

Excerpt from "The Status of Temperate North American Forest Genetic Resources. 1996. D.L. Rogers and F.T. Ledig, eds. Report No. 16, University of California Genetic Resources Conservation Program, Davis, CA. 102 p.



Preface

This report summarizes the results of a questionnaire on conservation and use of temperate North American forest genetic resources. It also presents recommendations on the management of forest genetic resources offered by participants in the Workshop on North American Temperate Forest Genetic Resources.

The workshop was held from June 12–14, 1995, in Berkeley, California in preparation for the Fourth International Technical Conference on Plant Genetic Resources, which will be organized by the Food and Agriculture Organization (FAO) of the United Nations, in June 1996 in Leipzig, Germany. One of the main outputs from the Technical Conference will be a Global Plan of Action for Plant Genetic Resources. The Global Plan will:

- Propose policies and actions;
- Set priorities for action;
- Strengthen national capabilities.

The recommendations formulated at the workshop will help ensure that forestry has a voice in the Global Plan of Action which will be adopted at the Technical Conference. This is crucial because the forestry enterprise is unique and does not fit well into the agricultural mold. We hoped that a workshop on

North American forest genetic resources would identify the differences between forestry and agriculture and explore a conservation strategy appropriate to forestry.

We asked the participants to:

- Help clarify the conservation status of North American temperate forest genetic resources;
- Identify problems in the conservation of forest genetic resources;
- Recommend needs and assign priorities for the effective conservation and utilization of these resources.

Convening the workshop was a task undertaken by the Forest Genetic Resources Study Group (FGRSG) of the North American Forestry Commission (NAFC). The NAFC is one of several regional forestry commissions established by the FAO. The FGRSG is one of several study groups within the NAFC, and includes representatives from Canada, México, and the United States. The mission of the FGRSG is to: coordinate research activities on forest genetic resources of interest to North America; encourage international cooperation; and facilitate the exchange of information. It is in the spirit of encouraging international cooperation and the exchange of

information that we organized this workshop. Several of the FGRSG members were participants.

The task of convening the workshop was actually urged upon the FGRSG in 1993 by Dr. Timothy J.B. Boyle, then of the Canadian Forest Service. Dr. Boyle would have been admirably suited to organize this gathering, but shortly thereafter he accepted a position with the Centre for International Forestry Research (CIFOR) of the Consultative Group on International Agricultural Research (CGIAR) in Indonesia.

The FGRSG was able to carry on with the assistance of several organizations. Because the U.S. Forest Service Research division, under the direction of Dr. Jerry SESCO, considers the conservation of forest genetic resources as one of the most important problems affecting forestry, agriculture, and the environment, it contributed substantial funding at an early stage.

The workshop was undertaken with the technical collaboration of the FAO through its Forest Resources Division. Oudara Souvannavong, Forest Genetic Resources Officer, and Christel Palmberg-Lerche, Chief of the Forest Resources Development Service, participated in planning the workshop from its inception.

The University of California's Genetic Resources Conservation Program (GRCP) cosponsored the workshop. The GRCP is a unique organization. California is the only state in the United States with a program for conservation of genetic resources ranging from the level of microbes to forest trees. The GRCP provided funding to offset costs of travel and to publish this report. Most importantly, Drs. Calvin O. Qualset, Director, and Patrick E. McGuire, Assistant Director, are to be recognized for their counsel in planning, for contributing to the workshop as both discussants and recorders, for providing a perspective from the agricultural viewpoint, and for directing the publication of this report.

The Department of Environmental Horticulture (EH) at the University of California at Davis was

another cosponsor. Without the assistance of EH, particularly Dr. James A. Harding and Ms. Suzanne G. Melendy, this gathering would not have been possible. The Department took responsibility for leasing the meeting site, making travel arrangements for the participants, handling reimbursement, and the scores of tasks necessary to manage an international meeting.

Input from the Canadian Forest Service was invaluable. Thanks to the initiative of Gordon Murray, Tom Neiman, and Kurt Johnsen of the Canadian Forest Service, consultation was ongoing from the beginning of the planning process. We benefitted from the ideas that they raised during their planning for the Workshop on Boreal Forest Genetic Resources. The Workshop on Boreal Forest Genetic Resources took place in Toronto the week after this workshop.

The outcome of the workshop largely met our objectives. The workshop participants proposed and developed a set of recommendations that were then accepted by consensus. The recommendations were sent to the participants for review, and then transmitted to FAO for consideration in formulating the Global Plan of Action for Plant Genetic Resources. The specific recommendations are listed in a separate section following the Executive Summary, and each appears individually in the body of the report so the reader can better appreciate its context.

This report also provides detail on the status of North American temperate forest genetic resources as plantation exotics outside North America. Our methods in gathering and summarizing data on the status of North American species are described in the Report Methodology section. While a wealth of information was provided by the workshop participants and survey respondents, the text of this report is largely our own, with the exception of the recommendations. It is not a proceedings of the workshop. We assume sole responsibility for errors in fact, omission, or misinterpretation.

Deborah L. Rogers and F. Thomas Ledig

Acknowledgements

A report of this size and scope has understandably drawn on the resources of many individuals. The workshop participants who developed the recommendations listed in this report and provided other information are gratefully acknowledged. Not only did they give freely of their ideas and enthusiasm during the workshop, but many participated in the workshop with support from their agencies or companies.

We heartily thank those individuals who made special contributions. Kenneth G. Eldridge and Rowland D. Burdon deserve special recognition for their multiple contributions as participants in the workshop, respondents to the questionnaire, authors of several case studies, and reviewers of the report. Calvin F. Bey, Patrick E. McGuire, Christel Palmberg-Lerche, and Oudara K. Souvannavong reviewed

the entire report and made substantial improvements in its clarity and quality. Certain sections of the report received the constructive attention of W. Thomas Adams, Calvin O. Qualset, Peter J. Kanowski, Robert C. Kellison, J. Jesús Vargas Hernández, Nicholas C. Wheeler, and Alvin D. Yanchuk. Many other individuals contributed to the report with case studies and with questionnaire responses. Authors of the case studies are acknowledged in the boxes scattered throughout the report. Respondents to the questionnaires are acknowledged in Appendices A and B. We gratefully acknowledge the information provided by David B. Boomsma, José Luis Campo Diaz, Erich Haber, Shirley M. Sheppard, Gilles Villeneuve, and many others.



Executive summary

This report describes the status of North American temperate forest genetic resources, including their condition as exotic plantation species, and provides recommendations for their conservation. A workshop was convened in Berkeley, California from June 12–14, 1995 to address the problems and issues concerning the conservation of these resources. Participants in the workshop proposed and reached consensus on a series of 12 recommendations, which were subsequently submitted to FAO to assist in the formulation of the Global Plan of Action for Plant Genetic Resources. In addition, information concerning the status of these genetic resources was garnered from responses to a survey of individuals in Canada, México, and the United States, where these resources are native, and of others in countries where they are used as exotic plantation species. The responses to those surveys form the bulk of this report. The report also includes case histories relevant to the discussion of conservation of North American temperate forest genetic resources.

Central to any and all issues concerning conservation of genetic resources in North American temperate forest tree species is the lack of a comprehensive information base. Basic information such as species distributions, changes in distribution or health over time, effect of management practices, location and

nature of *ex situ* and *in situ* reserves, etc. is not readily available. In some cases, the information simply does not exist, but more commonly it is not retrievable due to the diversity of land ownership and management agencies. Thus, the development of a comprehensive information base is one of the most compelling needs in conservation as it can serve to identify concerns and contribute to coordinated conservation efforts.

While forestry and agriculture have some common ground, conservation strategies for forest tree species generally will not follow agricultural models because:

- Even partially domesticated forest tree species are less differentiated from progenitor populations than are agricultural crops, whose ancestors are often lost in prehistory;
- Forest trees have values other than commodity values (e.g., ecosystem and esthetic values), in contrast to most agricultural crops;
- The long cycle between harvests in forest tree species (especially relative to annual crops) precludes all but exceptionally profitable investments in cultivation and protection;
- Most North American forest tree species with commercial value are managed and harvested *in situ* and regenerate naturally, whereas the agri-

cultural model is one of intensive *ex situ* cultivation and conservation;

- The domestication process for forest tree species began with the evaluation of genetic resources, whereas agriculturalists began the process with collection, distribution, and storage of resources.

As a result of these factors, conservation of forest tree species will rely heavily on *in situ* methods, and because evaluation of the genetic resources is well advanced, *ex situ* conservation in forestry can be practiced at a more economical scale than is customary in agriculture.

It is noteworthy that the existing reserves for North American forest tree species are almost exclusively defined on criteria other than genetic values. Furthermore, reserves follow land ownership and development patterns, leaving certain species more vulnerable than others. For example, the greater proportion of federally managed land in the United States is in the West, which means that there are more reserves for western species than for eastern.

Currently threatened or endangered tree species in Canada or the United States are few, six and seven, respectively. In general, species with commercial value in Canada and the United States have adequate genetic resources—in reserves, genebanks, or plantations. For these two countries, the concern is for the erosion and potential loss of populations—populations that may harbor valuable genetic resources. For example, some populations may be affected by loss and fragmentation of habitat; e.g., black walnut (*Juglans nigra*). Some species have been severely affected by introduced pests; among these are American chestnut (*Castanea dentata*) attacked by chestnut blight (*Endothia parasitica*), Port-Orford-Cedar (*Chamaecyparis lawsoniana*) attacked by *Phytophthora lateralis*, butternut (*Juglans cinerea*) affected by butternut canker (*Sirococcus clavigignenti-juglandacearum*), and western white pine (*Pinus monticola*) and sugar pine (*Pinus lambertiana*), both attacked by white pine blister rust (*Cronartium ribicola*).

Of the three countries that coexist in North America, México is the richest in species diversity. The United States and Canada together have about 650 tree species (Little 1979) while México has about 2,000 to 3,000. México is a center of diversity for pines, being

home to over half the world's species. Unfortunately, an estimated 17% of Mexican plant species is considered endangered. In México, loss of habitat through deforestation is affecting the range of many species including Gregg pine (*Pinus greggii*), Mexican weeping pine (*Pinus patula*), Maximino pine (*Pinus maximinoi*), Chihuahua pine (*Pinus leiophylla*), and Chiapas pine (*Pinus chiapensis*).

No systematic, coordinated national programs now exist for *in situ* or *ex situ* conservation of forest genetic resources in North America. Coordination of information and development of conservation plans at the national level is needed in Canada, México, and the United States. National-level plans and coordination should be used to ensure that species and supporting ecosystems are addressed in a comprehensive manner. For many species, international coordination is desirable. This does **not** imply top-down delivery of conservation policy (much of the forest land is not owned or managed by the federal government in these countries, especially in Canada and México), nor does it imply one model for conservation—the most appropriate models will vary according to local biological and social environments.

Effective conservation requires solutions acceptable to all stakeholders: landowners, government, environmental organizations, forest industry, the scientific community, and the public. Penalties and regulations regarding conservation of genetic resources on private land could possibly accelerate their loss. Education, recognition, and compensation to landowners who lose the value/use of their land to conservation are required for effective and long-term conservation of genetic resources.

At least 25 North American forest tree species are valued as plantation species in other countries. A minimum estimate of the total area they cover as exotic plantation species is over 15 million hectares. Some species, such as Douglas-fir (*Pseudotsuga menziesii*), are highly valued for commercial purposes both domestically and in other countries. Other North American species have a higher economic status as exotics on other continents than they do in their native range. For example, Monterey pine (*Pinus radiata*) is currently planted in plantations covering close to four million hectares outside of North America. The commercial value of this species, in countries such as Aus-

tralia, New Zealand, and Chile, is immense. Yet the species is not valued for timber or fiber in North America, where native populations are managed for aesthetic value if they are managed at all. Members of the global community hope that species such as Monterey pine will be conserved *in situ* because it may be necessary to draw upon these genetic resources in the future.

International transfer of germplasm is beneficial, not only for commercial purposes, but for conservation. Plantations of North American species on other continents are themselves a mechanism for *ex situ*

conservation of genetic resources. However, transfer of germplasm is fraught with the danger of introducing new pests.

After considering the problems and potentials for conserving North American temperate forest genetic resources, the workshop participants made twelve recommendations that were adopted by consensus in plenary session. It is recognized that many of the recommendations presented below extrapolate easily to regions outside the North American temperate zone.



Recommendations of the workshop

Workshop on North American Temperate Forest Genetic Resources, June 12–14, 1995, Berkeley, California

The following is a list of consensus recommendations developed by the participants in the Workshop on North American Temperate Forest Genetic Resources.

1. We **recommend** the development of national programs to address issues in the conservation of forest genetic resources. Due to the complexity of land ownership patterns and land management objectives within and among Canada, México, and the United States of America, coordination on the national level is necessary. All of those directly involved with forest land ownership and/or management should be actively involved with the national program—contributing to databases, participating in conservation planning, and implementing action plans for conservation of forest genetic resources. These programs should include the exploration, inventory, documentation, and monitoring of forest genetic resources, both *in situ* and *ex situ*. Both exotic forest tree species growing in North America and native North American species growing elsewhere should be considered in national programs. Furthermore, because species cross national borders, coordination and cooperation among nations will be required.
2. We **recommend** that conservation of forest genetic resources be addressed by multiple approaches, and that, whenever possible, they should include ecosystem reserves. We recognize, that for noncommercial species, ecosystem reserves may be the only economically practical method of conservation. We recognize that while biotechnology can be useful in many ways, it is not a substitute for an adequately funded, field-oriented genetic conservation program.
3. Recognizing that many North American temperate forest tree species are important plantation species on this and other continents, and that it may be necessary to draw upon these forest genetic resources in the future, we **recommend** that Canada, México, and the United States conserve these resources *in situ*. We assume that other countries outside North America will reciprocate with regard to their native genetic resources.

4. We **recommend** an increase in funding for research on conservation of forest genetic resources. This research should involve, when appropriate, interdisciplinary, inter-agency, and international collaboration.

Some (nonprioritized) examples of research needs are:

- Exploration and inventory of species' distributions and patterns of spatial genetic structure within species;
 - Development of more efficient methods of evaluating genetic variation for adaptive traits;
 - Evaluation of the relative utility of various types of genetic data in the development of sampling strategies for conservation;
 - Analysis of the impacts of sociopolitical structures on the effectiveness of programs for the conservation of genetic resources;
 - Analysis of factors influencing population viability;
 - Analysis of the effects of habitat fragmentation, forest management practices, and environmental change on genetic resources.
5. Recognizing the high level of species and genetic diversity in México and the extreme lack of information on this resource, we **recommend** that research on Mexican tree species should receive special attention.
 6. Recognizing that forest management practices may have positive or negative impacts on genetic diversity and population viability and, in fact, that some form of management will be necessary to maintain genetic resources, we **recommend** a research emphasis on the consequences of forest management practices. We encourage the use of reference populations within long-term ecological research sites, 'model forests', and research natural areas for studies on the effects of forest management.
 7. We **recommend** that the FAO encourage the development of a centralized metadata-base of genetic resources. We see this as composed of local databases, coordinated

through a network and designed to facilitate exchange within the international community.

8. We **recommend** that member countries request FAO, through their Regional Forestry Commissions, to promote and coordinate national forest genetic resource conservation programs, and their integration into forestry practices.
9. Recognizing that private-sector owners and managers play an important role in *in situ* conservation of forest genetic resources, we **recommend** that the FAO and conservation agencies explore a range of incentives and agreements (e.g., tax incentives, easements, and land trusts) to foster conservation of forest genetic resources by the private sector.
10. Recognizing that effective genetic conservation programs are very long term in nature, we **recommend** that the FAO encourage and assist in the education of natural resource professionals and the lay public to foster a conservation ethic.
11. Recognizing that species introductions affect native ecosystems and local cultures and economies, we **recommend** the development of guidelines for the introduction of species. These guidelines should include general procedures for conducting risk analyses for biological, social, and economic factors as well as general procedures for monitoring the species after introduction.
12. Recognizing the importance of the Convention on Biological Diversity, the benefits of unrestricted exchange of germplasm, and the distinction between forest genetic resources and those of domesticated crops, we **recommend** that the forest genetic community provide leadership in addressing the emerging issues of intellectual property rights, indigenous peoples' rights, and plant breeders' rights as they pertain to forest genetic resources.