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TREE MORTALITY AND DEFOLIATION CAUSED BY WESTERN HEMLOCK LOOPER IN BRITISH COLUMBIA IN 1994 AND FORECAST DEFOLIATION FOR 1995

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Defoliation of mature to overmature western hemlock-western red cedar by western hemlock looper, *Lambdina fuscicornis lugubrosa*, in four forest regions declined in area for the second consecutive year to 7960 ha (Map 1), down from 92 750 ha last year. Additionally, tree mortality was mapped over about 64 260 ha in four forest regions and averaged 35% (range 10-90%) in stands previously moderately to severely defoliated by the looper (Map 2). The population decline was predicted, due to increased levels of parasitism and low numbers of egg masses at 34 sites sampled in 1993.

Table 1. Areas of defoliation and tree mortality by the western hemlock looper in British Columbia. Natural Resources Canada, Canadian Forest Service, Forest Insect and Disease Survey, 1994.

Forest Region	Number of infestations	light	Area defoliated (ha)			Area of mortality	Total(ha)	
			moderate	severe ¹	total		1994	1993
Cariboo	-	-	-	-	-	3 960	3 960	100
Kamloops	58	-	-	-	-	15 530	15 530	1 150
Nelson	178	2370	650	-	3020	9 150	12 170	48 500
Prince George	121	390	3980	570	4940	35 620	40 560	43 000
Total	357	2760	4630	570	7960	64 260	72 260	92 750

- ¹Light - discolored foliage barely visible from the air, some branch tip and upper crown defoliation.
- Moderate - pronounced discoloration, noticeably thin foliage, top third of many trees severely defoliated, some completely stripped.
- Severe - bare branch tips and completely defoliated tops, most trees more than 50% defoliated.

Cariboo Forest Region

Populations collapsed following four consecutive years of defoliation. No current defoliation occurred, down from 100 ha of light defoliation recorded last year. Tree mortality, averaging 40% with an additional 10% severely damaged and not expected to survive, was recorded over about 4 000 ha of previously moderately to severely defoliated stands.

Kamloops Forest Region

Populations collapsed following three consecutive years of defoliation; no current defoliation was recorded. This was down from 1150 ha in 1993. Tree mortality and top-kill, ranging from 10-60%, was recorded in 58 pockets over 15 530 ha in areas previously moderately to severely defoliated. These include areas between Albreda and Blue River, Upper Adams River, and in Wells Gray Provincial Park along Hobson Lake and Clearwater areas. Preliminary data from damage appraisal plots established in defoliated stands found tree mortality averaging 34% in a moderately defoliated stand, and 38% and 44% in two severely defoliated stands. Heart rot by the Indian paint fungus, *Echinodontium tinctorium*, and attack by secondary insects have contributed to the mortality.

Nelson Forest Region

In the fifth year of the current outbreak, defoliation declined by over 90% to 3020 ha, of which 2370 was light and 650 was moderate. Current defoliation was recorded south of Revelstoke at mid-elevations along upper Arrow Lake and east to Trout Lake. Additionally, some 9150 ha of previously severely defoliated stands had mortality averaging 43%, while some 80 000 ha of previously lightly to moderately defoliated stands averaged 9% mortality. Initial estimates of top-kill found an average of 33% of trees affected in previously severely defoliated stands, and 9% in other stands. Most mortality and top-kill occurred near Downie, Bigmouth, Woolsey, Jumping, Lardeau and Pingston creeks, and Illecillewaet, Tangier and Goldstream rivers.

Prince George

In the fourth year of the outbreak, current defoliation was recorded over 4940 ha, down from 43 000 ha recorded in 1993. Defoliation was light on 390 ha, moderate on 3980 ha, and severe on 570 ha. Most of the current defoliation was in white spruce and alpine fir stands adjacent to previously defoliated western hemlock and western red cedar stands from Purden Lake to Walker Creek, and near Ptarmigan Creek and LaSalle Lakes. Additionally, tree mortality mapped over 35 000 ha, averaged 40% (range 10-90%). The largest areas of mortality and top-kill occurred in the Torpy River and Walker Creek drainages, as well as the

Ptarmigan and Catfish creeks and LaSalle Lakes areas. Preliminary data from tree mortality plots established in severely defoliated stands found an average of 87% (range 60-100%) mortality in western hemlock and an average of 43% (range 15-60%) mortality in western red cedar. Initial estimates of top-kill in long term study plots show top-kill of up to 5m on 10% of the hemlock and 35% of the cedar.

Forecast

The number of overwintering eggs sampled at representative sites declined for the second consecutive year. Only light defoliation is forecast to occur at seven locations (Map 1), based on egg samples taken at 25 sites this year. However, even these sites may not experience the level of defoliation predicted, due to high levels of egg parasitism at 14 of the sites, which averaged 76% (range 31-100%). This is up from an average of 21% egg parasitism in 1993, and 11% in 1992. Previous infestations have collapsed when egg parasitism averaged greater than 30%. Most egg parasitism is attributed to the Hymenopterous parasites *Telenomus* and *Trichogramma* spp.

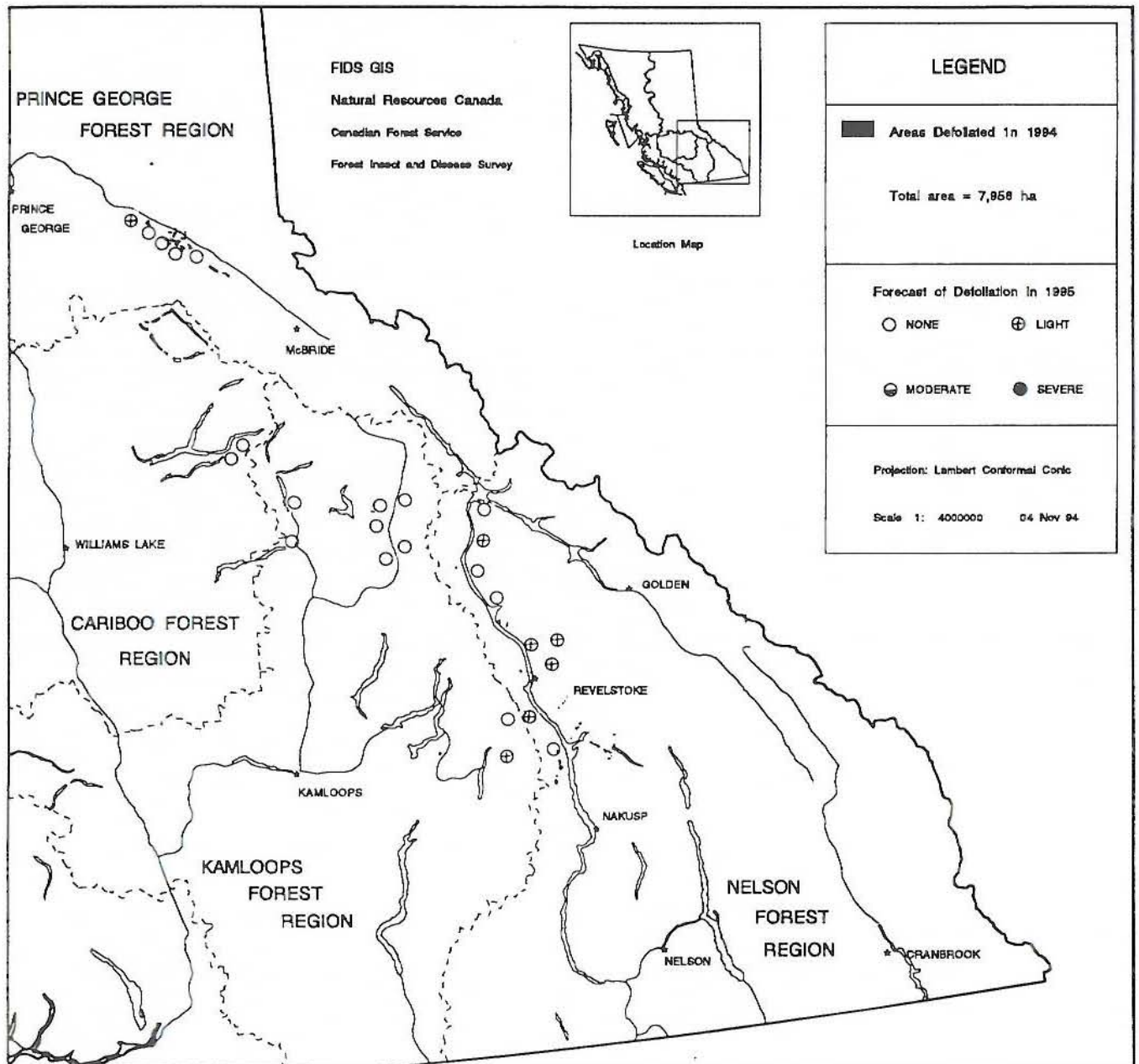
Another factor pointing to a significant decline in looper populations is reduced numbers of moths in pheromone traps. Calibration of a pheromone trapping system, carried out for three consecutive years at 23 sites province-wide, found an average 88% reduction (range 50-100%) in moth catches this year compared to last year.

Impact

Previous infestations have caused extensive top-kill and scattered mortality. In past infestations, more than half the trees classed as 80%+ defoliated, have died. Mortality is often due to to attack by secondary insects and disease organisms. This mortality can continue for up to three years after an outbreak collapses.

Mortality plots have been established in four forests impacted by the current outbreak. Details on mortality, as related to percent defoliation and length of infestation, will be available in the various FIDS detailed regional reports due later this year.

Map. 1 Areas defoliated in 1994 by the western hemlock looper in British Columbia and a forecast of 1995 defoliation.



Map. 2 Areas where mortality was recorded in British Columbia in 1994, caused by successive years of defoliation by the western hemlock looper.

