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SURVEY BULLETIN

Forest Insect and Disease Conditions in Ontario
Fall 1989



Tony Hopkin (newly appointed field pathologist) and Lyall MacLeod (who retired on 24 November 1989 after 44 years of service as a FIDS ranger)

FOREST INSECT AND DISEASE CONDITIONS IN ONTARIO

Fall 1989

This is the third of three bulletins issued annually by the Forest Insect and Disease Survey (FIDS). Together, they present a summary of pest conditions in the province.

STAFF CHANGES

Pictured on the bulletin's cover are Lyall MacLeod, who retired from FIDS on 24 November 1989, after a career spanning nearly 44 years, and Tony Hopkin, who was recently recruited to fill the position of Disease Survey Officer.

Lyall MacLeod joined the Department of Agriculture in 1946 after active service with the RCAF Bomber Command in Europe, and spent his entire career as a FIDS Ranger. He fulfilled assignments in many parts of the province, including the Chalk River, Minden and Fort Frances areas; however, his longest and most recent assignment was in Temagami District. Lyall's retirement marks the end of an era, in that he is the last of the original survey group hired in the mid-1940s, when FIDS was in its infancy. He was respected by his fellow staff members and the many FIDS clients and his wealth of experience and specialized knowledge of northern Ontario pest conditions will be missed.

Dr. Hopkin is a native of Winnipeg, Manitoba, and holds a Ph.D. in forest pathology from the University of Manitoba. He replaces Dr. Henry Gross who has been transferred to a research position in forest pathology.

NOTICE OF PEST MANAGEMENT CONFERENCE

Attached to this bulletin as an appendix is a notice of a conference on recent advances in pest management. The conference will take place at the Water Tower Inn, Sault Ste. Marie, Ontario, from 22 to 24 October 1990.

FOREST PEST REVIEWS

For the 13th consecutive year, pest reviews were held in northern and southern Ontario to provide a forum for discussion of pest conditions in Ontario forests. The northern review was held in Thunder Bay on 2 November, with 65 people in attendance. The morning session addressed such topics as spruce budworm, an update on nursery pests, a novel way to control white pine weevil, major pests in Manitoba, vegetation management in northern Ontario, blowdown (pests and decay), silverleaf disease and white birch dieback. The afternoon session included jack pine budworm, pests of northern Ontario plantations, and the effects of pests on crown

structure and seed production in black spruce. Both the northern and southern pest reviews featured an address by Dr. George Green, Director General of the Forest Pest Management Institute (FPMI), who spoke on the future of pesticides in forestry in Ontario. A copy of Dr. Green's address has been attached to this bulletin as a second appendix. Other speakers at the northern pest review included representatives of the Ontario Ministry of Natural Resources (OMNR), the Manitoba Department of Natural Resources, the Lakehead University School of Forestry, Dendron Resource Surveys Limited, and Forestry Canada (Ontario Region and Northwest Region).

The southern pest review was held in London on 27 November, with 130 people in attendance. Topics addressed at this meeting included the gypsy moth, forest tent caterpillar, pear thrips, scleroderris canker, the health of sugar maple in Ontario, an update on nursery pests, vegetation management needs, pests of plantations in southern Ontario and other forest pests. Presentations were made by representatives of OMNR, the Ontario Ministry of the Environment, and Forestry Canada (Ontario Region and FPMI).

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

In 1989 the spruce budworm caused moderate-to-severe defoliation over an area of some 6,239,636 ha. This was an increase of a little more than one million ha over the area affected in 1988, reversing the trend of declining populations that had been evident for several years. The entire area of moderate-to-severe defoliation was located in the North Central and Northwestern regions. The infestation pattern was similar to that in 1988, with two very large infestations surrounded by a number of smaller ones. More specific information on the areas affected is contained in the Summer 1989 Survey Bulletin.

Surveys were carried out during the latter part of the field season to determine the extent of spruce budworm-induced tree mortality. These revealed an increase of some 529,155 ha within which mortality of balsam fir and spruce was evident, which brought the total area affected by mortality during the current outbreak to 15,044,874 ha. The largest increases were recorded in Atikokan and Dryden districts, in which 279,445 and 110,420 ha of new mortality were recorded, respectively (Fig. 1).

As usual, spruce budworm egg-mass surveys were conducted in August for the purpose of forecasting population trends in 1990. In all of 434 locations were sampled, 329 of which had also been sampled in 1988. A comparison of these locations showed an overall increase of 73% in egg-mass densities in the province.

In the Northwestern Region, there was an overall decline of 3% in egg-mass densities. This resulted from declines in the Ignace (6%), Kenora (8%), Sioux Lookout (12%) and Red Lake (29%) districts, which were somewhat offset by increases of 26% and 58%, respectively, in the Dryden and Fort Frances districts. As a result, in 1990 moderate-to-severe defoliation will probably persist throughout much of the area infested in the Northwestern Region in 1989 with the possibility of a slight expansion along the northern edge of the infestation, particularly in Red Lake District.

Over all, there was an increase of 179% in egg-mass densities in the North Central Region as a result of increases in the Geraldton (516%), Nipigon (171%), Terrace Bay (701%) and Thunder Bay (125%) districts. In Atikokan District, a decline of 25% was recorded. An analysis of these results indicates that infestations will intensify within areas already infested in the Nipigon, Geraldton and Terrace Bay districts and in eastern Thunder Bay District, but little spread or expansion is expected in this segment of the outbreak. A decline in both intensity and area of defoliation will likely occur in southwestern Thunder Bay District and in Atikokan District. Although egg-mass densities increased in Northern Region and in southern Ontario, they remain sufficiently low that the spruce budworm is unlikely to cause significant defoliation in either area in 1990. The only exceptions are Uxbridge Township, Maple District, and Adjala Township, Huronia District.

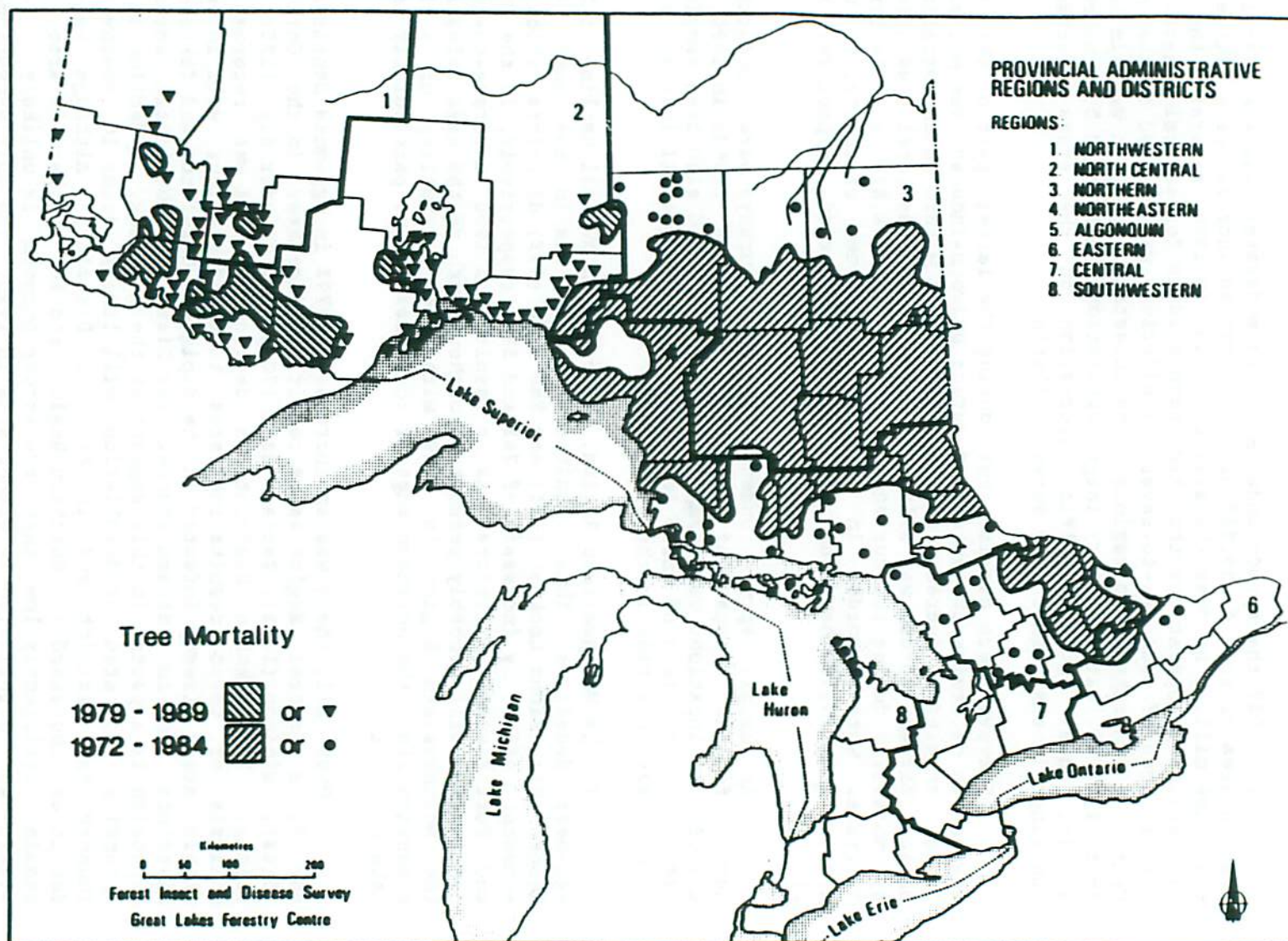


Figure 1: Tree mortality caused by spruce budworm in Ontario.

in which single white spruce plantations will probably sustain moderate-to-severe defoliation.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

The Summer 1989 Survey Bulletin reported marked declines in populations of the jack pine budworm in Ontario in 1989. The total area of moderate-to-severe defoliation was reduced from 737,482 to 248,311 ha. All of this defoliation occurred in the Red Lake and Sioux Lookout districts. Egg-mass surveys were conducted in late August, with a total of 108 locations sampled. A comparison of 69 locations sampled in 1988 and 1989 showed a reduction of 72% in overall egg-mass densities. An analysis of all results showed that only a few small, scattered pockets of light or moderate defoliation may occur in Red Lake District in 1990.

Gypsy Moth, *Lymantria dispar* (L.)

Gypsy moth populations increased in 1989 for the second consecutive year. The total area of moderate-to-severe defoliation was 81,640 ha, compared with 29,693 ha in 1988. The bulk of the increase in defoliation occurred in the Tweed, Brockville and Napanee districts of the Eastern Region, the areas in which the insect has been present for the longest period. Sizeable increases were also recorded in the Lindsay and Simcoe districts and somewhat smaller increases occurred in Niagara and Pembroke districts. Small decreases in the area of moderate-to-severe defoliation were recorded in the Carleton Place and Bancroft districts. A general population increase characterized by small numbers of larvae and light infestations was evident in many other locations across southern Ontario. Tables 1, 2 and 3 summarize gypsy moth defoliation in 1989 and contain several corrections from figures published in the Summer Survey Bulletin.

A burlap trapping program was carried out to capture larvae in provincial parks in southern Ontario, with the following results. In the Eastern Region, larvae were captured at 10 of 12 parks for which results have been received. No results have yet been forwarded from Fitzroy Provincial Park or Ferris Provincial Park. Increased numbers of larvae were captured in 9 of the 12 parks and decreases were recorded at two parks. The largest numbers of larvae captured were at Sharbot Lake Provincial Park (2,159) and Jessup's Falls Provincial Park (1,069). This compares with 1988 counts of 1,195 and 61 larvae, respectively. Large numbers of larvae were also captured at Silver Lake (710), Murphy's Point (269), Charleston Lake (314), Frontenac (422) and Lake on the Mountain (378) provincial parks.

Trapping in the Algonquin Region yielded larvae at 9 of 23 locations. Numbers were generally small at most locations.

In the Central Region, larvae were caught at 15 of 16 locations. Increased numbers of larvae were recorded at 14 locations and a decrease occurred at one location. The largest catches were at Balsam Lake

Provincial Park, where the number of larvae increased from 17 in 1988 to 489 in 1989; Emily Provincial Park, from 4 to 291; Serpent Mounds Provincial Park, from 43 to 333; McRae Point Provincial Park, from 30 to 172; and Springwater Provincial Park, from 26 to 103. A decrease from

Table 1. Gypsy moth infestations in Ontario, 1981-1989.

Year of infestation	Gross area of moderate-to-severe defoliation (ha)
1981	1,450
1982	4,800
1983	40,954
1984	80,624
1985	246,342
1986	167,776
1987	12,678
1988	29,693
1989	81,640

Table 2. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth in Ontario, 1985-1989.

Region	District	1985	1986	1987	1988	1989
Eastern	Tweed	172,232	73,525	3,329	16,089	39,096
	Napanee	58,326	57,780	4,781	6,198	15,001
	Carleton Place	4,197	13,386	1,355	3,918	2,634
	Brockville	11,232	22,283	2,099	1,865	12,250
Algonquin	Pembroke	90	221	0	124	1,154
	Bancroft	240	164	111	370	15
	Minden					65
Central	Lindsay	25	417	888	861	4,071
	Niagara	0	0	0	28	2,177
	Maple	0	0	0	0	370
Southwestern	Simcoe	0	0	115	240	4,807
Total		246,342	167,776	12,678	29,693	81,640

Table 3. Gross area (ha) of moderate-to-severe defoliation by the gypsy moth, 1986-1989.

County	1986	1987	1988	1989
York ^a	0	0	0	370
Northumberland	1,430	2,131	5,341	8,231
Peterborough	179	167	565	3,045
Hastings	11,668	4,511	5,625	22,262
Lennox and Addington	8,627	407	10,007	12,660
Prince Edward	540	0	0	340
Frontenac	109,442	1,775	1,861	11,625
Leeds	22,283	2,099	1,865	12,250
Lanark	13,356	1,355	3,918	2,590
Ottawa-Carleton ^a	221	0	0	44
Durham ^a	0	118	51	50
Haldimand-Norfolk ^a	0	115	240	4,937
Victoria	0	0	68	35
Renfrew ^a	0	0	124	1,154
Niagara ^a	0	0	28	2,047
Total	167,776	12,678	29,693	81,640

^a regional municipality

821 larvae in 1988 to 373 larvae in 1989 occurred at Six Mile Lake Provincial Park.

In the Southwestern Region, larvae were caught at 7 of the 11 parks in which trapping was carried out, in comparison with 3 of 11 parks in 1988. The largest number of larvae was caught at Selkirk Provincial Park, where 1,040 larvae were recovered (in comparison with 17 the previous year). At Turkey Point Provincial Park, 761 larvae were trapped, up from 120 in 1988. Catches at other locations in the region were generally low.

A pheromone trapping program was again carried out in parks and campgrounds in northern and southern Ontario. In most cases, two sticky traps were deployed in each park, one near the entrance and one in the camping area. In parks outside the general range of gypsy moth in which adults were caught in 1988, 10 traps were deployed in 1989. Analysis of results for the program in southern Ontario shows that adult moths were caught in all 64 parks in which traps were recovered. Pheromone trapping at Canadian Forces Base (CFB) Borden and CFB Petawawa and at the Canadian Forces Tank Range (Meaford) yielded positive results. Increases in the number of male moths captured were recorded at 54 of the 64 park locations as well as at the three military bases. Catches at the other 10 locations either decreased or remained unchanged.

In northern Ontario, adult moths were captured at 15 of the 16 parks trapped in the North Bay, Sudbury, Blind River and Espanola districts; the traps were destroyed by vandals at one location. The

trapping results are not unexpected, as the insect continues to expand its range northward. In the remainder of northern Ontario, three moths were captured at Kap Kig Iwan Provincial Park in Kirkland Lake District and at Agawa Bay in Lake Superior Provincial Park, Wawa District. Single moths were caught at Rabbit Blanket Lake in Lake Superior Provincial Park, Wawa District, at Pancake Bay Provincial Park in Sault Ste. Marie District, and at Blue Lake Provincial Park in Dryden District.

In 1989, the Plant Health Division of Agriculture Canada discontinued pheromone trapping for gypsy moth in Ontario. In an effort to take up some of the slack, the FIDS Unit of Forestry Canada, Ontario Region (FCOR) installed additional traps in southern and central Ontario. Moths were caught in all the locations in which traps were set with the exception of Bouch Township, Blind River District, and the Batchawana Bay Campground, Sault Ste. Marie District. A brief summary of the number of locations trapped and average number of moths captured, by district, presented in Table 4.

Table 4. Number of locations in which traps were set for gypsy moth, and average number of moths caught.

District	No. locations	Avg. moths/trap
Carleton Place	1	21.5
Algonquin Park	3	14.7
Bancroft	4	17.5
Pembroke	2	20
Bracebridge	2	20.5
Minden	3	15
Lindsay	4	23.5
North Bay	3	8.3
Sudbury	3	2.8
Espanola	7	6.3
Blind River	4	1.5
Sault Ste. Marie	7	10

Gypsy moth egg-mass surveys were carried out by several agencies including OMNR, FIDS and municipal authorities. An analysis of the results provides a forecast of how gypsy moth infestations may develop in 1990. Briefly, infestations are expected to increase and intensify in eastern Ontario, with the largest and most widespread defoliation occurring in an area stretching westward from the north shore of the St. Lawrence River between Brockville and Howe Island to the Galway-Cavendish-Harvey townships area. This will encompass large parts of the Brockville, Napanee, Tweed, Lindsay and Minden districts. Sizeable areas of infestation may develop in the Lavant-Darling-Pakenham townships area of Carleton Place District, along with several small pockets in the Galletta-Dunrobin area of West Carleton Township. Scattered pockets of infestation will likely occur in Alice, North Algona, Radcliffe and Raglan townships in Pembroke District. Similarly, many small pockets of

infestation could occur in the Minden-Bexley-Galway townships area of the Minden and Lindsay districts. A sizeable area of medium-to-heavy infestation can be expected near the northwestern end of Rice Lake in Cavan and South Monaghan townships, Lindsay District, with scattered patches of light and medium-to-heavy infestation immediately south of this in the Pontypool-Bewdley area. In the Central Region, small pockets of heavy infestation may occur south of Uxbridge in Uxbridge Township. A larger area of light infestation with patches of moderate-to-severe defoliation may occur in the King-Whitchurch-Stouffville townships area between Newmarket and Richmond Hill. Small but probably heavy infestations are likely to occur near Avenda and Six Mile Lake provincial parks and just west of Barrie in Vespera Township, Huronia District.

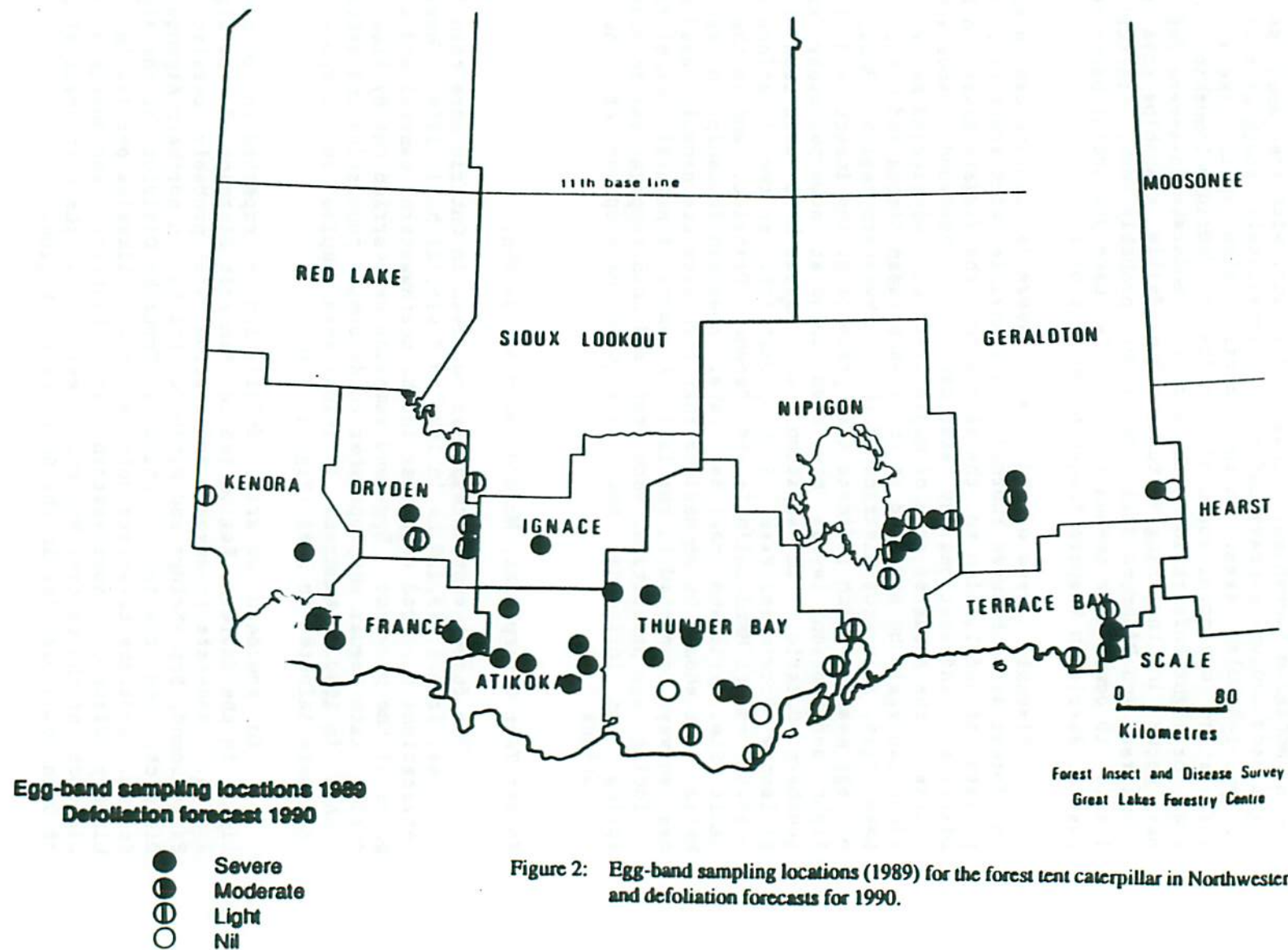
Sizeable areas of moderate-to-severe defoliation can be expected in forest areas between Thorold and Dunnville, with scattered, smaller pockets of defoliation to the east along the Niagara River in Niagara District. Infestations may also develop in hardwood stands south of Dundas in the Ancaster area of Maple District. Widespread heavy infestations can again be expected in the area between Simcoe and Clear Creek by Lake Erie, in Simcoe District of the Southwestern Region. Small numbers of egg masses, which indicate the presence of the insect, and trace or light defoliation levels have been found at numerous other areas in southern Ontario. In addition, egg masses have also been found in Killarney Provincial Park, Sudbury District, at two locations on the eastern end of Manitoulin Island, Espanola District, and in the city of Sault Ste. Marie and near Bass Lake, Aberdeen Township, in Sault Ste. Marie. It should be emphasized that forecasts are usually based on egg-mass surveys conducted in the fall. A number of natural control factors, including egg parasitism, snow depth and cold temperatures in winter and spring can influence the subsequent development of the insect populations.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The forest tent caterpillar outbreak in Ontario more than doubled in size, from 3,965,229 ha in 1988 to 7,915,111 ha in 1989. Three major infestations occurred this year in the northwestern, central and southern parts of the province. Egg-band sampling was carried out by FIDS rangers during late August and September to determine population and defoliation trends in 1990. Numerous locations were sampled in and around areas that were infested in 1989 (Fig. 2, 3 and 4).

In southern Ontario, defoliation is expected to be generally light in the Eastern Region and in Bancroft District of the Algonquin Region. Moderate-to-severe defoliation will probably persist in the Parry Sound, Bracebridge and Minden districts, in northern Algonquin Park District, and at a few locations in Pembroke District of the Algonquin Region. Moderate-to-severe defoliation will likewise persist in northern Lindsay District, northeastern Maple District, and northern Huronia District of the Central Region, as well as in the north-central portion of Owen Sound District in the Southwestern Region.

NORTHWESTERN ONTARIO



NORTHEASTERN ONTARIO

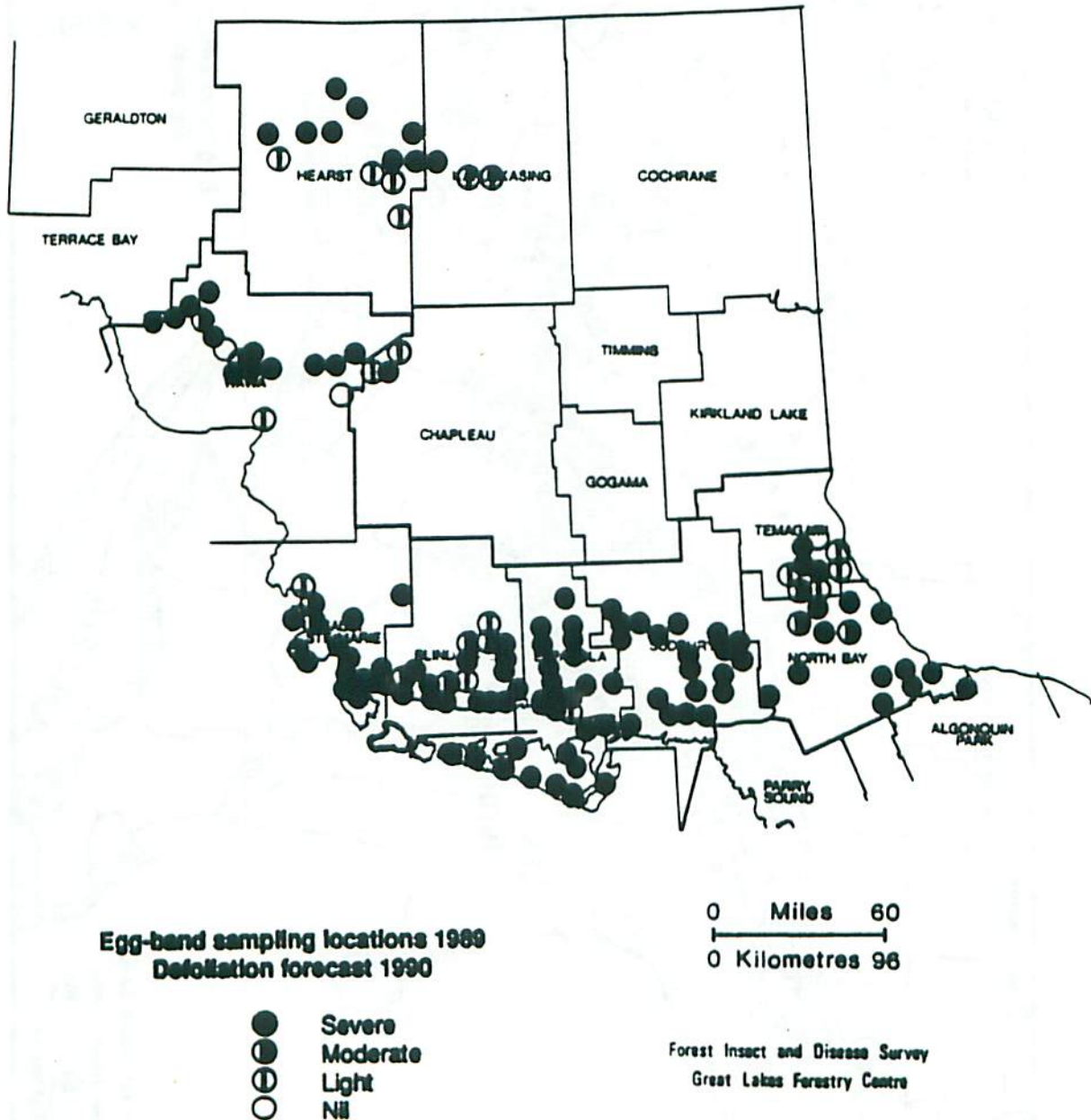


Figure 3: Egg-band sampling locations (1989) for the forest tent caterpillar in Northeastern Ontario and defoliation forecasts for 1990.

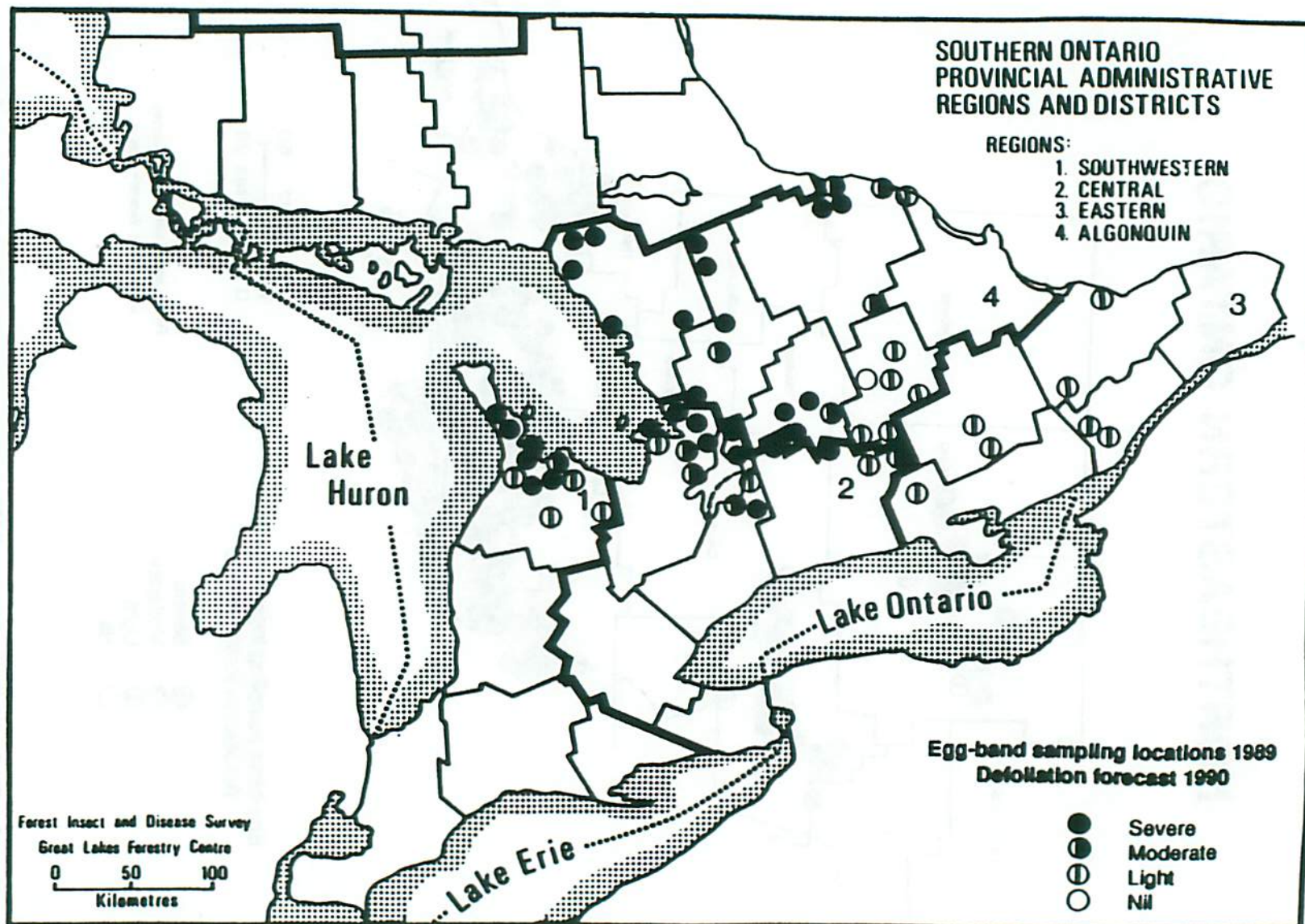


Figure 4: Egg-band sampling locations (1989) for the forest tent caterpillar in Southern Ontario and defoliation forecasts for 1990.

Egg-band counts in the central part of the province indicate that moderate-to-severe defoliation will likely persist throughout the North Bay, Sudbury, Espanola, Blind River, Sault Ste. Marie and northern Wawa districts of the Northeastern Region. Populations will probably continue to decline in Temagami District, in which the oldest part of the current outbreak is located. Moderate-to-severe defoliation may persist in northern Hearst and western Kapuskasing districts of the Northern Region.

It should be noted that, egg counts notwithstanding, many of the infestations sampled in the southern and central parts of the province have been present for several years. This means that parasites, diseases and predators are beginning to take their toll. In addition, many of the egg bands counted were smaller than normal. For these reasons, sudden population collapses are possible in many of the areas described above.

The situation is somewhat different in northwestern Ontario, in which large areas were newly infested in 1989. Egg-band counts in this region indicate that infestations will remain heavy in Fort Frances District, in southern Kenora District, and in the Dryden and Ignace districts of the Northwestern Region. Infestations will also remain heavy in Atikokan District and western Thunder Bay District, as well as in a number of widely scattered areas in the Nipigon, Terrace Bay and Geraldton districts of the North Central Region.

Black Army Cutworm, *Actebia fennica* (Tausch.)

No infestations of the black army cutworm were found in 1989. A pheromone trapping program that was carried out at the Thunder Bay Forest Tree Nursery and on prescribed burns in several areas in the Northern Region generally yielded low numbers of moths. The total numbers of moths caught at trapping sites in Haig and Legge townships, Hearst District, were 48 and 42, respectively. Thirty-six moths were caught at a site in Gurney Township, Kapuskasing District, and 12 at a site in Inglis Township, Cochrane District. Eight traps that were set in the tree nursery at Thunder Bay yielded a total of 183 moths.

Jack Pine Tip Beetle, *Conophthorus banksianae* McP. and Red Pine Cone Beetle, *C. resinosae* Hopk.

In addition to information presented in the Summer Survey Bulletin, light infestations of the jack pine tip beetle were reported from single locations in each of the Kapuskasing, Geraldton and Nipigon districts and at two locations in Ignace District. Heavy infestations of the closely related red pine cone beetle persisted on shoreline red pine stands on Lake Temagami, Temagami District.

Pitted Ambrosia Beetle, *Corthylus punctatissimus* (Zimm.)

Reports of this pest of sugar maple regeneration increased in 1989. The heaviest infestation occurred in a 2-ha maple stand in the

Mill Pond Conservation Area in North Burgess Township, Brockville District. Here, 56% of the 0.5-m regeneration was killed. Pockets of high mortality were also observed in a maple stand in Allan Township, Espanola District. Infestations that caused approximately 10% mortality were reported in Oro and Floss townships, Huronia District, and in Vaughan and Albion townships, Maple District.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

The Summer Survey Bulletin reported that infestations of this serious pest of oak were mainly light at most locations sampled in 1989. Egg sampling carried out in the fall of 1989 indicates this situation will probably prevail again in 1990. The single exception to this trend occurred in the Dufferin County Forest of Huronia District, in which examination of one egg sample produced a forecast of moderate defoliation for 1990.

Beech Scale, *Cryptococcus fagisuga* Lindling.

Surveys were continued for this vector of beech bark disease, *Nectria coccinea* var. *faginata*. In 1988 the insect was found in a number of areas in the Central and Eastern regions. In 1989 the insect was collected again at several of these areas and new infestations were discovered at Sibbald Point Provincial Park in Maple District and in Short Hills Provincial Park, Niagara District. The beech bark disease was not found.

Maple Trumpet Skeletonizer, *Epinotia aceriella* (Clem.)

For the third consecutive year, heavy infestations occurred in a 25-ha sugar maple stand in Presqu'ile Provincial Park, Napanee District, in which 90% of the trees sustained 60% foliar damage. A similar situation prevailed in a 20-ha stand in Hallowell Township, Napanee District, in which 60% of the trees were infested with an average of 60% foliar damage. Defoliation in a sugar maple stand in Port Burwell Provincial Park in Bayham Township, Aylmer District, averaged 80%. Light infestations, with foliar damage of about 5%, were reported at a few areas in Brockville District.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

This insect was widespread in parts of northern Ontario. The most serious damage was recorded in a jack pine stand on the Sapawe-Upsala road, Atikokan District, where 2.7-m trees sustained 20% leader damage. Leader damage of 15.3 and 10.3%, respectively, was recorded in young jack pine stands at East Bay (Dog Lake) and on the Mack road, Thunder Bay District. Numerous other jack pine stands in these districts had leader damage ranging from 1 to 8%. In Kirkland Lake District, a 10-ha, 1-m jack pine plantation in Charters Township had

16.6% of the leaders destroyed, and 14 and 13% leader damage was recorded in Macklem and Carscallen townships, respectively, of Timmins District. In Copperfield Township, Chapleau District, 12% of the leaders were destroyed in a 2.4-m, 68-ha jack pine stand and 10% leader damage was recorded in a 25-ha stand of 1.8-m jack pine in Hanmer Township, Sudbury District. Numerous other light infestations were recorded in young jack pine stands in northern Ontario. In southern Ontario, the only infestation of any significance was reported in a white pine seed orchard in Snowden Township, Minden District, in which 12.7% of the 1-m trees sustained leader damage.

Sugar Maple Borer, *Glycobius speciosus* (Say)

Assessment of sugar maple plots revealed the presence of the sugar maple borer at a number of locations in the Algonquin and Central regions. The insect was most numerous in Clarke Township, Lindsay District, in which 24% of the roadside trees were infested. Sugar maple stands in Gibson Township, Parry Sound District, and Wood Township, Bracebridge District, had 20 and 12% of the trees attacked, respectively. The incidence of attack ranged from 4 to 8% at a number of other locations in the Minden, Lindsay and Bracebridge districts.

Fall Webworm, *Hyphantria cunea* (Drury)

The heaviest infestations of this insect were recorded in Brockville District and in southern Napanee District. In these districts, individual and small groups of trees in the area immediately north of the St. Lawrence River were often completely covered with webbing, and accompanying defoliation was in the 90% range. Scattered individual trees and small stands in the adjacent Cornwall and Carleton Place districts sustained defoliation ranging from 30 to 90%. Increased populations were observed in the Niagara, Simcoe and Aylmer districts, in which forest-edge and roadside hardwood trees sustained defoliation ranging from 10 to 50%. Other notable infestations occurred in Pembroke District, in which a 5-ha stand of white ash was 80% defoliated, and in southern Kirkland Lake District, in which numerous infestations were evident on small clumps of willow and alder. Infestations that had been heavy for a number of years in the North Bay and Espanola districts declined to low levels. Light infestations consisting of single or small numbers of nests were recorded in the Lindsay, Minden, Bracebridge, Parry Sound, Sault Ste. Marie, Blind River, Thunder Bay, Timmins and Temagami districts.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Medium and heavy infestations caused severe defoliation and sporadic tree mortality in red pine plantations in a number of areas in the Minden and Parry Sound districts. Current defoliation averaged between 15 and 25% in a number of plantations; however, in some cases individual trees sustained defoliation in the 90% range. Infestations

were also widespread on red pine in the Algonquin Park, Bancroft and Pembroke districts, where average defoliation was in the 10 to 15% range; however, at one location in Grattan Township, Pembroke District, average defoliation was 40%. Increased populations were evident in the Espanola, Sudbury and North Bay districts. The most severe damage occurred in Orlig Township, North Bay District, in which small pockets of mortality were recorded in a 30-ha red pine plantation. Infestations were also widespread on planted red pine in the Blind River and Sault Ste. Marie districts, but in most cases the average defoliation was less than 20%. In a few areas, open-grown, ornamental and fringe trees sustained up to 100% defoliation.

Swaine Jack Pine Sawfly, *Neodiprion swainei* Midd.

Infestations were recorded in two pockets of light defoliation that totalled about 200 ha in the northwestern part of Trethewey Township, Temagami District, in 1988. Helicopter surveys also revealed dead tops at a few points within these areas. Moderate-to-severe defoliation of jack pine trees was again recorded on Island 127 in Lake Temagami, where a small infestation has persisted for several years. Small numbers of colonies were found in other island and shoreline jack pine stands in Lake Temagami and in jack pine plantations in Gamble and McGiffin townships, Temagami District.

Redheaded Jack Pine Sawfly, *Neodiprion virginiana* complex

Increased population levels were evident in the Chapleau, Gogama, Sudbury and Espanola districts in 1989. The largest numbers were reported in a 200-ha plantation of 1.5-m jack pine in Alcona Township, Chapleau District, in which 54% of the trees sustained an average defoliation level of 35%. A 0.5-ha stand of 4-m jack pine in Margaret Township sustained an average of 15% defoliation. Defoliation levels of about 8% were recorded on 9% of the trees in a 10-ha, 4.2-m stand of jack pine in Moncrieff Township, Sudbury District. A small stand of scattered 15-m trees in Farquhar Township, Hearst District, sustained 20% defoliation. Reports of small numbers of colonies were also received from the Kirkland Lake, Geraldton, Thunder Bay and Nipigon districts.

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

Populations of this insect, which declined in 1988, remained generally low in 1989. The most notable exception to this trend was in Hallowell Township, Napanee District, in which a 20-ha sugar bush had 80% foliar damage. Roadside trees along county road 12 in the same township sustained 30% foliar damage. Twenty percent of the sugar maple trees in a 10-ha stand in Murphy's Point Provincial Park, Carleton Place District, had approximately 25% foliar damage. Damage levels of about 5% were recorded in a 2-ha sugar maple stand at Fort La Cloche, Espanola District, and in Restoule Provincial Park in Patterson Township, North Bay District.

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

This late-season insect caused severe browning of fringe, under-story and young, open-grown trembling aspen in the Northwestern Region, particularly in the Ignace, Red Lake and Sioux Lookout districts. In these areas, foliar damage was often 75% or higher. In Nipigon District of the North Central Region, 70% foliar damage was recorded and 95% foliar damage occurred along Highway 580 in Summers Township. Foliar damage ranging from 70 to 100% was recorded on fringe trembling aspen at French Lake, Atikokan District, and in Sibley and Laurie townships, Thunder Bay District. Infestations were somewhat lighter in Geraldton District, in which foliar damage of 65% occurred along the Lukinto Lake road and 40% damage occurred along the Goldfield road in Parent Township.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* Roh.

In addition to damage reported in the Summer Survey Bulletin, infestations of this defoliator were widespread on young, open-grown spruce in Chapleau District. In the town of Chapleau and in Wakami Provincial Park, repeated defoliation has resulted in a mortality level of about 10%. New, heavy infestations with defoliation in the 65% range occurred on ornamentals in the village of Foleyet. Increased population levels were reported in areas in the Geraldton and Terrace Bay districts. In Roberta Township, Geraldton District, defoliation ranged from 40 to 50% in several black spruce plantations. Mortality in these plantations ranged from 15 to 20% as a result of repeated defoliation. A small, 0.5-ha plantation of 2-m black spruce in the Burrows Lake area of Geraldton District sustained defoliation in the 50 to 90% range, with accompanying mortality of 30%. In Terrace Bay District, open-grown white spruce at one location in Strey Township had 40% defoliation and in Tuuri Township, a small group of 2-m black spruce sustained 50% defoliation and 10% mortality. Populations declined in most areas in the Thunder Bay and Atikokan districts. At the O'Connor seed orchard in Thunder Bay District, in which high population levels have required chemical control for the past several years, only occasional larvae were found. In the villages of Shebandowan and Stanley, white spruce hedgerows sustained 100 and 50% defoliation, respectively. At Cache Bay, Atikokan District, shoreline black spruce were 20% defoliated, with light mortality evident after heavy defoliation in 1988. Infestations were reported from several other areas, with defoliation ranging from 10 to 40%.

White Pine Weevil, *Pissodes strobi* (Peck)

This insect was widespread in northern Ontario, with some localized pockets of heavy infestation in young pine stands or plantations. The most notable of these were as follows: 25 and 16%, respectively, leader damage in two jack pine stands in Hurlburt Township, Sault Ste. Marie District; 18.6 and 17.3% in two jack pine plantations in Viel Township, Blind River District; 22 and 24% in two white pine plantations in Pardo Township, North Bay District and Tennyson Township, Espanola District; 18, 20 and 15%, respectively, in jack pine stands on the

Sapawe-Upsala road, the Camp 517 road and Hagey Township, Thunder Bay District; 16% in a jack pine stand on the Poshkokagan River, Nipigon District; 26 and 14% in jack pine plantations in Charters and Lawson townships, Kirkland Lake District; and 18% in a jack pine plantation in Milne Township, Temagami District. In the Ferguson black spruce seed orchard, Ignace District, 19.3% of the leaders were infested. Numerous other infestations, most with leader damage in the 1-10% range, were reported elsewhere in northern Ontario.

In southern Ontario, the highest incidence of attack occurred in a 3.5-ha white pine plantation in Ross Township, Pembroke District, in which 27% of the leaders were weevilled. A 2.5-ha white pine plantation in Augusta Township, Brockville District, had 16% of the leaders destroyed. In the Southwestern Region, where sporadic medium and heavy infestations have occurred for the past few years, populations declined to low levels in 1989. Data from a number of other locations disclosed widespread infestations; however, in all cases, damage was less than 10%.

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

Populations of this midsummer pest remained generally low in the province after declining in 1988. The highest population levels were reported near the Ear Falls airport, Red Lake District, where 90% defoliation occurred on roadside trees. Defoliation in excess of 75% was observed on ornamentals in the towns of Ear Falls (Red Lake District), Sioux Lookout (Sioux Lookout District), and near Murillo (Thunder Bay District). Open-grown mountain-ash trees in Ivanhoe Provincial Park, Chapleau District, sustained 60% defoliation. Defoliation levels of 20 to 25% were reported from several areas in the Chapleau, Gogama, Nipigon and Terrace Bay districts.

Pear Thrips, *Taeniothrips inconsequens* (Uzel.)

The Summer Survey Bulletin described the survey conducted to determine the presence of this pest in Ontario. At that time, a single collection from Vaughan Township, Maple District was confirmed as pear thrips. Since then the insect has been found to be present at some 40 additional locations in the Niagara, Owen Sound, Wing, Tweed, Huronia, Cambridge, Lindsay, Pembroke, Brockville, Cornwall, Napanee, Minden, Bancroft, Sudbury, Espanola, Blind River and Sault Ste. Marie districts (Fig. 5). In all cases in which the pear thrips has been found, damage to the host sugar maple trees was negligible. Recent communications with Mr. Kevin Kerr of the Ontario Ministry of Agriculture and Food revealed that pear thrips has been present in fruit orchards in Ontario for a number of years but has not been considered a serious problem.

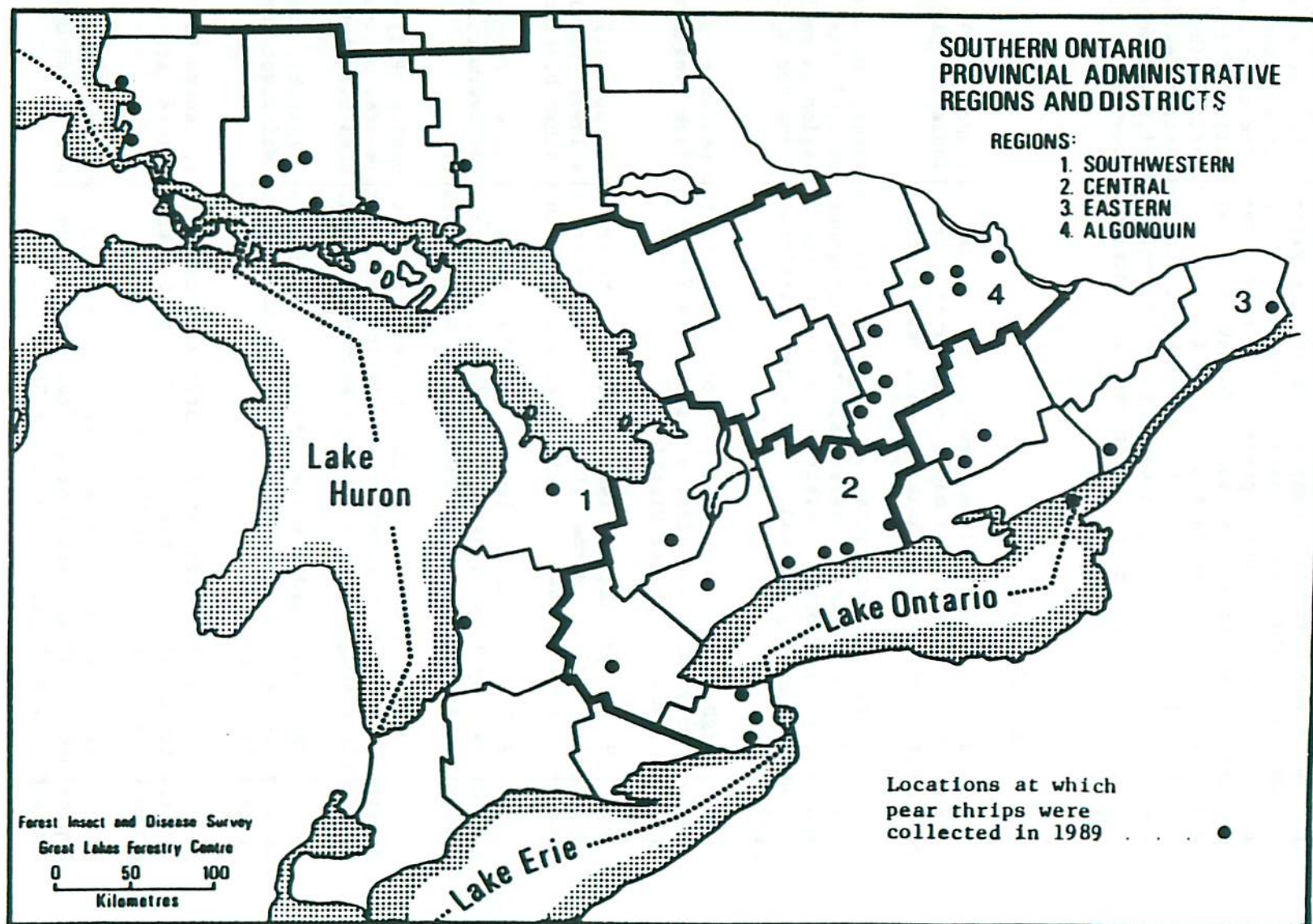


Figure 5: Locations in Southern Ontario at which pear thrips were collected in 1989.

Maple Webworm, *Tetralopha asperatella* (Clem.)

Large populations of this pest were found in sugar maple stands in Owen Sound District. Many stands in the Eastnor, Albemarle, Keppel, Sydenham and Euphrasia townships had 100% of the trees infested with large numbers of insects present. In most cases, the trees had been defoliated earlier in the year by forest tent caterpillar, which caused added stress to the trees and made it impossible to estimate the proportion of defoliation caused by each insect. Low population levels were reported at a number of locations in Huronia District as well as at single locations in the Otonabee and Mariposa townships, Lindsay District.

Other Noteworthy Insects

The greenstriped mapleworm, *Dryocampa rubicunda* (F.), caused 70-80% defoliation of red maple in the Turtle Lake-Findlayson Lake area, northwest of the town of Atikokan, Atikokan District.

Heavy infestations of the willow leafminer, *Micurapteryx salicifoliella* (Cham.), were reported throughout much of the Hearst, Kapuskasing and Cochrane districts of the Northern Region as well as in the Geraldton, Nipigon and Terrace Bay districts of the North Central Region.

High levels of 1- to 2-year-old damage by the whitespotted sawyer beetle, *Monochamus scutellatus* (Say), were found in jack pine stands in Marjorie Township, Hearst District.

High population levels of the hackberry nippegall maker, *Pachypsylla celtidismamma* (Riley), occurred on the lower portions of hackberry trees on Sheridan Point, Pelee Island, in Chatham District.

High population levels of the spruce beetle, *Dendroctonus rufipennis* (Kby.), were associated with dying mature and overmature white spruce in Lake Superior Provincial Park, Wawa District.

Varying numbers of the balsam fir bark beetle, *Pityokteines sparsus* (LeC.), were found in association with single-tree mortality of balsam fir throughout Lake Superior Provincial Park, Wawa District.

The pine needle scale, *Chionaspis pinifoliae* (Fitch), was found in large numbers in an 18-ha Scots pine plantation in Wainfleet Township, Niagara District.

The woolly alder sawfly, *Eriocampa ovata* (L.), caused 90 to 100% defoliation of alder in the city of Thunder Bay and in rural areas within a radius of about 30 km of the city.

Warren's root collar weevil, *Hylobius warreni* Wood, caused approximately 3% mortality of grafted Scots pine trees in an OMNR seed orchard in Gurd Township, North Bay District.

The walnut caterpillar, *Datana integerrima* G. & R., caused defoliation ranging from 50 to 100% on open-grown black walnut trees at a number of widespread locations in Simcoe, Aylmer and Niagara districts.

A heavy infestation of the variable caterpillar, *Pyrrhia exprimens* (Wlk.), occurred within an area of recently planted white and black spruce seedlings in Haig Township, Hearst District. Feeding damage, however, was confined to ground plants, mainly wild geranium and fireweed, and little or no damage occurred on the seedlings.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

In 1988, a national survey was conducted to identify the insect vectors of the pinewood nematode in Canada. FIDS units across Canada collected specimens of wood-inhabiting insects, which were shipped to Memorial University in Newfoundland, where they were processed to determine if any harbored specimens of the pinewood nematode. Some 1,454 insects were sent from Ontario. Nematodes were extracted from insects in 26 collections from Ontario. None of these were the pinewood nematode; however, two collections of sawyer beetle, *Monochamus* sp., did contain specimens of a nematode identified as *Bursaphelenchus* sp. The significance of this is not clear; however, it is apparent that potential insect vectors are not infested by pinewood nematode to any significant degree.

TREE DISEASES

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schlüpfer-Bernhard

As usual, intensive surveys were carried out for the European and North American races of this disease. The European race was collected in three plantations in Parry Sound District that had a previous history of the disease. Scleroderris was also collected again in a small red pine plantation in Mayo Township, Bancroft District, in which 8% of the trees were infected. A new area of infection was confirmed in Strong Township, Bracebridge District, where 16% of the 1.4-m red pine displayed symptoms of the disease. Although this represents a new occurrence of the European race, it is fairly close to previous infection centers and does not indicate a significant range extension.

The Summer Survey Bulletin described infection sites of the North American race at locations in the North Bay, Blind River, Geraldton and Nipigon districts. Since then, a light infection level has been recorded on 3-m red pine in a 2-ha plantation in Rowat Township, Espanola District. An infection rate of 69% was recorded in an 80-ha plantation of 2-m jack pine in Strey Township, Terrace Bay District, and 2% damage levels were noted on about 50 1- to 2-m regeneration jack pine on an old fire site along Highway 599 south of Lake St. Joseph, Sioux Lookout District.

Armillaria Root Rot, *Armillaria ostoyae* (Romagn.) Herink

The Summer Survey Bulletin reported this disease present in many young stands in Ontario at an infection level of less than 2%, with a few exceptions. Further observations and reports have confirmed this, and numerous other infection centers have been recorded. The most significant of these were as follows: a 10-ha white pine plantation in Labonte Township, Wawa District, with 7.3% of the 1.7-m trees infected; a 4-ha jack pine progeny test in Smilsky Township, Sault Ste. Marie District, with 3.3% of the 1.9-m trees infected; and a 10-ha white pine plantation in Pardo Township, North Bay District, with 2% of the 2.3-m trees infected. In addition, the disease was implicated in the 1% mortality of red oak in an oak health plot in Clarke Township, Lindsay District. The disease was also involved at an undetermined level in dead and dying mature and semimature white spruce at one location in Laurier Township, Bracebridge District. Other factors that probably predisposed the trees in this area to attack were several dry summers and moderate-to-severe spruce budworm defoliation from 1978 to 1985.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein) de Bary and *C. ledicola* (Peck) Lagerh.

These closely related diseases were widespread in northern Ontario, with the most numerous and heavy infections occurring in the North Central Region. The most severe infection was recorded in a young black spruce stand on the Lukinto Lake Road, Geraldton District, in which

foliar damage of 70% was recorded. A stand of 4-m black spruce on Highway 11 west of Brule Road in Thunder Bay District had 100% of the trees infected, with an average foliar damage of 60%. Infection levels of 100% were recorded in black spruce plantations and natural stands at numerous other areas in the Thunder Bay and Atikokan districts, with foliar damage ranging from 19 to 50%. Infections were also widespread in Northern Region, particularly in Cochrane, Kapuskasing and Hearst districts. The incidence of attack was often 100% in these areas, but actual foliar damage was slightly lower, usually in the 20 to 25% range. In some stands in the Cochrane and Kapuskasing districts in which infection levels were high, the rust disease was itself attacked by a parasite and, in one instance in Thorning Township, Cochrane District, 95% of the infected trees showed evidence of the rust's parasite. A single area of infection, with foliar damage levels of 30%, occurred in Striker Township, Blind River District, and very light infections were reported at many locations in the Chapleau and Gogama districts.

Ink Spot of Aspen, *Ciborinia whetzellii* (Seaver) Seaver

Unusually heavy infections of this foliar disease were reported from a number of areas in the Cochrane, Kapuskasing and Hearst districts. Numerous small stands of aspen 1-2 ha in size west of the town of Hearst had 100% infection levels, with actual foliar damage in the 50% range. Similar situations were also noted east of the village of Opasatika and west of Smooth Rock Falls in Kapuskasing District and east of the town of Cochrane in Cochrane District. Small pockets of infection, with infection levels of 80 to 100% and foliar damage ranging from 20 to 60%, occurred in Ware, Conmee, Forbes and Soper townships, Thunder Bay District, and near Red Rock, along the Gorge Creek Road, and in Ledger Township, Nipigon District. Populations were reduced in Terrace Bay District, although small infections were reported in Bomby Township and along the Industrial Road.

**Leaf Diseases of Balsam Poplar, *Mycosphaerella populicola* G.E. Thompson,
Septoria musiva Peck and
Linospora tetraspora G.E. Thompson**

Infections by *M. populicola* and *S. musiva* were widespread at high infection levels throughout the Ignace, Red Lake and Sioux Lookout districts of Northwestern Region. In this area, many balsam poplar stands sustained infection levels as high as 90%, which generally resulted in premature leaf fall. *M. populicola* occurred at 100% infection levels with 90% actual foliar damage in Lindsay Township and at Hoiles Creek, Geraldton District. Somewhat lower infection levels were encountered along Highway 614 in Terrace Bay District and in a number of areas in the Atikokan, Thunder Bay and Nipigon districts of North Central Region. *Linospora tetraspora* caused similar damage to balsam poplar stands in the Thunder Bay, Atikokan and Nipigon districts as well as in the Hearst, Cochrane and Kapuskasing districts of Northern Region.

Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

The Summer Survey Bulletin reported widespread infections by this disease, primarily on Scots pine (*Pinus sylvestris* L.) and Austrian pine (*Pinus nigra* Arnold) in the Central and Southwestern regions of southern Ontario. In August, the fungus was detected in three black spruce seed orchards in Sioux Lookout District and one in Ignace District in North-Western Region. Damage ranged from single dead branches to whole-tree mortality. In many cases, the entire portion of the tree above the initial branch infection died. The most severe damage was in the Goodie Lake North seed orchard, in which 26% of the trees were infected. More than 80% of these had a large proportion of the main stem killed. Infection levels were as follows in the other orchards: Goodie Lake South, 1.3%; Skurban, 4.0%; and Vermeerch, 4.5%. Black spruce is an unusual host for this disease and investigation of this occurrence will continue in 1990. In addition to the above, medium infection levels were observed on 2-0 Colorado blue spruce seedlings in a Christmas tree nursery bed in North Walsingham Township, Simcoe District, and heavy infections occurred on ornamental mugho pine (*Pinus mugho* Turra var. *mugho* Zenari) at one location in Townsend Township, Simcoe District.

Leaf Blight, *Septoria betulae* Pass. and *S. betulae odoratae* Bubák & Vleugel

Infection levels of *S. betulae*, which severely damaged white birch foliage over an area of 218,019 ha in Terrace Bay District in 1988, declined markedly in 1989. Aerial surveys revealed a reduced area of some 15,239 ha of moderate-to-severe foliar damage in five pockets. The largest of these (13,740 ha) occurred in the central part of Tuuri and Walsh townships and extended north to Foxtrap Lake. The other four pockets were located west of the one described above, in Syine, Strey and Priske townships, and just north of the Priske-Strey township boundary. Foliar damage ranging from 40 to 80% was reported on white birch regeneration in a number of areas in the northern portions of the Espanola and Sudbury districts. The largest of these occurred in Moncrieff Township, Sudbury District, where more than 50 ha of white birch sustained 100% foliar damage. The disease also caused premature discoloration and defoliation along Highway 527 in the Eaglehead Lake area and near Camp 230 in Thunder Bay District. *Septoria betulae odoratae* caused 30 to 40% foliar damage on white birch regeneration on dry gravel sites along the Nungesser Lake Road and the Dixie Lake Road in Red Lake District. Similar damage levels were reported on 8- to 10-m white birch south of Encamp Lake and at two locations along the Basket Lake Road in Ignace District.

Other Noteworthy Diseases

Infections of spruce cone rust, *Chrysomya pirolata* (Körn.) Winter, were reported at low levels on white spruce cones at single locations in Allan and Robinson townships, Espanola District, and at one

location in Gurd Township, North Bay District. The disease was also collected on black spruce cones at one location in Geraldton District.

Conifer-aspen rust, *Melampsora medusae* Thüm. caused foliar damage as high as 95% in a 2-ha hybrid poplar plantation at the Bonner Centre in Farquhar Township, Kapuskasing District.

Hypoxylon canker, *Hypoxylon mammatum* (Wahlenb.) J. Miller, was found infecting 70% of the trees and causing 30% mortality in a small trembling aspen stand in Dowling Township, Sudbury District. Infection levels in the 2 to 5% range were common in stands in northern Sudbury Districts and in Espanola District.

Infections of a needle cast, *Meloderma desmazierii* (Duby) Darker, caused defoliation of about 75% on approximately 7% of the trees in a small Scots pine plantation in Turnberry Township, Wingham District.

Horse-chestnut (*Aesculus hippocastanum* L.) trees at a number of locations in the Simcoe and Niagara districts sustained 95 to 100% foliar damage from horse-chestnut leaf blotch, *Phyllosticta sphaeropsoides* Ell. & Ev.

Speckled tar spot, *Rhytisma punctatum* (Pers.) Fr., caused complete leaf infection and defoliation of sugar maple in a 5-ha area in Stevens Township, Wingham District.

ABIOTIC CONDITIONS

Drought

For the second consecutive year, drought damage was widespread in Ontario's forests. The cumulative effect of this condition was evident over an area of some 242,480 ha, a large part of which occurred in Algonquin Region (Table 5, Fig. 6). In this area, aerial surveys disclosed a total of 213,148 ha of damage, including premature foliar discoloration and leaf drop, crown dieback and mortality. Branch and whole-tree mortality were recorded within a total area of 8,920 ha, with the most extensive areas (4,009 ha and 2,972 ha, respectively) in the Parry Sound and Bracebridge districts. Smaller areas ranging from 156 to 768 ha were recorded in the Minden, Algonquin Park, Bancroft and Pembroke districts. Red oak, sugar maple and trembling aspen were most severely affected, with most of the branch and tree mortality occurring on exposed, rocky sites.

Extensive drought damage also occurred in the Northeastern Region, with a total of 16,972 ha affected in the Blind River (10,002 ha), Sault Ste. Marie (5,000 ha), North Bay (1,650 ha) and Espanola (320 ha) districts.

In the Eastern Region, drought-induced damage was mapped within a total area of 10,991 ha. The most extensive damage was mapped in the Napanee and Cornwall districts, in which 5,150 ha and 4,200 ha of damage

Table 5. Summary of drought damage in Ontario in 1989.

<u>Region</u> <u>District</u>	<u>Species</u> <u>affected</u>	<u>Area of damage</u> <u>(ha)</u>
<u>Eastern Region</u>		
Cornwall	sM, tA, wB	4,200
Carleton Place	rM, tA, wB	1,159
Tweed	sM, rO, wB, tA	363
Brockville	sM, wB, tA	119
Napanee		<u>5,150</u>
		10,991
<u>Algonquin Region</u>		
Pembroke	sM, rO, wB, tA, wP	3,637
Algonquin Park	sM, rO, wB, tA, wP	104,400
Bancroft	sM, rO, wB, tA, wP	11,600
Minden	sM, rO, wB, tA, wP	15,322
Bracebridge	sM, rO, wB, tA, wP	43,289
Parry Sound	sM, rO, wB, tA, wP, jP	<u>34,900</u>
		213,148
<u>Central Region</u>		
Huronia	rO	<u>612</u>
		612
<u>Southwestern Region</u>		
Owen Sound	sM, wB	<u>2</u>
		2
<u>Northeastern Region</u>		
North Bay	rO, wP	1,650
Espanola	rO, wP	320
Blind River	sM, rO, wB, tA, wP	10,002
Sault Ste. Marie	sM, rO, wB, tA, wP	<u>5,000</u>
		16,972
<u>North Central Region</u>		
Terrace Bay	wB, tA	<u>255</u>
		255
<u>Northwestern Region</u>		
Ignace	wB, tA	300
Kenora	wB	<u>200</u>
		500
Total Ontario		<u>239,430</u>

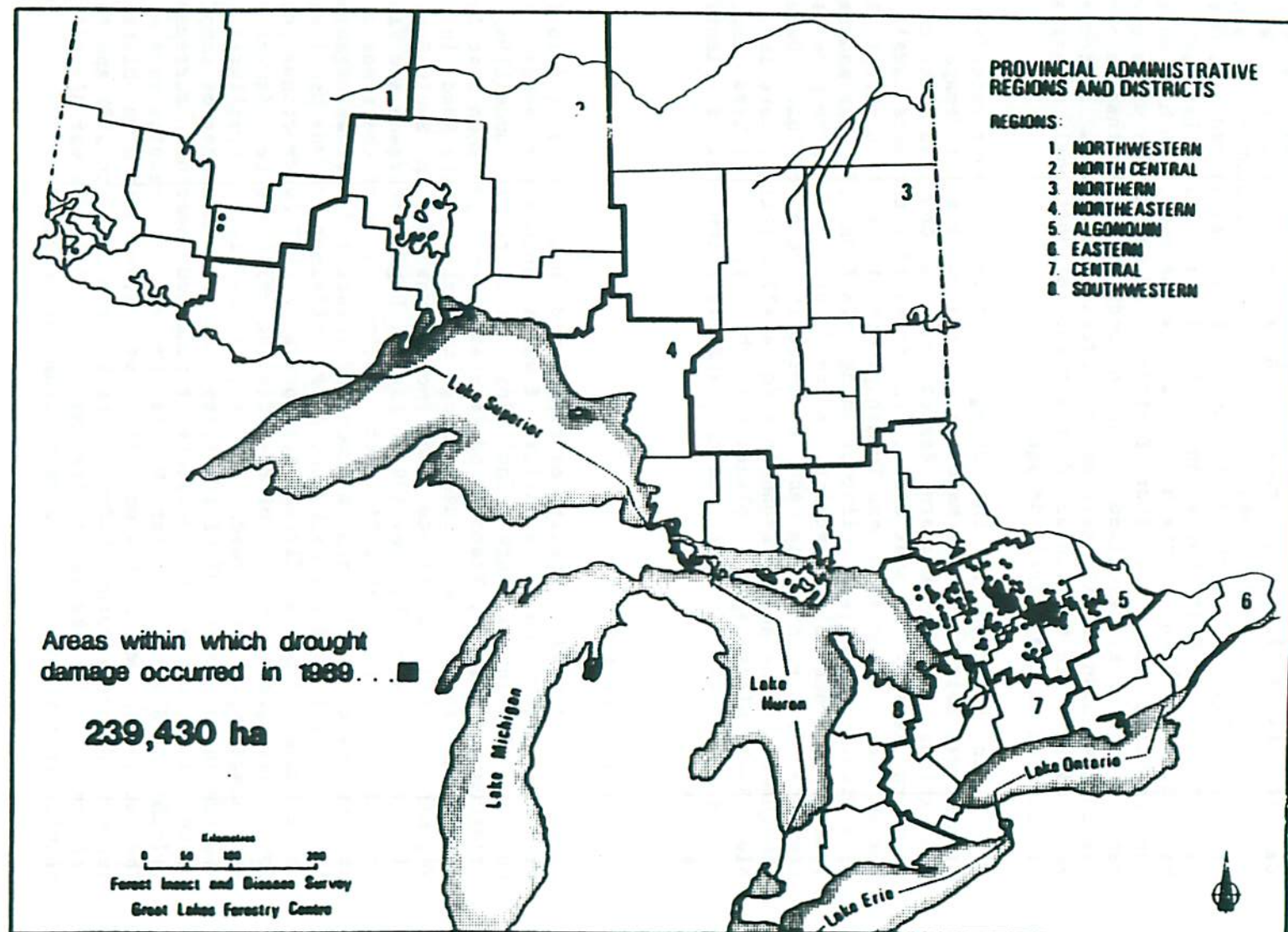


Figure 6: Areas within which drought damage occurred in 1989.

were recorded, respectively. The remainder of the damage occurred in the Carleton Place (1,159 ha), Tweed (363 ha) and Brockville (119 ha) districts. Drought damage was also recorded in a number of other districts, as follows: Huronia District, 612 ha, mainly red oak; Owen Sound District, 2 ha, sugar maple and white birch; Terrace Bay District, 255 ha, white birch and mountain-ash; Ignace District, 300 ha, white birch and trembling aspen; and Kenora District, 200 ha, mainly white birch. In many of the areas described in the Algonquin and Northeastern regions, stands have been heavily attacked by forest tent caterpillar for at least two years, which has subjected the trees to additional stress and thus contributed to the overall damage.

In addition to the damage to forest stands recorded above, drought was felt to be the major factor responsible for damage to conifer plantations in the Eastern Region and in Chapleau District of the Northern Region. In most cases, the trees affected were small (<1 m), but at one location in Nepean Township, Carleton Place District, 10-m red pine displayed complete foliar browning. In Front of Leeds and Lansdowne Township, Brockville District, a stand of 0.5-m white pine suffered complete foliar browning and a mortality rate of 20%. Drought was thought to be the agent responsible for a 42% mortality rate in a 3-year-old, 36-ha black spruce planting at the Island Lake Tree Improvement Centre, Chapleau District. At the same location, 56% of planted larch were dead.

Mortality of Balsam Fir

Widespread mortality of single and small clumps (up to 5 trees) of balsam fir and occasionally of white spruce was evident in Lake Superior Provincial Park, including mortality in Goodwillie, Giles, Brimacombe, Asselin, Tiernan and Peterson townships, Wawa District. The same conditions were evident along the Ranger Lake Road in Hodgins, Whitman, Curtis, Jollineau and Snow townships in Sault Ste. Marie District, and along Highway 129 in Casson, Dagle, Sturgeon and Villeneuve townships of Blind River District. Although many of the trees displayed no obvious cause of death, a number of insect and disease organisms were found. The balsam fir bark beetle, *Pityokteines sparsus* Lec., was found on a number of balsam fir and the spruce beetle, *Dendroctonus rufipennis* Kby., was present on some of the affected white spruce. Sawyer beetles, *Monochamus* spp., were present on many of the trees. Armillaria root rot was present on about 50% of the trees examined. A number of samples were taken to determine the presence of pinewood nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle; however, all results were negative. The stands in which the mortality was observed in Wawa District were subject to heavy spruce budworm attacks from 1971 to 1981 and the areas referred to in the Sault Ste. Marie and Blind River districts were heavily attacked by spruce budworm from 1974 to 1982.

Other Abiotic Damage

Sugar maple and, occasionally, other hardwoods growing along roadsides, fencerows and in other exposed situations, sustained various degrees of leaf scorch damage at numerous locations in the Southwestern and Central regions.

Physiological needle droop caused moderate-to-severe foliar damage in white pine plantations at a number of locations in the Aylmer, Simcoe and Niagara districts.

G.M. Howse
Head, FIDS

M.J. Applejohn
Chief Ranger

19 March 1990
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APPENDIX I



RECENT ADVANCES in PEST MANAGEMENT *(plenary & seminar sessions)*

The 2nd in a series: "Advances in Canadian Forest Research"

OCTOBER 21-23, 1990

WATER TOWER INN

SAULT STE. MARIE, ONTARIO

Under the auspices of the Canadian Institute of Forestry.
*Co-sponsored by Forestry Canada, Canadian Pulp & Paper Association,
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of The Canadian Institute of Forestry.

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A SAULT STE. MARIE FORESTRY CAPITAL OF CANADA 1990 EVENT

APPENDIX II

THE FUTURE OF PESTICIDES IN FORESTRY (IN ONTARIO)

Presentation to the 1989 Ontario Forest Pest Reviews
Thunder Bay, 02 November 1990
London, 27 November 1990

G.W. Green
Director General
Forestry Canada
Forest Pest Management Institute
Sault Ste. Marie, Ontario

The title of this presentation is exactly as Gordon Howse assigned it to me a few weeks ago. I'm not sure how he meant me to look at the subject. On the one hand, he might have been suggesting that I look at the future of pesticides in forestry, with special reference to Ontario. On the other, perhaps he might have been suggesting that there is no future for pesticides in forestry in Ontario.

No matter how you interpret his intentions, the problem area is a particularly real and troublesome one. No matter how you look at it, as a result of public perception and political reaction to it, forest managers in Canada are being denied the tools required to incorporate forest protection as an essential component of enlightened forest management and to protect our forest resource from unacceptable losses due to destructive forest insect pests and competing vegetation. At the very time when the forest sector is engaged in major programs of forest renewal and more intensive forest management across the country, forest managers are being stripped of the tools required to protect these investments in the most effective, economical, and environmentally conscious way.

Have we got a problem? You bet your life we have, and it is one that will be very difficult to find a rational and balanced solution to.

To paint a picture of just where we stand, let us look at the situation where insecticides and the spruce budworm are concerned. This picture would be mirrored to a great or lesser extent with herbicides and competing vegetation. To protect the spruce-fir forests of eastern Canada from this #1 forest insect pest, there are only two registered and readily available insecticides for the forest manager to choose from - fenitrothion and B.t., *Bacillus thuringiensis*. As if this were not bad enough, the situation is even worse in Nova Scotia, Quebec and Ontario, where fenitrothion (and any other chemical insecticide applied from the air, for that matter) has been withdrawn from the forest manager's tool box by provincial decision makers. The situation has become so critical in Ontario, as all of you here know, that even research applications of

chemical insecticides to Crown lands from the air have been banned. While this may be a "politically comfortable" situation, it has certainly placed forest managers in a shaky and unenviable position as far as forest protection is concerned.

In addition, despite a lack of new, technical information that has been subjected to peer review on the impact of fenitrothion on non-target components of the forest ecosystem, Environment Canada has prompted a re-evaluation of fenitrothion which is currently on-going and which -- just by the very fact that it is under way -- will add fuel to the anti-chemical pesticide movement. This, in turn has prompted the need for a balanced risk-benefit analysis of forest protection in general and fenitrothion in particular. Forestry's contribution to this will be to provide contracted economic-benefit analyses of both elements of this equation at a total cost approaching \$350K. While such analyses will be nice to have in hand, it seems to me that this money could be better spent on R&D to improve our pest management capabilities!

Along with this, and partially as a result of it, the pesticide industry has abandoned Canadian forestry where new chemical insecticides are concerned. Matacil, which is still registered, which is particularly effective against the spruce budworm and which is generally more "environmentally preferred" than fenitrothion, is no longer readily available and will only be produced by the manufacturer upon receipt of specific and very large orders. Zectran, another carbamate, which was proving in tests to be even more effective and environmentally innocuous than Matacil, is no longer being considered by the manufacturer for registration in Canada.

AND TO TOP ALL OF THIS OFF, THERE IS NOT ONE SINGLE, CLASSICAL, NEUROTOXIC-TYPE INSECTICIDE FOR FORESTRY USE CURRENTLY UNDERGOING THE CANADIAN REGISTRATION PROCESS.

I'm tremendously concerned about this and I think that you all should be too, whether you are forest managers, political decision makers, environmentalists, or members of any other renewable natural resource agency. We're down to the situation where, to all intents and purposes, we have all of our protection eggs in the one basket -- the B.t. basket -- and, unless you happen to be a Mississippi riverboat gambler, that's not a very smart place in which to be! I don't think we should be gambling with the future of our forest resource. I do think we should be protecting it and keeping the options open for future generations of Canadians. It's called sustainable development!

But, you say, what is the matter with this one-pesticide approach? We've been using only B.t. in Ontario ever since 1984 against pests such as spruce budworm, jack pine budworm and gypsy moth. Quebec has used only B.t. against spruce budworm for the past five or so years and only B.t. is used in Nova Scotia. New Brunswick has stated that they are making a slow but steady progression towards a higher proportion of B.t. in their budworm protection operations each year.

Now don't get me wrong, I have nothing against B.t. -- far from it! After all, my Institute was involved some three decades ago in the pioneering research that elucidated the crystal protein toxic element in B.t., explained its mode of action and so contributed greatly to its subsequent commercialization first for agricultural and later for forestry use. And since then, we have been involved together with Forestry Canada's regional establishments and other colleagues in developing ways and means of improving the application technology used with this material and prompting the production of more concentrated B.t. formulations, all of which has improved the effectiveness of B.t. and brought the comparative costs of B.t. vs. chemical insecticide operations closer together over the years.

Despite this sense of ownership, however, I cannot subscribe, as many people do, to B.t. being a panacea, a silver bullet, and all that we'll ever need to control important forest pests within acceptable limits. This "eggs-in-the-one-basket syndrome" is one that should be avoided at all costs, if we have not gone too far with it already.

B.t. is an absolutely great microbial insecticide, one of the best in the world--provided it is applied very carefully, at the right stage of development relative to its insect host, and that its application is followed by a day or two of good weather. But, if these conditions are not met, B.t.'s efficacy is variable to say the least. It had been New Brunswick's plan this year to implement about 80% of its spray program against budworm with B.t. but results of the 1988 B.t. application were so poor that the reverse occurred in 1989. In the Gaspé this year, spruce budworm populations are increasing rapidly and B.t. did not do nearly as good a job as Quebec had been accustomed to, thus raising questions about its utility during rapidly increasing budworm population cycles.

And I don't think many of us will soon forget the contamination scare with B.t. in 1988, the response to which nearly resulted in cancellation of planned protection operations in some jurisdictions.

The cost of application is another important factor. In the early 1980s, using Quebec as an example, the cost of B.t. applications were 3.0 to 4.5 times as much as those of chemical insecticide. By 1988 in New Brunswick, the relative cost of B.t. was approximately 1.3 times that of fenitrothion and the differential seems to be stabilizing at about this level. What this means in practical terms is that with a fixed protection budget, a forest manager could protect about a third more forest with chemical insecticide than with B.t. The forest management implications of this are apparent!

By taking "politically comfortable" stances on the matter in Nova Scotia, Quebec and Ontario, I think there is a very real danger of us being perceived as tacitly admitting that we must be causing permanent and significant damage to the forest ecosystem through the use of chemical insecticides. Are we not then placing ourselves in the position where the reintroduction of aerially applied chemical insecticide into forest protection operations will be virtually impossible in terms of

public opinion? I think there is a very great danger here and I think it's demonstrated by the fact that no new, neurotoxic chemical insecticides for forestry use are in the process of being registered in Canada. And I think it's demonstrated by the increased number of pesticide companies now involved in B.t. production as opposed to those involved 10 years ago.

With all of our eggs in the B.t. basket, what do we do if some major pest that happens to be immune to B.t. erupts over broad areas? I would hazard a guess that we could see another disaster like the Cape Breton Highlands budworm episode before the decision was reached that a chemical insecticide could be used. I hope I'm wrong.

Well, you say, isn't the biological control route the way to go in forest protection against destructive insects and competing vegetation in the future? Certainly it is, and my Institute, for example, is currently devoting about twice as much research effort to the biological control side as it is to the chemical pesticide side. There is no question that we should move this way for the future, but as we do, we must keep some hard facts in mind:

- . Biological control agents cannot be developed overnight for use against specific pests.
- . It took 30 some years to develop B.t. to the stage where it is an effective and broadly accepted microbial insecticide for forestry use.
- . It took 34 decades of R&D to get the first viruses ever registered in Canada for use against any insects - Lecontvirus, a truly excellent virus against the redheaded pine sawfly, and Virtuss, another very good virus for use against the Douglas-fir tussock moth and other closely related tussock moths.
- . The use of fungi is at an even lower rung on the development ladder.
- . Most naturally occurring microbial control agents, today at least, must be produced in living hosts, a very labor-intensive and hence costly procedure. Because most of them are very species specific, demands for them will be relatively small and sporadic. To date, this scenario has meant that production of biological controls has attracted little commercial interest. We are in a real Catch-22 situation. We've got, for example, two excellent microbial control agents (Lecontvirus and Virtuss) duly registered, environmentally acceptable and, hence, politically comfortable, and more of them are in the production line - but we have no commercial producers to mass produce them and make them readily available for use.

These and many other problems attending the development, registration and use of naturally occurring biological control agents can be overcome in the future and the application of biotechnological techniques

to the manipulation and enhancement of these materials has the potential to extend their versatility and usefulness to an almost limitless extent. There is hope that they may even replace chemical insecticides completely in time. But the fact remains that this will not happen overnight and our forest resource must be protected in the interim.

At the same time as all of this is going on, the demands for forest protection will increase. As we invest more in forest renewal and intensive forest management, it is axiomatic that we must protect that investment. Intensive forest management will undoubtedly make pests out of species that have not been important pests to date (the spruce budmoth in Quebec and New Brunswick is a case in point) and climate change will add another dimension of stress to many of our currently desirable tree species, making them even more susceptible to insect attack and less tolerant of competing vegetation.

All of this points to the fact that forest managers are going to be faced with an increasing array of insect pests competing with them for the use and harvest of the forest resource. If they are to compete successfully, forest managers will require a broad array of registered forestry-use insecticides available to them to treat the range of problems that they will be faced with. Because it will take time to develop effective biological control agents for specific pests, this array will have to include chemical pesticides for use when no other acceptable alternatives are available. Perhaps even more importantly than having chemical pesticides available, our forest managers will have to have the support of public and political decision makers to allow them to use these materials in the most effective and environmentally conscious way.

The road to getting the public and political decision makers on the side of forestry and forest protection will be a rocky one. A recent Decima Survey suggested that the general public did not perceive that pests were a serious problem in our forests! I guess that all of us in the forest sector have been negligent in actively and continually promoting the value of our forest resource and the need to nurture and protect it (i.e., manage it) carefully throughout its lifetime. We have taken this as a given fact, obvious to all. We have tended to bury ourselves in the technical side of our trade and we have not paid sufficient attention to the social concerns with respect to forestry that have been developing very strongly in this age of environmental consciousness. I guess you could say that we have backed away from our responsibilities in this area, or, at the very least, that we have not, perhaps until the 11th hour, understood what that full range of responsibilities was. As a consequence, the public doesn't trust us: environmental activists have entrenched themselves so deeply that they only hear and recognize what they want to hear and recognize, and renewable resource and environmental agencies, including forestry, are so busy protecting their own turfs and mandates, that, by and large, the battle lines have been drawn and we've become opposing forces.

It's time to change this. Where something as sensitive as forest protection and pesticides is concerned, I think that history has proven

that perception overrides technical fact all of the time. If this were not so, how do you account for the fact the outcry against pesticide use in forestry far outstrips that against pesticide use in agriculture, even though forestry uses only about 5% of the insecticides and 0.5% of the herbicides that agriculture does? And how do you account for the fact that a farmer in New Brunswick can apply permethrin from the air to his potato field on one side of the trans-Canada highway but can't do the same thing to his woodlot on the other side of the highway? It's perception, plain and simple, and if there is to be a future for pesticides in forestry, we must begin changing this perception right now. We've got to get ahead of the game, we've got to know where the other person is coming from, we've got to understand his concerns and we've got to help him to reach a better appreciation of the role forest protection plays in enlightened forest management. Only then will perceptions change!

If you think that we have a problem with the use of chemical insecticides in forestry today, what do you think the public reaction will be to the release of viruses and fungi and nematodes into the forest environment, and how will they react to our use of genetically manipulated organisms? The public and anti-pesticide factions are mesmerized with chemical pesticides today; they are pushing vigorously for biological alternatives without thinking much of the environmental consequences. The full impact of the biological control route that we have actively embarked on has not yet registered fully. Unless we begin a pro-active, factual and honest dialogue with "the other side" now, their concern for the biologicals is likely to far outstrip their current concern for chemical pesticides. If we allow this to happen, then there is no place left to turn in forest protection.

I don't pretend to know the best prescription for getting ourselves shed of our current dilemma. But some things I am sure of:

- 1) We must close ranks within forest management on the role of forest protection in enlightened forest management and the need for an array of pesticide options for the forest manager to use. We, in the forestry community, can't afford to be split on this issue!
- 2) We have to rid ourselves of the chemical vs biological pesticide comparisons. We are always pitting one side against the other - we keep saying we are searching for "alternatives to" or "replacements for" chemical pesticides when, in actual fact we should be striving for the most effective and environmentally conscious pest management strategies that we can devise. If we adopt this approach, what difference does it make if these strategies are based on biological or chemical pesticides or both?
- 3) From the top of our respective organizations right down, we must sit down, face and dialogue with our counterparts in what now are mostly opposing camps. We must expand our horizons beyond the forest sector alone and we must begin examining with them the concept of sustainable natural resource development in its broadest context. We must try to bring some perspective to this

whole problem area and we must face squarely the inevitable tradeoffs that will be required so that all sectors leave the table in a win-win situation.

It's going to be a rocky road, but a necessary one. Forestry has lost a number of battles in this general arena through errors of omission. For the forest sector's sake, we cannot afford to lose the war of sound forest management through continuing errors.