Forest Insect and Disease Notes

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MAJOR FOREST PESTS IN THE NORTHWEST REGION - PREDICTIONS FOR 1995

by
James P. Brandt

Spruce budworm

Alberta Land and Forest Services deployed 166 pheromone-baited traps in 1994 at 83 locations throughout the administrative districts in the province to monitor spruce budworm (*Choristoneura fumiferana* [Clem.]) population levels. Moth counts ≥500 moths/trap were observed at two locations in the Edson Forest in Willmore Wilderness Provincial Park and at 15 locations near known infestations in the Peace River Region. Second instar larvae (L_2) surveys were conducted in the Peace River Region and in the Athabasca and Lac La Biche forests, based on 1994 defoliation and pheromone trap results. The results indicated that in 1995 mostly moderate and severe defoliation will occur in the Peace River Region, including infestations along the Chinchaga and Amber rivers and the Zama ridge. Similar results are expected in the Athabasca Forest along the Athabasca River, while light and moderate defoliation is expected in the Lac La Biche Forest along the Athabasca and House rivers.

Saskatchewan Environment and Resource Management deployed 384 pheromone-baited traps at 128 sites. Data collected from the trap catches indicated relatively high population densities at many locations and helped to identify areas of concern for follow-up L_2 surveys. Moth counts ≥500 moths/trap were observed at 15 locations in the Hudson Bay Region, 4 locations in the Meadow Lake Region, and 22 locations in the Prince Albert Region. Second instar larvae (L_2) surveys were conducted in the Hudson Bay, Meadow Lake, La Ronge, and Prince Albert regions. The results generally indicated that severe defoliation is expected at many locations in the Hudson Bay Region in 1995. In the Prince Albert Region light defoliation is expected at many locations except those near Smoothstone, Doré, and Delaronde lakes, and near the Beaver River north of Green Lake where moderate and severe defoliation is expected. At almost all locations sampled in La Ronge Region severe or moderate defoliation is expected in 1995; this includes areas near Wapawekka, Morin, Besnard, and Egg lakes, Lac la Ronge, and along the Smoothstone River southeast of Pinehouse Lake. These forecasts are based on an average larval density per 10 m^2 of foliage for stands in each 100 km^2 map sheet area.

In 1994, 189 pheromone-baited traps were deployed at 63 sites throughout Manitoba. Moth counts ≥500 moths/trap were observed at 32 of these sites. Manitoba Natural Resources selected sites for spruce budworm egg-mass surveys in the Lake Winnipeg East and Mountain sections. Twenty-seven sites were surveyed near Davey Lake in Duck Mountain Provincial Forest. The results indicated that light and light-to-moderate defoliation is expected at 19 sites, moderate and moderate-to-severe defoliation is expected at 7 sites, and severe defoliation is expected at 1 site in 1995. The moderate-to-severe and severe defoliation is expected near Childs, Grassy Island, Davey, and Noses lakes. In Lake Winnipeg East Section, 67 sites were surveyed. The results indicated that light and light-to-moderate defoliation is expected at 24 sites, moderate and moderate-to-severe defoliation is expected at 23 sites, and severe defoliation is expected at 20 sites in 1995. The moderate-to-severe and severe defoliation is expected near the Manigotagan townsite, south of the Sandy River, near the Maskwa and Winnipeg rivers, north of Lac du Bonnet, and near Beresford, Bird, Flanders, Dorothy, and Falcon lakes.

Jack pine budworm

Jack pine budworm *(Choristoneura pinus pinus* Free) has not caused significant defoliation to pine stands in the Northwest Region since the last major outbreak, which collapsed in 1987. Jack pine budworm populations have been monitored through the ongoing efforts of FIDS in Alberta, Saskatchewan, and the Northwest Territories, and Manitoba Natural Resources in Manitoba. Efforts have concentrated on pheromone traps for male moths and egg-mass surveys. One moth was captured in a pheromone trap near Fort Simpson in the Northwest Territories. This is the most northerly location recorded for jack pine budworm. Based on the pheromone-trap and egg-mass surveys, populations of jack pine budworm are anticipated to remain low across the Northwest Region and little or no defoliation is expected.

Forest Tent Caterpillar

Forest tent caterpillar (*Malacosoma disstria* Hbn.) egg-band surveys were conducted in Alberta near infested areas at 30 locations east of Edmonton to the Cooking Lake area and 26 locations near Peace River. The results of these surveys indicated that mostly light defoliation is expected in 1995 north and south of Cooking Lake and in Elk Island National Park except near Islet Lake where severe defoliation is expected. In the Peace River area, light defoliation is expected in areas south of Jean Côté including the infestation north of Guy and south of the Little Smoky River. Moderate defoliation is expected north of Jean Côté and Marie-Reine and near Lac Cardinal. Moderate-to-severe defoliation is expected south of the Peace River townsite in the Peace River valley and north of Berwyn.

In Saskatchewan, forest tent caterpillar caused significant defoliation for the first time since the last outbreak collapsed in 1991. Egg-band surveys were completed at 11 locations in and around infested areas. In 1995, light defoliation is expected at five locations. Moderate defoliation is expected at three locations: at the north end of Mosquito Indian Reserve, in Red Pheasant Indian Reserve, and along Cooper Creek. Severe defoliation is expected at the other three locations: about 5 km south of Battleford on Secondary Highway 658, in the central area of Mosquito Indian Reserve, and about 10 km south of Battleford on Highway 4.

Forest tent caterpillar egg-band surveys were completed at 8 locations throughout Manitoba. The results of these surveys indicated that light defoliation is expected in 1995 near Manigotagan and Big Whiteshell Lake. No defoliation is expected in 1995 in Duck Mountain Provincial Park and Riding Mountain National Park, or near Red Rose, Mafeking, Landry Lake, or Flin Flon.

USING AUXILIARY INFORMATION IN SAMPLING

by
W. Jan A. Volney

The philosophy of sampling was examined in the last article in this series. Often the objective of sampling is to estimate the mean of a population. If the sampling fraction (the proportion of the population in the sample) is known, a population total can be derived from the sampling fraction and the estimate of the mean. Thus sample plots of known area, on which trees are measured, will permit an estimate of the mean volume of wood per unit area to be made. Knowledge of the sampling fraction (represented by the total area of plots sampled divided by the total stand area) will permit an estimate of the total wood volume in the stand to be made. Sample variance is also estimated because it is used in determining confidence intervals for the estimate of the mean (or total). In many biological studies, the population variance itself, estimated by the sample variance, is also of interest. There are also frequency distributions found in biological data, but this topic will be left for a future issue of the news letter.

The reliability of sample estimates are determined, in part, by the population mean and variances. Population means and variances are determined by nature and are not under the control of the investigator. However, the reliability of sample estimates is sensitive to the size of the sampling effort, the sampling design and the level of significance chosen by the investigator. These three aspects of sampling are briefly addressed in this article.

The size of the sampling effort is determined by the budget available. If this is fixed, the opportunity to improve sample reliability depends on the sampling design used. If the budget is inadequate for the task of obtaining estimates with the required degree of reliability, then alternatives to sampling should be sought or the sample estimates made and the reliability of the estimate, poor though it may be, must be reported.

Simple random sampling is the simplest approach that can be used in estimating population parameters. This approach requires that all individuals in the population be selected with the same probability. The population mean is then estimated by the sample mean and the population variance is estimated by the sample variance. This sampling design is efficient if the population is small and homogenous, or little is known about the population being sampled. Simple random sampling is especially useful if preliminary estimates of population means and variances are to be made for planning future sampling exercises.

If the population is not homogenous and the basis for this variation can be described, it may be useful to consider the auxiliary information in developing the sampling design. Often there is a biological basis for systematic variation in a population. This auxiliary information can be used in stratifying populations for sampling. An example of this is the tendency of many defoliators to concentrate their feeding in the upper crowns of trees. Thus crown levels are used as a basis for stratifying populations in sampling defoliators. Stratification is most efficient when the variance among strata is larger than the variance within strata. When auxiliary information is used in this fashion the approach is referred to as **stratified random sampling**.

Often the variance among individuals living within a neighbourhood is larger than the variance among neighbourhoods. This is often the case when sampling trees for defoliators. The largest source of variance in the density of defoliators is often associated with variation among trees in plots within the stand. In this case **cluster sampling** is most appropriate because the sample design can account for this pattern of variation and minimize its impact on the variance of the sample mean.

There are cases where the variable of interest is difficult or expensive to determine but it is correlated with an easily measured variable. In this case, the variable of interest and the auxiliary variable are determined on a small number of individuals to develop a relationship between the two variables. The auxiliary variable is then measured on a large number of individuals in the population and the relationship between the two variables used to obtain an estimate of the variable of interest. If the relationship developed between the two variables is a ratio estimate then the process is known as **ratio sampling.** If a regression estimate is used the procedure is known as **sampling with regression**. An example of sampling with regression is the estimation of tree volumes in stands. In this application, tree volumes are determined using stem analysis, which is expensive. At the same time the height and diameter at breast height are determined on the dissected trees to obtain the relationship between tree volume and the auxiliary information. In sampling a stand to determine the volume, tree heights and diameters are measured and these are used to calculate the total tree volumes. In this technique, the stronger the relationship between the variable of interest and the auxiliary variable, the more reliable the estimate (or the smaller the sample required to obtain an estimate with fixed precision).

In developing a sampling design, the investigator will exploit knowledge of the population of interest in selecting the combination of techniques to be employed. Equally important are the costs of taking samples of different kinds. By combining cost estimates and knowledge of the patterns of variation within and among strata or clusters, the investigator can allocate sampling effort to minimize the uncertainty associated with estimates derived from sampling. Thus, the more that is known about the population, whether from experience or otherwise, the better one is able to design sampling protocols. In practice, more than a single approach is used in designs used in assessing pest populations. This is necessary to exploit the patterns of variation found in nature so as to obtain estimates with respectable levels of reliability.

One last issue needs to be discussed. This is the choice of the level of significance, which is frequently denoted by α. This parameter is one of several that determines the width of confidence intervals. It is the investigator's responsibility to choose an acceptable value for α. Essentially the basis for this choice is an analysis of consequences should decisions be based on sample values that fail to approximate population values within confidence limits. This is where the expert in the field and the statistician are invaluable in suggesting the correct choice of α. Their work and the investigator's task is made easier if a clear statement of objectives and the use to which the estimates are to be put can be provided.

THE FEDERAL BUDGET AND THE CANADIAN FOREST SERVICE

The budget cuts announced in February 1995 by the federal government will impact the Canadian Forest Service's Northwest Region over the next three years. As a result, the number of staff in the region will be reduced to 110 in 1997-98 from the current 150, and the region's budget will be reduced to $12 million from the 1994-95's $22.5 million. The district offices in Prince Albert and Winnipeg will be closed as will all other CFS district offices across the country. In other regions, the Newfoundland Forestry Centre in St John's and the Petawawa National Forestry Institute in Chalk River will be closed, and the Forest Pest Management Institute and the Great Lakes Forestry Centre in Sault Ste. Marie will be merged. The Canadian Forest Service will emphasize research and policy development in the future. Regional establishments will become centers of excellence with national responsibilities for some program areas. Planning to implement the changes indicated by the budget is under way, and details will be announced as they are available over the next year.

RETIREMENT OF DR. YASUYUKI HIRATSUKA FROM THE CANADIAN FOREST SERVICE

An outstanding Canadian scientist, Dr. Yasuyuki Hiratsuka, retired from the Canadian Forest Service in December 1994. Dr. Hiratsuka was educated in Japan and the United States, receiving an internationally renowned and prestigious Fulbright Graduate Scholarship to study in the United States. He then received a National Research Council Postdoctoral Fellowship to work in Canada in 1962, where he remained and became a citizen in 1970. His entire professional career has been with the Canadian Forest Service or its predecessors. He is currently an emeritus research scientist at the Northern Forestry Centre.

Dr. Hiratsuka has and continues to develop knowledge about forest diseases, contributing over 90 papers to the primary scientific literature, writing books that have won international recognition and awards for technical excellence, and contributing to scientific and learned societies both in papers and as chair of the International Union of Forest Research Organizations (IUFRO) working groups. His professional standards, integrity, and enthusiasm have established him as a role model and mentor to young scientists in this field of research.

Perhaps the most significant contribution has been Dr. Hiratsuka's work on rust fungi. One of his books, co-authored with Dr. G.B. Cummins, is the internationally recognized text book on rust taxonomy, *Illustrated Genera of Rust Fungi*. The system he developed for describing spores is now used in mycology textbooks and has been adopted as a standard. He has made significant contributions outside the field of forestry, and he has advanced the study of fungi. His contributions to forestry are manifold; he is one of the authors of the scientific name for western gall rust of hard pines (*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka). He confirmed that this fungus does not require alternate hosts to complete its life cycle. This made the search for alternate hosts, as has been done in studying and managing other pine stem rusts, unnecessary. Dr. Hiratsuka also discovered the presence of heritable native resistance to rust infection in hard pines thus suggesting a means that can be used in breeding superior, rust-resistant trees. Although this knowledge contributes to a long-term strategy in managing western gall rust infections in plantations, he has also developed a novel technique to control the pathogen in the short term. The discovery, with co-workers, of fungi that parasitize the western gall rust fungus led to the suggestion that insects may be used in vectoring the myco-parasite to galls. This technique is now one of the most promising and environmentally benign means of managing western gall rust. Not surprisingly, this method is also being applied in agricultural systems.

With the emergence of aspen as a major timber species, Dr. Hiratsuka has adapted his research and made contributions in the management of stain and decay in this species. The discovery of fungi and their metabolites, which are antagonistic to decay organisms in aspen, has lead to pilot testing as a means to reduce the amount of bleach required to process aspen; consequently, improving the utilization efficiency of this species, reducing the cost of production, and reducing the release of byproducts of the bleaching process to the environment. This development is illustrative of Dr. Hiratsuka's dedication to sound scientific investigation involving several disciplines including mycology, chemistry, wood technology and forestry, in the solution of forestry problems.

Dr. Hiratsuka has served his discipline well by ensuring highly skilled and qualified scientists are trained in forest pathology in Canada. He has hosted several post-doctoral fellows in his lab and was the mentor to several successful doctoral and masters students. His lab is constantly hosting visiting scientists who acquire his drive and enthusiasm for forest pathology. He serves as Adjunct Professor in the Departments of Forest Science and Agricultural, Food, and Nutritional Sciences at the University of Alberta where he co-supervises graduate students, lectures undergraduates, and collaborates with academic staff.

The communication of his research findings and his passion for forest pathology are well illustrated by his books and technical publications aimed at students, forestry practitioners in industry, federal and provincial agencies, and academic and technical institutes. His book, *Forest Tree Diseases of the Prairie Provinces*, has become a classic and was awarded the Distinguished Publication Certificate at the 1988 National Technical Publications Competition in the U.S.A. and the Certificate of Excellence in 1989 by the Society for International Technical Communications. Recently, he co-authored a field guide to the forest insects and diseases of the prairie provinces that should be published this month. With well over 100 technical publications in addition to his publications in the primary scientific literature to his credit, Dr. Hiratsuka has made a most distinguished contribution in transferring the technology he was so instrumental in developing to the practitioner.

Dr. Hiratsuka has an impressive international reputation. He collaborates with scientists from the United States of America, Russia, Japan, The Peoples Republic of China, Brazil, and Korea in addition to his colleagues in Canada. He was chairman of the IUFRO working party on rusts of hard pines. He serves on the editorial board of scientific journals of international repute and has organized symposia for International Congresses in Plant Pathology, Botany, and Mycology. His books and contributions are used by students, forest technicians, foresters and researchers all over the world. His work on the biology and control of forest diseases have and will continue to yield spectacular dividends; particularly when we in Canada become more dependent on plantations and intensively managed naturally regenerated stands.

Last year Dr. Hiratsuka was presented the Department of Natural Resources Merit Award by the Honorable A. Anne McLellan, Minister of Natural Resources, for his contributions to forestry in Canada. He was also the recipient of the Canadian Institute of Forestry's Scientific Achievement Award in September. This is the most recent of the many national and international awards he has received for his work.

In addition to his scientific undertakings, Dr. Hiratsuka is an active and contributing member of his community. He serves as an elder in his church and chaired their worship and nurture committee. He is also a contributing member of the board of directors of the Friends of the University of Alberta Botanical Garden and of the board of directors of the Edmonton Japanese Community Association. He was recently appointed to the Tottori Mycological Institute in Japan as its director.

In short, Dr. Hiratsuka has made outstanding contributions to forestry through his research in forest pathology, technology transfer, education, and elevating the calibre of scientific research in forest pathology, which has made Canada the envy of the world. We are fortunate that he will continue to work with us in his retirement.

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

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