Forest Insect and Disease Notes

Northwest Region A-028

December 1994

Contents

Natural Resources Canada / Ressources naturelles Canada
Canadian Forest Service / Service canadien des forêts

Canada

UPDATE OF MAJOR FOREST PESTS IN 1994

by
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Spruce budworm

In Alberta, areas of spruce budworm (*Choristoneura fumiferana* [Clem.]) defoliation occurred in the Peace River Region (114 335 ha), in the Athabasca and Lac La Biche forests (12 370 ha), and in the Alberta portion of Wood Buffalo National Park (64 639 ha).

In the Peace River Region, the main infestation included areas along the Zama ridge, near Sousa Creek, and adjacent to the Chinchaga River. Other infestations were along the Hay, Amber, Steen, and Yates rivers, north of Watt Mountain, along the Little Rapids Creek, and near Hawk Hills.

In the Athabasca and Lac La Biche forests, infestations occurred along the Athabasca and House rivers, and southwest of Algar Lake.

In Saskatchewan, the total area of white spruce-balsam fir forests defoliated was 52 339 ha. The defoliated areas occurred in the Prince Albert (5463 ha), Hudson Bay (28 783 ha), and La Ronge (18 093 ha) regions. New infestations were observed in Prince Albert National Park, near Pinehouse Lake, along the Smoothstone River, and north of Lac la Ronge.

In the Prince Albert Region, defoliation occurred in seven areas near Smoothstone, Beaupré, Doré, and Mirasty lakes; west of Hurtean Lake; northwest of Weyakwin; and in Prince Alberta National Park.

In the Hudson Bay Region, two major spruce budworm infestations remained active in 1994, one near Red Earth and the other near Hudson Bay. The infestation near Red Earth consisted of one area south of Highway 55. The Hudson Bay infestation consisted of three areas south and west of the townsite.

In the La Ronge Region, the infestation reported at Morin Lake near Lac la Ronge in 1993 increased in 1994 to include large areas of spruce forests between Morin, Besnard, and Egg lakes and Lac la Ronge. Other infestations were noted near Pinehouse Lake, along the Smoothstone River southeast of Pinehouse Lake, near Potato Lake, west of Wapawekka Lake, and at several locations north of Lac la Ronge near Iskwatikan, Hunt, Stroud, Sulphide, and Otter lakes.

In Manitoba, spruce budworm infestations occurred in four administrative sections: Interlake (4140 ha), Lake Winnipeg East (34 456 ha), Mountain (5946 ha), and Pineland (3995 ha). A total of 48 537 ha of white spruce and spruce-balsam fir forests were infested.

In the Interlake Section, infestations occurred on Moose Island, Deer Island, near Ebb and Flow Lake, near Moose Lake, and near Washow Bay in Management Unit 40. In Management Unit 41, an infestation was detected on an island in Lake St. George.

In the Lake Winnipeg East Section, defoliation was observed in Whiteshell Provincial Park in Management Unit 30. In Management Unit 31, defoliation was observed on the north side of Lac du Bonnet; near Long, Happy, Manigotagan, Quesnel, Oiseau, Garner, Gem, and Wanipigow lakes; near Sandy, Black, and O'Hanly rivers; and areas on the east side of Lake Winnipeg across from Black Island. Other areas of defoliation were observed in the area of Loon Bay on Lake Winnipeg in Management Unit 35.

In the Mountain Section, spruce budworm defoliation occurred near Davey, Cutbank, Little Island, Snake, Noses, and Drugstore lakes.

There were two main outbreak areas in the Pineland Section. One area was in Management Unit 23 on the south side of Lac du Bonnet between the Winnipeg River and the Pinawa Channel. The second area was in Management Unit 20 and was an extension of the infestation near Falcon Lake in the Lake Winnipeg East Section. Two other small infestations were observed north of the Boggy River.

In the Northwest Territories, the area of defoliation increased from 173 118 ha in 1993 to 370 270 ha in 1994. Main infestation areas occurred along the Slave River including areas within Wood Buffalo National Park; along the Taltson, Liard, North Nahanni, South Nahanni, Martin, Jean-Marie, Willowlake, and Mackenzie rivers; the southern slopes of the Horn Plateau; and the Ebbutt Hills. Some tree mortality was evident near the south end of the Kotaneelee River, along the Liard River south of Fort Liard, along the Mackenzie River, and on the Ebbutt and Martin hills.

Aspen Defoliators

In Alberta, aspen defoliation was caused by **forest tent caterpillar** (*Malacosoma disstria* Hbn.), **aspen leafroller** (*Pseudexentera oregonana* [Wlsm.]), and **large aspen tortrix** (*C. conflictana* [Wlk.]). Forest tent caterpillar defoliation occurred at five locations in the province (196 547 ha): north and south of Cooking Lake and in Elk Island National Park, the Peace River valley near the Peace River townsite, a few kilometres north of Guy along Highway 34, south of the Little Smoky River along Highway 34, and north of Jean Côté.

In the spring of 1994, aspen leafroller caused defoliation in the Peace River Region, and the Grande Prairie and Slave Lake forests. Most of this defoliation occurred along the Little Smoky River from just east of Highway 34 to the Smoky River confluence, and then along the Smoky River to the Peace River confluence. Additional areas of defoliation were observed along the Peace River north of the Peace River townsite and near Dunvegan. In these three areas about 72 616 ha of aspen were defoliated.

Large aspen tortrix caused defoliation at several locations in Alberta. The largest areas were located in Wood Buffalo National Park (6968 ha). Other locations were near Hinton and Sundre, and north of Peace River as well as around Red Earth Creek, where it caused defoliation in association with aspen leafroller.

In Saskatchewan, aspen defoliation was caused by large aspen tortrix and forest tent caterpillar. Large aspen tortrix defoliation (214 242 ha) occurred near Green Lake, in Meadow Lake Provincial Park and areas north, southwest of Meadow Lake, northeast of Chitek Lake, near Helene Lake, south of Red Earth Indian Reserve, north and south of Hudson Bay, and in Greenwater Provincial Park.

Forest tent caterpillar caused significant defoliation for the first time since the last outbreak collapsed in 1991. Defoliation occurred on 23 134 ha of trembling aspen in four areas south of Battleford.

In Manitoba, aspen defoliation totalled 11 396 ha in 1994. Forest tent caterpillar was responsible for this defoliation in the Interlake Section in Management Units 40 and 41, in the Lake Winnipeg East Section in Management Units 31 and 35, and in the Pineland Section in Management Unit 23. In Riding Mountain National Park, aspen twoleaf tier (*Enargia decolor* [Wlk.]) caused moderate-to-severe defoliation in several localized areas at the north end of the park.

Bark Beetles

Mountain pine beetle (*Dendroctonus ponderosae* Hopk.) Infestations remained very low in the Northwest Region in 1994. Beetles were detected at several locations by means of pheromone-baited trap trees. Aerial and ground surveys also detected a few recent mountain pine beetle-killed lodgepole pine trees in Banff National Park. Surveys were concentrated in areas where dispersing beetles might invade including the foothills region in Alberta and Jasper, Banff, and Waterton Lakes national parks.

In 1994, aerial surveys were conducted over Banff and Jasper national parks to map areas of dead and dying lodgepole pine. Less than 20 recently killed trees were observed in the Bow River valley between the split in Highway 1A north to Corral Creek. Some trees were attacked in 1993; others had been strip attacked (attacked on only one side of the tree) in 1992 and then re-attacked in 1993, killing them. No mountain pine beetle-killed trees were observed in Jasper National Park.

During the winter of 1993–94 about 400 ha of dead white spruce were salvage-logged: 250 ha (70 831 m^3) near Nina Lake, and 150 ha (10 810 m^3) near Hawk Hills. These trees were killed by **spruce beetle** (*D. rufipennis* [Kby.]). More salvage cutting has been approved for the winter of 1994–95 amounting to 11 821 m^3 of spruce on about 80 ha in the Hawk Hills area. In Wood Buffalo National Park, scattered spruce beetle-killed white spruce trees were observed in six areas (13 655 ha) near the confluence of the Peace and Slave rivers, and along the Peace and Birch rivers.

Lodgepole Pine Dwarf Mistletoe

During 1994, surveys were conducted to map pine forests severely infected by lodgepole pine dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm.). In Manitoba, most mistletoe infestations were mapped by Manitoba Natural Resources between 1986 and 1989. The distribution of severe infestations of dwarf mistletoe extends from southeastem Manitoba through central and northern Saskatchewan to Alberta. Jack pine is infected by this disease in Manitoba, Saskatchewan, and Alberta; lodgepole pine is infected in Alberta. In Alberta, 54 329 ha of lodgepole pine and 112 125 ha of jack pine forests are severely infected by dwarf mistletoe. In Saskatchewan and Manitoba, 123 982 and 12 000 ha of jack pine forests were infected by dwarf mistletoe, respectively.

Other Noteworthy Pests

The **spruce gall midge** (*Mayetiola piceae* [Felt]) infestation in northern Alberta and adjacent areas in the Northwest Territories first detected in 1992 continued in 1994. Moderate-to-severe infestations were located west of the Hay River north of the Meander River townsite, west of the Chinchaga River north and south of Highway 58, and near Beaver Ranch Creek. Light infestations occurred over most of the area from Wadlin Lake and Notikewin Provincial Park northwest and north into the Northwest Territories. The 1994 survey indicated that populations have decreased from levels observed in 1993.

Satin moth (*Leucoma salicis* [L.]) was discovered for the first time in Alberta in 1994. Defoliated trees were observed near the municipal airport in Edmonton in June. Subsequent surveys indicated defoliation was present at 47 sites north and south of the airport. Moths were distributed over a wider area from St. Albert to the Millwoods neighbourhood in southeast Edmonton.

PEST MANAGEMENT SAMPLING PRINCIPLES

by
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This is the first in a series of articles about sampling as it is applies in forest pest management. Many of the operational and statistical issues pertaining to sampling forest insect populations were dealt with in a seminal paper by Morris (1955). Since then several techniques have been developed for particular sampling universes. I hope to give a brief outline of the philosophy and statistical theory, which underpins sampling forest pests.

Pest managers often need to make decisions about current pest conditions, evaluate the results of some treatment, or forecast future conditions. Quite often this involves the estimation of some population attribute on which a decision is to be made. Examples of these estimates are the density of insects, the damage they have caused, or the incidence of disease in a population. The pest management decision can be made without recourse to actual data but based on the manager's expertise. Although this approach has much in common with shamanism, experts are often listened to and it is only when they have been very wrong that concerns are raised. What is wrong with this process is that, although the expert may often be right, the means of producing the decision is not available for scrutiny, the process may be irreproducible (you may need another expert), and no objective assessment of the reliability of the estimate used in decision-making can be produced.

An alternative is to have a census, which is a complete enumeration and assessment of all elements in a population, and report on the true value for the population. This process has the attractive attribute of yielding values that are without error, easily reproducible, and reliability is not an issue. The census gives perfect information about the population. There is a major drawback to producing a census: it is often too expensive to conduct in most pest management situations. Ultimately, however, there must be a census or enumeration of units in the population if comparisons are to be made. We approach this with sketch maps of areas defoliated by an insect or the forest inventory maps on which forest stands are delineated. (I am assuming that there are no errors in this process; the errors that arise here are methodological and not due to enumerating the population of stands.)

In between the approach of the expert and the census-taker is sampling. Sampling requires that units to be assessed (sampling units) are selected from the population of interest (the sampling universe) with known probability. Every sampling unit need not be examined. However, implicit in this definition is the requirement that the population of sample units be countable. Moreover, in practical applications, a list of all sampling units may sometimes be necessary or it can be generated theoretically. There are two reasons for this: by selecting samples according to some procedure that employs some element of randomness, selection bias is avoided and by having a total count of the population the sampling fraction is known and the population total can be estimated. Thus the population estimate ultimately relies on some list of possible sample units: i.e., a census.

I distinguish between a collection and a sample by the means in which the units examined are obtained. A collection involves the arbitrary selection of units to be examined. If challenged to specify the probability used to obtain individuals in a collection, the collector will be unable to specify a number or a means of obtaining it. In sampling, the investigator will be able to specify a number or a formula that will yield the probability of obtaining a specific unit.

Not all individuals in a population are identical for traits being assessed. This arises because all biological populations are variable. There is some uncertainty to the estimate of the population parameter being estimated by sampling because not all individuals in a population are examined in sampling. Information in the sample can be used to obtain estimates of the population parameter and of the confidence that the true population value lies within a certain range. This is the estimate of reliability of the sample.

Sampling, in contrast to taking a census, is less than perfect. But it does produce estimates where the method of generating them is reproducible, a level of reliability can be reported and the whole process is open to scrutiny, often at a reasonable cost. It is a paradox of sampling that some knowledge of the population must be available before an efficient sampling scheme can be designed. This is where the expert is indispensable. The expert is able to use their experience and knowledge of the biological population to suggest values of population variance and the distribution of population attributes that may be used to design a sampling scheme that will yield an estimate, objectively obtained, with known reliability. Furthermore, it is a measure of the expert's skill if sampling schemes can be designed where the estimate is not too sensitive to the initial, subjective assumptions made when the protocols were designed. The objective application of the expert's knowledge in exploiting available information, such as a census of sample units, to design statistically sound sampling protocols distinguishes scientific surveys from shamanism.

The next article will deal with the attributes of populations and sampling designs that can be exploited to improve our knowledge of the sampling universe.

Reference

Morris, R.F. 1955. The development of sampling techniques for forest insect defoliators, with particular reference to the spruce budworm. Can. J. Zool. 33:225-294.

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This note, if cited, should be referred to as a personal communication with the author(s).

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