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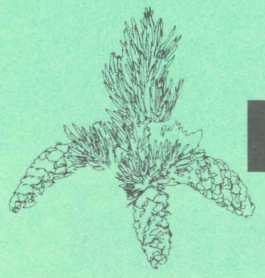
Environment Canada
Forestry Service

INFORMATION Forestry

PACIFIC FOREST RESEARCH CENTRE, VICTORIA, B.C.



Cone Production Research

Despite years of research, trying to discover a satisfactory method to manipulate cone crops to produce more seed, foresters in British Columbia must still rely on wild cone crops for the bulk of seed required for increasing needs. Successful control of cone-production may be obtained within 10 years if further research is undertaken. These and other observations are found in a comprehensive information report, 'CONE PRODUCTION IN CONIFERS', by Dr. George Puritch, a tree physiologist with the Pacific Forest Research Centre, Victoria. The report, BC-X-65, also contains an economic evaluation of benefits and costs of cone-production research, by Alan Vyse of the PFRC.

Foresters have recently recognized that the increased demand for suitable seed to meet the province's accelerated reforestation program could not be met solely through natural cone crops. Consequently the forest industry and the B.C. Forest Service requested the Canadian Forestry Service to undertake further research in hopes of establishing a continuous production of abundant seed. Before embarking on a new program, Dr. Puritch made a comprehensive review of current and past research which, he states, is fairly extensive and has involved a variety of approaches. His investigations include a compilation of 49 experiments by various agencies involving the use of fertilizers to induce cone crops. Data is summarized by species, age of tree, location, treatments, rate of application, results and major references. Another appendix presents similar information on girdling, strangling, and pruning experiments conducted to induce further cone production. Also a number of recommendations are made by Dr. Puritch.

(cont. on page 7)

Attractants For B.C. Beetles

Scientists at the Pacific Forest Research Centre have discovered that synthetic chemical attractants for bark beetles can be as potent to British Columbia insects as natural lures used by female insects to attract males.

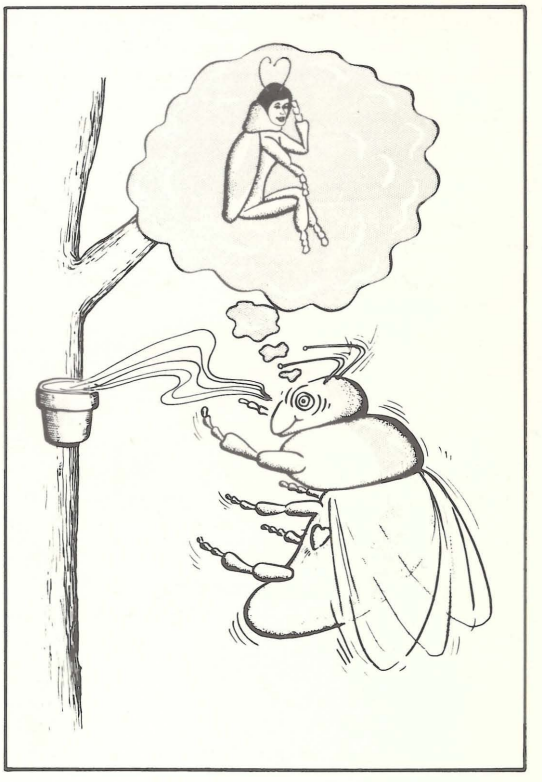
Under natural conditions when 'pioneer' beetles attack a tree or a log, they produce chemicals that increase the attractiveness of the attacked object. These chemicals attract both sexes, thus increasing the chance that attacked trees will be killed and made suitable for brood development.

Dr. John Chapman, a **PFRC** entomologist, reports that synthetic attractants may be used to:

trick beetles into attacking the wrong size or species of tree, with resulting brood failure;

bait trees ready for logging so that the attracted beetles will be removed and destroyed;

(cont. on page 5)



Wood Shortages Combated

OPTIMUM PRODUCTIVITY OF FOREST LAND WITHOUT DEGRADING THE ENVIRONMENT IS A GOAL THAT MUST BE ACHIEVED TO SUCCESSFULLY MEET THE INCREASED PRESSURE TO PRODUCE MORE WOOD FROM LESS FOREST LAND.

Wood shortages can be expected in areas of British Columbia within the near future if the diversion of forest land from timber growing to other uses continues at present rates.

In response to the need for more information on increasing productivity potentials of coastal forest stands in British Columbia, researchers of the *Pacific Forest Research Centre,* Victoria, have embarked on a comprehensive research program to explain the effects of thinning and fertilization practices on tree growth. Primary objective is to acquire knowledge and technology complimentary to *British Columbia Forest Service* Programs.

Because of the size and complexities of the task, project leaders have taken a *MULTIDISCIPLINARY TEAM APPROACH* to achieve their objectives.

In 1970, in collaboration with the *British Columbia Forest Service* and the *forest industry,* pilot trials were designed and initiated to measure response due to thinning and fertilizing with urea in a 26-year-old Douglas-fir crown plantation near Shawnigan Lake on Vancouver Island. The area is medium to low site glacial till.

In attempting to explain the effects of fertilization and thinning on the quantity and quality of tree growth under varying conditions, the research team will develop a better definition of growth limiting factors. In addition they will develop new and improved tools to sample and predict the measurement and interpretation of biological, physical and environmental factors over a wide range of sites, species, density and age types.

Complex chemical, physical and biological inter-relationships meant the project must include studies such as:

..... the physiology of tree growth in relation to stand treatment
..... nutrient distribution of a young Douglas-fir ecosystem.
..... nitrogen movement and urea-induced transformations in forest soils.
..... the role of soil fauna.
..... micro-organisms and their relationship to the ecosystem.
..... treatment responses of individual trees as a basis for prediction of growth and yield at managed stands in coastal B.C.

Several other researchers of the *Pacific Forest Research Centre* are associated with the program including insect and disease specialists and consultants in biometrics, meteorology, economics and land classification.

PROGRESS

To the end of 1972, forty-two 1/5 acre plots each with a 33-foot buffer zone were established on the Shawnigan Lake site. Treatments were applied to 18 plots in 1971 and an additional 18 plots in 1972. Application was in the form of urea at three levels: 0, 200, and 400 pounds nitrogen per acre. Four unthinned plots were treated with ammonium nitrate, two at the rate of 200 pounds nitrogen per acre, and two plots at 400 pounds nitrogen per acre. Two additional plots were thinned and treated with urea at the rate of 600 pounds nitrogen per acre.

According to project leader *Paul Brett,* the close involvement and cooperation between specialists on the site and in the laboratory has generated a tremendous exchange of ideas and information. In nutrient cycling-retention, redistribution, soil storage and environmental situations, the project team has identified and measured more than 45 factors. The resulting data is available to all researchers.

◀ *Shawnigan Lake site*

Mr. Brett said that a preliminary Douglas-fir tree growth model and a promising individual tree plot design have been developed. Both techniques are being tested on the Shawnigan Lake study area. If successful, the new systems will facilitate an early expansion and intensification of studies in cooperation with the *B.C. Forest Service* on other sites and age classes, imposing more levels of treatment, dealing with greater variety of fertilizers and thinning methods. The results of these studies will improve the biological base upon which the model is based thus enhancing its reliability.

Another example of progress being achieved is in tree physiology studies which indicate that only stands with leaf masses below optimum will benefit from fertilization. Rates of photosynthesis and respiration in these studies have been measured in relation to light intensity, and leaf water potential for trees receiving nitrogen treatment. Stand treatments such as irrigation and thinning, with or without fertilization, have further aided in explaining physiological aspects of nitrogen fertilization.

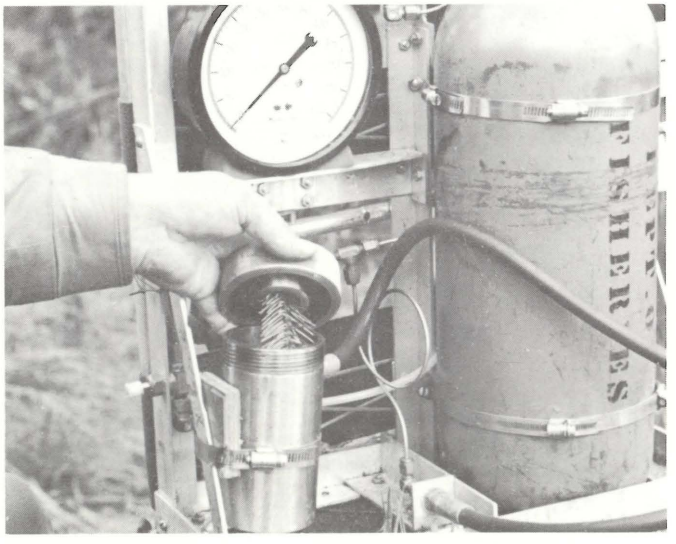
Mr. Brett admitted that the present program reflects a large concentration of effort in one place on field trials of limited design. However, this step is seen as a preparation phase or a 'launching pad' upon which it is necessary to construct a firm base before embarking on an adventurous but deliberate path through a maze of biological complexities.

He said the potential for meaningful results is good. The ecosystem in which an individual tree exists is not of unmanageable proportions. The resources and expertise required to study it and other individual tree-ecosystems intensively can be acquired and deployed without the extreme difficulties encountered in studying forest ecosystems.

Knowledge and experience gained from closely related studies at the Shawnigan Lake site with the development of sampling and predictive tools will lead to a better definition of future research needs and the increased probability that we can develop the technology to fulfill these needs and, ultimately, to the development of management prescriptions. ●

Single tree sampling methods and other techniques being developed during the Shawnigan Lake fertilizer-thinning studies were demonstrated to more than 100 representatives of industry and the B.C. Forest Service during recent tours. ▶

Tree physiology studies included the measurement of water stress in trees — an important factor in tree growth. ▼



Branch cutter

Fall surveys by the Forest Insect and Disease Survey group of the PFRC included use of a specially designed line gun technique to collect egg samples from infested stands. On the Coast, the blackheaded budworm was the major target as crews, assisted in most cases by forest company employees, made an egg count to forecast whether or not there will be a continuation of the epidemic next season.

The egg shoot involved the use of a blank cartridge to fire an aluminum missile over the desired branch. A nylon line is attached to the missile.

A branch cutter – designed by **Don Collis** and **John Harris** of the **PFRC** – is hauled up to the branch. Once the branch is in the V of the cutter, a tug on the line closes the blade, severing the branch which falls to the ground.

The technique was used successfully in gathering eggs from 120 sample points mostly on Vancouver Island.

SURVEY RESULTS

Surveys show that the **blackheaded budworm** has infested more than 410,000 acres of hemlock and amabilis fir stands on Vancouver Island.

Heavy defoliation occurred on over 60,000 acres, the most serious being in the Port Alice area where immature stands of western hemlock were almost completely defoliated. Forecasts for 1973 indicated that blackheaded budworm populations will decline south of the Alberni Inlet and increase on the north end of Vancouver Island.

ELSEWHERE

. . . . . the **western false hemlock looper** has defoliated Douglas-fir stands in the Salmon Arm area, around Shuswap Lake and along Shuswap River from Enderby to Mara Lake.

. . . . . the **real hemlock looper** caused serious defoliation of 600 acres of western hemlock near Coquitlam Lake.

EGG SHOOT

BLACK HEADED BUDWORM TARGET OF FIRED UP SURVEY RANGERS.

. . . . . **spruce budworm infestations** were moderate to severe in Douglas-fir stands in the Pemberton-Lillooet area, Hope-Fraser Canyon region, and the Hope-Sumallo area.

. . . . . heavy defoliation by the **tussock moth** in scattered stands of Douglas-fir from Salmon Arm to the international border. Most outbreaks were in the Kelowna-Winfield area. The largest near Osoyoos.

. . . . . the **spruce beetle** was quiet in all areas except Kamloops Forest District.

. . . . . the **mountain pine beetle** was found in abundance in lodgepole pine in the Okanagan area and in white pine in the upper reaches of the Shuswap River; numerous infestations in the Kitwanga and Hazelton areas; also active infestations in Nelson Forest District in lodgepole pine along Elk Creek and Kallis Creek and white pine around upper Arrow Lakes, Trout Lake and Erie Lake.

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Further details in BC-X-77 Annual Forest Insect and Disease Survey Reports by "Forest Districts". ●

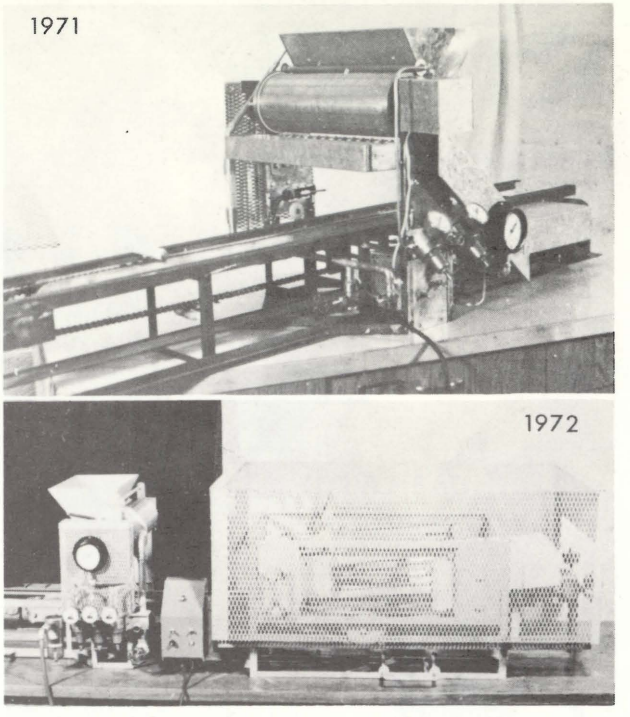
Missile being fired from line gun.

something new

A precision machine that can automatically sow tree seed in styroblock containers has been developed by Dr. E.O. Nyborg, Agricultural Engineer at U.B.C. under research and development contracts sponsored by the CANADIAN FORESTRY SERVICE. The machine is capable of rapid and precise seeding of several species of conifer seed and has been tested successfully in seeding 15 million containers at B.C. Forest Service nurseries during the last two years.

The B.C. Forest Service has ordered construction of production models for use in their nurseries.

The development of the seeder is a vital component in the use of containers in growing seedlings for the province's reforestation program. ●



Attractants for B.C. Beetles

(cont. from page 1)

spread widely the chemical signal in the forest so that beetles are confused and lose their ability to concentrate on a few trees;

bait trees around windfall patches or logging slash, sources of beetle brood to hold populations in those areas so the new adults will not disperse to remote and scattered spots;

survey levels or locations of pest populations;

attract beetles into trees treated with insecticides or other chemicals that kill the beetles or make the tree unsuitable for their broods;

to bait objects such as cylinders or plywood panels covered with sticky material or insecticide, to trap or kill attracted beetles.

Although the potential uses of bark beetle attractants offer promise, some early hopes for their effectiveness were overly-optimistic. The first attempt to identify such an attractant, from a species of **Ips** beetle in California, showed after a great deal of effort that the beetle produced three different chemicals, which had to be combined to be effective.... hardly a simple system.

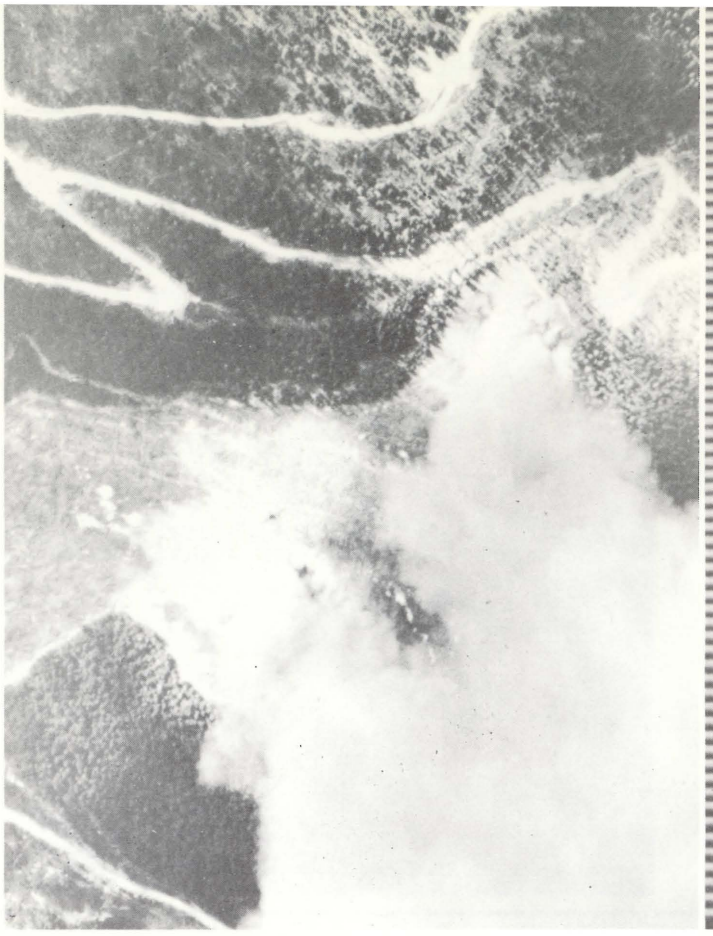
The biggest disappointment, according to Dr. Chapman, was the limited range of the attractants, which necessitates the setting up of bait centers at frequent intervals. The treatment or salvage of scattered baited trees, if they are killed by beetles, is time-consuming and expensive. Another problem with attractants is that natural beetle predators respond to baits and are affected by trapping or application of insecticides.

From **Ips** beetles, the entomologist-chemist teams shifted attention to a major group of tree-killers, aptly named by the Greek word "**Dendroctonus**". Several species of this insect have mauled North American forests badly, sometimes causing spectacular losses involving large areas of mature forests. Sometimes losses have been much less striking but, because of cumulative effects over many years, still serious. Synthetic attractants are now available for testing for the major British Columbia species of **Dendroctonus**, the spruce beetle, the mountain pine beetle (lodgepole and white pine) and the Douglas-fir beetle. Because mature forests are most susceptible to bark beetle damage and such forests of spruce are so extensive in British Columbia, a team of six entomologists and their support staff was formed in 1972 to intensively study this insect and to learn how forests can best be managed to avoid future losses.

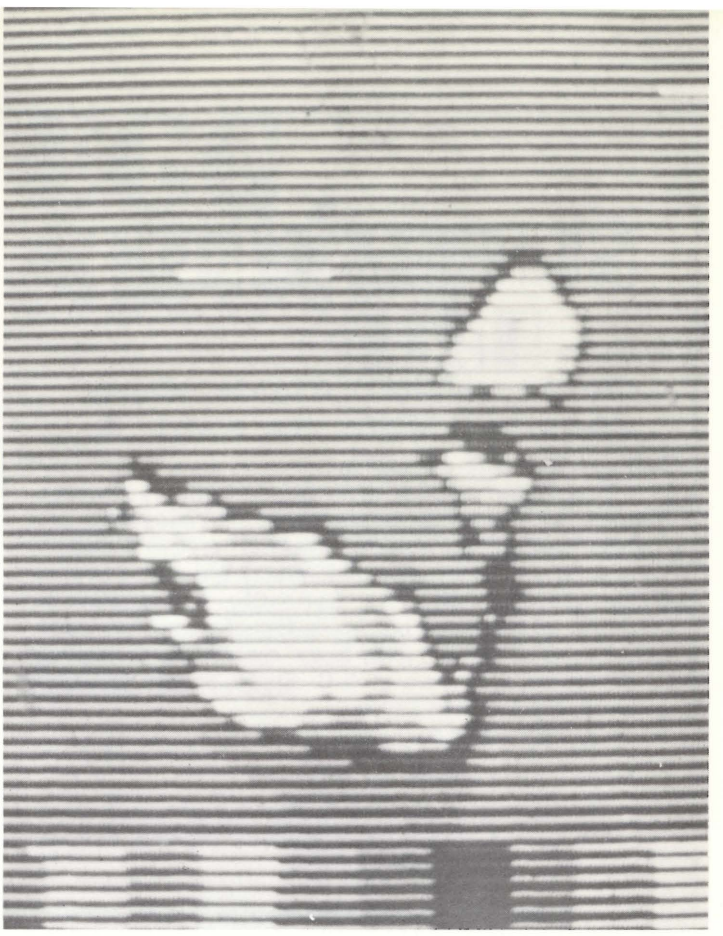
SCIENTISTS OF THE PFRC BELIEVE IT IS NOW POSSIBLE TO CONTROL THE LOCATION OF BEETLE ATTACK ..... two years' experience with a synthetic attractant for the spruce beetle involving tests in the Nelson, Kamloops and Prince George Districts, have shown that attacks can be directed at will to trees by baiting them with the chemical. Tests have included insecticide treatment of baited trees, and application of tree-killing agents to baited trees so beetle brood cannot develop normally. Also the chemical has been tested as a survey tool, to measure the numbers of beetles in a given area or for a given period. The attractant has proved useful as a research tool, permitting prior selection of trees for experimental beetle attacks and setting up equipment or apparatus needed to measure response of beetles and of trees to attack.

ANTI-ATTRACTANTS, that keep beetles from attacking trees or logs have been found for two species related to spruce beetle. Beetles may use these natural chemicals as a signal when there are sufficient insects on a tree so that new arrivals will attack an adjacent tree.

Without doubt, the arrival of bark beetle attractants has given research on these insects a big boost and offers promising possibilities for study and control of bark beetles. ●



(a) *Prescribed fire obscured by smoke from 4000' flying height.*



(b) *Infra-red image of same fire showing perimeter and levels of fire intensity.*

Infra-Red Fire Study

Remote sensing using infra-red imagery from an aircraft will be tested this summer by fire specialists of the PFRC. Studies will determine the effectiveness of the system to acquire data necessary to develop fire behavior guidelines for fire management and fire control.

The new approach has the advantage over conventional ground studies by being able to penetrate heavy smoke cover and monitor more fires in a shorter period with fewer personnel.

The imagery provides a relative fire intensity profile displaying 10 different temperature contours.

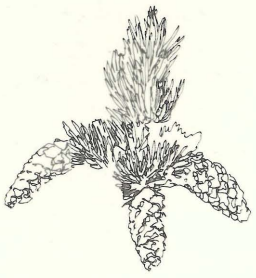
Results of the study will be used in conjunction with the **CFS Forest Fire Behavior System** used by the B.C. Forest Service and the industry. •

SPECIAL RESEARCH TEAM FORMED to tackle spruce beetle problem in B.C.

Six scientists will study means for forecasting outbreaks, and developing techniques for manipulating beetle populations in managed stands to reduce or avoid damage.

Group includes:

E.D.A. Dyer	— *Coordinator and studies on control.*
J.A. Chapman	— *Chemical attraction*
T.S. Sahota	— *Insect physiology*
L. Safranyik	— *Insect population dynamics*
H.S. Whitney	— *Associated fungi*
D.M. Shrimpton	— *Tree physiology*



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Cone Production Research

In his economic analysis, Mr. Vyse maintained that without successful research or abundant wild cone crops before 1981, the predicted seed shortages will cause reforestation delays. He said the four major potential contributions of cone production research on high elevation Douglas-fir are: maintaining low seed costs; avoiding seed shortages; facilitating direct seeding, and accelerating tree improvement benefits. The contributions could also apply to Douglas-fir in other zones, white spruce and other western conifers. The economic benefits expected from applying successful research are also outlined in the report.

Copies of BC-X-65 (94 pages) may be obtained from Information Services, PFRC, Victoria. ●

staff

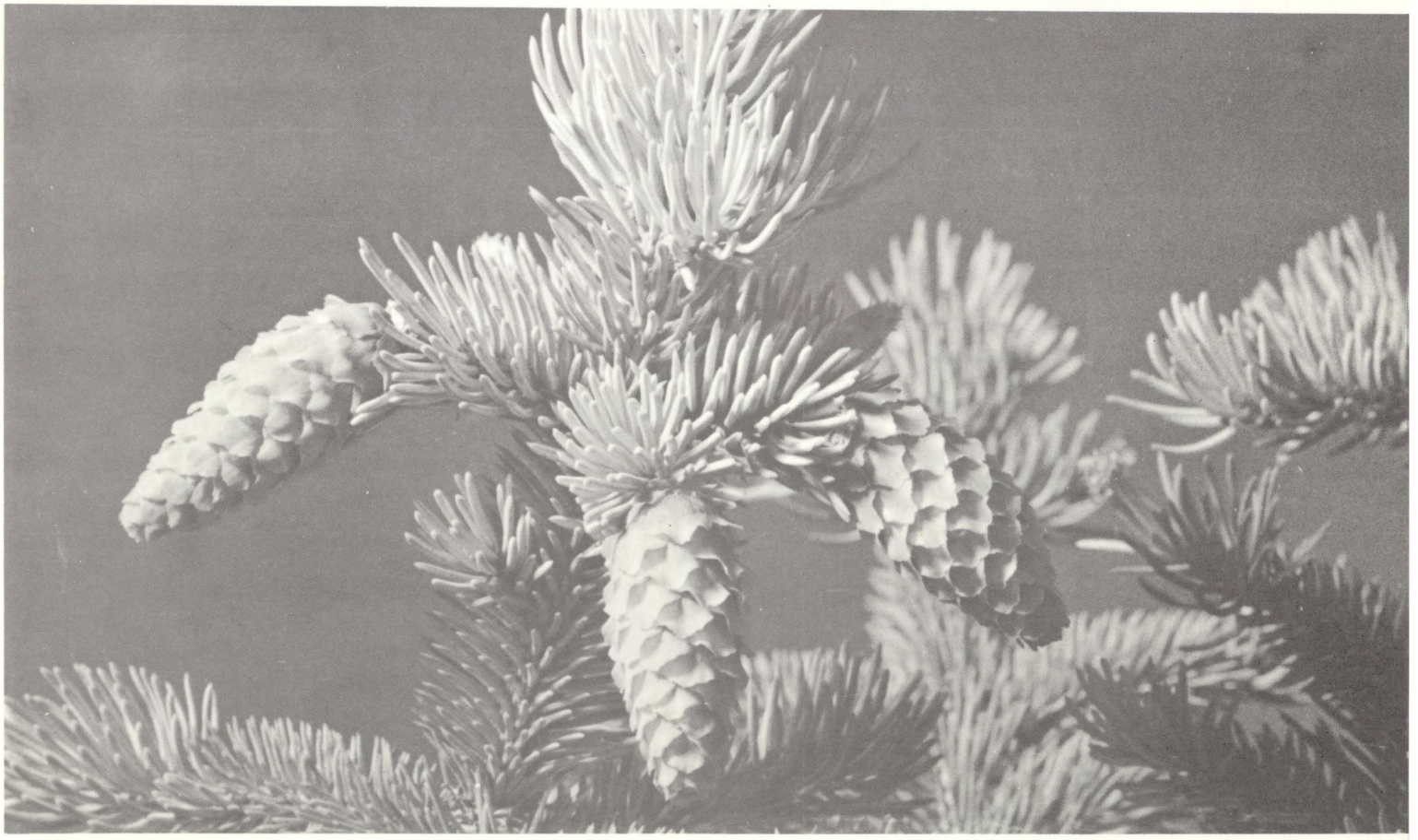
ECONOMIST

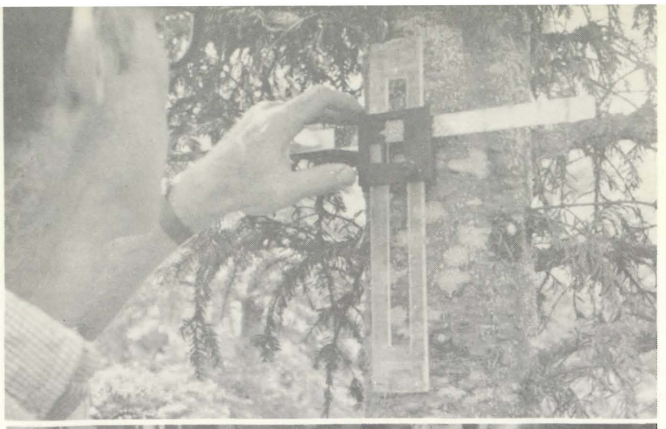
R.M.C. 'Mike' Massie is the new head of the Economics Unit at the **Pacific Forest Research Centre, Victoria.** He replaces George Nagle who left to join FAO in Rome. Dr. Massie was formerly a senior forest economist in charge of the resource analysis section at the Forest Economics Research Institute, Ottawa. In his new position, Dr. Massie will be responsible for planning and conducting economic studies in the resource field. He will work in contact with industry and the provincial Forest Service as well as provide an economic advisory service to researchers at the **Pacific Centre.**

COMPUTER HEAD

Jim Inkster, computer systems analyst at the PFRC since 1970, has been appointed head of the Biometrics Unit at the Pacific Centre.

The section provides a computing service in support of research projects involving simulation, statistical analysis, and data processing. Jim is a UBC graduate and has experience in computing at UBC and the University of Victoria. ●





New Developments

The arduous job of making accurate insect and egg counts on infested trees has been made more efficient and a great deal easier with new techniques developed by Rod Carrow and Roy Shepherd of the Pacific Forest Research Centre.

Dr. Carrow's apparatus allows rapid estimation of populations by visually comparing aphid populations on the study tree with photographs of known population levels.

The technique enables the researcher to make a count in approximately 5 minutes compared to up to 6 hours with a microscope. The system is being used in conjunction with studies to determine the effect of fertilizers on the balsam woolly aphid.

Dr. Shepherd's new egg poaching method has cut research time and doubled the samples researchers are able to study. During the fall blackheaded budworm appraisal, the poaching technique enabled investigators to count eggs on 1200 infested branch samples in only two weeks. In the past, three months were required to complete egg counts on only 500 branches.

An 18-inch branch sample is immersed in boiling water for 30 seconds. The budworm eggs poach and float free in the water. The water is then poured through a filter which traps the tiny eggs. The eggs are easily counted with the use of a microscope. ●

NEW PUBLICATIONS

BC-X-72 Dealing with recommendations for the Control of Dwarf Mistletoes in British Columbia — Baranyay & Smith.

BC-X-73 Forest Cover Anomalies in the Peace River District of B.C. — Oswald & Senyk.

Can. J. For. Res.

— R-55 Rodent Repellent: Effect on Germination in Douglas-fir and Western Hemlock — Edwards & Olsen.

— Lateral Root Pruning of Sitka Spruce and Western Hemlock Seedlings — Eis and Long.

— Cone and Seed Production of One-Year-Old Rooted Cuttings of Western Hemlock — Piesch.

New Forest Pest Leaflets

No. 44 — Dwarf Mistletoes in B.C.

No. 48 — Broom Rusts of Conifers in B.C.

No. 50 — Spruce Cone Rusts in B.C.

No. 51 — A Conifer Seedling Weevil in B.C.

No. 52 — Lophodermium Needle Cast of Pines in Nurseries and Plantations.

No. 53 — Corky Root Disease of Douglas-fir Nursery Seedlings.

No. 54 — Introduction to Forest Disease Problems.

No. 55 — True Heartrots of B.C.

No. 56 — Rhizina Root Rot of Conifers.

INFORMATION

Forestry Newsletter

This Information Forestry Newsletter is designed to keep you continuously informed on the work undertaken on your behalf by the staff of the Pacific Forest Research Centre, Canadian Forestry Service, Victoria, B.C.
Copies of all reports and publications mentioned in the Newsletter may be obtained by contacting the Information Service Office at the PFRC. ●

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