forestry report

CANADIAN FORESTRY SERVICE NORTHERN FOREST RESEARCH CENTRE

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# PESTICIDES AND THE ENVIRONMENT

The human population explosion is causing both an increasing demand for the necessities and amenities of life and an increasing degree of environmental pollution. The latter is a by-product of the accelerated production of food and goods that is occurring in the attempt to keep pace with man's demands. Since the desire to increase production strongly conflicts with the desire to reduce pollution many people have reacted emotionally, giving unqualified support to one of the two opposing factions.

The Entomological Society of Canada recently attempted to present an unbiased and moderate view of this complex problem.[1] Portions of the statement prepared which may be of interest to those engaged in forestry work are given here.

"Pollution problems will not be solved permanently until man's numbers and his demands are reduced to a level at which a chosen standard of living can be sustained without jeopardizing the stability of the biosphere. Population control must therefore be man's major objective but it may take many years to accomplish. In the meantime, there is a need for a short-term policy for resource management that will provide an acceptable way of reconciling demands for a reasonable standard of living with the need to preserve a healthy environment."

"To maintain standards of human health and comfort, at present or even somewhat reduced levels, effective pest control, for some resources, will remain essential. Chemical pesticides, for the time being at least, are necessary to achieve this control. The belief that there are many alternative methods available for immediate use if pesticides are withdrawn is a misconception. This is partly because the wide initial success of pesticides reduced the apparent need to strengthen research on other methods of control and partly because most alternative methods are tailored to a particular pest or crop, and are correspondingly more difficult to develop."

"Certain chemical pesticides have harmful side effects. The residues of persistent ones may accumulate in food chains and may achieve concentrations, as they pass through these chains, of more than 8 million-fold. Compounds that have been classed as harmless on the basis of direct toxicity tests can damage the ecosystem in ways that may pass undetected for many years."

"In the control of forest pests during the past 18 years, less than 1% of Canada's forests have been sprayed. At first heavy dosages of DDT, up to 1 lb. per acre, were used against the spruce budworm and many insects and fishes in streams were killed. The dosage was gradually reduced and "safer" materials were used near lakes and streams. A set back occurred in 1964 when there was direct kill of birds by phosphamidon although it had no evident deleterious effect on fishes. In 1970 fenithrothion was used at the rate of 2 to 4 ounces per acre, a dosage that was designed to kill only about 70% of the target pest, this being the minimum mortality needed to keep the trees alive. Although the potential hazard to the forest environment from pesticides is great it can perhaps be acceptably reduced by: timely consultation with other resource agencies; use of less harmful materials; reduction of dosage; regular monitoring of relevant effects; and use of alternative methods such as biological control."

"In agriculture the persistent pesticides have had little impact on soil structure and soil microorganisms but have greatly reduced the number of soil arthropods, most of which are beneficial or harmless. The residues found to date in cow's fatty



[1] Bulletin of the Ent. Soc. of Canada Vol. 3 (1): 14 pp.

tissue and milk have with few exceptions been recognized as non-hazardous to human health. Most serious are the indirect effects to wildlife resulting from residues getting into aquatic ecosystems by seepage and runoff. In the control of biting flies and nuisance insects, especially in resort areas, aerial application of persistent pesticides is liable to harm the ecosystem rapidly and disproportionately, and is a cause for serious, immediate concern. In the control of urban and household pests serious environmental contamination can result due to the likelihood of pesticides being washed rapidly into storm sewers or drainage systems."

"The short-term solutions lie in two main directions.

1. Regulating the way in which pesticides are applied, and in particular by:

- requiring that the most dangerous pesticides be sold on prescription as are dangerous drugs;
- limiting their use to licensed applicators, and ensuring that such applicators are well qualified;
- improving the mechanism of pesticide registration by expanding the existing agency to make it more efficient and effective in meeting increased requirements and disseminating information;
- fostering the trend towards "recommended use" becoming the only use that is permitted;
- subjecting certain uses (e.g. application from the air) to scrutiny and approval by standing committees representing relevant resource-defined bodies before permitting them; and
- monitoring the side effects of pesticide application when and where these may endanger non-target resources.

2. Reducing the amounts of pesticide used, in an orderly way, and in particular by:

- using pesticides only when necessary and in the minimal amounts needed to give adequate protection;
- reviewing, and where possible relaxing, present tolerances of pest damage and making nutritional quality of food rather than appearance the all-important criterion;
- making available alternate methods of insect control than now await registration (e.g. several insect pathogens);
- developing alternative methods (including new chemicals) that, in appropriate situations, can replace existing pesticides or increase their effectiveness;
- informing the public of the philosophy underlying the use of alternative methods, namely that the latter can and should reduce pesticide use by providing a complete or partial substitute in appropriate situations but that since no single alternative approach can apply to all pest situations it is illogical to propose that any one method will render pesticides obsolete; and
- informing the public of the root causes of pollution and of the price that society will have to pay to avoid it."

## DECAY AND CULL – IN THE MERCHANTABLE SPECIES IN THE PRAIRIES REGION.

Knowledge of the extent of decay, and other defects that reduce merchantability of forest stands, are a prerequisite to intelligent forest management. Knowledge of the location, accessibility and quality of immature, mature and overmature stands, allows the forest manager to assign priorities for protection and effective utilization of valuable forests in the Prairies Region.

Because of the vast forested areas in the Prairies Region, all inventory systems, including special purpose inventories such as those designed to measure the presence of decay and other defects, must rely on the extrapolation of data obtained from intensively measured sample trees that are representative of the forests in this region.

The sample trees are dissected, in order to measure the various types of internal defects. This information is analyzed, for volume of decay in cubic feet and for volume of cull in board feet. Cull includes rot and additional defects such as shake, pitch ring, heart check, frost crack or split, and lightning scar which reduce the usable portion of a tree for sawlogs or peelers. Decay and cull volumes are usually averaged by stand or tree characteristics such as species, site class, age class, height class, dbh class and growth rate. The objective is to be able to assign decay or cull percentages to stands for which the above parameters have been determined. Of all the above mentioned stand and tree characteristics, only age could be related to decay and cull volume. Tree age is important in relation to decay and cull in two different ways: 1. the closer the tree is in age to the end of its biological life span, the more susceptible it will be to injury and subsequent infection. 2. the older the tree, the longer it has been exposed to environmental hazards which can cause defects, and which are potential infection courts for stain and decay fungi.

## SEED TREATMENT FOR CONIFER DAMPING OFF: A NECESSITY.

Damping-off of conifer seedlings is a well known problem to nurserymen. In the prairie forest nurseries it can cause losses as high as 98% in some years and as low as 8% in others. The disease can be caused by any one of 6 or 7 different fungi in the soil. The symptoms of damping-off are flaccid stem tissue and drooping of fallen seedlings. The symptoms are generally seen in the first 8 weeks after germination. By fall the seedlings tend to outgrow the fungi and become more resistant.

In many nurseries the conifer seed is treated with fungicides to control the disease. It appears that in some years there is no need for fungicide treatment as there are no differences in final seedbed stands of treated and non-treated seed. However the following year the treated seed will give up to 77% better stand in the seedbeds. At first it appears that the efficiency of the fungicide is in doubt, but not so, as it is the efficiency of the fungi that really is in doubt.

We still have no sure way of telling which fungus will cause damping-off in any given year. Therefore it is very important that all seed be treated to insure more consistant stands in seedbeds.

Conifer seed should be pelleted with a mixture of 4% methyl cellulose and fungicide. The fungicides generally suggested for use are Captan 50WP and Arasan 75. After 4 years of research several new seed-treatment fungicides can be added to the list: Res Q, Dual-Purpose Res Q, and Polyram ST. The fungicides are usually applied at rates of 2 lb. of formulated chemical to 3 or 4 lbs. of seed.

## FOREST INSECT & DISEASE SURVEY

Since 1936 the Forest Insect and Disease Survey has been determining the relative importance of different insects and diseases in Canada's forested areas. For a country as large as Canada with millions of square miles of many different species of trees, this is a major undertaking.

The trees in our forests are subjected to stress by insect and disease attack, in some instances periodic, in others continuous. Some of these insects and diseases are beneficial in that they speed the natural thinning of overstocked stands but most are detrimental, causing varying degrees of damage depending on the nature of the organism and the severity of the attack. Since its inception, the Forest Insect and Disease Survey has been monitoring outbreaks of the major pests, and has gathered a large amount of data on factors affecting these outbreaks, thus leading to a better understanding of forest insect disease problems.

Most of Canada's recreation areas are located within major forest areas and with the public interest and activity centred on these park areas the 1971 program of the survey will be concentrated in the larger parks and high use, wood fibre production areas. Insect and disease problems, no matter where they occur should always be brought to the attention of the District Agricultural representative, Forest Ranger, or Warden who is familiar with the information contained in the Insect and Disease Survey. However, if a situation arises where the advice of our scientific staff is required, the Northern Forest Research Centre in Edmonton is always ready and willing to assist and provide the best possible service.

# INSECT, DISEASE AND ASSOCIATED PROBLEMS OF CAMPGROUNDS

Most campgrounds in the Prairies Region have been established within some type of relatively mature forest community either representative of or unique to the general area. Barring catastrophic events such as fire or serious outbreaks of insects or diseases, these forests go through the process of reproduction, maturation and succession and remain relatively stable for long periods of time. The establishment of campgrounds in the forest reduces the stability of the ecosystem and often tips the balance in favor of certain insects and diseases which do not normally cause significant damage in an undisturbed forest. Continued heavy use may result in mechanical damage to the site and to the plant community seriously reducing the vigor of the tree cover and its ability to reproduce itself. Investigations carried out by the Forest Insect and Disease Survey have pointed up a number of problems associated with campgrounds in natural forest stands.

Opening up the forest to provide access and space for facilities often weakens species of trees that require shade or the support of dense growth and creates an environment favorable to sun-loving insects that are more commonly a problem on shelterbelt and ornamental plantings than in natural forests. These include a number of sawflies such as the yellow-headed spruce sawfly and some species of wood borers, notably the poplar borer and the bronze birch borer. The dusty conditions often associated with campgrounds also favor a number of sap-sucking insects and mites including a variety of aphids, scale insects and the spruce spider mite.

Mechanical damage caused during construction, careless park visitors and soil compaction resulting from heavy traffic on fragile forest soils often weakens trees and provides entrance courts for tree diseases such as Cytospora and Hypoxylon cankers on aspen and trunk and root rots of all tree species.

The use of pesticides in the control of one insect may reduce the natural parasites and predators of other insect species allowing populations to rise to epidemic levels.

Over zealous thinning and clearing of underbrush to create a park-like appearance and the cutting of regeneration for weiner sticks, fishing poles and tent pegs may seriously impair the ability of the forest to perpetuate itself.

In recognition of these problems associated with high use recreational areas, and in response to Provincial and Federal agencies, more intensive surveys of selected areas will be carried out in 1971 by the Forest Insect and Disease Survey in co-operation with specialists in related fields.

*A good example of frost damage to trembling aspen.*

# POPLAR DISEASES IN SHELTERBELTS, PARKS AND NURSERIES

The Canadian Forestry Service began to participate in poplar tree improvement for farm shelterbelts and parks and recreational plantings in 1965. One of its aims has been the detection and reduction of losses from stem deformities caused by fungal infections and by injury from unfavorable environmental conditions. The aim was coordinated with progeny tests of existing introduced hybrid poplar and with the tree breeding program designed to improve hardiness. Between 1965 and 1969 a cooperative research program involved the P.F.R.A., Indian Head, Saskatchewan and the Department of Natural Resources, Manitoba. Liaison has been maintained with the Alberta Tree Planting Committee, Alberta Department of Agriculture, and the Western Horticultural Society of Canada on a continuing basis since about 1963.

The above agencies have long shown concern about the planting and maintenance problems. For years there has been loss of entire shelterbelts stocked from Federal and Provincial nurseries in many parts of the Agricultural Zone. At the same time many of the plantations have survived and have thrived to maturity in spite of reversals in nearby plantings.

Some of the failures were due to biological causes, mainly insects and diseases, but non-biological causes were far more common, especially winter injury, mechanical, fire, or a combination of these.

Winter injury is a very common cause of stem disorders such as frost crack, canker, dieback, wilting, and late leafing out with progressive loss of vigor. Mortality occurs (gradually or suddenly) when roots and stems are exposed to sudden, extreme temperature changes during the early and late winter. Unthrifty shoots and mechanically wounded stems are particularly vulnerable. In nurseries, damage is severe in stooling stock, resulting in a short life span.

Death of parts or whole trees is only one form of winter injury. However, loss to the forest industry can be equally as important when damaged trees are harvested for pulpwood. Presently under study is a predominance of lower quality and shorter fibers in trees that are injured but not killed by severe winter conditions.

During the spring, fire singe destroys entire shelterbelts and natural stands with little or no charring effects of the bark and wood at the bases of trees. It occurs when grass cover is repeatedly flash burnt over a period of a few years to allow new grass to grow earlier. The damage to trees is not noticed until later in the summer when trees fail to grow after the initial leafing out. The leaves often wilt and die as a result of cankering followed by complete girdling and mortality.

Mechanical injury by cultivation, rodents and rabbits can be serious especially by weakening the vigor of the tree and exposing the above ground parts to winter drying.

All injured trees discussed so far require sanitation pruning and retraining if a new sucker or leader is to be given a chance for proper growth and development. In the first year, it may need fertilizer and watering to allow new growth to form summerwood early.

Septoria canker is one of the prevalent fungal diseases in stooling beds and in salable stock of poplar in nurseries. Losses are heavy in occasional years when severe leaf infections in mid-summer are followed by stem infections in the latter part of the summer and during the fall of the year. Stem infections result in small cankers which usually heal in the following year. The fungus is not a problem in shelterbelts and plantations. Sanitation and a foliage spraying program during the summer can be effective in controlling the fungus.

A report on disease problems of poplar was published recently by the Canadian Forestry Service for use by Provincial agencies of the Prairies Region, especially Agriculture, Provincial and Federal Parks and Nurseries. A photoguide was made necessary in order to delineate differences in cankering and dieback associated with a variety of causes.

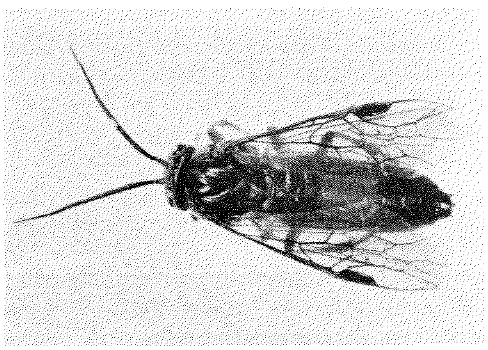
BEFORE USING ANY INSECTICIDE

**STOP**

READ THE LABEL

# TAMARACK AND THE LARCH SAWFLY

*Tamarack recovering from severe larch sawfly attack. Note short branches these have grown from adventitious shoots, after the trees lost their original branches.*



*Adult larch sawfly*

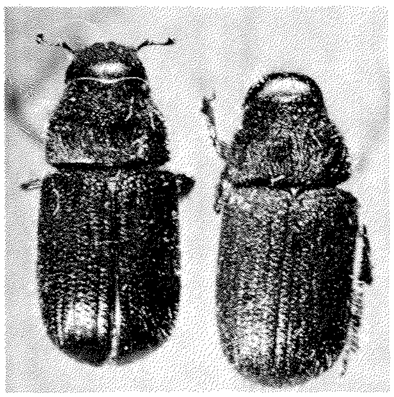
*Larch sawfly larvae*

Tamarack, a member of the larch family of trees, is the fastest growing conifer of the Prairie Region on good sites. It plays an important role in watershed conservation as it often occupies swampy land where other trees won't grow. But, there are few tamarack trees in North America, over twenty years of age, that have not been attacked by the larch sawfly which defoliates and eventually kills the tree. The first recorded outbreak of this pest began in New England in the 1880's moving westward and reaching Alberta about 1914. Another outbreak was recorded in Manitoba in 1940 and in the next twenty-five years spread to the limits of the host tree. If protection from the larch sawfly could be obtained, tamarack would be increasingly used for pulp wood, saw timber, fuel wood, pilings, poles, ties and veneer and it's use in forest plantings would be increased. We could also expect the various larch species to be more widely used in home and park plantings because the larch family of trees are very attractive. The future of tamarack in North America now appears brighter as forest scientists have been successful finding parasites that may eventually establish biological control of the larch sawfly. In 1961, and for the next three years, a program was carried out to introduce a number of parasites from Europe where the larch sawfly is exceedingly rare. Because of the fact that considerably more species of parasites attack it there than in America, the prospects for achieving control appear good.

One species of parasitic wasp is now well established. Where it was first released it has attacked over 90% of the host sawfly for the last five years at the same time reducing the number of sawfly cocoons per acre from 333,000 to 26,000. But, as is often the case, our parasite itself was attacked by a hyperparasite which first appeared in 1966 and whether this species will have a detrimental effect is a matter for some concern.

One of the other larch sawfly parasites or wasps from Europe had been introduced much earlier – 1910 - 1913. It had shown promise of being successful until about 1940 when it was found to be ineffective because the larch sawfly had developed a resistance against it. Blood cells in the sawfly larvae form capsules around the parasite eggs preventing them from hatching. Another strain of the same species from Bavaria was found to be little affected by this encapsulation and was introduced in 1963 and '64. The new Bavarian strain is now becoming established and time alone will tell how successful it will be. Forest scientists and other foresters will be following with great interest the drama of the larch sawfly and the future of tamarack trees.

# SPRUCE BEETLE



The spruce beetle *(Dendroctonus rufipennis* Kirby) and its associated blue stain fungi kill an estimated 1/3 to 1/2 billion board feet of timber annually. In the Prairies Region, the spruce beetle attacks Engelmann and white spruce throughout their range; black spruce is rarely attacked. The life cycle in this area is generally completed in 2 years, but can vary from 1 to 3 years, depending on weather conditions.

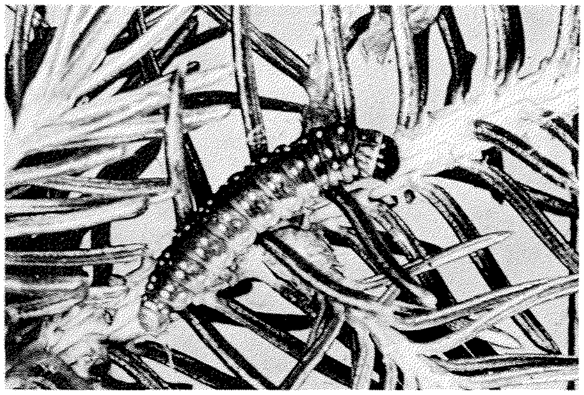
All major outbreaks of the spruce beetle originated from blowdowns, cull, or right-of-way logging operations. Widely scattered fallen trees are especially conducive to population increase. Although outbreaks can develop in immature stands, the most susceptible stands are over 120 years old. The initial attacks in standing timber usually occur in the largest trees, especially those along streams and valley bottoms. The presence of some singly scattered infested trees in mature stands may be normal and does not necessarily mean the beginning of an outbreak. Development of epidemics depends on a complex interaction of many factors that predisposes trees to attack and favours the reproduction and survival of the beetle population. Hence, forecasting of outbreaks is a difficult task.

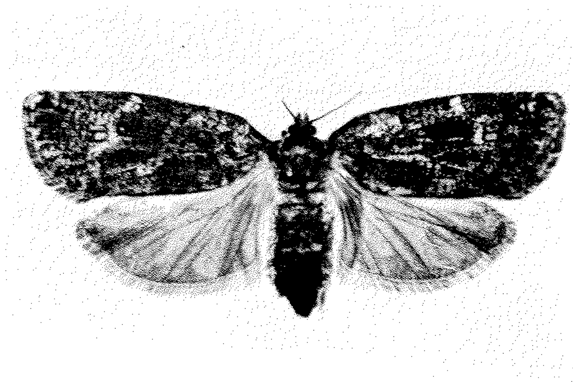
The most effective method of detecting incipient outbreaks lies in the continuous inspection of the susceptible areas. Potential outbreaks can often be checked by clear cutting the infested patches of timber, preferably during the flight period of the beetles. The logging operation should be carried out in accordance with strict rules of sanitation: cutting low stumps; burning large diameter slash, preferably after they have absorbed some of the attacking beetles; checking the edges of the residual stand for blowdowns and removal of the fallen trees. Felling trap trees around the periphery of the control area in advance of logging is often effective for reducing the beetle population. Trap trees are felled in the fall or in the spring prior to beetle flight; the boles of these trees should lie on the ground in shaded locations. If trap trees or infested logs cannot be disposed of prior to beetle emergence, the broods can be killed by spraying the bark, until thoroughly wet, with a mixture of diesel oil and lindane concentrate at a ratio of 14:1.

All known outbreaks of the spruce beetle in the Prairies Region occurred in Alberta. An outbreak in southwestern Alberta from 1952 to 1956 destroyed about 23% of the mature spruce on 1200 acres. During the early 1960's, in Wood Buffalo National Park, up to 5% of the mature spruce were killed in a 50 square mile area. The current outbreak in southwestern Alberta began in 1966 as a result of extensive blowdown in mature stands during the summer of 1964. This outbreak extends over 4,500 acres and to date an estimated 25 million board feet of timber has been killed. The outbreak reached its peak in 1968 and declined during the last 2 years. It is believed that high mortality of the broods from unusually cold weather prior to the arrival of deep snow conditions during the winter of 1968-69, increased resistance of the residual trees, and removal of much of the infested and susceptible trees during salvage and control logging operations were primarily responsible for the population decline. In 1970, the incidence of attacks was about one-third of that in 1969 and comprised about 1% of the volume of the infested stands. It is predicted that the incidence of new attacks in 1971 will be about the same as that in 1970 and attacks will probably be concentrated on trees that survived previous attacks. Current population levels still constitute a potential hazard to the residual stands and the continuation of logging operations to remove infested and susceptible trees is recommended.

Current research efforts on the spruce beetle are concentrated on deterioration of infested trees and the relation between tree mortality and tree size, age, and population level. In addition, a survey will be conducted to estimate current damage and population level.

# SPRUCE BUDWORM



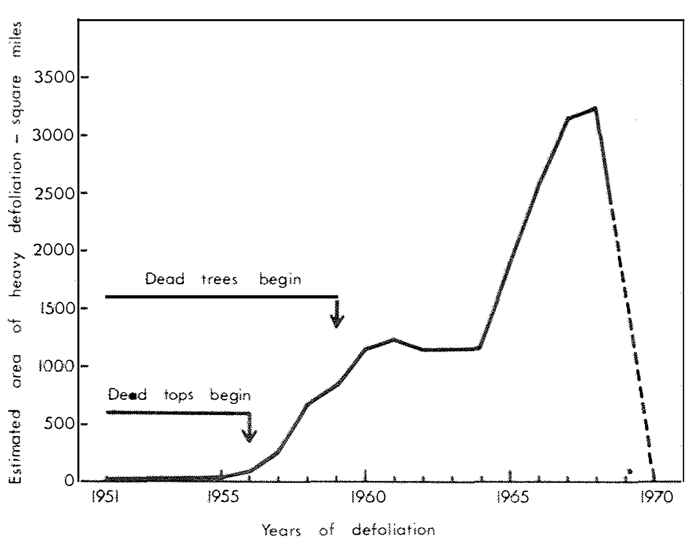


Larvae of the spruce budworm, *Choristoneura fumiferana* (Clem.), are among the major defoliators of white spruce and balsam fir in the Prairies Region. Most outbreaks have occurred in the northern half of the Region, although smaller infestations have occurred farther south in the Cypress Hills and Sprucewood Provincial Park. The northern outbreaks have typically persisted along the major river drainages. An example of the development of an outbreak is shown in the accompanying diagram of defoliation near Flin Flon, which was first detected near Namew Lake in 1951. Other outbreaks differed in the duration, rate of spread and intensity of defoliation from the one depicted, but all showed a sharp decline in 1969 and 1970, attributed, in part, to a late spring frost in 1969.

In the depicted outbreak, top-killing occurred after five years of heavy defoliation, tree mortality after eight years and radial increment was greatly reduced in the surviving trees. Similar effects were noted in the other outbreaks. Along the Wabasca River, in 1968, 44% of the trees had dead tops and an additional 39% were dead. During the outbreaks, much of the balsam fir and white spruce regeneration has been severely damaged or killed.

Information in the literature suggests that extensive, mature and pure stands of white spruce are likely to provide the most susceptible conditions for initial development of budworm outbreaks, enhanced by dry, sunny weather during May to July, the feeding period of larvae. The extent of damage during outbreaks is largely dependent upon the duration of the outbreak and the intensity of attack or levels of budworm populations. Although the timing of outbreaks cannot be forecast, the hazards of the budworm can be predicted on a year-to-year basis by monitoring population levels annually and surveying the resultant damage effects on the forest. Work along these lines forms a major part of the current research program.

This year, studies will be largely concentrated in the Footner Lake Forest in northern Alberta and will include aerial surveillance of susceptable white spruce stands, damage impact in infested commercial stands and examination of techniques for measuring budworm populations. An experiment to determine whether budworm dispersal from residual stands poses a threat to white spruce seedlings planted in adjacent clearcut strips will be initiated with cooperation of the Alberta Forest Service. A main objective of the studies is to find ways to reduce the hazard of the budworm and to provide guidelines to forest managers for improved management of the stands.




*Pattern of defoliation by spruce budworm during an outbreak near Flin Flon, Manitoba, from 1951 to 1970.*

# NORTHERN FOREST RESEARCH CENTRE OFFICIALLY OPENED

On June 21, the Northern Forest Research Centre was host to numerous dignitaries and over five hundred guests at the building's official opening. Eymard Corbin, M.P., Parliamentary Assistant to Jack Davis, M.P., P.C., Minister of the Department of the Environment, performed the opening ceremony on behalf of the Minister. Notable among the other guests were Dr. M.L. Prebble, Assistant Deputy Minister for Lands and Forest and Wildlife Services, Department of the Environment; Dr. R.M. Belyea, Acting Director of Canadian Forestry Service, Department of the Environment; Hon. Dr. Hu Harries, Member of Parliament for Edmonton South; His Worship Mayor Ivor Dent of Edmonton; Dr. J. Donovan Ross, Minister of Lands and Forests for the Province of Alberta; W.W. Mair, Deputy Minister, Mines, Resources and Environmental Management, Manitoba; J.E. Weymark, Deputy Minister, Department of Natural Resources, Saskatchewan; and M.H. Drinkwater, Director of the newly-established Northern Forest Research Centre.

During the three days following, the doors of the new building were opened to the public. Approximately seven thousand toured the three-storey laboratory. Visitors were presented with many informative displays and interesting demonstrations designed that they might appreciate not only the well-equiped laboratory itself, but the scope of the research activity being carried out on behalf of Canada's forested areas.

## CANADIAN FORESTRY SERVICE ESTABLISHMENT NAMES

The advent of the Department of the Environment has necessitated revising some of the names of establishments connected with the Canadian Forestry Service.

The recently opened establishment in Edmonton, new headquarters for the region covering Manitoba, Saskatchewan, Alberta, the Yukon and Northwest Territories will be known as the

**Northern Forest Research Centre**
Canadian Forestry Service
Department of the Environment
5320 - 122 Street
Edmonton 70, Alberta, Canada
Area Code No. 403
Telephone No. 435-7210
Telex No. 037-2117

To avoid any possible delay, we would request that the above address be used on all correspondence directed to the Edmonton office of the Northern Forest Research Centre.

The centre in Victoria, covering the Province of British Columbia, will now be known as the Pacific Forest Research Centre, and in Sault Ste. Marie for Ontario the Great Lakes Forest Research Centre. The following are the new approved names for eastern Canada: Laurentian Forest Research Centre, Ste. Foy, Quebec; Maritime Forest Research Centre, Fredericton, New Brunswick; and Newfoundland Forest Research Centre, St. Johns, Newfoundland.

The two Forest Products Laboratories will now be known as the Western Forest Products Laboratory in Vancouver and the Eastern Forest Products Laboratory in Ottawa. For the time being the Forestry Institutes will retain their present names.

CONTRIBUTORS:

L.W. CARLSON (Seed treatment for conifer damping off: a necessity) is working on tree diseases in forest nurseries.

H.F. CERESKE (Spruce budworm) is responsible for investigations on the spruce budworm, the root collar weevil and wood-borers.

W.G.H. IVES (Forest insect and disease survey) is head of the Forest Insect and Disease Survey, Northern Forest Research Centre and is doing work on the population dynamics of insects.

A.A. LOMAN (Decay and cull) is studying methods for minimizing timber losses due to heart rot and other diseases.

J.A. MULDREW (Pesticides and the Environment; Tamarack and the larch sawfly) is conducting a program on the biological control of the larch sawfly, and is participating in a population dynamics study of this insect.

J.K. ROBINS (Insect, disease and associated problems of campgrounds) is Chief Ranger, Forest Insect and Disease Survey, Northern Forest Research Centre, and has a wide-ranging interest in insect and disease problems in this region.

L. SAFRANYIK (Spruce beetle) is responsible for research on bark beetle problems, and has devoted much of his efforts to sampling problems with mountain pine beetle.

H. ZALASKY (Poplar diseases in shelterbelts, parks and nurseries) is studying the pathological and physiological diseases of native and hybrid poplars in the Prairie Provinces.

ERRATA
The larvae shown in the previous SPECIAL REPORT as a yellow-headed spruce sawfly, *Pikonema alaskensis*, is that of the balsam fir sawfly, *Neodiprion abietis*. The yellow-headed spruce sawfly larvae is very similar, but has slightly different stripes and only six pairs of prolegs.

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For further details concerning articles in this issue address the Director or Information Officer.