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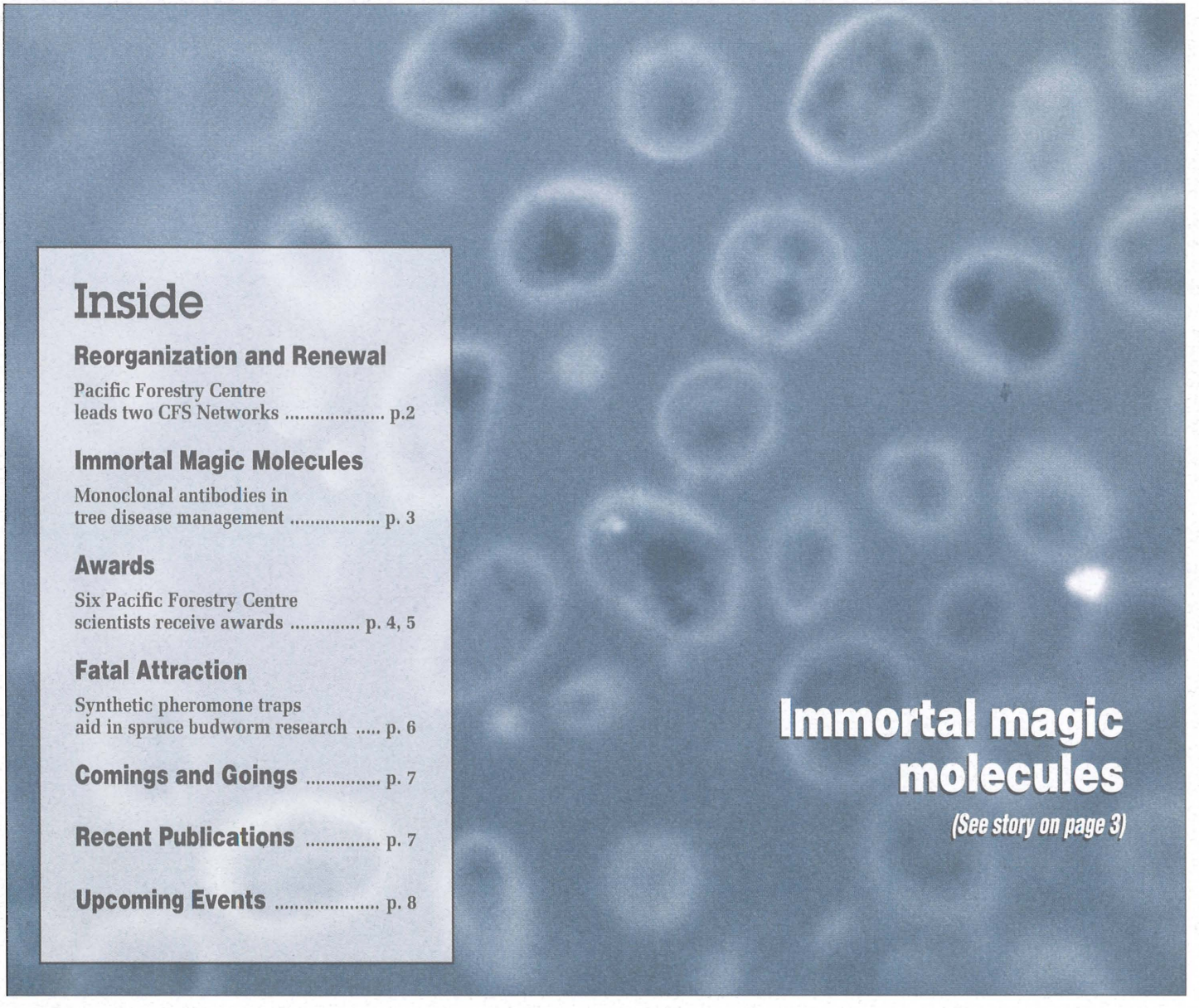
INFORMATION FORESTRY

Pacific Forestry Centre



Inside

Immortal magic molecules

(See story on page 3)

Natural Resources Canada
Canadian Forest Service

Ressources naturelles Canada
Service canadien des forêts

Canada

Re-organization and Renewal

"The purpose of the networks is to ensure complex forestry issues are addressed in the most comprehensive way possible..."

Renewal is a vital part of a healthy forest. And it's essential to a productive environment. The Pacific Forestry Centre has been experiencing the challenges of change through re-organization.

Over the past year, the Pacific Forestry Centre has been re-organizing its structure to accommodate the renewed mandate of the Department of Natural Resources: to focus on science and policy for the sustainable development and use of Canada's natural resources, while continuing to provide essential forestry research to the forest sector. Dr. Carl Winget, Director General of the Pacific Forestry Centre, explains: "Our role has been redefined to basically two goals: forest science and the application of forest science to forest policy. There's now more cohesiveness, more unity of purpose, less fragmentation."

An integral part of this change is the network structure established within The Canadian Forest Service. "The new network structure (provides) much more open access to forestry expertise that is physically located in other parts of Canada," said Dr. Winget, "and makes it much easier for us to apply those resources of expertise when and where they're needed."

The purpose of the networks is to ensure complex forestry issues are addressed in the most comprehensive way possible, maximizing expertise from across Canada and around the world. There are ten networks within the Canadian Forest Service, with The Pacific Forestry Centre as the lead for two: "Landscape Management" and "Effects of Forestry Practices".

Canadian Forest Service Science and Technology Networks

Network	Lead Centre
Tree Biotechnology and Advanced Genetics	Quebec
Climate Change	Edmonton
Fire Management	Edmonton
Forest Biodiversity	Fredericton
Forest Ecosystem Process	Sault Ste. Marie/Quebec
Forest Health	Fredericton
Effects of Forest Practices	Victoria
Landscape Management	Victoria
Pest Management Methods	Sault Ste. Marie
Socio-Economic Research	Edmonton

Landscape Management Network

MISSION STATEMENT: *To develop the scientific understanding and decision support tools to assist in decision making in the sustainable management of Canada's forests*

To ensure sustainable management, forestry decisions must be based on expert advice from a variety of sources within a complex web of landscape management information. National in scope, the Landscape Management Network will assist forest managers to make intelligent decisions by identifying the information required and developing the decision support tools needed to use it. The Landscape Management Network will also develop methods to monitor Canada's progress in the sustainable development of its forests.

"The concern is no longer just timber values," said Dr. Murray Strome, Manager of the Landscape Management Network. "One must consider the other values of the forest and question how they will be affected by forest management decisions."

Landscape management today means ecologically sound integration of silvicultural operations, pest management, wildlife, hydrology, and ecosystems and their dynamics. Also integral to landscape management are social issues such as recreation, aesthetics, land use conflicts, forest-based communities, and the concerns of First Nations.

"We must understand how the forest will be affected by various management options such as harvesting, silviculture treatments, pest management, fire management, and managing for other values," Strome explains. "We are asking, 'How is the Canadian forest landscape changing, what impact do these changes have on sustainable forest management, and what information do we need with respect to all forest values, to support sustainable management?' "

To answer these questions, the Landscape Management Network will integrate information from within the Canadian Forest Service, provincial governments, forest industries and others concerned with research and development of landscape management, both nationally and internationally. Advanced information technologies and new methods of environmental modeling will be used and results will be communicated to partners, information users, and policy makers.

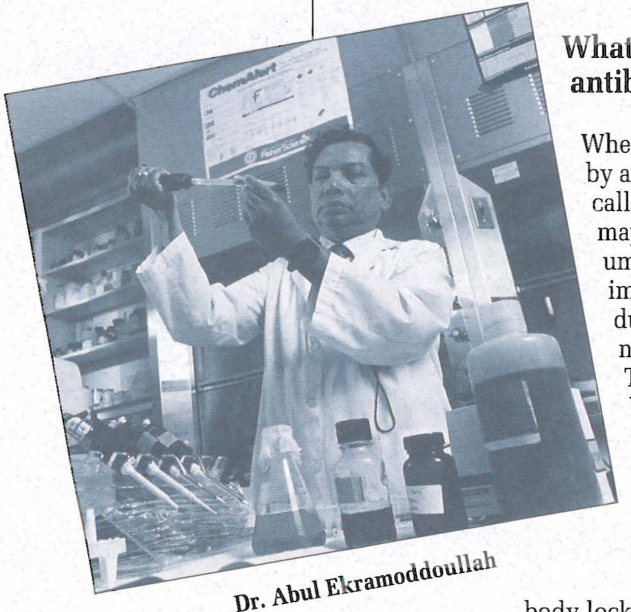
see "Reorganization" on page 8

Immortal Magic Molecules: Monoclonal Antibodies

"Eventually, with a monoclonal antibody specific to white pine blister rust fungus, Ekramoddoullah hopes to breed trees for resistance."

Molecules that not only have diagnostic capabilities likened to finding a beach ball in the middle of an ocean, but have the specificity of a guided missile. And they can be cloned and stored *indefinitely*. Such are monoclonal antibodies, or "immortal magic molecules" as aptly termed by Pacific Forestry Centre Research Scientist Abul Ekramoddoullah.

A major breakthrough in medical science, monoclonal antibodies are proving to have considerable impact in forestry research. They were used by the Pacific Forestry Centre in the mid 1980s for detecting the disease *Sirococcus strobilinus*. "In addition to applications in diagnostics, monoclonal antibodies are used to enhance our basic understanding of disease processes," said Dr. Ekramoddoullah. "They allow us to understand how a fungus develops in a tree, which of course aids in disease management."



Dr. Abul Ekramoddoullah

What are monoclonal antibodies?

When a body is invaded by a foreign substance called an antigen (which may be a virus, bacterium, or chemical), its immune system produces antibodies to neutralize the antigen. These antibodies are Y-shaped protein molecules that are produced by a type of white blood cell called a B-lymphocyte. The arms of the Y-shaped antibody lock onto an antigen - but this "key" fits only a specific "lock" or antigen. Antibodies react specifically to the antigens that induced their formation.

Monoclonal antibodies are produced by a clone of cells that are derived from the same mother cell and are therefore identical. So when the antigen stimulates the cell to create antibodies, it produces the same ones. Such exact replication is not possible in nature, but in the lab, limitless quantities of monoclonal antibodies are secreted by cells called hybridomas. ("Hybrid" because it is derived from two different types of cells, and "oma" because one is a tumor cell).

The process of producing these hybridomas is best understood in reference to cancer cells. When a mouse, for example, is immunized with an antigen, it will start producing antibodies. Cells from the spleen, a major organ of the immune system, are removed and fused with tumor cells. "The resulting hybrid cell will produce antibodies, like the immune spleen cells, and will grow indefinitely, like the tumor cells." explains Ekramoddoullah. "These hybrid cells are immortal, and are a source of unlimited amounts of antibodies." Hence the term "immortal magic molecules".

Hybridoma cells are extracted through a dilution technique and then cloned. Ekramoddoullah uses two immunochemical techniques for selecting clones that secrete antibodies of a desired specificity: enzyme-linked immunoassay (ELISA) and Western immunoblot. Both methods are a two step process: 1) Allowing antibodies to bind to antigens; and 2) Applying an enzyme-labeled "second" antibody which reacts when applied to a substrate. In the ELISA method, the reaction is in colour, allowing this "second" antibody to be quantitatively related to the amount of antibody involved in the first step of the process. With the Western immunoblot method, the enzyme-labeled "second" antibody appears as dark bands in the membrane. Both processes establish the specificity of a monoclonal antibody.

How do the "magic molecules" affect forestry research?

Dr. Ekramoddoullah has produced monoclonal antibodies specific to the white pine blister rust fungus. By studying the "magic molecules", he has been able to trace the path of the fungus from the time it enters the tree and throughout its development. Eventually, with a monoclonal antibody specific to white pine blister rust fungus, Ekramoddoullah hopes to breed trees for resistance.

Screening trees for susceptibility to white pine blister rust disease presently takes about seven years. Ekramoddoullah is developing tests to speed up that process. "By looking at the pine needle at a cellular level, one can determine the presence of fungal antigens to, in this case, the white pine blister rust fungus," explains Ekramoddoullah. "The amount of fungal mass will be greater in a susceptible tree than in a resistant tree." In this way, even with an

see "Monoclonal Antibodies" on page 8

Pacific Forestry Centre Secures

The Canadian Forest Service Merit Award Program recognizes an individual or team's exceptional performance over an extended period of time and the outstanding successful completion of a major project. Five of the Pacific Forestry Centre's group of eminent scientists were recipients for the 1995 Merit Awards.

Dr. Carl Winget, Director General of the Pacific Forestry Centre, presents Mr. Jim Arnott the Excellence in Partnership Award.

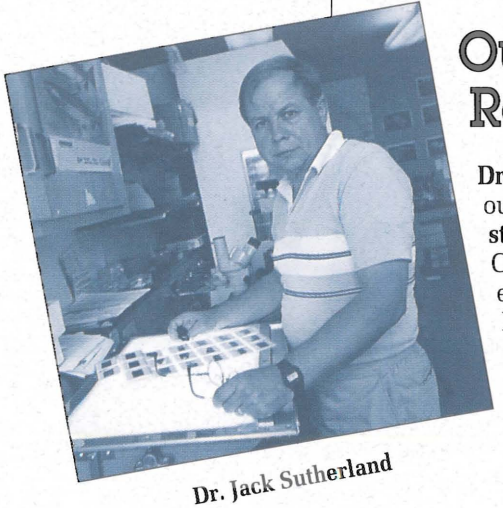
The **Excellence in Partnership Award** was presented to **Jim Arnott**, Senior Research Scientist, Silviculture, for his development of a multiagency partnership concerned with alternatives to clearcutting. Arnott's scientific and technical expertise, combined with his diplomacy, tenacity, and negotiating skills, lead to the establishment of MASS: Montane Alternative Silviculture Systems, a multiagency partnership (CFS, Macmillan Bloedel Ltd., Forest Engineering Research Institute of Canada, Industry Canada, the University of British Columbia, the University of Victoria, and B.C. Ministry of Forests) studying clearcutting alternatives in mid-to-high elevation old-growth forests of Vancouver Island.

"Basically, the MASS project is a study of four silvicultural treatments and their comparison to an unharvested, old-growth area," explains Mr. Arnott. "We believe, so far, that the most desirable silvicultural method for its biological and aesthetic value is the shelterwood system, where 30% of trees are retained. Viewed from a distance, the shelterwood area barely looks like its been logged. However, this system is 50% more expensive than harvesting a clearcut."

The MASS research and operations partnership has been held up as a model of new forestry practices regionally, nationally and internationally, and offers enormous social and economic benefits to Canada.

The **General Excellence Award** was granted to **Allan Van Sickle**, Research Scientist and Head of Forest Insect and Disease Survey (FIDS) at the Pacific Forestry Centre. The award acknowledged Dr. Van Sickle's contribution to reducing concerns among European trading partners about pinewood nematodes in Canadian

Dr. Allan Van Sickle receives the General Excellence Award from Dr. Carl Winget, Director General of the Pacific Forestry Centre.



Dr. Jack Sutherland

Outstanding Research Award

Dr. Jack Sutherland has been honoured with the prestigious **Outstanding Research Award** of the Canadian Phytopathological Society. A research scientist at the Pacific Forestry Centre, Dr. Sutherland is recognized world-wide as an authority on pest management systems for forest nurseries and tree seed production.

Dr. Sutherland creatively applied his interest in biology and ecology to the study of plant pathogens, resulting in the elimination of high impact diseases on seed and seedling production at minimal cost to the nursery industry. He used extraordinary vision and judgment in extending his research to the operational phase, persuading the forestry industry to implement his recommendations.

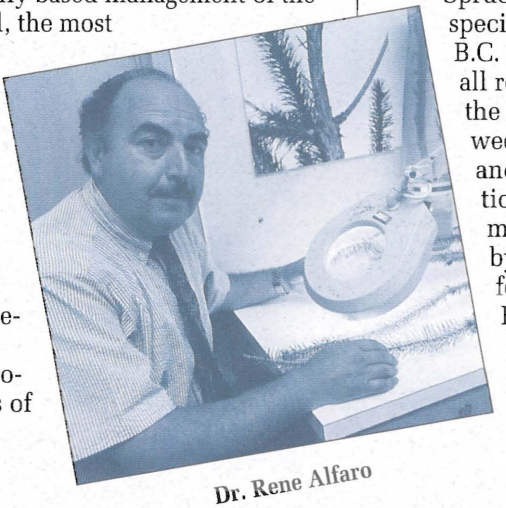
Having been in forest research for 31 years, Sutherland has seen quite a few changes. "There have certainly been some technological as well as biological changes," he said. "Logging

ıree Merit Awards for Excellence

exports. FIDS research determined that the parasitic worm is absent from western red cedar, rarely found in western hemlock, and not detected in samples from 50 mills in the Pacific and Yukon Region. Based on the scientific evidence, the European Union agreed to undertake a new, more detailed risk assessment of Canadian logs and lumber. The recognition of the high quality of Canadian forest products by Europe has obvious significant social and economic benefits to Canada.

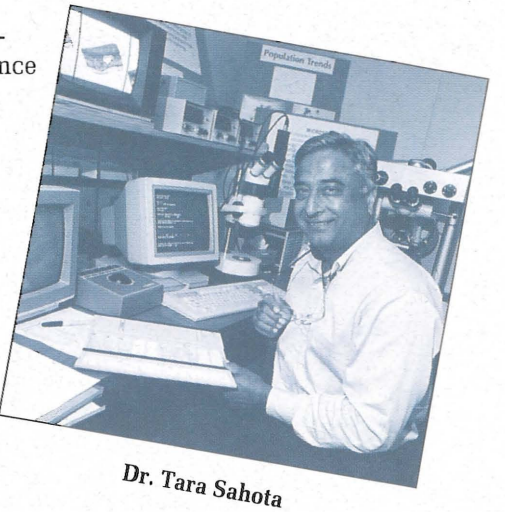
For a detailed description of Dr. Van Sickle and the FIDS team's research, please refer to page 6 in the August 1995 issue of Information Forestry.

The award for **Scientific Excellence** was given to a team of three Pacific Forestry Centre research scientists - **Rene Alfaro**, **Michael Hulme**, and **Tara Sahota** - for their development of ecologically based management of the white pine weevil, the most damaging pest of young spruce in northwestern North America.



Dr. Rene Alfaro

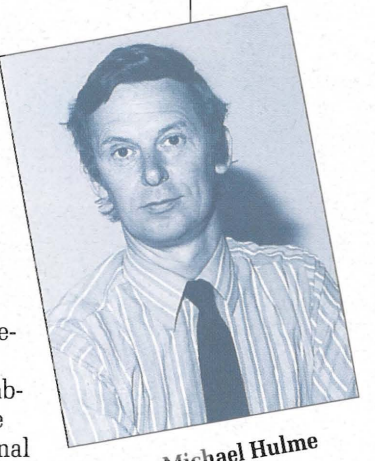
Dr. Sahota's primary contribution involves the development of a host resistance theory based on the effects of the reproductive processes of the weevil. Dr. Hulme demonstrated the effect and importance of host and pest phenology in host resistance. Dr. Alfaro's work includes characterizing host defences in terms of primary and induced resinosis, as well as work on dispersal and attack behaviour.



Dr. Tara Sahota

"Working with Simon Fraser University, the University of British Columbia, industry and the BC Ministry of Forests," Dr. Alfaro explains, "we developed an effective integrated management system for the weevil which utilizes resistant host genotypes in silvicultural weevil management."

Spruce is a valuable species for reforestation in B.C. and is found in nearly all regions of Canada and the U.S. But the white pine weevil causes leader death and serious growth formations which can reduce marketable wood volume by 30 to 40 percent. Therefore, the work of Alfaro, Hulme, Sahota and collaborators has considerable national and international significance.



Dr. Michael Hulme

is occurring at higher elevations than years ago, so now besides Douglas fir, spruce and pine, other species of seedlings are being grown. This has, of course, presented new challenges in forest research."

Few scientists have succeeded in combining scientific achievement, technology transfer, and international recognition. But Dr. Sutherland is in demand for lectures and courses throughout Europe and Asia and is an adjunct professor at the Southwest Forestry College in Kunming, China. He has published over 130 scientific papers, articles, book chapters, and major reports, and serves as associate editor for several scientific journals.

Dr. Sutherland will be retiring from the Canadian Forest Service on 31 March 1996, but he will remain active in the scientific community. "I will continue working in my field," he said, "but strictly as a consultant, rather than a research scientist." Although his work will continue to have a national as well as international scope, Jack Sutherland will remain in Victoria.

Fatal Attraction

"Traps were placed at over 152 locations across western and northern Canada and Alaska."

The male spruce budworm may think it's in for some *procreation*, but the scent of its mate may mean *termination*. Traps baited with synthetic pheromones have been attracting spruce budworm males, resulting in the discovery of four new species and the most extensive distribution study of the insect in Alberta, B.C., Yukon Territory, Northwest Territories and Alaska.

Although the use of synthetic pheromones is not new, researchers at the Pacific Forestry Centre (in cooperation with the Canadian Forest Service in Alberta and the U.S. Forest Service in Alaska) have been using sticky traps baited with lures containing pheromone to identify spruce budworm species and determine their distribution. Traditionally, budworms were detected and monitored by forest rangers, who identified the insect mainly by its host. But Tom Gray, forest entomologist at the Pacific Forestry Centre, has found pheromone traps to be more accurate and cost-effective than previously used methods.

Synthetic pheromone traps aid in spruce budworm research.

"Morphological differences using colour, shape, and size of spruce budworm species are difficult to determine visually," explains Gray. "Pheromone traps have greatly assisted in the separation of species, as pheromones are species specific."

Traps were placed at over 152 locations across western and northern Canada and Alaska. At each site, ten traps made of new 2-liter milk cartons were hung on branches 1.5 to 2 metres above the ground. Five of the traps were baited with an aldehyde lure and five with an acetate lure. The separation between species was determined according to which pheromone component they were attracted to. These traps remained on the host tree for the entire flight period, creating 334 sets of data specific to year and location. Four new species were discovered, making a total of eleven in B.C. alone (which is more than twice the number found in eastern Canada).

The distribution of some species was found to be more extensive than previously realized, sometimes hundreds of kilometers greater than the recorded range. This knowledge is important should an outbreak of one of the spruce budworm species occur. The value of the host tree species can be determined and if necessary, control measures can be implemented to protect the resource.

"Between 1910 and 1920 there was an outbreak of spruce budworm in eastern Canada," Gray said. "It destroyed 200 million cords of wood, which is roughly enough to heat 60 million houses for one year. Should an infestation like that occur in B.C., we will be prepared to manage the problem through biological, rather than chemical means."

Pheromone traps indicated a population increase of spruce budworms in 1993, suggesting that outbreaks may occur in the near future. As a defoliator of both coniferous and deciduous trees, budworms destroy the production of the tree's nutrients by eating the leaves. Chemical means to combat infestation sometimes can affect other insects, parasites and non-target organisms such as birds, fish and animals. But the use of pheromones for control may be a safe alternative.

Past work with synthetic pheromones at the Pacific Forestry Centre (Information Forestry, February 1995) proved to be 100% successful in preventing Douglas-fir tussock moths from mating. The method used involved saturating an area with synthetic pheromone in 0.25-mm-diameter plastic spheres to confuse male moths and prevent mating. Similar methods could be used to manage a spruce budworm outbreak. The small plastic balls containing the synthetic pheromone could be sprayed onto the host's leaves to effectively target and suppress specific species without harming the environment.

In 1995 experimental tests to control moderate spruce budworm infestations near Merritt, B.C. were conducted using the mating disruption method. Preliminary analysis of the results look promising and additional tests are currently being planned for the 1996 field season.

Whether used for behaviour and distribution studies, or to alleviate an outbreak of spruce budworm, synthetic pheromones contribute greatly to the safe protection of tomorrow's forest resources.

Staff Comings and Goings

Dr. Michael Bonnor, Head, Timber Production Research Program, has worked internationally on the establishment and maintenance of forest growth and measurement. He is retiring from the PFC but plans to continue work as a forest growth consultant.

Graphic Artist **Dan Dunaway** is leaving PFC to apply his talents to his own writing and graphic design business and plans to establish a new environmental publication.

Andrea Eastham is leaving her position in Prince George as Forestry Officer, Stock Production and Regeneration to work for a private forestry service as a regeneration and research specialist.

Dr. George Edwards is leaving his position as Research Scientist in Silviculture after 28 years at the PFC. Recognized internationally in the forestry field, George is a specialist in tree seed biology and technology, and has a strong background in silviculture and forest ecology. He will continue work in tree seed problems as a contractor.

Silviculture/Growth & Yield Forestry Officer **Craig Farnden** has been assisting with solving silviculture problems unique to Northern British Columbia. He will be leaving the Prince George Office to work as a private consultant in silviculture planning.

As Program Head, Fire Management Program, **Bruce Lawson** has been concerned with wildfire suppression and the reduction of emissions and impacts of smoke from prescribed fires. Bruce will apply his 30 years of experience to work as a consultant in fire prediction modeling.

Dr. Doug Pollard is retiring after 29 years as a Research Scientist in Ecosystem Dynamics, studying climate change and the effects of old growth harvesting on coastal forests and how they develop in sequential stages of second growth. He will continue work in his field as a private consultant.

As Seed Service Officer, **Frank Portlock** has provided certification services to the forest tree seed export industry in B.C. and Yukon Territory. After 29 years of service, Frank is retiring to work as a contractor in forestry seed certification.

Alan Stewart, Ranger, Forest Insect and Disease Survey (FIDS), has been responsible for the detection, assessment and reporting of forest insect and disease conditions. Al is moving to the Nelson Forest Region to pursue work as a forest health consultant.

Secretary/Receptionist **Marion Suel** is leaving the Prince George office after nine years of service. She will be pursuing other areas of employment.

Research Scientist **Dr. Jack Sutherland** is leaving the Pacific Forestry Centre after 32 years of service. His work and future plans are featured in the "Awards" story of this issue.

The Pacific Forestry Centre welcomes Research Scientist **Dr. Francois Gougeon** and Research Officer **Susan Yatabe**. Both have moved from Petawawa to work in the Landscape Management section of the Forest Systems Division.

Recent Publications

Forest Insect and Disease Conditions, B.C. and Yukon
BC-X-358
by N. Humphreys and G.A. Van Sickle

This summary of forest pest conditions in British Columbia and Yukon Territory in 1995 highlights pests that are or may become major forest management problems. It was compiled from field reports and other records of nine Forest Insect and Disease Survey rangers with contributions from the forest industry, researchers, and other agencies. The status and impact of 33 major pests are described and some forecasts are made for 1996.

Recent Publications - 1995
BC-X-357

A listing of 1995 reports and publications authored by staff of the Pacific Forestry Centre. Includes the topics: biological control; biology and immunology; ecology; entomology; environment; fire; forest insect and disease survey; industry; trade and economics; inventory; growth and yield; pathology; remote sensing and mensuration; silviculture; soils; and vegetation management.

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Upcoming Events

Sustaining Ecosystems and People in Temperate and Boreal Forests

An International Conference on Integrating Conservation of Biological Diversity with Social and Economic Goals

September 8 - 13, 1996
Victoria, British Columbia, Canada

This conference will explore practical ways of integrating biological diversity with economic and social systems. Uniting people from a broad range of forestry interests and expertise, the conference will emphasize constructive long-term solutions to ensure biological diversity and the human communities they support.

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"Reorganization" continued from page 2

Effects of Forestry Practices Network

MISSION STATEMENT: *To assess and develop forestry practices for use in the sustainable development of the Canadian Forests*

By developing sound forest management techniques and methods of communicating them, the Effects of Forest Practices Network will ensure that the best possible forest practices are being utilized so that the future of Canada's forests is not jeopardized.

"We must always consider the environmental, economic, and social costs," explained Dr. Paul Addison, Manager of the Effects of Forestry Practices Network. "Canada's forestry practices must be both environmentally and socially sensitive while still being competitive at the international level."

The Effects of Forestry Practices Network asks:
1. What are the effects of current forestry practices on forest ecosystem productivity and site quality, biodiversity, and water, air and soil quality?
2. How should current forestry practices be altered to meet environmental, economic and social goals?
3. How well are Canada's forestry practices meeting the goal of sustainable forest management?

In addressing these concerns, the Effects of Forestry Practices Network plans on combining expertise from across the country, within the Canadian Forest Service and other federal government departments, as well as provincial governments, universities, industry, and private organizations. The Effects of Forestry Practices Network will develop a registry and create a mechanism for communicating the overwhelming amount of expertise available, both nationally and internationally, to land managers and other information users.

"There are 426 million hectares of land in Canada, with about 165-220 million hectares of productive forest. It is a challenge to deal with an area that large, spread across several vastly different ecozones," explained Addison. "There are no blanket solutions to problems in forestry practices. Every area within each ecozone must be considered separately when making forestry decisions to ensure sustainability. What's an ideal forestry practice in one area of an ecozone may be the worst practice in another area."

Along with the nine other Canadian Forest Service Networks, the Effects of Forestry Practices Network will ensure that Canada manages its 10% of the world's forests responsibly, securing their social, economic and environmental value for future generations.

"Monoclonal Antibodies" continued from page 3

absence of symptoms, one could determine whether a tree was susceptible to the disease.

Besides being a diagnostic tool, Ekramoddoullah hopes to apply monoclonal antibodies to the breeding of resistant trees. "We are asking, 'Can we put the antibody gene into the tree in such a way that the tree will start producing this antibody in their foliage to maybe not kill, but at least deter the fungus?' If we can show that it is possible with the white pine, then it will pave the way for the development of a similar technology in managing root-rot diseases." Dr. Ekramoddoullah's work with monoclonal antibodies affects not only three important North American species (the western and eastern white pine, and the sugar pine), but development could apply to other trees as well. Forest research in monoclonal antibodies has the potential to become a major factor in tree disease management.