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INFORMATION FORESTRY

Pacific & Yukon Region

Meddling with Mating

(See story on page 3)

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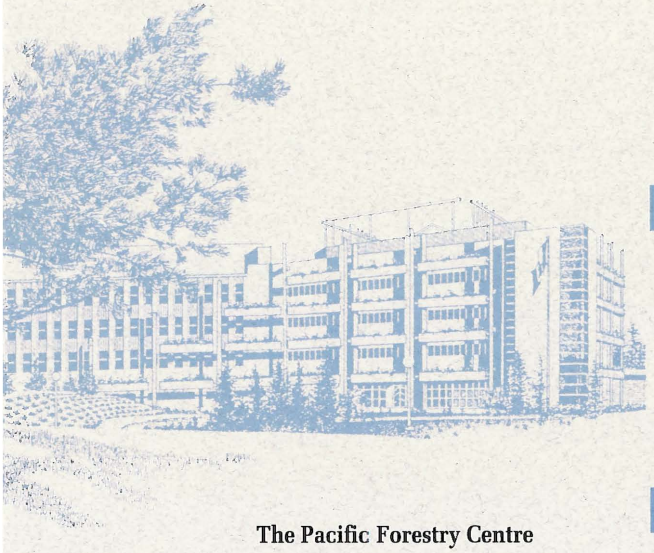

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front cover: foreground
male Douglas-fir tussock moth (L) locates his wingless female mate (R) through pheromones.
background:
Douglas-fir denuded by moth larvae

back cover: the larvae of the Douglas-fir tussock moth voraciously feed on the foliage of Douglas-fir and other conifers

Activities and Goals of the Canadian Forest Service in the Pacific and Yukon region

Forest Protection Research

To help protect the forests of British Columbia from insects, disease, and wildfire.

Integrated Disease Management
Integrated Insect Management ..... *see page 3*
Fire Management

Sustainable Forestry Research

To develop technical solutions and build knowledge of sustainable forestry.

Forest Ecosystem Dynamics ..... *see page 4*
Silvicultural Systems ..... *see page 5*
Timber Production

Applied Programs

To conduct surveys and deliver applied programs.

Forest Insect & Disease Survey

Northern Centre for Applied Research ..... *see page 6*

In Search of Hi-Tech Solutions

To supply British Columbia forestry with emerging hi-tech, new science solutions.

Advanced Forest Technologies
Biocontrol of Forest Weeds

Forest Development

To manage targeted federal forestry programs on sustainable and small scale areas.

FRDA II
Tree Plan Canada
Model Forests ..... *see page 6*
South Moresby Forest Account
Canada-Yukon Forestry Agreement ..... *see page 6*

Industry

To enhance industry, government, and public understanding of forestry opportunities, and increase the global competitiveness of Canada's forest industry.

Canadian scientific first curbs moth populations

"Tussock moths are so sensitive to the pheremone that only small amounts of the substance are needed

Two Canadian Forest Service (CFS) researchers, Dr. Michael Hulme and Mr. Tom Gray, have accomplished a Canadian scientific first in the forests near Keremeos, B.C. Douglas-fir tussock moths in that region, however, can be forgiven for not celebrating this achievement.

In 1992 Hulme and Gray successfully used sex pheromones to block mating of the moths, voracious defoliators of Douglas-fir trees. Best described as a kind of powerful insect perfume, sex pheromones are chemicals released by wingless female moths to attract males for mating.

Knowing that male tussock moths depend on these substances to locate a mate, Hulme designed an experiment to take advantage of the idea that the presence of too much pheromone would be just as disorienting to male moths as a complete lack of it. The tussock moth pheromone was synthesized and distributed in such a way that male moths smelled females everywhere. Unable to orient to the female pheromone because it was masked by the synthetic chemical, the males failed to locate mates and were unable to reproduce.

Dr. Michael Hulme

Scientists have only known about the existence of insect pheromones for about 30 years, and so pheromone technology is still developing. However, the synthetics are already widely used as lures in insect traps. The often contemplated idea that an abundance of pheromones could be used to confuse and control insect mating was first demonstrated in a U.S. experiment to control another moth species. The work of Dr. Hulme and Mr. Gray represents the first time in Canada that any forest insect pest has been completely suppressed in this manner.

According to Hulme, the pheromone procedure has some real ecological benefits over other forms of insect control. "Unlike insecticides," he explains, "pheromones do not directly kill the insect. This method only confuses the adult males so that they find it difficult to locate a mate."

Another advantage of pheromone technology is that each pheromone is species specific. Most humans and other organisms can't even smell the particular tussock moth pheromone. "In fact," says Hulme, "tussock moths are so sensitive to the pheromone that only tiny amounts of the substance are needed. We measure it in units called nanograms, which means we are working with amounts that are one billionth the size of a gram."

The application for controlling the tussock moth also appears to be versatile. After the pheromone was synthesized, it was impregnated into plastic beads that can be sprayed from either the air or ground. By testing these two different application techniques, Hulme and Gray were able to show that the method was as effective for a small woodlot owner with basic equipment as it would be for someone using a plane or helicopter.

Hulme and Gray monitored the success of their study by hanging traps baited with either synthetic pheromones or unmated females at different locations within the study area. They checked the traps on a regular basis to count the number of male moths caught. After a period of seven weeks, they collected 903 males from traps in the untreated areas baited with unmated females. In contrast, they found only 3 moths in the areas treated by ground spraying and not one moth in the aerially sprayed areas.

Now that he and Gray know the technique works, Hulme says their next project is to refine the method and establish the minimum dosage level for the pheromone through more trials. The technique promises to be an effective tool in balancing our need to curb insect damage in the forest with our responsibility to maintain biodiversity in ecosystems.

Forests receive wintery nitrogen-boost

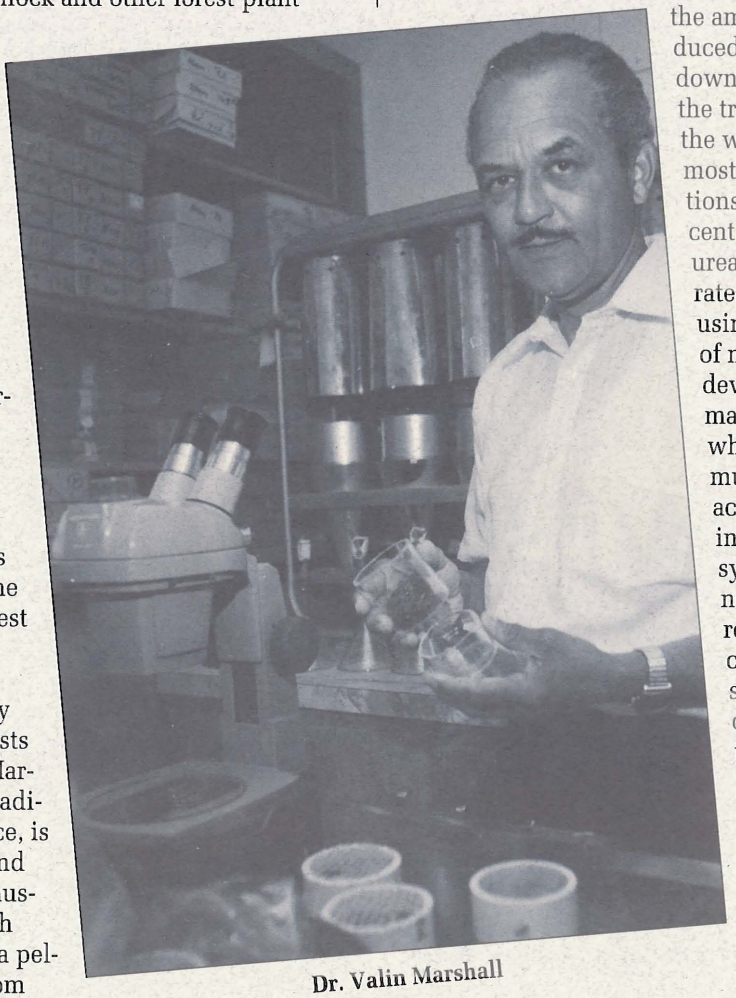
"It's just one more forest management tool with real benefits to those who tend the province's forests

Ten thousand years ago, glaciers pushed most of the nitrogen-rich soil in western Canada southward to what are now the states of Wisconsin to the east, and central Oregon to the west, leaving only a thin layer of nitrogen-depleted soil behind. Then, approximately 30 years ago, foresters began fertilizing the forests to replace some of that migratory nitrogen to accelerate reforestation. We now routinely release fertilizer over lodgepole pine, Douglas-fir, western hemlock and other forest plant species via fixed-winged aircraft. And it's worked. Fertilized trees grow faster and usually recover from some pest damage more quickly than those that haven't been fertilized.

Another important discovery made along the way is that the best time to fertilize a forest is between November and March. This, say research scientists like Dr. Valin Marshall of the Canadian Forest Service, is when the soil and air are moist, causing nitrogen-rich ammonium urea pellets dropped from above to enter the root systems of trees instead of evaporating. But this optimum fertilizing season is also snow season in most of B.C. - a previously unknown factor in determining the effectiveness of fertilization. Researchers knew urea pellets would melt through the snow, but didn't know whether trees would still benefit.

"We started off with three component studies," explains Dr. Marshall, "asking how urea behaves under cold conditions, what transformation happens with the nitrogen, and whether the trees pick it up as well in the winter as they do in the fall and spring."

Working from more than a dozen sites around the province, Dr. Marshall and his colleagues came up with some answers. They discovered that enzymes in the soil convert urea pellets into ammonium very quickly in near-zero degree weather.



Dr. Valin Marshall

But how much of the ammonium produced by the breakdown of urea gets into the tree? Even under the wettest, seemingly most-favorable conditions, 10 to 20 percent of ammonium in urea pellets evaporates. However, using a heavy form of nitrogen and devices like the mass spectrometer which detects how much nitrogen is actually getting into the tree root systems, stems and needles, the researchers discovered that on snow, less than one percent of the ammonium escapes into the air.

The other evidence to support the effectiveness of fertilizing on snow, says Dr. Marshall, is in the trees themselves. Branches are longer, needles are greener, and timber volumes are higher in snowpack areas where trees have been fertilized than in snowpack areas that have not been fertilized.

"In some instances, fertilizer on snow worked even better than on bare ground," Marshall points out. "It's just one more forest management tool with real benefits to those who tend the province's forests."

A montane beauty crosses the border

"Even in the most severe conditions, noble fir fared no worse than the species native to those locations

Noble fir seems to be a silviculturist's dream tree. Stately and beautiful, it is relatively resistant to insects and diseases and produces strong wood at a higher volume than most other native conifers. What's more, with noble fir's love of wet, high-elevation slopes and its amicable relationship with the species found in hemlock ecosystems, it should be a natural part of British Columbia's southern coastal forests. Yet it is not.

Its natural spread confined to an area stretching along the Cascade mountains from southern Oregon to Steven's Pass in Washington State, noble fir has not yet reached the Canada-U.S. border. Some Canadian foresters and researchers, though, find its close proximity too significant to ignore, especially when it comes to reforesting B.C.'s montane forests.

An increasing amount of our timber harvest comes from these montane sites, found between 600 and 1200 metres above sea level. To ensure successful regeneration in these locations, it is imperative that we develop a wide range of silviculture techniques and know which tree species are best suited to each variation of this severe climatic environment. According to several recent B.C. studies, noble fir could become one more viable species option for coastal montane forests.

Forestry technician Kevin McCullough measures a 10-year-old, 2.5 metre Noble fir growing near Port Renfrew, B.C.

Jim Arnott, a Canadian Forest Service researcher, is one of several who believe that noble fir could have a place on B.C.'s forested slopes. In the years from 1978-1980, Arnott and Frank Pendl, a B.C. Ministry of Forests researcher, planted a series of species trials on twelve different sites. The sites are located in two different biogeoclimatic zones, and range in altitude and latitude.

At each site, they planted noble fir and native tree species. After thirteen years of annually recording growth and damage to all of the trees, Arnott and Pendl discovered that, even in the most severe conditions, noble fir fared no worse than the species native to those locations. So far, the tree has shown excellent growth and form, and has grown much faster than the native high-altitude champion, amabilis fir.

Arnott is quick to add that no definite recommendations for noble fir can be made from this trial since only fourteen years have passed. "The jury will be out until at least the year 2000," he says. "You have to be very cautious when introducing species that are not native to a particular ecosystem."

However, Arnott and Pendl's study, as well as trials conducted by B.C. Ministry of Forest researchers C.C. Ying and C.Y. Xie, lend evidence to the idea that the absence of noble fir above the 48th parallel may have more to do with the reproductive characteristics of the tree, rather than an unsuitability to more northerly coastal ecosystems.

Researchers think that several traits contributed to noble fir's lack of natural geographic spread. The tree's seeds are heavy and therefore don't disperse for great distances. Like other true fir trees, the seeds which noble fir does produce tend to have poor germination rates. What's more, the species is shade intolerant, meaning that while noble fir thrives on open sites, like clearcuts and burns, the tree grows poorly in shady, established forests.

Noble fir is already recommended in the B.C. planting guidelines for introduction as a minor species in certain, very specific conditions, and it has been planted here commercially. In the 1992-93, for instance, 39,000 noble fir seedlings were planted in B.C. While this number may seem large, when compared to the over five million western hemlock seedlings planted in that same period alone, it becomes quite evident that foresters are taking their time with the non-native species.

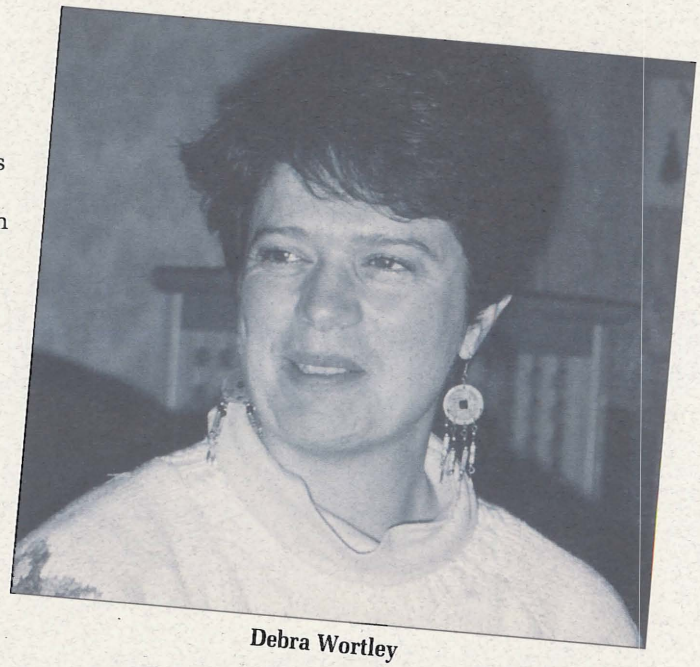
However, it is possible that when we have taken the time to confirm that noble fir is as at home in the southern coastal ecosystems of B.C. as it is in the Cascades a few degrees of latitude to the south, the province's foresters will have one more option for reforesting montane sites. And a majestic one at that.

Forestry symposium first of its kind in the Yukon

Approximately 200 people almost as diverse as the forest itself met in Whitehorse Feb. 2-4 for the first forestry symposium of its kind to be held in the Yukon. Sponsored by the Canada-Yukon Cooperation Agreement on Forestry Development and Yukon College, the three-day symposium entitled Yukon Forests: A Sustainable Resource attracted speakers from throughout the Yukon, B.C. Alaska, and as far away as Wisconsin.

Debra Wortley, Forestry Development Officer with the Canadian Forest Service in Whitehorse and conference co-organizer, was delighted with the success of the symposium. "We were expecting about 80 people to attend, but almost 200 participated which shows that Yukoners are truly concerned about where the forest industry is going, and that our resources are used in a sustainable manner. The sheer number of people in attendance illustrates a real thirst for information in the Yukon. Everyone wants to see the right thing done."

The Yukon forest industry is at a stage that is unique in Canada, and which provides unprecedented opportunities. Although there is a long history of logging in the Yukon, the industry is still in its infancy, and because of this, Yukoners are now exploring various forest management options, looking at other regions, and building on their knowledge. Gordon Weetman, Forestry Professor at the University of British Columbia and keynote speaker for the symposium, told the audience that "We have an opportunity to do it more elegantly in the Yukon," explaining that Yukoners have the advantage of learning from others' mistakes.



Debra Wortley

To explore some of the options facing Yukon forestry, the symposium included presentations on maintaining wildlife habitat, soil and climate considerations, ecosystem classifications, the ecology of northern forests, and the perspectives of First Nations and industry.

CFS researchers help model the McGregor

Thanks to a recently signed agreement, Canadian Forest Service researchers are now part of the myriad of activity taking place in Prince George's McGregor Model Forest. Grouped together as the Forest Practices Project, these researchers will undertake a number of different studies to help us learn more about the McGregor Model Forest and to give us clues to processes that affect forests everywhere.

The McGregor Model Forest is one of ten Model Forest sites established across Canada. Funded by the federal Green Plan for a Healthy Environment, the Model Forests were created to test and demonstrate innovative and sustainable forestry practices. With over 28 different organizations taking part in the McGregor, the Model Forest also serves as a shared workshop where participating partners can work together and learn from each other's expertise.

Since new forest management strategies can be developed only with detailed knowledge of what has happened in the past, several of the CFS Forest Practices studies will examine the impacts of previous human use on the McGregor. Two studies will look at how different silvicultural practices influence the forest's landscapes, while another will show how these activities affect soil properties and processes.

Other CFS studies will focus on climate, insects and diseases, and wildfire threat in the Model Forest. All the data gathered will join that of other McGregor partners as part of a giant computerized information system. This system will allow foresters to look at many factors simultaneously and see the range of impacts that may be caused by various management strategies. In this way, the CFS' Forest Practices Project will help McGregor foresters to shape the innovative forestry techniques that will lead us into the next decade and beyond.

Staff Comings and Goings

Regional Science Director **Dr. R.C. Dobbs** began a seven-month secondment to the British Columbia Ministry of Forests in February. Dr. Dobbs has been a director of research programs at the Pacific Forestry Centre since 1984. He began his career with the Canadian Forest Service in 1966 as a research scientist, first in Winnipeg and then at the Pacific Forestry Centre. His research area was reforestation. In 1977, Dr. Dobbs moved to CFS Headquarters in Hull Quebec where he managed the Enfor Proram and the Resources prgroam of the Research and Technical Services Directorate.

Dr. R.C. Dobbs

FIDS Ranger **Janice Hodge** has left the Canadian Forest Service to form a silviculture consulting company in the Okanagan. In 1989, when Ms Hodge joined the CFS, she had the distinction of being the first woman ranger in the Forest Insect and Disease Survey. For the past six years, Ms Hodge has conducted annual surveys of the southern Kamloops Forest Region from her summer field location in Summerland.

Recent Publications

Impacts of soil disturbance on root systems of Douglas-fir and lodgepole pine seedlings

by E.F. Wass and R.B. Smith

Researchers Wass and Smith examined the root systems of ponderosa pine and Douglas-fir seedlings growing in five disturbance categories within a clearcut near Golden. This report details their findings and recommends the most favourable locations for planting in disturbed sites.
BC-X-348

Timber supply and nonindustrial private forests in British Columbia

by Glenn H. Manning

This report presents information on the forest management practices and demographic characteristics of owners of non-industrial private forests in B.C. and other jurisdictions. Possible improvements in government programs designed to enhance forest management on private forest lands are discussed.
BC-X-349

Recent Publications - 1994

A listing of the reports and publications authored by the staff of the Canadian Forest Service in the Pacific and Yukon Region during 1994.
BC-X-350

Forest regeneration in the ESSF zone of north-central British Columbia

by Craig Farnden

This report provides practising silviculturalists in north-central B.C. with up-to-date knowledge of the environmental conditions in subalpine forests; how changes in these conditions following harvesting can contribute to regeneration problems; the effects of the conditions on tree survival and growth; forest practices that can modify adverse conditions, and the silvical characteristics of affected tree species. Specific environmental conditions and forest practises are also discussed.
BC-X 351

Mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.): an annotated bibliography

by D.G.W. Edwards and M.D. Meagher

This bibliography contains 209 new references. The oldest citation dates to 1867, the most recent , 1994. Articles are listed alphabetically by authors, and all have been abstracted.
BC-X-352

A guide to the STIM growth model.

by G.M. Bonnor, R.J. DeJong, P. Boudewyn, and J.W. Flewelling

The Stand and Tree Integrated Model (STIM) , designed to make growth projections , includes both a tree and stand growth model component. STIM operates on IBM and compatible microcomputers with a Windows user interface.The core program is written in Fortran.
BC-X-353

Forest insect and disease conditions: British Columbia and Yukon — 1994

by 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-X354

(See story on page 3)