**Chapter 4. CAPACITIES, INSTITUTIONAL AND POLICY FRAMEWORK FOR CONSERVATION AND MANAGEMENT OF FOREST GENETIC RESOURCES**

**Introduction**

This chapter examines institutional, policy, and legal frameworks for FGR management at national, regional, and global level. It explores national and international forest programs, networks, agreements, and other mechanisms for promoting and supporting collaboration.

**4.1 NATIONAL PROGRAMMES AND INSTITUTIONS FOR FOREST GENETIC RESOURCES**

FGR are integrated in forest national programs and are managed by national government institutions such as the Ministry of Agriculture and the Ministry of Environment. Institutions are very diverse and are under different levels, ministries, at both a national and state level. If the country has decentralized administration, the conservation may be managed under different regions and states. Furthermore, there are also private institutions that help conserve FGR. Many institutions of different nature participate in FGR management.

Most countries have institutions working for the preservation and utilization of forest genetic resources which cover: applied research on fast-growing forest tree species; forest seed testing stations; registration and control of forest reproductive materials; sustainable use of forest resources; in-situ and ex-situ conservation, tree improvement utilization, and experimental stations. The Forest Department often is the national institution which is most actively involved in the conservation and use of forest genetic resources. Usually, there is some collaboration among different institutions, but often there is no coordination arrangement for forest genetic resources related activities.

Over the last decade, many countries have successfully formulated national plans and programs concerning FGR conservation and management, and activities relevant to research, education, training and legislation, which have promoted FGR protection and management. These plans have incorporated FGR protection into national action plans -- from the ban on logging of natural forest to the establishment and the protection of nature reserves of key species and typical ecosystems with national priority for protection.

In most countries, there is no national program for forest genetic resources. National forest programs have general measures for conserving forest ecosystems, but in most cases there are no specific provisions related to forest genetic resources.

In developed countries, there are usually a number of institutions actively engaged in forest genetic resources conservation and management. These include universities and colleges, federal and provincial departments, industry, forest genetic conservation and management research, sustainable resource development, non-governmental organizations (NGOs), and tree improvement councils and programmes.

Regional governments generally are responsible for managing forests within their mandates and boundaries. As such, they conduct field and laboratory work. Often, industry also conducts and supports field and laboratory work addressing forest genetic resources (for example, biodiversity and ecosystem health-related research). Some jurisdictions may have tree improvement councils or cooperatives that are responsible for managing and ensuring the sustainability of forest genetic resources. These groups often support or are engaged in field and laboratory work.

**4.2 LEGAL FRAMEWORK**

In general, forest genetic resources legislation needs to be improved, and the effectiveness of existing forest genetic resources regulations should be strengthened. FGR protection and management regulations should be supported, regulatory gaps filled, and FGR management should be promoted in accordance with the law. Governments should also address the requirements for reporting and sanctions for non-compliance. Cooperation between forest genetic resources and national authorities should be enhanced. In some cases, where cooperation between national authorities does not exist, a permanent national commission for conservation and management of forest genetic resources should be established.

Many countries have no specific laws on genetic resources, and FGR-related policies and management tools are outdated. In other countries, there are legislative or policy provisions relevant to forest genetic resources. The objectives are mainly the conservation and protection of the national forests, and to a smaller scale, the national forest genetic resources. Although there are provisions, often no legal framework for forest genetic resources strategies, plans, and programs have been established.

A specific law on genetic resources is needed, and other FGR-related regulations need to be improved. Some countries that have a vast territory (such as China) with rich FGR and high genetic diversity, have identified the need for a specialized FGR research and development institution to coordinate nationwide FGR collection, conservation and utilization for research use, and provide technical support to government departments to formulate relevant policies.

**4.3 EDUCATION AND TRAINING**

Around the world, countries have university courses for bachelor's degrees in forestry. There are universities, colleges, and institutes that offer courses (academic, field, laboratory, extension, and certified) in forest genetic resources conservation education and training. There are also institutions that are accredited to award the educational and scientific degree “Doctor” (PhD). Some smaller countries note that many students study forest genetics aboard, after which they graduate, and return to their home country to work in forestry.

Some colleges have recognized technical forestry programs where students enrolled in these programs can obtain a diploma upon completion of a two to four year program (depending on discipline and co-operative education option). Universities offer degree programs at the undergraduate and graduate levels from faculties of Science in Forestry or Natural Resource Management and a number of these programs address forest genetic resources in their courses.

Enrolment in forestry programs has decreased over the past several years. Universities and colleges are examining new ways to entice students into their programs. Some ideas are to rebrand and transform their programs, develop new programs and partnerships, and broaden the relevance of the faculty and programs.

For many universities, FGR has not been set as an independent discipline in higher and secondary education on forestry. Only few universities have taken FGR as a thesis subject for their postgraduate students; course studies on FGR have been insufficient.

In some countries, the provincial central forestry authorities have organized a number of FGR training workshops at different scales. This of training and dissemination of relevant laws, regulations and policies, has increased the understanding of the FGR importance, strongly promoting the protection and utilization of FGR.

Nevertheless, there has been a general worldwide decline in enrolment in university forestry programs. Recommendations to address this problem include:

(1) have forestry schools join forces with the broader forestry community (for example, forest industry) to enhance the image of the forest sector and the forest profession;

(2) develop an effective partnership framework among all forest research organizations in the county; and

(3) develop or enhance existing partnerships with funding agencies and develop an international forestry education and research program.

Another recommendation to attract students was that programs need to reflect a shift from timber-oriented forestry to “new forestry,” described as sustainable forest management and resource management.

**4.4 RESEARCH**

Some countries, research institutes, universities, production and management institutions have carried out collaborative FGR research and conservation. The forestry research institutions and technology development organizations engage in research and development of FGR. These institutions carry out studies on collection, evaluation, conservation and sustainable utilization of FGR. Some countries, such as Indonesia, have research and development programmes on biotechnology and agricultural genetic resources under the Ministry of Agriculture.

Furthermore, countries have set up a number of special research projects to conduct studies on survey, collection, conservation, evaluation, and utilization of forest genetic resources. These projects have catalogued and documented forest genetic resources, set up and networked with forest genetic resources conservation banks, assessed forest genetic diversity, developed information platforms, and provided sharing services of FGR information. Priorities for improving the monitoring of genetic erosion and for assessing species’ vulnerability include: supporting continued research to assess and monitor species’ genetic diversity, and their adaptive potential to various stressors, and to identify native tree species’ resistance to high-impact stressors.

FGR research and discipline development needs to be improved, theoretical and technical systems need to be enriched, and long-term stable funding support mechanisms should be established. The lack of sustained and stable financial support to FGR research needs to be addressed. The weakness of staffing and capacity in FGR can be further strengthened through the FGR education, research, and training.

**4.5 PUBLIC AWARENESS AND COMMUNICATION**

In general, public awareness on forest genetic resources should be increased. As such, initiatives should be created for greater visibility for forest genetic resources, or awareness programmes for forest genetic resources. It would be useful if parks, reserves, territories of regional forestry boards, state forests and game enterprises, educational and practical forest enterprises, and specialized forest schools were also involved.

The general population is hardly aware of the function and importance of forest genetic resources. For example, Germany reported results of a survey where many agree to the statement “Biological diversity should be preserved and passed on to our children and future generations”. Yet only a small percentage of those surveyed could explain what the term “biological diversity” means and only 12 percent were aware that this also involves genetic diversity within the species. The numerous activities carried out in the 2010 Year of Biological Diversity probably contributed to the increase in awareness of the term “biological diversity” among the population.

Most countries do not have specific programs for creating awareness of forest genetic resources. Throughout the world, the public is more engaged with regard to threats to forest genetic resources in areas such as climate change and changes in land use, since this pertains to the boreal forest and other old-growth forested areas. These topics are prevalent in the media. Public education can be further strengthened by using network, television, newspapers and other media to carry out public education on forest genetic resources, and enhance public awareness of forest genetic resources protection.

The lack of understanding of forest management is accompanied by the lack of understanding about planting productive provenances and of forest plant breeding. Information about the importance of forest genetic resources is not one of the chief priorities of institutions conducting public relations about forests, forestry and nature conservation. In our information-flooded society the “forests” in general and forest genetic resources in particular compete for public attention with many other subjects. Even for those people who are interested in and seek information about the forests the large number of stakeholders with their respective own interests create a rather confusing picture.

Furthermore, much of the public is skeptical about genetic engineering. In some developed countries, genetic engineering and genetics are often considered one and the same. Genetics and all related terms often have mainly been given negative connotations. This greatly hinders conveying knowledge of the importance of forest genetic resources.

A genetic resources communication strategy should be created and access to forest genetic resources information should be improved. Countries should also provide forest genetic resources training and education, and improve understanding of benefits and values of forest genetic resources.

For the countries that do not have a national program, their main challenge is the need for a national program for forest genetic resources with multi-stakeholder participation. These countries also need to develop national forest genetic resources networks.

For other smaller developing countries, there is no specific public awareness program for forest genetic resources. This is often due to the state of ownership of the managed forests which are public and state forests. However, in these countries, there are satisfactory public awareness programs for the importance of national forest ecosystems and resources.

Some surveys showed that the public and NGOs have the lowest awareness of the roles and values of forest genetic resources. Industry and government rated much higher. In general, the values of forest genetic resources have not been widely communicated at a national level. However, public awareness concerning the value of forests and the species within these forests can be enhanced through programs and activities from diverse groups, including the federal government, botanical gardens, small woodlot partnership programs, and through forest or tree-specific conservation groups. Federal and jurisdictional in situ conservation areas have also raised public awareness of the forest and its resources. Furthermore, environmental NGOs have increased awareness of the value of forested areas and associated species.

Some large Asian countries note that public awareness on forest protection has increased continuously over the past 10 years. This is believed to be due to the increase in education on forest ecology. In these countries, forest genetic resources data and information has been gathered and disseminated through professional websites and portals of relevant government agencies, significantly improving the efficiency of dissemination of FGR information.

In sum, the lack of knowledge about nature and the increasing urbanization of the population are impediments to public awareness. There is a lack of reference to the subject matter of “forest genetic resources” in people’s private lives. The forests are the workplace and source of income of only a small fraction of the population. Because of this, understanding for forest management is dropping; the forests are perceived more as natural assets for protection or as the green backdrop of recreational activities.

Institutional strengthening, training, and support to research, are needed for countries to be able to respond to pressing and increasingly varied needs in conservation and FGR management. This includes, among others, training and research aimed at capitalizing on recent developments in forest inventory (remote sensing, GIS), and forest genetics (traditional and more recent molecular marker technologies and other biotechnological tools, as applicable).

Support to training is needed both at professional and technical level. Sensitizing policy-makers, the public and local populations to needs and benefits, responsibilities and advantages of FGR management action in the short, as well as in the longer-term, is also of utmost importance. Networking and institutional twinning, which has long traditions in forestry, has continued potential and should be vigorously promoted.

**4.6 TRENDS IN SUPPORT TO FOREST GENETIC RESOURCES**

Over the last decade, the trends in support of forest genetic resources have generally become stronger but the funding has generally decreased. In only rare exceptions have countries budgets slightly increased over the past ten years.

It is difficult to make an estimate of budget allocations to forest genetic resource research. Forest genetic research falls under a number of different departments within the federal government as well in provincial and territorial government departments. There are also universities and colleges that have programs with individual budgets allocated to research, depending on the project or area of expertise. A large number of organizations have ongoing research in forest genetic resources. This is dependent on the funding and fiscal policies of the current government, both federal and provincial, and therefore, is not easy to determine empirically.

There is little precise and reliable data about budgets for forest genetic resources available, due to the fact that the institutions involved in this activity are often subordinated to many different ministries. The proportion of forestry budget to forest genetic resources is often not more than one percent.

Since domestic funding is often limited, capacity-building activities are sometimes carried out through bilateral cooperation in the form of (project-based) technical assistance programmes and research grants from international agencies. Funding provisions for training and postgraduate studies overseas have normally been a part of the projects.

For some developing countries, the national research for forest genetic resources is very poor and only a small proportion of the forestry budget goes to forest genetic resources. This is due to the lack of a national research institute or university school dealing with forestry. Small-scale research is carried out, occasionally, by forestry schools and institutes abroad or in the frame of small projects.

**4.7 INTERNATIONAL AND REGIONAL COLLABORATION**

***International collaboration***

Countries are interdependent in terms of forest genetic resources. This interdependency calls for cooperation and collaboration at the regional and international level. To this end, countries link with various regional and international agencies, relevant to conserving and managing forest genetic resources. International forestry cooperation and exchange is developing rapidly. Many countries are collaborating with other countries and international organizations to save their forest genetic resources. These collaborative efforts are expected to be a great help in improving a countries' capacities in conservation and sustainable management of FGR.

Many developed countries have established good relationships and cooperates with numerous countries and international organizations around the world. In general, the main form of regional and international cooperation is participating in international networks, bilateral or multilateral cooperation, and implementing international conventions.

Against the background of the continued advancing destruction of forests worldwide, it is the paramount objective of international forest policy to halt deforestation and further degradation of the forests. This is also an important contribution to the internationally agreed Millennium Development Goals to protect the climate, conserve biological diversity, combat desertification, and also to the objective of poverty alleviation, especially in rural regions.

To this end, over the past 35 years the number of international, regional and national institutions, mechanisms and discussion fora which are concerned with forests and forest biological diversity have greatly increased. In some cases, these collaborations are not with the direct purpose of preserving forest genetic resources, but safeguard forest habitats indirectly since they regard the conservation and sustainable use of forest genetic resources. Many countries have formed international collaborations with countries that are in the same region. While institutions generally cover different aspects of work, collaboration among them needs to be strengthened, based on their mandates and comparative advantages.

Harmonization of action will help ensure that wasteful duplication of efforts is avoided, important FGR issues are not inadvertently neglected, reporting burden on countries is minimized, and provision of data and information is consistent across sectors, thus facilitating cross-sectoral linkages.

The UN Food and Agriculture Organization (FAO) is cited by many countries as an important forum for influencing development policy in agriculture, forestry and fisheries sectors. In recent years, the Ministries of Agriculture and Forestry in many European countries have considerably reinforced their roles in both national and international discussions on development policy issues. Another organization that countries cited for international collaboration is The Organization for Economic Co-operation and Development (OECD). The OECD is an international economic research institute for and a think tank for policy planning. The OECD Committees for Agriculture and Fisheries and Working Parties bring together leading civil servants and experts from the 20 member countries. Many Ministries of Agriculture and Forestry are active in agricultural and fisheries policy research and policy design in the OECD context.

Many international agreements are relevant to the sustainable use, development and conservation of forest genetic resources. Various FGR conservation and management issues are covered under international agreements. International cooperation through agreements should address some crucial issues on FGR, such as access, benefit sharing, bio-security and intellectual property rights. The cooperation should also include joint efforts in fighting against illegal trade of FGR. Research collaboration on FGR-related fields should also be promoted.

International cooperation programs and information exchanges such as shared databases, joint research publications, technical guidelines, and germplasm exchange, may also indirectly address forest genetic resources by addressing stresses to the forest (such as climate change under the UN Framework on Climate Change).

The global movement of forest reproductive material should be facilitated. The transfer of this material has been a common practice for several centuries, and field trials established with introduced material have provided valuable insight on the performance of different tree species and their provenances. Results of field trials have directly influenced the transfer of and requests for germplasm and have given countries the opportunity to test new material. Nonetheless, it is increasingly difficult to move forest reproductive material for research purposes with regard to the high collection costs, lack of access to the genetic resources and the misinterpretation of laws. Large international efforts that took place in the past to systematically assess the performance of forest reproductive material would not be possible today due to such difficulties.

The appropriate use of forest reproductive material is a crucial part of forestry and agroforestry and forest development. However, the supply of forest reproductive material is often insufficient to meet the demand; this trend is expected to continue to increase in the future. The movement of forest reproductive material is sometimes based on a variety of agreements (bilateral MTAs or MoUs). However, no standard MTA is used (excluding the ICRAF collection of tree germplasm), and, in many cases, the movement of the material is poorly documented. Documentation associated with secondary transfer of germplasm, in particular, is crucial to maintain the identity of the material and to ensure its appropriate use. The dialogue on ABS issues on forest genetic resources has, thus far, been rather limited within countries; however, these issues are increasingly being considered, following the example of the agricultural sector.

The use and movement of forest reproductive material of both exotic and native tree species brings considerable benefits and opportunities for improving the livelihoods of rural communities that depend on forest resources. However, it is often feared that movement of forest reproductive material may contribute to the spreading of pests or diseases. Preventive measures must be targeted in a manner which does not create barriers to the movement of the reproductive material.

Transfer of forest reproductive material may be needed to facilitate adaptation of trees to climate change. Scientific debate on this issue is ongoing and guidelines for transferring forest reproductive material have not yet been formulated due to many uncertainties. Nonetheless, the use and movement of tree germplasm should be considered as an important component of the national and regional adaptation strategies to climate change. Furthermore, the gene pools of important tree species are rather narrow in certain countries and regions. In these instances, there is a need to broaden the gene pools to maintain the adaptability, productivity and disease resistance of the tree species.

Measures must be taken to address the current weaknesses of existing tree germplasm delivery systems at national and local levels. In many countries, interventions undertaken internationally to improve the exchange of forest reproductive material are likely to have only a limited impact on the material available for smallholders to plant. In developing countries, formal suppliers are able to provide only a small proportion of the material cultivated by smallholders and most farmers indicate lack of access to germplasm as a major constraint. There is a need to rethink the operational means by which tree germplasm reaches smallholders; innovation is required to reallocate roles among current actors to improve quality, capacity and information flows.

***International and regional FGR networks and programmes***

International FGR networks serve different purposes for conservation in-situ and ex-situ. International institutions and networks refer to the participation by a number of countries, institutions, and other global or regional cooperation and exchange networks. Many countries have participated in networks or international institutions such as FAO and IUFRO, which are related to forest genetic resources. Activities such as information exchange, database development, conservation strategies, and seed exchange have promoted sharing of FGR information, improving technical standards, and upgrading international status. International cooperation and exchanges have focused on numerous species.

Some developing Asian countries, for example, used international networks to share information on the status of research and development of forest genetic resources, and gather relevant inputs for forest genetic resources' conservation and management.

As another example, some African countries are members of organizations and networks on forest genetic resources that lapsed in the last 10 years, including CAMCORE, SADC-TSCN and IUFRO-GFIS. As these African economies stabilize, it will be critical for them to reconsider rejoining important groupings such as the CAMCORE and the IUFRO which benefit scientists working on forest tree breeding, forest management, and forest and gene conservation.

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BOX: An example of an international FGR network – EUFORGEN, European Forest Genetic Resources Programme

The objective of EUFORGEN is to promote the conservation and sustainable utilization of forest genetic resources for the welfare of present and future generations. It was set up in October 1994 for the purpose of implementing Resolution No. 2 (conservation of forest genetic resources) of the First Ministerial Conference on the Protection of Forests in Europe (MCPFE), which was held in Strasbourg in 1990. The Member States voluntarily cooperate in it to promote in-situ and ex-situ conservation of forest genetic resources, to coordinate measures, exchange ideas, and disseminate information. EUFORGEN is funded by the Member States and coordinated by the institute Bioversity International in cooperation with the Forestry Department of the United Nations Food and Agriculture Organization (FAO). International activities are harmonized between the individual states. A steering committee, made up of national coordinators, supervises. EUFORGEN recently coordinated and facilitated the establishment of EUFGIS, European Forest Genetic Information System, a tool that is being used for assessing and monitoring the status of FGR in European countries, including the definition of regional conservation strategies.

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Not all networks are successful, however. For example, although some developing countries have been participating in number of regional and sub-regional networks, they have not had many benefits from the networking except in some cases where networking has helped technology development and information sharing.

The lack of coordination between the government and network generally creates this sort of issue. To address this issue, it is essential to have a realistic plan of action compatible with national priority. In addition, some governments may lack sufficient skilled human resources to participate effectively in the networks and benefit fully. Likewise, if the country does not have adequate conservation infrastructures, it is more difficult to receive greater benefits from the networking.

Many countries expressed the need for faster development of scientific infrastructure, advanced methodologies, and modern and unique laboratory equipment. They also noted that the trend of international financial support to forest genetic resources over the past ten years has slightly declined. Many countries do not have any specific monetary aid for international gene conservation purposes.

At this stage, established networks may encourage more intensive communication among the countries in a region. Some similarities among the countries, for example in forest tree species, ecosystems and socio-cultural environments, can be used as entry points for developing a network. Extending the network to reach existing regional organizations should be considered in order to gain support from a broader scope of stakeholders in each of the member countries.

The distribution of forest genetic resources does not correspond to political borders, and this is an important basis for cooperation and coordination on issues related to the management of forest genetic resources. Environmental drivers for change, including climate change, are also issues that span political borders.

International networks should collaborate to amalgamate knowledge and data pertaining to forest genetic resources that is hosted by various agencies and institutions. This amalgamated data would be beneficial for conservation and management strategies. The sharing of national forest resource inventories could include forest ecosystem maps and disturbance databases. The opportunity to further strengthen relationships and cross-border studies will become more apparent as gaps in forest genetic resource knowledge are studied.

Monitoring, which can be closely linked to information management, is also important. Monitoring forest genetic resources and biotic stressors (for example, invasive alien species) impact these resources at a regional level. Work of this type is highly beneficial for developing effective long-term strategies for conserving resources and for either minimizing the impacts of the stressors or for developing scale-appropriate mitigation strategies. With regard to invasive alien pests that can impact the forest sector, the sharing of data concerning outbreaks in other regions is also important as this can assist researchers and forest managers to develop proactive responses to future potential stresses.

Continued collaborative research is important as it addresses issues that are often addressed at the level of species distribution. Further networking to maintain and expand existing research capacity is also useful. It is also important to enhance the ability of research to inform policy at national and regional levels, and to coordinate its implementation.