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INFORMATION FORESTRY

Pacific Forestry Centre

White pine blister rust

(See story on page 2)

Natural Resources Canada
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Ressources naturelles Canada
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Canada

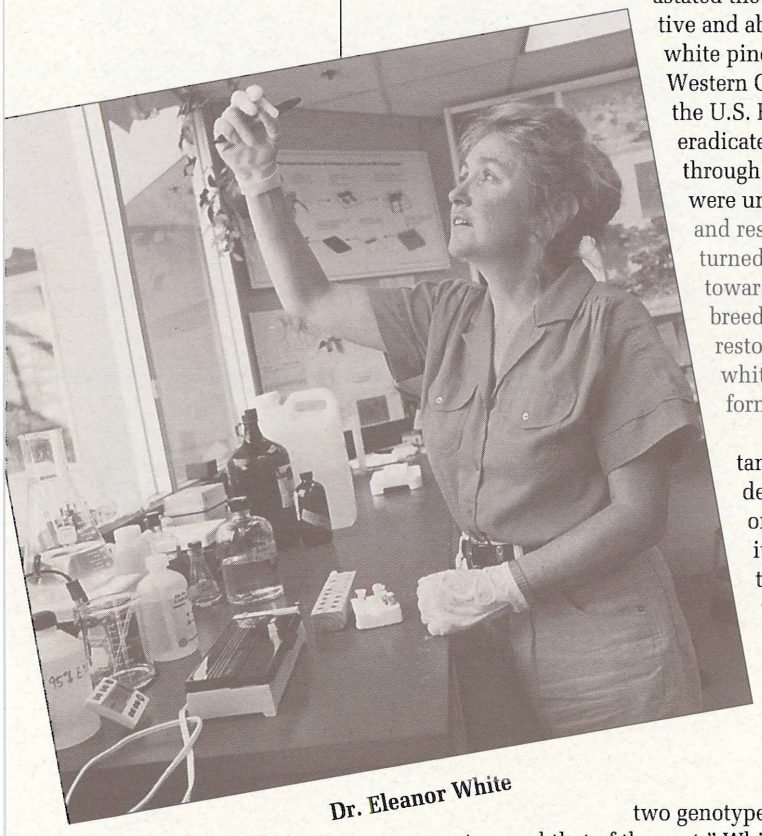
Know your Enemy

"A tree's resistance is the result of the interaction of two genotypes, that of the tree and that of the pest."

Know your enemy," says Dr. Eleanor White, a molecular biologist with the Pacific Forestry Centre. The phrase evokes images of generals huddled around the table studying maps of enemy territory. But the enemy to whom Dr. White refers is not of the human variety. Rather, it is an orangy fungus, *Cronartium ribicola*, white pine blister rust, a deadly foe of western white pine. Other species of pine, such as sugar pine, are also susceptible.

Now a series of studies undertaken by Dr. White and colleagues will give campaigners in the battle against the blister rust an unprecedented close-up look at the innermost secrets of their enemy.

Since its introduction to British Columbia at the turn of the century, white pine blister rust has devastated the once lucrative and abundant white pine forests of Western Canada and the U.S. Efforts to eradicate the disease through quarantine were unsuccessful and researchers turned their efforts towards resistance breeding to restore western white pine to its former glory.



Dr. Eleanor White

But resistance does not depend solely on the tree itself. "A tree's resistance," explains Dr. White, "is the result of the interaction of two genotypes, that of the tree and that of the pest." While a great deal is known about western white pine, blister rust has remained a mystery.

One of the difficulties in learning more about blister rust is that the spores are incredibly minute and exhibit no morphological differences. Unable to observe variation, scientists came to believe that none existed. Until recently, many scientists accepted that blister rust was a single organism that reproduced asexually with each spore a virtual clone of the other.

The first concrete evidence of genetic variation in blister rust came to light in the late 1970s in a sugar pine plantation in California. The trees in the plantation all possessed a gene that confers resistance to blister rust. For more than ten years, the trees thrived despite exposure to the fungus. Then, inexplicably, their immunity vanished and the plantation was stricken with the disease. What had happened? Had the trees suddenly lost their immunity or was this strain of blister rust somehow different? When scientists exposed other sugar pines whose resistance was proven to samples of rust taken from the afflicted trees, they too became infected. The scientists then knew they were dealing with a different, more virulent variation of blister rust.

The discovery posed many questions. Variation suggests that blister rust breeds through mating rather than self-propagation. This being the case, is the rust inbreeding or outbreeding? How much variation is possible? How does variation affect virulence? The questions remained unanswered for more than a decade.

With the recent development of a method to culture blister rust, scientists were finally able to apply techniques of molecular biology to look deep inside the cells of the rust. Dr. White and colleague Dr. Bohun Kinloch of the U.S. Forest Service's Southwest Range and Experimental Station in Berkeley, California, devised a series of studies using ribosomal DNA (rDNA) as a molecular marker to look for genetic variation within blister rust populations.

The molecular markers proved to be the key researchers had long hoped for. White and Kinloch's studies so far prove that there is definite genetic variation within populations of blister rust. The genes show characteristics inherited from two different individuals, proving that blister rust reproduces by mating. The diversity of genetic variation within large, old cankers demonstrates that the fungus is also highly outbreeding. This information suggests that white pine blister rust is readily able to recombine genes and produce new combinations of virulence determinants.

The results of the first in the series of experiments will be published in the *Canadian Journal of Botany*. The researchers are now taking a closer look at the effects of genetic variation on virulence.

White and Kinloch's studies make a valuable contribution to resistance breeding programs. The knowledge they uncover helps us to better know this enemy and, in doing so, perhaps win the war against white pine blister rust.

National Forest Inventory moves to PFC

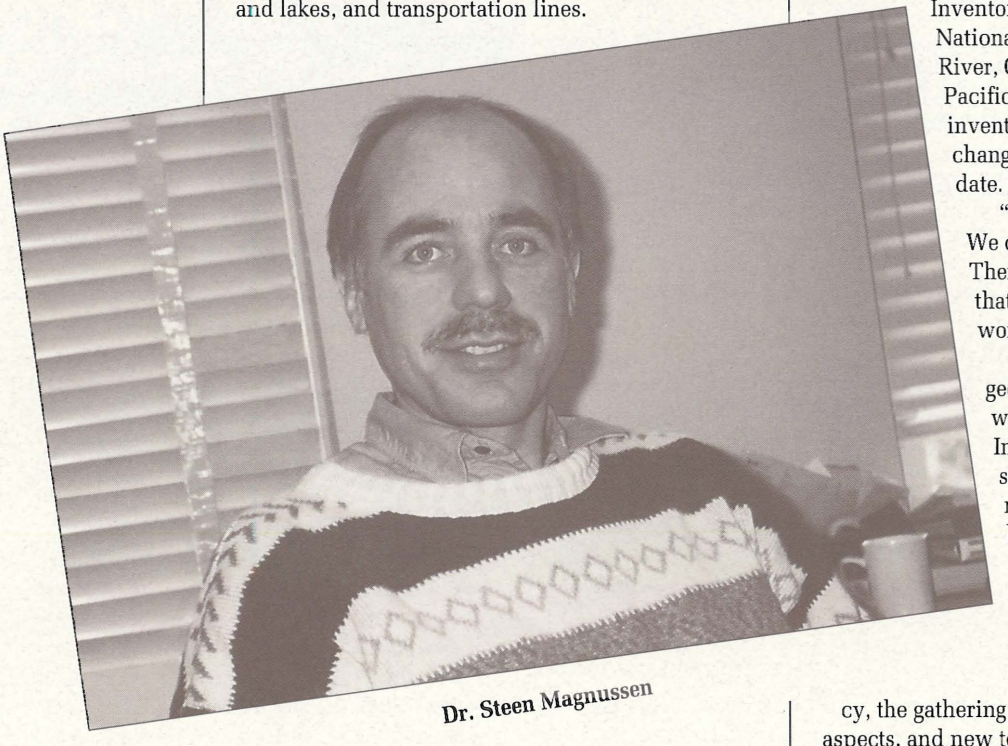
"It's a database of everything that is important in Canada's forests,"

Canada is spread out over nearly one billion hectares, 42% of which is forest land. An area of this size and scope requires extensive monitoring and analysis which is where the National Forest Inventory comes into play.

"It's a database of everything that is important in Canada's forests," said Katja Powers, an inventory specialist in the National Forest Inventory Project.

Every five years, the Canadian Forest Service (CFS) conducts a national compilation of provincial and territorial forest inventories, including information such as age, maturity, forest type, volume, area, and species.

Powers says the inventory covers many different areas such as forest sections, climatic regions, provincial boundaries, national boundaries, rivers and lakes, and transportation lines.



Dr. Steen Magnussen

"It usually takes us two to four years to build the national geo-referenced database, and then a year or two to report on it, and then you're back into a new round of work," says Steen Magnussen, the project leader of the National Forest Inventory.

In order to create the database, the federal government obtains data from provincial, federal, and territorial agencies. The Canadian Forest Inventory Committee, consisting of inventory chiefs and specialists from across the country, assists in the sharing of information between the various levels of government. The data is then stored in a geographically referenced database.

"We have information stored by map sheets that we call "cells", and there are 44,000 cells across Canada," says Powers. "It's quite a large database, with 2.7 million records."

The information in each cell can be summarized by province, forest section, geoclimatic zone, or any area that can be digitized.

Powers says the national inventory receives requests for information from a large variety of people, including CFS contractors, researchers from universities, and other government departments. Most requests are for information covering specific areas, and specific variables of interest. "We send them data that's a lot smaller than 2.7 million records," she adds.

Until recently, the National Forest Inventory operated out of the Petawawa National Forestry Institute in Chalk River, Ontario. Now located at the Pacific Forestry Centre in Victoria, the inventory staff look at the move as a change in facilities, and not in mandate.

"We could have gone to Ottawa. We could have gone to Edmonton. There is no further expectation but that we continue to improve our work," says Magnussen.

Since the creation of the first georeferenced database in 1981, the work that the National Forest Inventory has achieved has been substantial. The research component of the national inventory has been in existence for three years now, and with three databases completed, Magnussen says they are looking at broadening the scope of the inventory by looking at ways to improve efficiency, the gathering of information, statistical aspects, and new technologies.

"We're looking at a new design for the National Forest Inventory in light of the increased data needs as a result of the criterion indicators on sustainable forestry."

After they have completed a five-year update of the inventory database, a release of a national report illustrating the extent and nature of Canada's forest resources, as well as a compendium on the technical aspects of the database, will follow.

Powers adds that certain information "that we call land type data which combines a few of the classifiers in our regular database," can also be found on the World Wide Web at http://www.pfc.forestry.ca.

Groundwork Laid For Interna

"Canada is committed to being a responsible steward of forests and to playing a leadership role in promoting the sustainable development of forests for all values.

Delegates to the recent international forestry seminar in Prince George, British Columbia completed their week-long series of deliberations by drafting recommendations calling for an international, non-binding set of guidelines of forest practices.

The United Nations-sponsored FAO/ECE/ILO Joint Committee on Forest Technology, Management and Training drew over 200 delegates from 32 countries to discuss sustainable forest management and how to move towards operationalization through a code that promotes best practice.

George Rideout, M.P. and Parlimentary Secretary to the Minister of Natural Resources of Canada, one of the seminar co-hosts, told the delegates that Canada is commited to being a responsible steward of forests and to playing a leadership role in promoting the sustainable development of forests for all values.

"Co-hosting this seminar with the Province of British Columbia is a demonstration of Canada's commitment to work through partnerships inside and outside Canada to promote the sustainable development of the world's forests," said Mr. Rideout.

Andrew Petter, British Columbia Minister of Forests, outlined the many initiatives British Columbia has undertaken over the past four years to turn sustainable forest policy into feasible operational forest practices.

"I welcome the establishment of fair international standards for sustainability as an effective way for British Columbia to prove its commitment to sustainable forest management to customers, potential investors, and the international forestry community at large," said Mr. Petter.

In their final report, delegates told organizers that an international, non-binding set of guidelines for codes of forest practice needs to be prepared and will serve as a framework for the establishment of standards or codes of forest practice at the national, regional and local level.

Dr. Paul Efthymiou, Chairman of the FAO/ECE/ILO Joint Committee on Forest Technology, Management and Training was pleased the delegates placed the highest priority on getting the results of their work and the recommendations operational as quickly as possible.

Information on the seminar, guidelines, recommendations and other documents arising from the seminar are available on the World Wide Web. A link to this site can be found on PFC's home page, http://www.pfc.forestry.ca.

FAO delegates in Prince George, B.C.

Conclusions and Recommendations of the Seminar: Highlights.

19. Codes of forest practices differ widely, notable in their scope, level of detail and legal status. The appropriate solution in each particular case is determined by national, regional or local circumstances. However, a common set of principles which are generally applicable may be identified.
20. Therefore, the seminar considered that an international, non-binding set of guidelines for codes of forest practice should be prepared. This would be a useful contribution to the international forest policy debate and to improving planning and operational standards world-wide. These guidelines would not themselves be a code of forest practice, but serve as a logical framework for those responsible for setting standards or drawing up codes of forest practice at the national, regional or local level.
21. The seminar laid a basis for this work by drawing up a preliminary list of some of the major areas which the proposed guidelines might cover:

a) need for a clearly stated vision of strategic objectives;
b) need for a definition of the term 'code of forest practice';
c) need to base codes on the best available science, knowledge and understanding;
d) need for a land use allocation process where forestry would be integrated with other land uses;

onal Guidelines of Forest Practices

e) need for early and continuous responsible participation of all stakeholders in the decision process;
f) need for detailed ecological site classifications and sound understanding of local ecological conditions and processes;
g) need to give full attention to social aspects and societal values, including employment, all human rights, including those of indigenous peoples, occupational safety and health, forest dependent communities, non-wood forest products, impact on either land users, cultural/spiritual attributes of forests;
h) need to take account of socio-economic aspects and effects on production, such as community stability;
i) need for an adequate inventory and monitoring of the forest as determined by data needs for management objectives;
j) need to consider ecological processes at the appropriate scale, such as landscape;
k) need to weigh carefully and appropriately the costs and benefits of policy options;
l) need for monitoring of the management process, evaluation of results and a system for feedback, notably as regards planning, and dialogue;
m) need to design and apply codes in such a way that they can evolve;
n) need to consider, at the implementation phase, human resource requirements, and training needs, including further development of education and communication techniques;
o) need for a clearly stated definition of accountability; and p) need for participatory conflict resolution methods. In general, choices should be made at the lowest possible level.

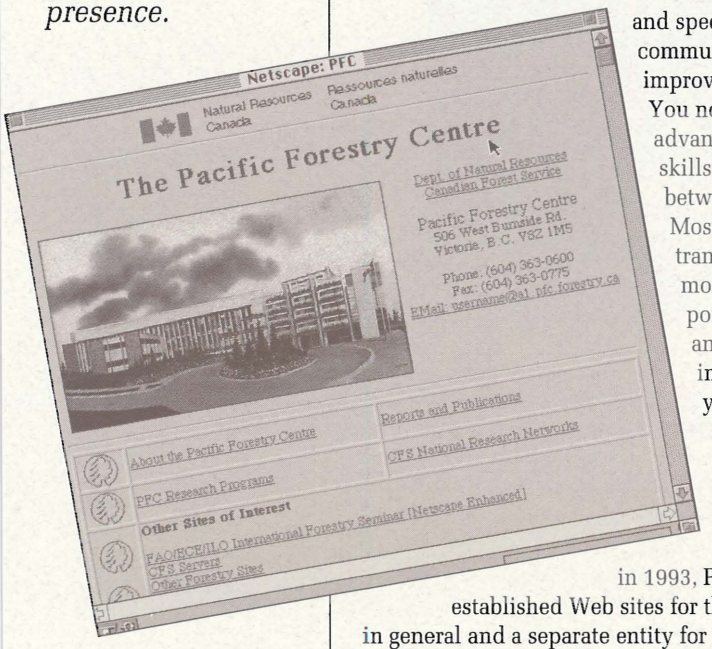
22. The seminar attached the greatest importance to ensuring that its work and recommendations be transmitted to the appropriate bodies and made operational as soon as possible. However, the seminar itself was not in a position to determine which of the bodies had the correct status and resources to carry out this work.
23. The secretariat should also explore the question of the resources which would be necessary for the satisfactory and rapid conclusion of this work.
24. The first draft of the guidelines should draw on the material collected at the seminar, notably the contributions of the working groups and sub-groups and take into account appropriate international documents, including sets of criteria and indicators. Once the first draft guidelines are prepared, they should be submitted to a widespread consultation process.
25. Once the guidelines are developed, FAO and ILO should consider follow-up work to assist countries which request technical assistance to develop and implement codes of forest practice which reflect their circumstances, according to the international guidelines.

"The delegates placed the highest priority on getting the results of their work and the recommendations operational as quickly as possible.

Pacific Forestry Centre On the Web

"The Pacific Forestry Centre is renovating and expanding its World Wide Web presence.

Recent news reports have detailed how the Canadian federal government plans to use the internet, specifically that portion known as the World Wide Web, to more-efficiently make information available to Canadians. This is old news to staff at the Pacific Forestry Centre who have used the internet since the late 1980s to exchange information with remote clients, collaborators, and colleagues.



Over time, the ease and speed of electronic communication has improved dramatically. You no longer require advanced computer skills to transfer files between continents. Most information transactions are no more difficult than pointing a cursor at an icon and clicking a button on your mouse.

When the first graphical browser for the World Wide Web appeared in 1993, PFC quickly established Web sites for the establishment in general and a separate entity for the highly specialized requirements of the Advanced Forest Technologies program. With the increasing popularity of the internet, demand on both these World Wide Web servers has grown dramatically.

In response to the increased demand for electronic services, the Pacific Forestry Centre is renovating and expanding its World Wide Web presence. "There's no doubt about it," says PFC Media Relations Officer Rod Maides. "Our clients and the public are telling us that they wish to receive information electronically and on demand."

"Over the next few months, you will find more programs, details of the new CFS National Research Networks, research results, and even publication distribution going online at PFC." Maides adds.

Steve Glover, head of the publications unit, confirms that a method for ordering publications via the World Wide Web is under construction. "We expect to have it operational by the beginning of 1996." Plans call for a system that will enable clients to browse the titles and, where available, abstracts of reports, journal articles and other publications, then use an interactive form to place their order. "Certain publications may also be available for downloading in a portable document format from our ftp server."

Among the programs scheduled to go online is the Montaine Alternative Silvicultural Systems project, known as MASS. The MASS site will provide background on the extensive project as well as findings to date and information on the various component studies and links to the partners in this cooperative research program.

To visit any of the PFC Web sites, point your browser to http://www.pfc.forestry.ca/.

Reorganization of CFS continues

Pacific Forestry Centre Director General, Dr. Carl Winget, has announced the final organization structure of the Pacific Forestry Centre that will take effect on April 1st, 1996.

Senior Policy Advisor:
Dr. Bill Wilson

Liaison and Technology Division:
Elaine Teske, Director

This division will oversee Collaborative Forestry Programs, Business Development and Marketing, Land Claims, Media Relations and PFC's publishing unit.

Forest Biology Division:
Dr. Paul Addison, Director

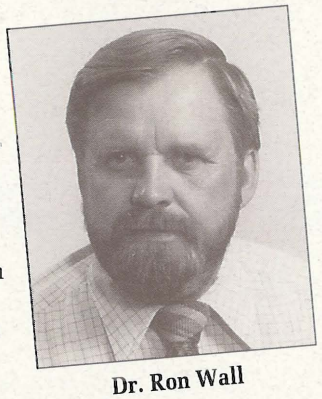
Components of the Forest Biology Division include research into biodiversity, ecosystem processes, impacts of forestry practices, pest management methods, plant biotechnology. and biomonitoring. In addition, Dr. Addison is Director General of the CFS Impacts of Forest Practices Research Network of which PFC is the lead establishment.

Forest Systems Division:
Dr. Murray Strome, Director

The Forest Systems Division includes fire management, landscape management, and climate change. It will eventually also include the biomonitoring component now in the Forest Biology Division. Dr. Strome is also Director General of the CFS Landscape Management Research Network of which PFC is the lead establishment.

Staff Comings and Goings

Departures



Dr. Ron Wall

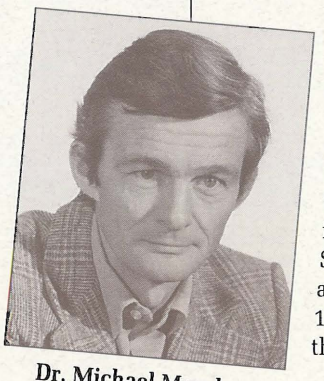
Dr. Ron Wall

Dr. Ron Wall has retired after almost 30 years with the CFS in Winnipeg, the Maritimes and at PFC. Since arriving at PFC in 1987, Dr. Wall has focused his research on forest vegetation management and biological control of forest weeds. He is well known for his work on the use of the fungus *Chondrostereum purpureum* as a natural agent of weed control.

Katya Power

Katya Power

Ms Katya Power, an inventory specialist in the project, received her BSc. in Forestry from the University of Toronto in 1982. That same year, Ms Power began working for the CFS at PNFI in the Forestry Statistics and Systems Branch's Research and Development Program. In 1985, Ms Power moved into the Forest Inventory Project



Dr. Michael Meagher

Dr. Michael Meagher

After eleven years with PFC's white pine improvement research projects, Dr. Meagher has retired from the civil service. Dr. Meagher came to PFC in 1984 from the B.C. Forest Service. His expertise in genetics has contributed greatly to the success of white pine resistance breeding in this region.

Dr. Chuck Bulmer

Soil scientist Dr. Chuck Bulmer has parted with the CFS after more than two years at the Prince George location. Dr. Bulmer now works with the B.C. Forest Service.

Lavina Galbraith

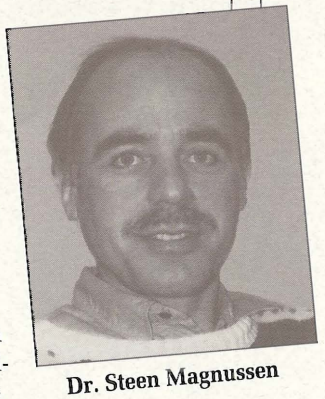
Communications Officer Lavina Galbraith has left PFC to pursue a career in World Wide Web design and writing services. Ms Galbraith joined PFC in 1988. Since 1992, she has been the editor of Information Forestry.

Arrivals

The Pacific Forestry Centre is pleased to welcome the three members of the National Forest Inventory Project who have transfered to this establishment from the Petawawa National Forestry Institute.

Dr. Steen Magnussen

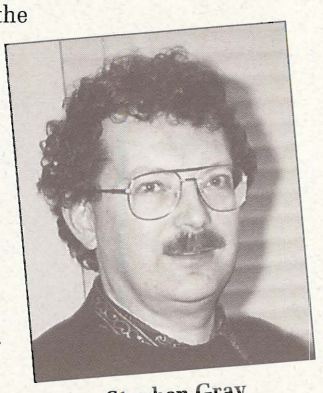
Dr. Magnussen received his PhD in Silviculture from the Georg August University at Gottingen, Germany in 1980. In 1985, with funding from the Royal Veterinary and Agricultural University of Copenhagen, Denmark, he arrived in Canada to accept a post-doctoral position with PNFI's Tree Improvement Program. In 1986, Dr. Magnussen received NSERC funding to continue his post-doctoral position. In 1990, Dr. Magnussen became an indeterminate employee of the CFS and project leader of the Tree improvement Program. He has led the National Forest Inventory Project since 1992.



Dr. Steen Magnussen

Stephen Gray

Stephen Gray is a naturalist, photographer, botanist and ecologist specializing in wetlands. Mr. Gray graduated from the University of Toronto in 1971 with a BSc. in zoology and ecology. He also holds a post-graduate diploma in plant ecology from the University of Saskatchewan at Saskatoon. Prior to joining the CFS in 1980, Mr. Gray worked as a self-employed plant ecologist, with a Toronto consulting firm, and as a regional park planner for the Ontario government. Mr. Gray's work in Canada's Forest Inventory includes planning, designing and loading the database as well as preparing reports.



Stephen Gray

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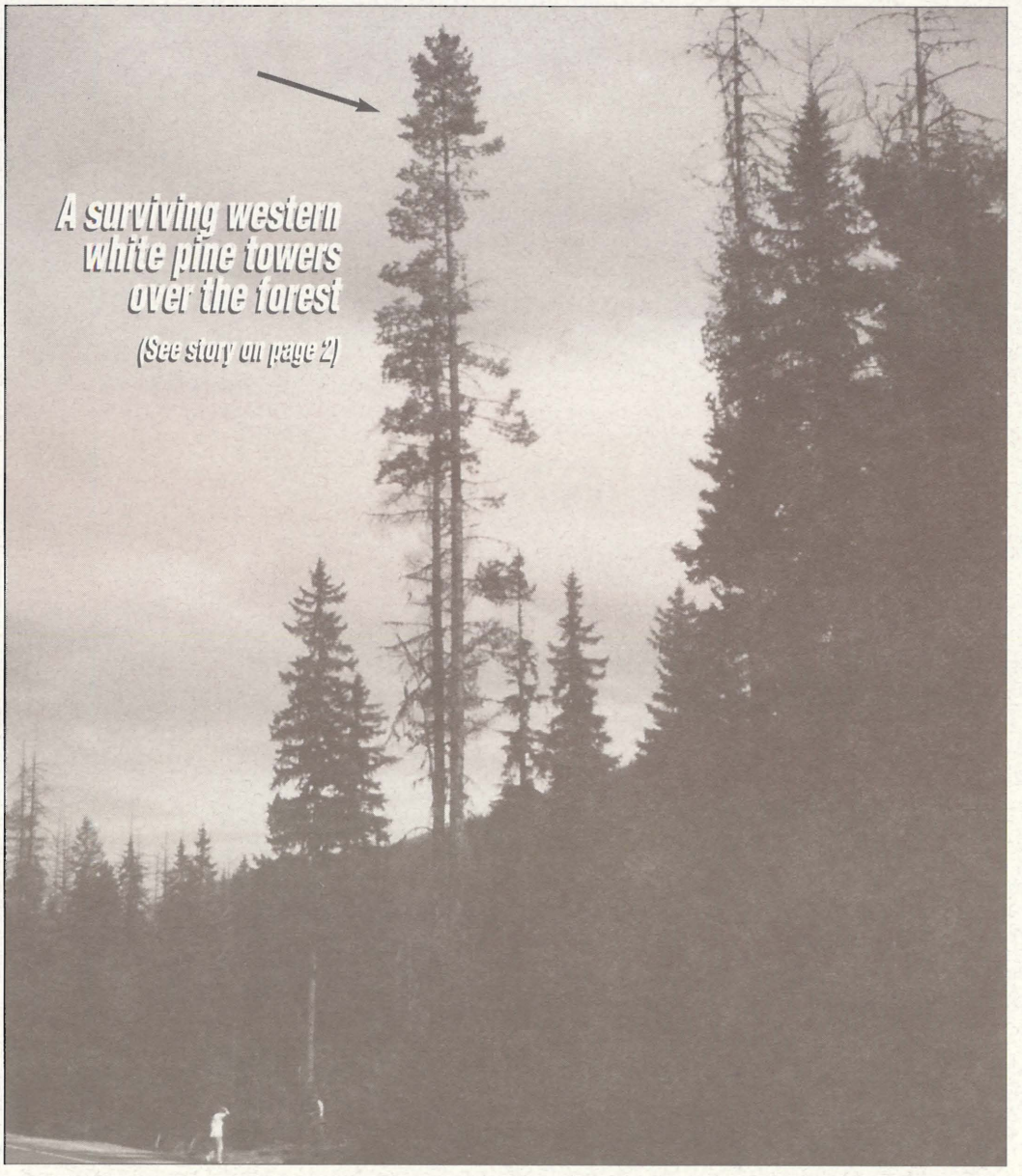
A surviving western white pine towers over the forest
(See story on page 2)