Forest Insect and Disease Notes

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Contents

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Canada

YELLOW WITCHES' BROOM OF SPRUCE

by
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Yellow witches' broom is the most conspicuous disease of white and black spruce in the prairie provinces. The witches' broom is a dense clustering of branches that occurs in an abnormal pattern. One or more yellowish witches' brooms of various sizes can occur on a tree and are noticeable from a distance. Brooms produced by other causes such as insects, genetic abnormalities, etc. are usually the same colour as the normal needles and can be distinguished easily from yellow witches' brooms.

The disease is caused by the rust fungus, Chrysomyxa arctostaphyli. This fungus requires an alternate host, kinnikinnick or common bearberry (Arctostaphylos uva-ursi), to complete its life cycle. Fragile spores (basidiospores) produced on overwintered leaves of kinnikinnick infect young shoots of spruce and initiate perennial systemic infection (witches' broom). The abnormal proliferation of short shoots produced every year creates the witches' broom. Brooms increase in size every year, and big brooms 20 to 30 years old that often measure more than 1 m in diameter are common. Every summer orange-yellow, blister-like, spore fruiting structures (aecia) are produced on needles of brooms, and spores (aeciospores) are released from the brooms infect kinnikinnick growing under the infected spruce trees.

Brooms on spruce are commonly associated with spike-tops, dead branches, bole deformation, loss of increment, and sometimes mortality. Significant increase of cull (average cull factor of 24 %) mainly caused by Phellinus pini (Fomes pini) of broomed Engelmann spruce was reported from Colorado. Damage caused by the disease in the prairie provinces has not been appraised but is considered insignificant.

Control:

No control measures have been developed for this disease in the Northwest region but elimination of brooms by pruning has been recommended for high value spruce stands in the United States.

Further reading:

Hiratsuka, Y. 1987. Forest tree diseases of the prairie provinces. Canadian Forestry Service, Northern Forestry Centre, Edmonton, Alberta. Information Report NOR-X-286.

Ziller, W. G. 1978. The tree rusts of western Canada. Environ. Can., Can. For. Serv., Ottawa, Ont. Publ. 1329.

G.I.S. AND FOREST PEST MANAGEMENT

by
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G.I.S. means "good insect surveys" in our book. In other peoples' lexicon, it also means Geographic Information Systems. The two meanings are indeed compatible and if you add diseases to the mix, the pest management connection becomes even stronger.

A geographic information system can be thought of as consisting of two components: a means of referencing geographic features to the land base, and a means of attaching other attributes (information) to those features. For example a forest stand is located somewhere in the land base, and the attributes we wish to associate with that stand can be linked to the geographical co-ordinates which locate the stand on the map. This description can be applied to conventional maps with overlays. What distinguishes the current Geographic Information Systems is that they are computer based, it is easier to deal with large geographical areas involving large data sets easier. It also permits the automation of decision making required to manage large tracts of land in which there may be several thousand items to be considered. This technology will revolutionize forest pest management in the Canadian context.

The most rudimentary application of a G.I.S. to forestry is simply the maintenance of an inventory related to the forest resource. Pest management considerations become one of several concerns that can then be integrated with the basic forest resource inventories. As the user expectations of the system become more demanding, more sophisticated uses of the G.I.S. will have to be developed and implemented. These would include links which require models to work on the attributes associated with the items in the inventory to produce forecasts of conditions in the future. The results of this process can then be used to apply decision making rules which will provide the manager with an action plan to implement. Depending on the sophistication of the system, artificial intelligence can be built into the system to update the rules used in the decision making process and to redefine the relationships used in making forecasts as the system operates over time. The link to the artificial intelligence module becomes a self improving feature of the system. At any point, the system can also be modified at the request of the management as new information becomes available. At no point, however, should the manager be allowed to think that the system's output cannot be over-ridden. The ultimate responsibility for decisions has to remain with the manager who should, justifiably, regard the system as no more than a tool.

Most pest management decisions in this region will require inputs to a G.I.S. on an annual basis. Our annual insect and disease survey information is an example of this. Over the years, the accumulated information on individual pests can be utilized to assess the accumulated effects of pests on stands within various forest management areas. The information can also be examined to determine the spatio-dynamic aspects of pest epidemiology. This would then permit objective risk ratings of stands faced with impending outbreaks. The accumulated pest maps also provide a means of evaluating the cumulative effects of pest on a timber supply. This application would require additional rules to permit this evaluation, but the G.I.S. is essential in application of the rules to the large data bases typical of the forest resource management agencies in this vast region.

A different application for the G.I.S. is to take point sample data acquired by ground based surveys, such as young stand or root disease surveys, to extend them to areas not sampled directly. Naturally this process of extending the point based information to an area would incorporate rules about the pest epidemiology to draw boundaries delimiting areas of similar pest incidence. Such rules would incorporate data already available on the G.I.S. such as biophysical data including stand age, density, volume, height and species composition. This is another instance in which the pest information would have to be updated on an annual basis.

Daily updates might be contemplated where some action or treatment may be triggered by the occurrence of some phenological event. The development of a pest which would be controlled at a specific phenological stage falls into this category. The spruce budworm is normally targeted to be controlled at specific instars. The date on which the critical instar is to occur depends on daily heat unit accumulations. Thus weather forecasts together with our understanding of insect phenology can be incorporated to produce phenological gradients delimiting areas in which insect development has reached a certain stage. If control operations were to be deployed over large areas this information would provide a means of scheduling treatments to the different control blocks.

These are but a few applications of G.I.S. to pest management problems currently being investigated at the Northern Forestry Centre. There are research applications that deal with aspects of pest biology and epidemiology. Historical records on major pest outbreaks are in the process of being accumulated. The reconstruction of these outbreaks is in need of development but should prove invaluable in determining the dynamics of out break development and spread on a regional scale. Pest ranges and collections is another application which is being developed and the maps in the annual F.I.D.S. reports are currently produced using the G.I.S. at NoFC.

Our experience with the G.I.S. has led us to the conclusion that the applications are practically limitless. Part of this arises out of the increased expectations derived from knowledge of the tool's power. However, like everything else, there is a cost: the maintenance of this capability requires highly trained and skilled people.

MAJOR FOREST INSECT PEST CONDITIONS IN 1990 AND 1991 PREDICTIONS*

by

J. Emond

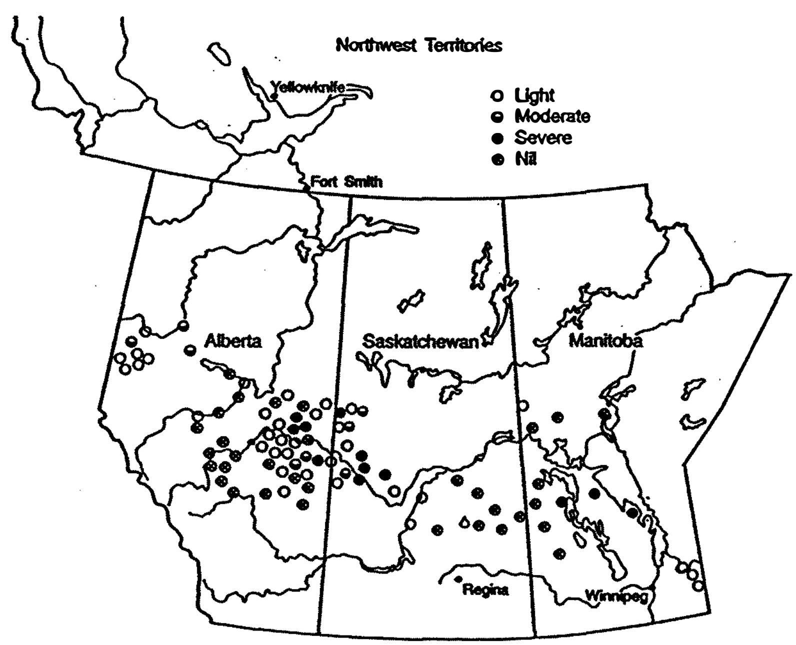
FOREST TENT CATERPILLAR - Malacosoma disstria (Hbn).

A summary of the moderate-to-severe defoliation of trembling aspen by the forest tent caterpillar in 1989 and 1990 is shown below. Forest tent caterpillar egg-band surveys were carried out in the three prairie provinces in the fall of 1990. Results suggest a continuing decline in population levels may occur in all areas sampled. (see FTC prediction map).

Summary of moderate-to-severe defoliation of trembling aspen by the forest tent caterpillar in 1989 and 1990.

Province	Area of defoliation (ha) 1989	Area of defoliation (ha) 1990
Alberta	1 179 800[a]	609 272[a]
Saskatchewan	790 740[a]	260 922[a]
Manitoba	325 045	15 178
Total	2 295 585	885 372

[a] Estimated as 20% of the total land area mapped.



PREDICTED 1991 DEFOLIATION OF ASPEN BY THE FOREST TENT CATERPILLAR BASED ON EGG-BAND SURVEYS

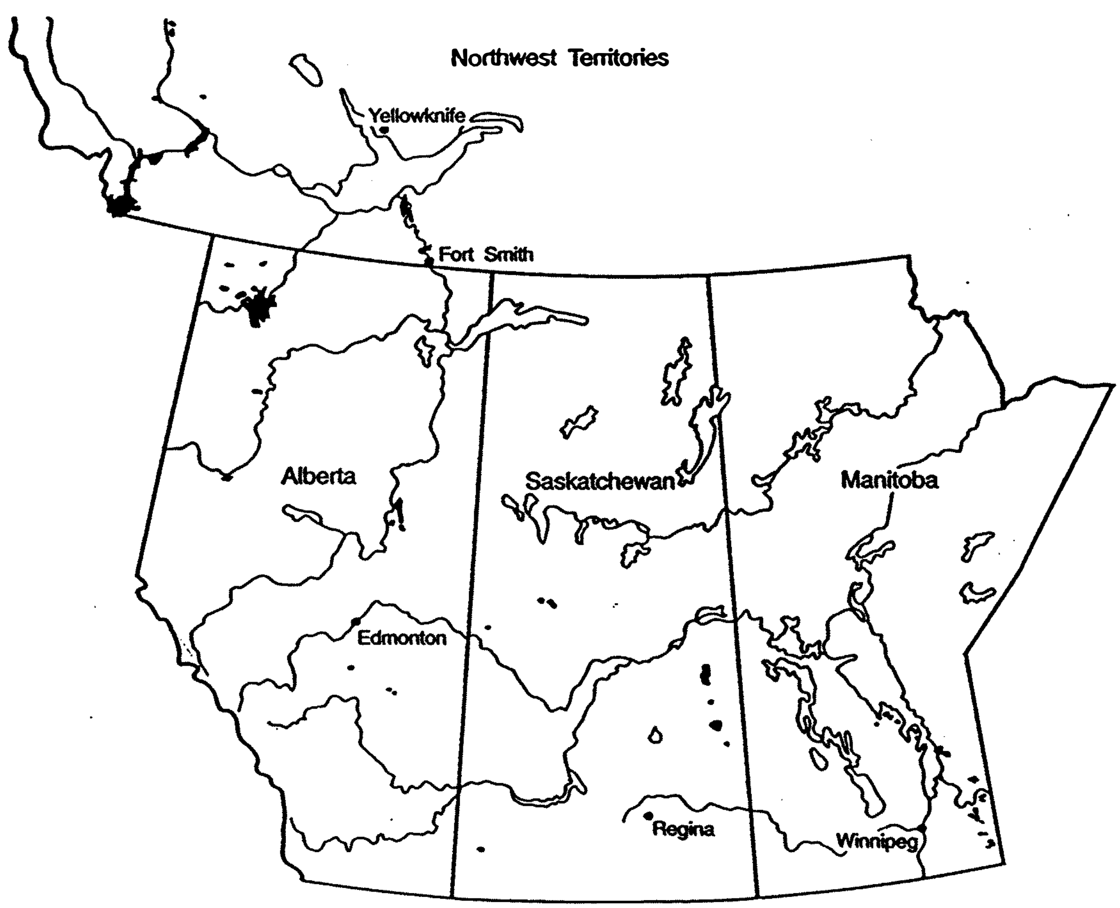
*Extracted From: Cerezke, H.F.; Emond, F.J.; and Gates, H.S. 1991. Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1990 and predictions for 1991. Forestry Canada, Northern Forestry Centre, Info. Rpt. NOR-X-318.

SPRUCE BUDWORM Choristoneura fumiferana (Clem.)

In the Northwest Region spruce budworm infestations showed some increase in size and intensity in several areas of Alberta and the Northwest Territories. In Saskatchewan and Manitoba budworm infestations caused some defoliation in the majority of the previously reported outbreak areas, but some decline in infestation levels was evident.

Summary of spruce budworm defoliation in the Northwest Region, sketch-mapped from aerial and ground surveys in 1989 and 1990.

Location	Area of defoliation (ha)		
	1989	1990	Change
Alberta	85 850	109 150	+ 23 300
Saskatchewan	34 650	18 780	- 15 870
Manitoba	58 016	18 985	- 39 031
Northwest Territories	98 600	113 625	+ 15 025
Totals	277 116	260 540	- 16 576



Areas of moderate-to-severe defoliation by the spruce budworm in 1990.

Results of surveys for spruce budworm defoliation in 1990, and predicted defoliation levels in 1991.

Location	Average defoliation 1990 (%)	Predicted defoliation 1991
Alberta		
Eaglesham (Bt treated)	72[a]	moderate-severe
Chinchaga (Bt treated)	93[a]	moderate-severe
Chinchaga (Bt untreated)	77[a]	moderate-severe
House River	100[a]	severe
Hawk Hills (untreated)	100	severe
Block 1 (Bt treated)	87	moderate-severe
Block 2 (Bt treated)	92	moderate-severe
Saskatchewan		
Delaronde Lake	98[b]	severe
Taggart Lake	88[b]	moderate-severe
Manitoba		
Birds Hill Provincial Park	17	light
Spruce Woods Provincial Forest	25	moderate
Red Deer River	0.2	nil
Duck Mountain Provincial Park	1.7	nil
Riding Mountain National Park	0.3	nil
Northwest Angle Provincial Park	0.4	nil
Whiteshell Provincial Park	22	severe
Wannipigow	21	moderate
Hecla Island Provincial Park	9	moderate
Lac Ste. George	0.7	nil
Rocky Lake	0.8	light
Simonhouse	1.7	nil
Pisew Falls	0.2	nil
Northwest Territories		
Fort Liard	-	moderate-severe[c]

[a] Data collected by Alberta Forest Service
[b] Data collected by Weyerhauser Canada Ltd., Saskatchewan Division
[c] Based on spruce foliage collected by Northwest Territories Renewable Resources

Compiled by K.I. Mallett

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

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