



Forest genetic resources

BRINGING SOLUTIONS TO SUSTAINABLE FOREST MANAGEMENT

Forests are complex ecosystems that cover 30 percent of the global land area, providing habitat for countless terrestrial species. Forests are vital for livelihoods as well as economic and social development, providing food, raw materials for shelter, energy and manufacturing. They are also critical for environmental protection and conservation of natural resources. Forests contain more carbon than the atmosphere. With climate change, forests, with their dual roles as both producers and absorbers of carbon, take on a new importance.

Genetic diversity provides the fundamental basis for evolution of forest tree species. This diversity has enabled forests and trees to adapt to changing and adverse conditions for thousands of years, and has resulted in a unique and irreplaceable portfolio of forest tree genetic resources. Nevertheless, the vast majority of forest genetic diversity remains unknown, especially in tropical forests. Estimates of the number of tree species vary from 80 000 to 100 000, yet fewer than 500 have been studied in any depth for their present and future potential. Until recently, studies of forest tree genetic resources have concentrated on domesticating those few deemed most applicable for wood, fibre and fuel production from plantations and agroforestry systems.

As a result of pressures on forest lands and the effects of unsustainable use of forest resources, the great potential of forest genetic resources is at risk of being lost forever, before it can be identified, let alone utilized. Forest loss and degradation remain major global concerns despite the enormous efforts to achieve sustainable forest management. There is also increasing awareness of the critical values that forest genetic diversity provide per se and as means to confront global challenges, such as climate change.

SUSTAINABLE FOREST MANAGEMENT

Focus on forest genetic resources

Understanding and managing forest tree genetic diversity is important in all types of forests. Monitoring the diversity of tree populations in primary forests can improve our knowledge on how ecosystem services and goods are

being delivered. Intensive genetic selection and breeding takes place in plantation and agroforestry systems.

The sustainable management of forests requires a better understanding of the specific features of forest trees and their genetic diversity. Forest tree species are generally long lived and extremely diverse. One species can naturally occur in a broad range of ecological conditions. In addition, forest species have evolved under several periods of climatic change; their genetic variability provides the capability to adapt to emerging climatic conditions. Trees have different mechanisms for natural seed dispersal allowing trees to migrate over large distances. However, even this important characteristic might not be sufficient for many species to survive today's rapidly shifting climatic zones.

Forest trees are generally managed with long rotation periods (the time between regeneration and harvesting), from 5-10 years and up to 150-200 years. With climate change it can no longer be assumed that today's growing conditions will be the same in 100 years and adaptability to change over lengthy rotation periods will increasingly be an important management consideration.

Forest genetic resources have provided the potential for adaptation in the past, and will continue to provide this vital role as we address the challenge of mitigating or adapting to further climate changes. In developing sustainable forest management, forestry practices that maintain genetic diversity over the longer term will be required.

Maintaining evolutionary processes and genetic diversity within forest tree populations requires a "dynamic



gene conservation” approach. Such an approach is based on managing tree populations within the environment to which they are adapted (*in situ*), or artificial, but dynamically using tree populations removed from their natural habitats (*ex situ*). In recent decades, countries have established conservation areas, such as forest gene conservation areas. However, the selection, management and monitoring of such areas would in general benefit from better planned and coordinated action to effectively conserve the genetic diversity of species that are often found across several countries and regions. Exchange of information, methodologies and experiences, and coordination of efforts will be crucial in the future.

The sustainable use of forest genetic resources, including the appropriate selection of forest seed and germplasm management are fundamental in forest plantations. The right match of species and seed source according to site conditions, combined with proper silviculture can improve productivity by well over 20%. Forest genetic resources provide important traits for increasing productivity and quality of outputs, and enables adaptation to biotic and abiotic stressors.

THE COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE Integrating the potential of forest genetic resources

The field of forest genetic resources is undergoing significant changes. Traditionally concerned with technical issues of genetic conservation, tree improvement and seed supply, the scope of genetic management is expanding to include ecosystem services. Scientific advances in biotechnology and legal developments concerning exchange of genetic resources bring new possibilities and challenges, which require development of an enabling policy environment.

The Commission on Genetic Resources for Food and Agriculture is well-positioned to link forest genetic resources to relevant global policy issues, and integrate this area into cross-sectorial strategies. Under its Multi-Year Programme of Work (MYPow) the Commission is working with its member nations to survey what is currently known about the world’s forest genetic resources, which will enable the preparation of the first *State of the World’s Forest Genetic Resources*.

The State of the World’s Forest Genetic Resources will be based on information from country reports and results of thematic studies on important issues related to the conservation and management of forest genetic resources.

Threats to forest genetic diversity

DEFORESTATION: Each year, 13 million ha of forests are being lost, mainly through conversion to other land uses. While this loss is somewhat offset by 5.7 million ha of new forest restoration and afforestation annually, the earth is still losing some 200 km² of forests each day. It is impossible to accurately estimate genetic loss that is resulting from deforestation and forest degradation given our general lack of knowledge of forest genetic resources. However, there is little doubt that deforestation and forest degradation result in many cases in genetic erosion.

CLIMATE CHANGE: Changing weather patterns are altering the growing conditions for forest trees as well as the population dynamic of the pests and diseases that attack them. In Canada, cold winters used to prevent or reduce the spread of a bore beetle plague. The insect is now, with warmer winters, expanding into new areas and attacking pine trees that have no resistance, and therefore threatening the genetic diversity of forest populations. Improving knowledge of forest genetic diversity, including on pest resistance, will be increasingly important in forest management, as this example illustrates.

The preparation of *The State of the World’s Forest Genetic Resources* will be undertaken in synergy with other activities of the FAO Forestry Programme, in particular the Global Forest Resource Assessment (FRA). The Committee on Forestry (COFO) and the FAO Regional Forestry Commissions will be involved in the process. FAO will seek cooperation and synergy with relevant regional and global programmes and instruments, such as the Convention on Biological Diversity.

The State of the World’s Forest Genetic Resources will provide the basis for developing a framework for action at national, regional, eco-regional and global levels.

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