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INFORMATION FORESTRY

Pacific & Yukon Region

Twenty-one years after logging there is vibrant life in this regrown forest

Forestry Canada Forêts Canada

Canada

Life after logging

Today people are horrified by the scenes of clearcuts they see in the media. They are given the impression that forests will never again grow on that piece of land. ...They are not shown the area in the following years when a new forest has taken hold. Their conclusions are based on only part of the story.

The photographs on the front cover show the Adam River on northern Vancouver Island. The inset shows the site in 1971. The valley and adjacent mountainsides had just been clearcut and the slash had not yet been burned in preparation for replanting. The larger photograph shows the site as visitors see it today. The scars of logging have healed and a lush young forest stretches to the horizon.

Stave Lake, near Mission in the lower Fraser Valley mainland, is the location shown on the back cover. The inset shows a mountainside covered by burned and blackened slash. Forestry Canada forest technician Keith King was there. "This photograph was taken in 1970," says Keith. "I was part of our fire research team at the time and this was one of our test burns." The larger photograph shows the same mountainside twenty-two years later. A dense forest of Douglas-fir, interspersed with naturally regenerated Hemlock, blankets the slope.

Keith has seen numerous clearcuts and walked through countless second-growth and third-growth forests in all areas of the province in his thirty-two years as a forestry technician. He is disturbed by what he sees as a one-sided portrayal of logging in British Columbia. "Today people are horrified by the scenes of clearcuts they see in the media. They are given the impression that forests will never again grow on that piece of land and that clearcuts are, therefore, bad," he says. "They are not shown the area in the following years when a new forest has taken hold. Their conclusions are based on only part of the story."

To present the whole story, Keith developed "Life After Logging", a series of displays illustrating the regenerated forests of British Columbia. "It is a look beyond the clearcuts," says Keith.

"Life After Logging doesn't defend poor logging practices or deny that they have occurred," he continues. "We simply want to show the results of careful harvesting and reforestation that are the norm. The best way to do this is to let the forests speak for themselves." And they do so very eloquently.

If a picture is worth a thousand words - Life After Logging is a library. Each photograph is a volume. The Life After Logging displays feature scenes of second-growth and third-growth forests now growing on harvested sites. Wherever possible, pictures of the sites taken immediately after logging are contrasted with recent photographs of the same location.

Keith King in a second-growth B.C. forest that was logged and burned over in 1917

The striking 'before and after' scenes of logged sites plainly show that clearcuts are being regenerated. The images of young rainforests - green, mossy and rich in biodiversity - are not the neat, tidy rows of trees growing like corn in a farmer's field that many imagine all second-growth to be. Eighty-year-old trees nearing harvest are evidence that we will have a future source of wood. And third-growth forests are testimony that second-growth can also be renewed.

The displays have been shown at numerous forestry events around the province and have received international exposure. Some of the photographs were included in an information package given to Prince Philip when he visited B.C. in his role as international president of the World Wildlife Fund. The photographs have recently traveled to Europe and have appeared in a Dutch magazine.

Keith welcomes help in gathering photographs for the continuing Life After Logging series. "It's easy to find healthy second-growth and third-growth forests in this province. What's not easy is tracking down the 'before' pictures and learning the history of the site." If you have any old photographs of logging operations you'd like to share, please contact Keith at 363-0724 or write to him at Forestry Canada, 506 West Burnside Road, Victoria, B.C. V8Z 1M5.

Litter bags reveal data

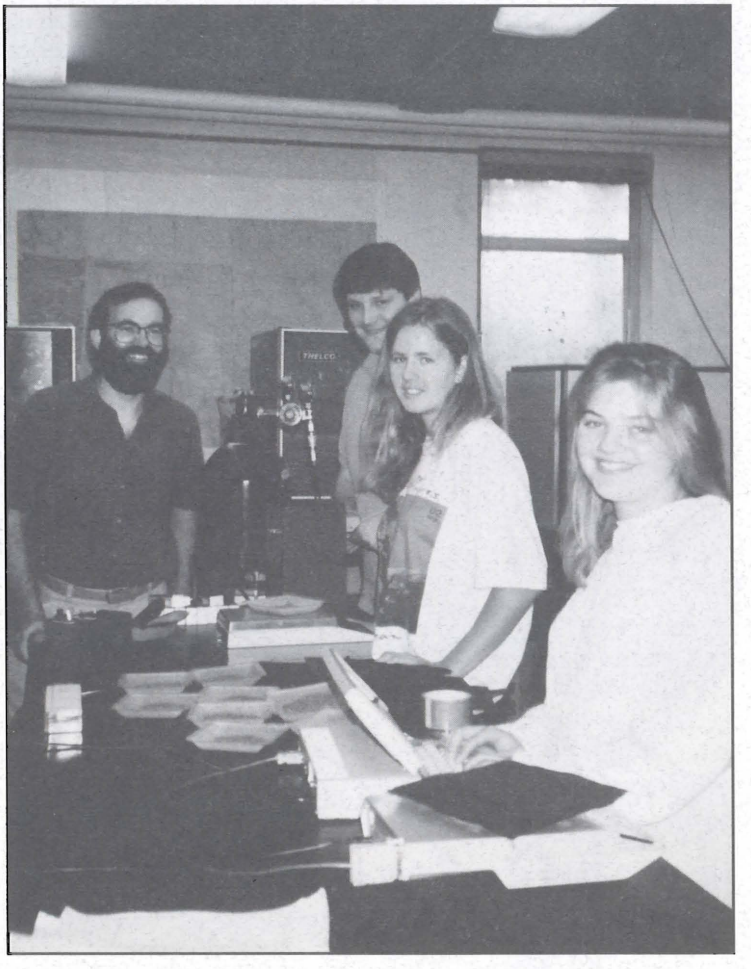
A great deal of carbon is stored in the foliar litter of the forest floor and gradually released into the atmosphere through decomposition.

Most people collect litter, bag it and dispose of it once and for all. Other people collect litter, bag it, place it back into the environment then spend the next ten years picking it up and unbagging it. Why in the world would anyone do such a thing? PFC scientist Tony Trofymow, head of the Canadian Intersite Decomposition Experiment (CIDET), explains why.

" CIDET is one of a series of research projects Forestry Canada has developed under the Green Plan to look at Climate Change and how it effects the sustainability of Canada's forests," says Trofymow. " The carbon cycle is a catalyst to climate change and litter is an important part of the carbon cycle."

A great deal of carbon is stored in the foliar litter of the forest floor and gradually released into the atmosphere through decomposition. The rate of decay is determined in part by the composition of the leaf, which varies among different species, as well as by moisture and temperature levels. Understanding the possible effects of projected changes in climate regimes and changes in ecoclimatic regions on this process is important to the sustainability of the present carbon budget of Canada's forests.

To gather the data necessary to understand the processes, the members of the CIDET project have installed plots consisting of bags containing samples of 10 different litter types over 21 sites representing a range of forested ecoclimatic regions. " We assembled a total of 11 000 litter bags, each containing 10 grams of litter, and sent them to 14 site cooperators for placement in the field, " says Trofymow. "That was quite an interesting task in itself." The samples first underwent chemical and NMR (Nuclear Magnetic Resonance Spectroscopy) analysis to determine their chemical constituents.



Forestry Canada's Tony Trofymow (l) with students Eric Anderson, Jennifer Kinnis and Stacey Dixon.

Each year for the next 10 years the samples will be examined to note changes in litter mass, carbon, as well as total nitrogen and phosphorous. Information on the mean temperature, degree days and total precipitation will be collected from nearby climate stations. Measurements on soils and microclimate will also be taken.

Trofymow says " Despite the importance of litter to the carbon cycle of the forests, our knowledge of litter decomposition is deficient. Some forest types have been extensively studied, while others have not. Long-term studies are rare; most are conducted only over a period of 2-3 years".

Scientists will use the experimental data to examine the role various types of litter and climate have on long-term decomposition rates and the relative importance of site factors and microclimate on decay rates. The information will also allow researchers to study the influence of site moisture regimes on decay rates and test specific hypotheses on the patterns of litter decay.

Spruce weevil – Enemy of reforestation

Because the pest attacks only young trees, it has an enormous impact on reforestation activities and jeopardizes our future wood supply.

The spruce weevil, *Pissodes strobi* (Peck), is responsible for the devastation of thousands of acres of young spruce plantations throughout coastal and interior British Columbia. Economic losses attributable to weevil attacks are estimated at between 50 and 500 million dollars per year. It is quite possibly the most serious pest of regenerated forests in British Columbia.

The pest is a native insect that breeds and feeds on the leaders of young, thriving spruce, depriving the leader of nutrients and causing it to die. When this occurs, lateral branches strive for dominance and begin to grow upward causing crooks and forks to form in the tree. Subsequent attacks can cause extreme deformity and render entire plantations worthless.

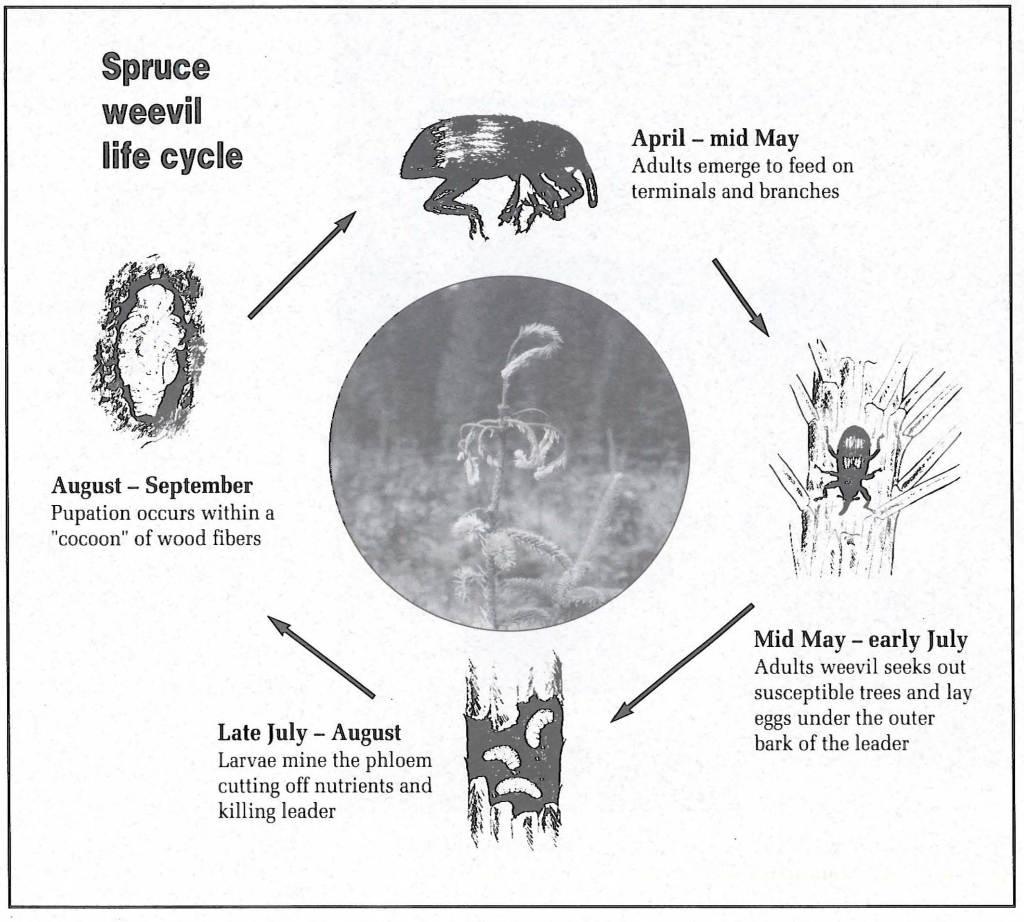
Because the pest attacks only young trees, it has an enormous impact on reforestation activities and jeopardizes our future wood supply. So great is the risk of spruce weevil attack in coastal British Columbia that Sitka spruce, one of the province's most highly-prized trees, has been excluded from use in most reforestation plans. Interior species of spruce are similarly threatened.

At Forestry Canada's Pacific Forestry Centre a research team is devoted to finding ways to reduce the level of damage inflicted by this rapacious pest.

The effect of weevils on stand dynamics and forest productivity is the focus of Dr. René Alfaro's research. He is currently developing an integrated pest management system to help decrease the economic losses resulting from weevil attacks.

Drs. Tara Sahota, Michael Hulme, John Manville and Eleanor White are exploring many avenues in their quest. These include searching for effective biological control methods using insect predators and parasites and investigating the natural resistance some spruce trees exhibit to weevil attack (see story page 5).

The researchers are probing the very essence of spruce trees and weevils to uncover clues that may lead to effective methods of control. Natural chemicals found in the needles and bark of spruce trees are providing information about the genetic make-up of that tree. These chemical profiles may one day help foresters identify trees that are better able to withstand weevil attack. DNA fingerprinting, similar to that used in crime solving, reveal differences in DNA that could be used to identify weevil populations. Similar analyses are used to identify and track genes involved in insect development related to reproduction.



Breaking the resistance barrier

By breeding resistant trees researchers and forest managers hope to produce a strain of stock that can be used in replanting to limit the incidence of weevil attack.

An exciting breakthrough recently achieved by PFC's spruce weevil research team will allow tree breeders to accurately predict which trees are resistant to the weevil and will eventually result in a practical method to control the pest's devastation of British Columbia's young spruce forests.

The breakthrough is the result of research conducted by Drs. Tara Sahota, John Manville, Michael Hulme, and Eleanor White. It arose from the observations that individual spruce trees resist weevil attack even when weevils are caged on them.

It has been observed that weevils consistently avoid some trees while other nearby trees suffer repeated and devastating attacks. This indicates that some trees are able to resist attack. Evidence also suggests this resistance can be inherited. By breeding resistant trees researchers and forest managers hope to produce a strain of stock that can be used in replanting to limit the incidence of weevil attack.

Up to now, however, there was no sure way to determine whether a tree was truly resistant or had merely escaped attack due to other circumstances. Tree breeding programs are time consuming and require extensive effort to determine if desired traits are passed on to progeny. Scientists were unable to explain resistance or accurately predict which trees would not be attacked. The team's discovery has at last provided a means to reliably identify resistant trees.

Researcher Tara Sahota whose 'hunch' led to breaking the resistance barrier.

" This may be one of the most important discoveries in this field in fifty years," says Dr. Sahota, whose 'hunch' led to the finding.

" I couldn't help but wonder, based on my knowledge of the biology of weevils and similar insects, if resistant trees somehow prevented the spruce weevil from entering its reproductive cycle," he says. "The presence of young, susceptible spruce is necessary to the weevil's breeding process. The attacks begin in the spring when the adult female seeks out the leader of a suitable tree. Only then do her ovaries mature and produce eggs. She bores holes in the leader and lays her eggs under the outer bark. The developing larvae mine the phloem, blocking nutrients and causing the leader to die (see illustration). If resistant trees interfere with any of these reproductive stages, damage cannot occur. This was consistent with what has been published. It also explained observations that were inconsistent with the previous concepts of resistance."

To test Dr. Sahota's theory, the researchers caged female weevils with immature ovaries on the leaders of trees that had shown resistance. In contrast with the normal expectations, no eggs were laid on the resistant leaders. Dissections of the weevils revealed their ovaries had failed to mature so no eggs were produced.

In a second test, the researchers caged mature female weevils containing a number of ripe eggs on the leaders of both resistant and susceptible trees. On the resistant trees, weevils were able to deposit only a few of their eggs. Dissection revealed that the remaining eggs had been resorbed into the female. Similar mature female weevils caged on susceptible trees were able to lay all their eggs. The eggs deposited on resistant trees failed to produce viable progeny and none of the infested leaders were killed. Eggs deposited on susceptible trees produced healthy offspring, killing the infested leaders.

" This is the first time cause and effect of resistance has ever been demonstrated for spruce and the weevil," says Dr. Sahota. "We have proved that resistant spruce protect themselves from weevil attacks by blocking the reproductive processes. We have shown this occurs in three different ways: resistant trees block ovarian maturation in adult weevils with mature ovaries; stop and reverse egg production in adult weevils with mature ovaries; and, when eggs are forcibly deposited, prevent the development of offspring."

" Amidst our excitement, it is pertinent to reflect that the development of our ideas has been aided by the work of many researchers before us, " adds Dr. Sahota. " Plantations established by the scientists with the provincial Ministry of Forests for field trials of resistant and susceptible stock provided us the opportunity to make the observations that gave us the insight necessary for our discovery."

Drs. Sahota, Manville, Hulme and White are continuing to investigate the complexities of spruce resistance to spruce weevil attack. They are confident the next three years will see significant advances in this promising field.

The buried treasure of Heal Lake

Tom Bown beside 12 000 year old logs at PFC.

The quality of preservation of the materials is remarkable. The logs at PFC look to have been sawn from live trees no more than a few short years ago.

Just beyond the entrance to the grounds of the Pacific Forestry Centre (PFC) stands a disc cut from an enormous Douglas-fir. The rings of this former rainforest giant contain the records of B.C.'s climate for each of its nearly 1000 years of life. In the shadow of the impressive disc lies a nondescript stack of logs. The average diameter of these logs measures a mere 30 cm, indicating perhaps only 100 or 200 years of growth. Yet the climate chronicle of their rings may take us back more than 12 000 years ago to the end of the last ice age.

The ancient trees were discovered recently when Victoria's municipal authorities began draining nearby Heal Lake to expand their present landfill capacity. Dr. Richard Hebda, head of botany at the Royal British Columbia Museum, on site to collect sediment samples for pollen analysis, noted an unusual abundance of well preserved remains of trees embedded in the peaty bottom of the lake. Dr. Hebda notified his colleagues at PFC and efforts began to salvage as much of the material as possible. PFC quickly agreed to provide storage for many of the recovered logs.

A band of ash, clearly visible in the near-black peat, provides a reliable means of dating the age of the logs. The layer of ash, which appears in many locations throughout B.C., is known to have come from the eruption of Mt. Mazama that led to the formation of Crater Lake, Oregon approximately 6 700 years ago. The logs stored at PFC were taken from both above and below the level of ash and span the years between modern times and the early post-glacial period of approximately 12 500 years ago. This is potentially one of the world's longest continuous tree ring records. FRDA II is providing funds for carbon-14 analysis and cross-dating of logs to provide the most accurate dating possible.

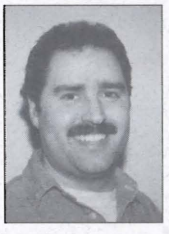
The quality of preservation of the materials is remarkable. The logs at PFC look to have been sawn from live trees no more than a few short years ago. PFC technician Tom Bown, on site during some of the excavation activities, was amazed by the finds. " As the peat crumbled away, fragments of insects, seeds and leaves appeared," says Tom. "Some slabs of bark were riddled with beetle galleries and other trees showed identifiable signs of damage from woodpeckers and other animals. What most impressed me was when we reached the fine layer of clay overlaying the glacial till we found lodgepole pine cones. Lots of them. These cones fell from trees that were actually growing just after the glaciers receded. Not only are they perfectly preserved but when exposed to room temperatures the cones open to show intact seeds."

The ancient ancestors of today's temperate rainforests are a treasury of information. This is an unparalleled opportunity to study a continuous series of tree rings from which Vancouver Island's post-glacial climates may be interpreted. Paleoenvironmental and paleoclimatic research of this kind will reveal how Vancouver Island's forests evolved or adapted in response to the many changes of climate believed to have occurred over this great length of time. Armed with this knowledge, we will have a better understanding of the implications of climate changes promised for the future. Based on the past, we may be able to predict future cooling and warming trends, the speed at which they may occur, and the impact on the forests of today.

People in Forestry Canada

We'd like to introduce you to the following new staff members of Forestry Canada: Pacific and Yukon Region.

Pal Boghal, Scientific Systems Associate, and **Davinder Manak**, Research Associate - Remote Sensing, have joined the Advanced Forest Technology Program. Pal has been involved in SAR remote sensing and image processing since 1985 as a contractor at the Canadian Centre for Remote Sensing. Davinder was also a contractor at the Canadian Centre for Remote Sensing. There, she was involved in remote sensing and GIS applications relating to global change and environment.



Forest Health Research Officer **Bill Riel** is assisting Dr. Terry Shore in the Insect Management Program to develop hazard and risk rating systems and management strategies for mountain pine beetle infestations. Prior to joining PFC, Bill was employed in the Growth and Yield Department of Canadian Pacific Forest Products.

Wink Sutton has joined us on a two year secondment to become our new Senior Policy Advisor, Industry, Trade and Economics. Wink was a scientist with the Forest Research Institute of New Zealand's Forest Service for twenty years, later joining Tasman Forestry Limited as Strategic Development Executive. Most recently he spent a year as a forest industry delegate to the Preparatory Meetings of UNCED (UN Conference on Environment and Development).

Model Forest Coordinator **Bryan Wallis** is responsible for the coordination and implementation of B.C.'s two Model Forests. Bryan has worked for British Columbia Forest Products and T.M. Thomson and Associates.

Rod Maides has joined the Communications and Extension Division as a Public Relations Officer. Rod comes to us from Ottawa, where he was most recently Press Secretary to Forestry Minister Frank Oberle.

Mark Messmer has joined our Forest Economics program as Economic Modeller. Mark worked with the Forest Industry Development Division of the Alberta government before joining Forestry Canada in 1990, first in the Maritime Region then in the Policy and Economics Directorate in Ottawa.

Site Productivity research scientist **Dr. Charles Bulmer** is the newest member of the Prince George Office. Chuck has taught in the Environmental Protection Technology Program at Kwantlen College and has worked as a company forester for the Buchanan Lumber Company in Alberta.

Reports and Publications

- **Forest Insect and Disease Conditions in Canada 1989,** compiled by B.H. Moody in cooperation with officers of Forestry Canada establishments. Published 1992. Provides quantitative and interpretive data on damage and depletion caused by forest pests in Canada during 1989. Compiled from regional FIDS surveys.

- **British Columbia's Forestry Sector**
  An overview of the importance of forestry to British Columbia containing the most recent data available from a number of sources, including Statistics Canada, the provincial government, and industry.

- **The yews and taxol: a bibliography (1970-1991).**
  A.K. Mitchell
  A bibliography of over 300 references covering more than two decades of research on the Taxus species. Also contains a list of Taxus species and varieties and an index of articles pertinent to the Pacific northwest and the taxol issue.
  BC-X-338

- **Recent developments in microscopical techniques for application in forest research.**
  Terry A. Holmes and Lesley E. Manning
  A review of microscopical techniques, including transmission and scanning electron microscopy, light and fluorescence microscopy, and immunocytochemistry. Examples from recent literature illustrate prospective forestry applications.
  BC-X-339

- **Forest Insect and Disease Conditions, British Columbia and Yukon-1992**
  C.S. Wood and G.A. Van Sickle
  This summary of forest pest conditions highlights pests that are, or may become, major forest management problems. It was compiled from field reports and other records of 11 Forest Insect and Disease Survey (FIDS) rangers, with contributions from the forest industry, researchers and agencies.
  BC-X-340

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Twenty-two years after logging this hillside is alive with a second-growth forest