STATUS OF SPRUCE BUDWORM INFESTATIONS IN NOVA SCOTIA IN 1971 AND A FORECAST FOR 1972

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INTRODUCTION

Until 1968, the spruce budworm had not been a forest insect of major concern in most of Nova Scotia. From 1900 to 1968, those budworm infestations of note that had occurred in Nova Scotia were limited to Cape Breton Island and the adjacent mainland from the Straits of Canso to the New Brunswick border. Light infestations occurred for a brief period from 1950 to 1953 over large areas of the mainland (Webb *et al.* 1961; Brown 1970).

Characteristically, the high budworm infestations on Cape Breton Island have occurred sporadically and have been of short duration. In the late 1950's, tree mortality due to budworm feeding was confined to older stands of balsam fir over an area of about 20 miles square, west of Wreck Cove in Victoria County (Mott 1961). During this and previous infestations, however, additional mortality occurred when other insects, notably the black-headed budworm, hemlock looper, and eastern spruce bark beetle, were feeding on the trees at the same time as or after budworms. Infestations of the budworm on the mainland have also been of short duration and loss of trees has been slight. The status of the budworm remained as such up to 1968. Since then, the spruce budworm has become established in western Nova Scotia and the infestation has increased in size or intensity, or both each year. This has been an unprecedented move. The infestation started in Kings, Annapolis, and Cumberland counties in July 1968 when a flight of budworm moths, presumably from New Brunswick, invaded the Cumberland Peninsula and the North Mountain. Subsequent egg-mass surveys in August 1968 detected a number of medium to high spot infestations on the North Mountain in the vicinity of Douglas Road, Forest Glade, and Canada Creek and in the coastal forest of the Cumberland Peninsula. These data indicated that patches of light, moderate, and severe defoliation would be evident in these areas in 1969. The expected occurred.

In August 1969, egg-mass surveys indicated an increase in extent and severity of the infestation, particularly in Annapolis and

Kings counties. Counts of overwintering larvae corroborated the results of the egg-mass survey. In 1970, the expected defoliation occurred and large areas of moderate and severe defoliation were detected throughout the high infestation area. At this time, the insect posed no threat to the forest in terms of immediate tree mortality; however, its effects were being felt by some Christmas tree growers. At this point, the future progress of this infestation was in doubt primarily because of the lack of history of high infestations in this area. However, sampling for overwintering larvae in the fall of 1970 showed that the infestation had intensified in terms of population but not in area affected. Further moderate to severe defoliation was predicted for 1971 in areas already attacked in 1969 and 1970.

SAMPLING AND SURVEYS

Essentially, five sampling techniques and surveys are usually conducted in Nova Scotia to chart the course and effect of spruce budworm infestations.

They are the egg-mass survey, overwintering larvae survey, early summer large larva survey, defoliation survey, and moth trapping: each of these survey techniques is described below.

Egg-mass Survey

The female budworm lay their eggs during July and early August on the foliage of fir and spruce trees. Counts of these egg masses give an early indication of the intensity of the population of the new generation of budworms and serve as a valuable aid in predicting the course of the infestation. The sampling regime consists of taking one whole mid-crown branch from each of four co-dominant or dominant balsam fir or spruce trees at each sampling location. The foliated length and width of each branch are measured. The samples are forwarded to Fredericton where the branches are processed using a sequential counting system. Not all branches are necessarily examined. Counts of egg-masses are related to branch size and the density is expressed as egg-masses per 100 ft^2 of foliage. Conversions of egg-mass data to infestation level are shown in Table 1.

Table 1. Conversions of various survey data to population infestation levels and expected defoliation of current foliage by the spruce budworm

Egg masses per 100 ft^2	Overwintering larvae per 100 ft^2	Infestation level	Expected defoliation (%)
0	0	Nil	0
1-99	1-100	Low	1-30
100-239	101-300	Medium	31-65
240-399	301-650	High	66-90
400+	651+	Extreme	90-100

Sampling for Overwintering Larvae

Budworm eggs hatch in July and August and the larvae from these eggs disperse, locate secluded areas on the branches, form a silk hibernaculum, and hibernate until spring. It is possible to extract budworm larvae from this foliage by soaking the branches in hot 1% sodium hydroxide solution. The larvae are then filtered out onto a filter paper and counted. Usually one whole mid-crown branch is taken from each of four codominant or dominant fir or spruce trees per location.

The branches are measured and the counts of larvae are expressed as larvae per 100 ft^2 of foliage. This survey has proven useful in checking the results of the egg-mass survey, obtaining more detailed information on budworm populations, and predicting damage in the coming year (Table 1).

Sampling for Large Larvae

Large budworm larvae (fifth and sixth instar) can be easily dislodged from their feeding sites by beating the tree. The Forest Insect and Disease Survey has 33 semipermanent sample plots that are sampled each year for large budworm larvae to provide data on the general year-to-year abundance of budworm larvae. In the past 2 years, the "beating" method has been standardized to a 3-foot square tray and a 3-foot beating stick. Data gathered from this survey are not

particularly useful in predicting what is going to happen, but provide an easy way to get an historical record of the rise and fall of budworm populations.

Defoliation Surveys

Defoliation surveys are usually conducted in July each year on the ground and from the air to determine the nature and extent of feeding by the budworm. Defoliation is usually classified as either Trace (1 - 5%), Light (5 - 20%), Moderate (30 - 60%) or Severe (70 - 100%) loss of new foliage. In the past few years, the Nova Scotia Department of Lands and Forests has assisted in defoliation surveys by supplying aircraft at critical times.

Moth Trapping

A network of blacklight moth traps are operated by Forest Insect and Disease Survey in the Maritime Provinces to monitor the abundance of adults of many important insect species. Budworm moths are attracted to these traps and counts of the moths may indicate unusual movements of budworms.

RESULTS

Predictions and Defoliation (1970-71)

In the fall of 1970, 107 locations were sampled for overwintering larvae of the spruce budworm and high infestations were detected in Cumberland, Kings, and Annapolis counties. In 1971, the fall summary report of the Forest Insect and Disease Survey stated that "an aerial survey...delineated 398,400 acres of severe, 51,700 acres of moderate, and 112,600 acres of light defoliation. This defoliation was patchy because of the discontinuous nature of the forest. The main areas of severe defoliation were in western Cumberland County extending from Joggins in the north to Cape D'or in the southwest (110,600 acres), and on the North and South Mountains of Kings and Annapolis counties (287,000 acres)" (Table 2, Fig. 1). "This represents a significant increase in damage over 1970. Elsewhere in Nova Scotia no major increase in defoliation was noted."

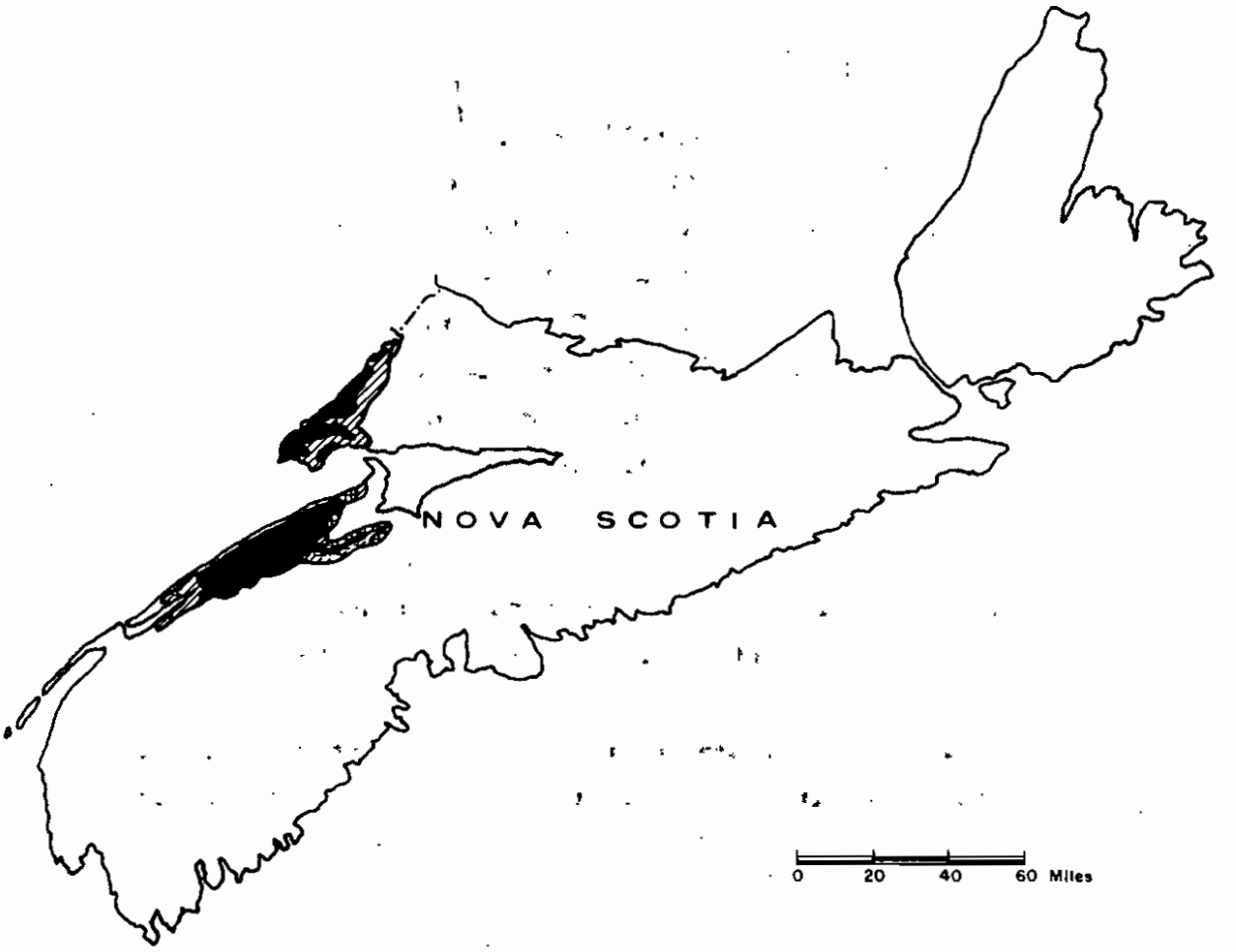

Fig. 1. Current defoliation by the spruce budworm in western Nova Scotia, 1971.

Table 2. Defoliation by the spruce budworm as determined during an aerial survey, July 1971

County	Acres of defoliation		
	Light	Moderate	Severe
Cumberland	54,800	0	110,600
Annapolis and Kings	57,800	51,700	287,800
Total	112,600	51,700	398,400

Forecast of Infestations for 1972

In August 1971, 39 locations in Nova Scotia were sampled for egg-masses to obtain a quick estimate of the status of the budworm. This survey detected high populations in Cumberland and Kings counties, moderate to high populations in Annapolis County, and nil to low populations elsewhere in Nova Scotia. Using this information as a guide, the Forest Insect and Disease Survey, with help from the Nova Scotia Department of Lands and Forests and the wood-using industries, collected samples from 179 locations for counts of overwintering spruce budworm larvae. The results of this survey (Table 3) indicate a general rise in budworm populations in Nova Scotia as compared with the previous year and confirm the results of the egg-mass survey, particularly in Cumberland, Kings, and Annapolis counties (Fig. 2). The large increases in Cape Breton, Digby, and Lunenburg counties are notable, particularly the latter where the infestation has intensified from light to moderate in the northern quarter of the county, indicating a major extension of the infestation.

As a result in 1972, many spruce and fir stands in Cumberland, Kings, and Annapolis counties should receive moderate to severe defoliation (Fig. 2) and some stands in northern Lunenburg County moderate defoliation. Defoliation elsewhere should range from nil to light. Further proof of the southerly extension of the infestation is the capture of more than 1,500 moths at a light trap operated at Kejimkujik National Park.

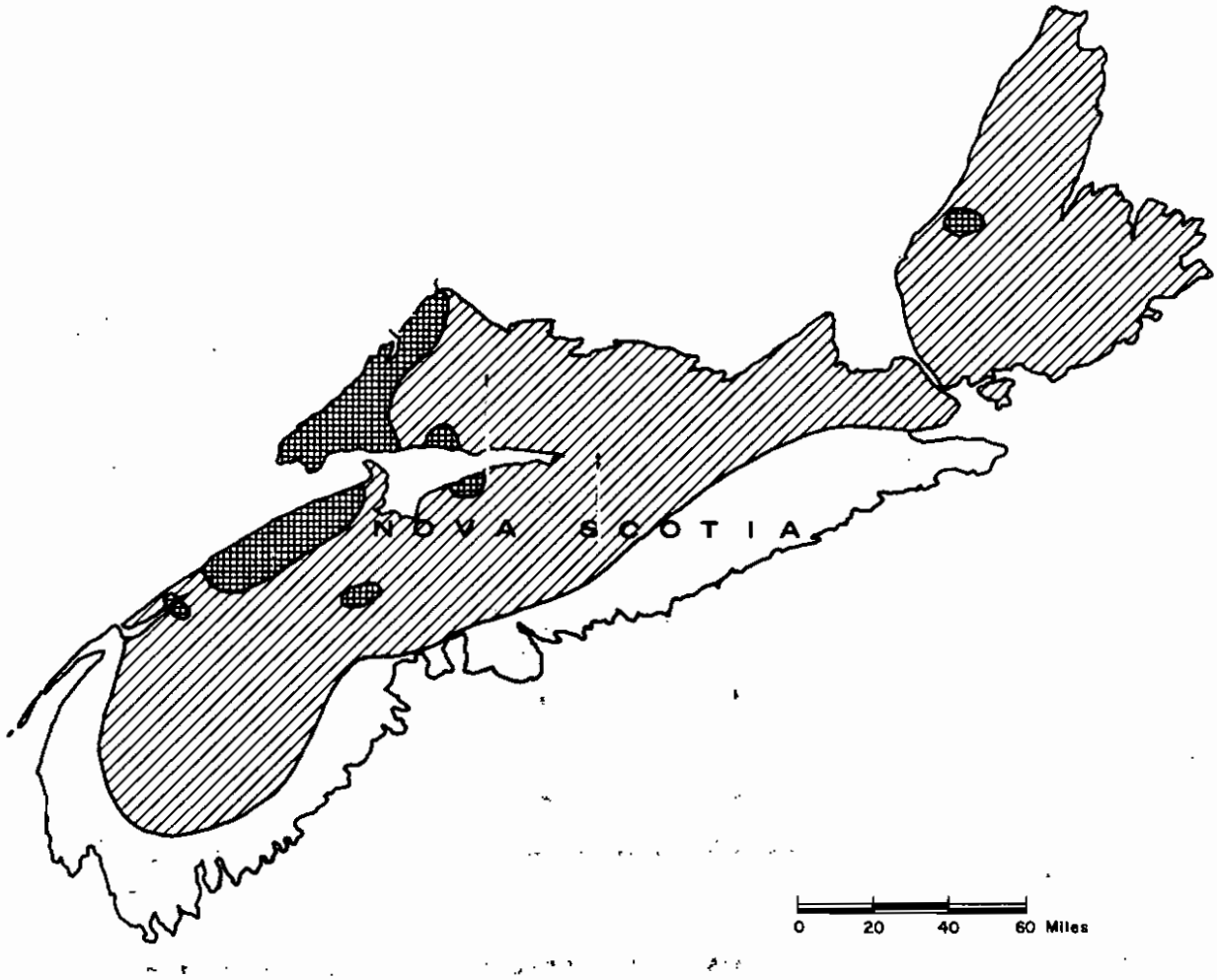

Fig. 2. Spruce budworm infestations based on counts of egg masses and overwintering larvae in Nova Scotia, fall 1971.

Table 3. Overwintering spruce budworm populations in Nova Scotia in the winters of 1970-71 and 1971-72 and the ratio between the two years

County	Plots		Overwintering larvae per 100 ft^2 of fir foliage[a]		Ratio 71/72
	1970/71	1971/72	1970/71	1971/72	70/71
Shelburne	0	2	-	89	-
Queens	6	9	36	77	2.14
Lunenburg	6	13	24	123	5.12
Halifax	2	4	0	4	-
Guysborough	0	2	-	27	-
Antigonish	1	7	33	115	3.48
Pictou	0	5	-	75	-
Digby	2	4	16	84	5.25
Kings	19	22	377	574	1.52
Annapolis	18	26	164	374	2.28
Hants	5	8	85	123	1.45
Colchester	6	10	58	145	2.50
Yarmouth	0	2	-	19	-
Cumberland	21	40	861	946	1.10
Inverness	10	13	64	80	1.25
Victoria	8	9	60	53	.88
Cape Breton	2	2	8	74	9.25
Richmond	1	1	0	36	-
Total Plots	107	179	-	-	-

a. See Table 1 for conversions to infestation levels and expected defoliation.

This increase in population is a reflection of what is occurring across eastern Canada as detected in "beating" samples and as shown in overwintering samples in the Maritimes (Table 4).

Table 4. Overwintering spruce budworm population in New Brunswick, Nova Scotia and Prince Edward Island in the winters of 1969-70, 1970-71, and 1971-72

Province	Mean no. overwintering budworm larvae per 100 ft^2 of fir foliage		
	1969-70	1970-71	1971-72
New Brunswick	825	916	1,057
Nova Scotia	267	285	384
Prince Edward Island	--[a]	185	474

a. No samples taken.

Forecast of Hazard to Trees in 1972

Hazard estimates are based on the cumulative effect of 2 or more years of moderate to severe defoliation, the condition of the trees as determined from subjective observations, and from the projected effects of the known egg-mass and overwintering larval populations.

This is the first time an evaluation of hazard has been made for a budworm infestation in western Nova Scotia, and as a result may lack some depth due to lack of experience. However, I believe that Fig. 3 gives a fair evaluation of the area of high hazard. High hazard means that fir and spruce stands within the area delineated should experience significant loss of growth, top killing, and some tree mortality. There are about 264,000 acres inside which there are areas of high hazard--100,000 acres in Cumberland County and 164,000 acres in Kings and Annapolis counties (Fig. 3).

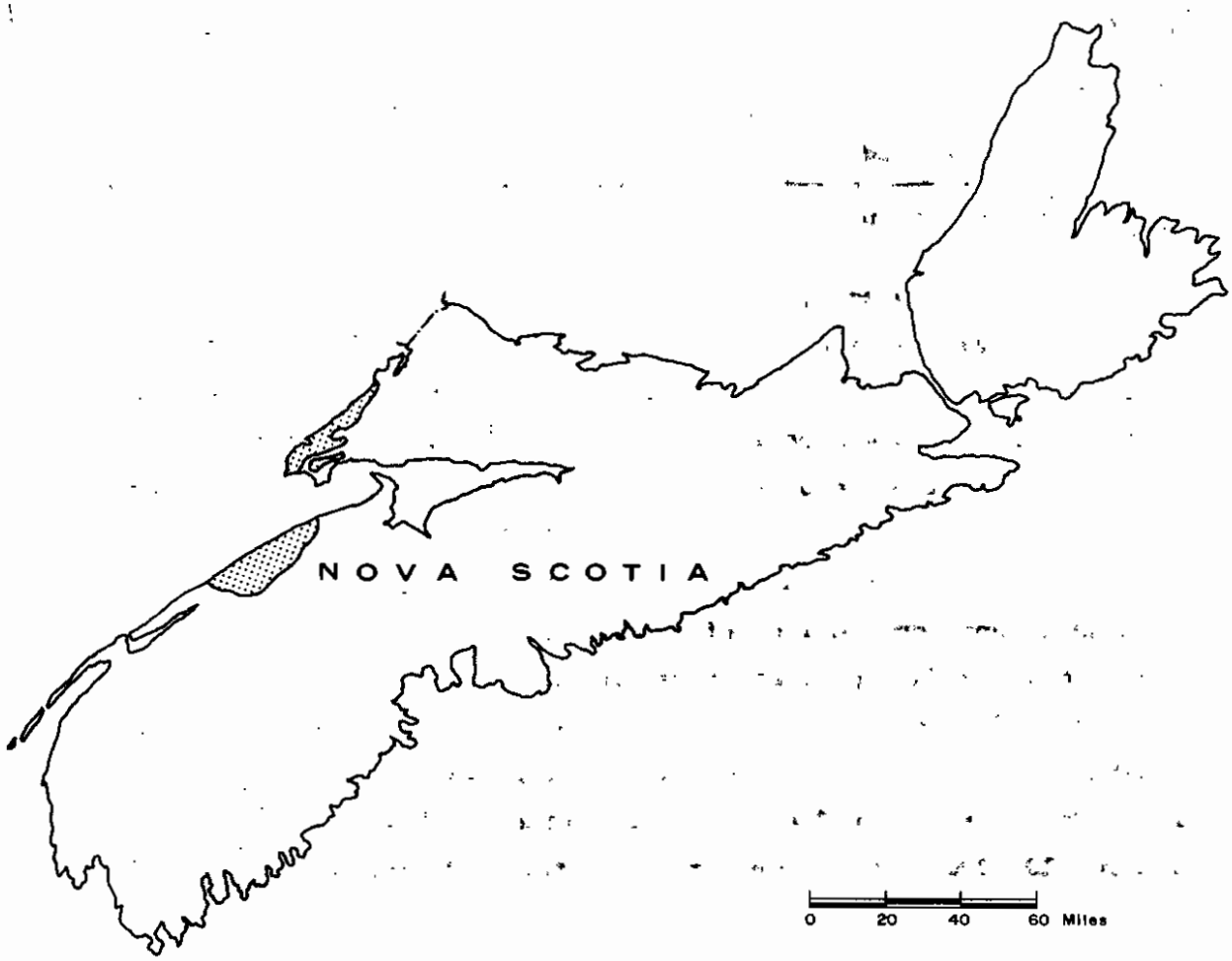

Fig. 3. Areas of high hazard to fir and spruce trees in western Nova Scotia for 1971-72. High hazard denotes loss of tree growth, top killing, and some tree mortality.

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