentals)
<i>Melampsora medusae</i> Thum.	Tamarack-larch	Eastern Labrador	50% foliage affected on 30% of trees
<i>Milesia fructuosa</i> Faull	Balsam fir	Western Newfoundland	>5% foliage affected
Ocellate gall midge <i>Cecidomyia ocellaris</i> (Osten Sacken)	Red maple	Eastern Newfoundland	High population on few trees
Psyllids	Pin cherry	Eastern Newfoundland	Common where host occurs
Pine looper <i>Hypagyrtis piniata</i> (Pack)	Balsam fir	Throughout Newfoundland	Low numbers
Poplar leaf-tier <i>Nycteola cinereana</i> N. & D.	Trembling aspen	Central Newfoundland	Low numbers near Grand Falls
Purple eye spot <i>Phyllosticta minima</i> (Bert and Curt.)	Red maple	Central Newfoundland	Trace of damage near Aspen Brook

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Purplestriped shootworm <i>Zeiraphera unfortunana</i> Powell	White spruce	Western Newfoundland	Low numbers
Redlined conifer caterpillar <i>Feralia jocosa</i> (Gn.)	Balsam fir	Western Newfoundland	Low numbers (widespread)
Rusty tussock moth <i>Orgyia antiqua</i> (L.)	Balsam fir	Bay d'Espoir	Low numbers near Twillick Brook
Saddleback looper <i>Ectropis crepuscularia</i> (D. & S.)	Balsam fir	Western and Eastern Newfoundland	Low numbers
Satin moth <i>Leucoma salicis</i> (Linn.)	Trembling aspen Poplars Willow	Central and Eastern Newfoundland	Low numbers at Badger Moderate to severe damage on ornamentals at Clarenville
Scab and black canker <i>Fusicladium saliciperdum</i> (All. & Tub.) Lind. and <i>Glomerella miyabeana</i> (Fukushi) V. Arx & Muller	Laurel willow Wax willow	Western Newfoundland Avalon Peninsula	Up to 30% damage on ornamental willow
Shot hole <i>Coccomyces hiemalis</i> (Higgins)	Pin cherry	Western Newfoundland	Common near Deer Lake.
Small pine looper <i>Eupithecia palpata</i> Pack	White spruce	Northern Peninsula	Low numbers at Hawkes Bay
Spruce and balsam fir looper <i>Semiothisa signaria dispuncta</i> (Wlk.)	Balsam fir	Western Newfoundland	Low numbers near Grand Lake

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Spruce coneworm <i>Dioryctria reniculelloides</i> Mut. & Mun.	White spruce	Western Newfoundland	Low numbers
Spruce false looper <i>Syngrapha selecta</i> (Wlk.)	Balsam fir	Western Newfoundland	Low numbers
Tufted spruce caterpillar <i>Panthea acronyctoides</i> (Wlk.)	Balsam fir	Western Newfoundland	Low numbers
Uglynest caterpillar <i>Archips cerasivoranus</i> (Fitch)	Choke cherry	Western Newfoundland	Light defoliation near Deer Lake
A Weevil <i>Hylobius</i> sp.	Balsam fir	Western Newfoundland	Low numbers
Willow flea beetle <i>Isochnus rufipes</i> (Leconte)	Willow	Western Newfoundland	Trace of defoliation in Corner Brook
Willow leafminer <i>Micrurapteryx salifoliella</i> (Chambers)	Willow	Eastern Labrador	50% - 90% defoliation near Otter Creek, Beaver and Paradise Rivers
Willow redgall sawfly <i>Pontania proxima</i> (Lep.)	Willow	Western Newfoundland	Severe damage to roadside willow - Baie Verte Peninsula and near Birchy Lake
Willow sawfly <i>Nembatus limbatus</i> (Cress.)	Willow	Western and Central Newfoundland	Severe defoliation near SW Brook, Bald Mtn. Brook, and Mint Brook

OTHER INSECTS, DISEASES OR DAMAGE (Cont'd.)

Insect, Disease or Damage	Host(s)	Location	Remarks
Yellow leaf spot <i>Taphrina populina</i> Fr.	Poplar	Western Newfoundland and Avalon Peninsula	Low incidence

APPENDIX I

Locations of hemlock looper pheromone-baited traps in Newfoundland in 1994 and 1995 and the total number of larvae (per 3 tree samples), the total number of male moths (per 3 traps) and the total number of overwintering eggs (per 3 branches) in October.

Plot No.	Location	<u>No.Larvae</u>		<u>Total Adults</u> <u>(3traps)</u>		<u>Overwintering</u> <u>eggs</u>	
		1994	1995	1994	1995	1994	1995
1	Overfalls Brook	4	4	795	1483	13	34
2	Codroy Pond	0	2	1320	2300	2	18
3	Mitchells Pond	0	39	4985	6000*	3	3
4	Fishells River	-	91	489	750*	0	0
5	Barachois Brook	0	1	240	330	0	0
6	Trout Brook	2	10	1058	3700	0	2
7	Campbells Creek	2	0	950	2130	0	0
8	Gallants Road	49	25	1650	2800	8	8
9	George's Lake	5	0	1587	3635	2	4
10	Pinchgut Lake Road	7	3	1667	4000	3	5
11	Corner Brook Stream	18	28	3397	6000	26	59
12	South Brook Valley	6	75	7610	710	24	3
13	Bay of Islands	1	6	447	2950	1	11
14	Goose Arm Road	24	60	3040	887*	67	9
15	Big Bonne Bay Pond	6	28	8800	4650	21	61
16	Lomond	70	32	4790	9000	29	8
17	East Arm, Bonne Bay	3	26	3080	9000	9	20
18	Sally's Cove	0	6	868	940	0	3
19	Daniel's Harbour	0	16	2335	9000	33	52

Plot No.	Location	No. Larvae		Total Adults (3traps)		Overwintering eggs	
		1994	1995	1994	1995	1994	1995
20	Hawkes Bay	0	6	1190	9000	0	2
21	Ten Mile Lake	0	0	8	31	0	0
22	Birchy Lake	25	52	7800	2660	4	4
23	Black Brook	0	0	1190	1460	0	3
24	Burlington Road	1	4	508	950	0	3
25	LaScie Road	0	2	243	846	0	0
	Avg./trap (Western)			801	1184		
26	West Brook Road	0	0	724	288	0	-
27	Gullbridge Mines Road	10	0	1167	1400	3	3
28	6.3 km W of Catamaran Park	2	3	1158	927	1	39
29	Aspen Brook Road	30	21	2950	1700	4	7
30	Buchans Highway	1	0	682	391	5	0
31	5.3 km S of Exploits Dam	4	9	934	205	1	-
32	Quinn Lake	1	0	1306	550	3	-
33	New Bay Pond Road	0	-	323	-	0	0
34	1.4 km E of Exploits River, Grand Falls	0	0	272	25	0	0
35	Tote Brook	0	0	158	655	0	0
36	Bay d'Espoir Highway, 9.1 km S, Northwest Gander River Bridge	0	0	271	630	0	-
37	Bay d'Espoir Highway at Gull Pond	0	0	326	840	0	-
38	Twillick Brook	18	0	515	700	0	0

Plot No.	Location	<u>No.Larvae</u> 1994 1995		Total Adults (3traps) 1994 1995		Overwintering eggs 1994 1995	
39	St. Joseph's	7	0	811	132	1	0
40	Burnt Woods Road, Bay d'Espoir	10	-	1680	1044	0	1
41	Gander Bay Road	3	0	479	1600	0	5
42	Glenwood	8	0	1117	300	0	0
	Avg./trap (Central)			292	237		
43	Gambo	2	30	198	200	0	8
44	4.5 km W Dunphy's Pond Rd., TNNP	0	71	337	4750	9	137
45	Thorburn Lake	134	114	557	2500	6	-
46	TCH, 1.2 km W Hillview	0	0	845	2220	7	4
47	Whitbourne	0	0	-	850	1	0
48	Heart's Content	-	16	658*	1250	2	0
49	Salmonier Line	-	0	500	2400*	5	2
50	Torbay	-	0	482	498	0	0
	Avg/trap (Eastern)			179	638		

* 2 traps only

APPENDIX II

Locations of spruce budworm pheromone-baited* traps in Newfoundland in 1994 and 1995 and the total number of larvae (per 3 tree samples) in June, the total number of male moths (per 3 traps) and the total number of overwintering larvae (per 3 branches) in October.

Plot No.	Location	<u>No. Larvae</u>		<u>No. Adults</u>		<u>Overwintering Larvae</u>	
		1994	1995	1994	1995	1994	1995
1	Overfalls Brook	0	0	1	0	0	59
2	Codroy Pond	1	0	0	0	0	0
3	Mitchells Pond	0	0	1	0	0	0
4	Fishells River	0	0	1	3	0	0
5	Barachois Brook	0	0	4	6	0	0
6	Trout Brook	0	0	5	3	1	32
7	Campbells Creek	0	0	15	10	0	29
8	Gallants Road	0	0	0	0	0	53
9	George's Lake	0	0	1	0	0	0
10	Pinchgut Lake Road	0	0	1	0	0	0
11	Corner Brook Stream	0	0	4	0	0	46
12	South Brook Valley	0	0	2	0	0	36
13	Bay of Islands	0	0	14	31	0	84
14	Goose Arm Road	0	0	0	0	0	72
15	Big Bonne Bay Pond	0	0	0	2	0	80
16	Lomond	0	0	0	1	1	0
17	East Arm, Bonne Bay	0	0	0	1	1	0

Plot No.	Location	<u>No. Larvae</u>		<u>No. Adults</u>		<u>Overwintering Larvae</u>	
		1994	1995	1994	1995	1994	1995
18	Sally's Cove	1	0	10	14	0	104
19	Daniel's Harbour	0	0	0	0	0	0
20	Hawkes Bay	0	0	3	0	0	0
21	Ten Mile Lake	0	0	0	0	0	0
22	Birchy Lake	0	0	0	6	0	57
23	Black Brook	0	0	1	10	0	0
24	Burlington Road	0	0	0	4	0	27
25	LaScie Road	0	1	0	2	0	118
26	West Brook Road	0	0	0	0	0	-
27	Gullbridge Mines Road	0	0	0	2	0	-
28	6.3 km W of Catamaran Park	0	0	0	2	0	-
29	Aspen Brook Road	0	0	0	0	0	-
30	Buchans Highway	0	0	0	0	0	-
31	5.3 km S of Exploits Dam	0	0	0	0	0	-
32	Quinn Lake	0	0	0	0	0	-
33	New Bay Pond Road	0	0	0	0	0	-
34	1.4 km E of Exploits River, Grand Falls	0	0	0	0	0	-
35	Tote Brook	0	0	0	0	1	-
36	Bay d'Espoir Highway, 9.1 km S, Northwest Gander River Bridge	0	0	0	0	0	-
37	Bay d'Espoir Highway at Gull Pond	0	0	0	0	0	-

Plot No.	Location	<u>No. Larvae</u>		<u>No. Adults</u>		<u>Overwintering Larvae</u>	
		1994	1995	1994	1995	1994	1995
38	Twillick Brook	0	0	0	0	0	-
39	St. Joseph's	0	0	0	0	0	-
40	Burnt Woods Road, Bay d'Espoir	0	0	0	0	0	-
41	Gander Bay Road	0	0	0	0	0	-
42	Glenwood	0	0	0	0	0	-
43	Gambo	0	0	0	**	2	-
44	4.5 km W Dunphy's Pond Rd., TNNP	0	0	0	0	0	-
45	Thorburn Lake	0	0	0	0	0	73
46	TCH, 1.2 km W Hillview Jct.	0	0	0	0	0	-
47	Whitbourne	0	0	0	0	0	18
48	Heart's Content	0	0	0	0	0	19
49	Salmonier Line	0	0	-	0	0	0
50	Torbay	0	0	0	0	0	0
Average							

*"Biolure" used in 1994 and 1995

**Traps missing or down