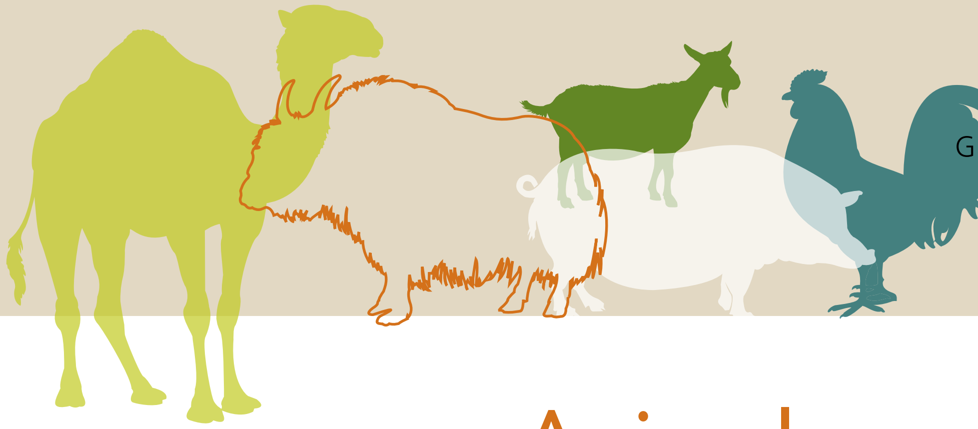


COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Animal genetic resources

A SAFETY NET FOR THE FUTURE

Livestock biodiversity is essential to food and livelihood security, particularly in the developing world. Livestock provide meat, milk, eggs, fibres, skins, manure for fertilizer and fuel, draught power for cultivation and transport, and a range of other products and services. Many of the world's rural poor – an estimated 70 percent – keep livestock and rely on them as important components of their livelihoods. Domesticated animals also contribute to the ecosystems in which they exist, providing services such as seed dispersal and nutrient cycling.

Genetic diversity underpins the many roles that livestock fulfil and allows people to keep livestock under a wide variety of environmental conditions. As a result, domestic animals survive in some of the most inhospitable areas on Earth – from Arctic tundras and high mountains to hot dry deserts – where crop production is difficult or impossible.

Livestock exposed to extreme climatic conditions develop adaptive characteristics that help them survive and produce where other animals would succumb. They adapt to local feed resources and develop resistance to diseases and parasites. Natural selection plays a role, but today's breeds with their unique combinations of genes would not have emerged without continuous active management and selection by farmers and pastoralists over the 12 000 years since the first livestock species were domesticated.

MAINTAINING THE LIVESTOCK GENE POOL

A challenging task

The cost of establishing and maintaining animal gene banks is high compared to those for crops. Preserving animal genetic material entails costly materials, equipment, trained staff and a constant power supply.

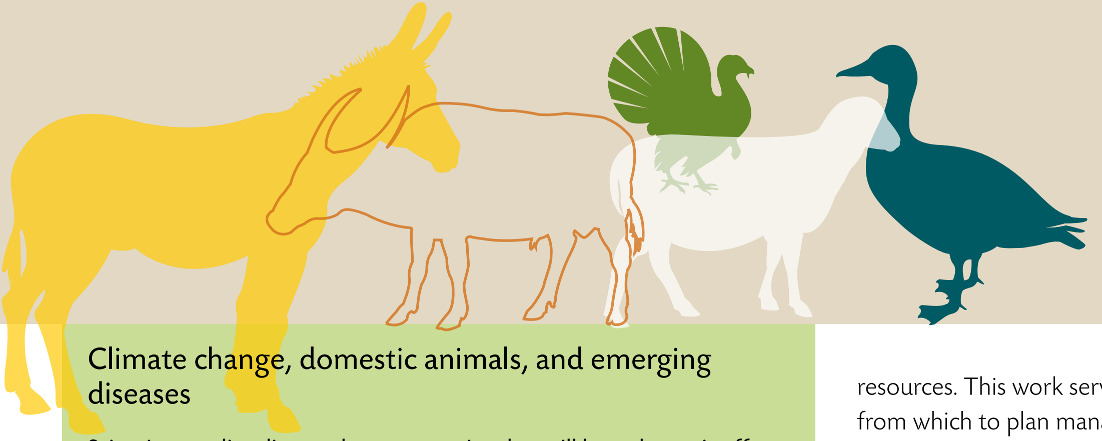
In reality, however, gene banks should primarily serve as a backup to maintaining the breeds in the production systems in which they were developed. The overall goal would be to foster the long-term sustainable use and development of livestock breeds – meeting the economic and social needs of livestock keepers and minimizing pressures on the environment and natural resources while retaining genetic options for the future. However, many constraints must be dealt with:

- knowledge is still lacking regarding the characteristics of many of the world's breeds, including their geographical distribution and population size;
- few countries have conservation programmes for their threatened breeds or even structured breeding programmes that could improve productivity and quality and keep breeds in use; and
- policies and laws affecting the livestock sector rarely pay attention to, let alone adequately support, the sustainable management of genetic resources; in fact, they sometimes discourage maintaining genetic diversity.

Without concerted action, the goal of achieving the conservation, sustainable use and development of animal genetic resources is unlikely to be met.

Genetic erosion: counting the loss

Despite their enormous potential contribution to sustainable development and to reducing hunger and poverty, animal genetic resources for food and agriculture are underutilized and underconserved. Of the 7 600 breeds reported to FAO by its Member Countries, more than 1 500 are at risk of extinction or are already extinct. During the first six years of this century, more than 60 breeds – almost one a month – disappeared forever, taking with them their unique genetic make-up. Losing these breeds is like losing a global insurance policy against future threats to food security. It undermines capacity to adapt livestock populations to environmental changes, emerging diseases or changing consumer demands.



Climate change, domestic animals, and emerging diseases

Scientists predict climate change scenarios that will have dramatic effects on livestock production:

- Heat stress caused by rising temperatures will impair reproduction.
- Water, feed and fodder availability will be affected by climate change as well as by increased demand for fuel crops, which will reduce the amount of land and water available for feed crops.
- Vectors that carry animal diseases will be able to expand their ranges to higher elevations and latitudes as temperatures rise, threatening many traditional breeds and leading to further genetic erosion.

Climate change pressures might favour the use of traditional breeds, which are generally more resistant or tolerant to diseases, and more resilient to temperature changes. New programmes for breeding and exchange of animal genetic resources with important traits will be required.

RECOGNIZING THE ROLES OF LIVESTOCK KEEPERS

At present, much of the world's animal genetic diversity is maintained by the farmers and herders of developing countries. The role of these livestock keepers in maintaining genetic diversity has been acknowledged by the international community, but much remains to be done to ensure that this acknowledgement is backed by concrete action. Animal breeding research rarely focuses on low external input production systems often found in the developing world. *In situ* conservation projects take place mostly in developed countries. Moreover, small-scale livestock keepers – pastoralists and smallholder farmers – are often marginalized from decision-making processes that affect their production systems, resulting in decisions and policies that pose a threat to their capacity to continue as custodians of livestock biodiversity.

Traditionally, livestock keepers willingly shared their animal genetic resources with their neighbours, and eventually among countries and regions, which contributed greatly to the breadth of breed diversity that exists today. However, as the livestock sector became more industrial, the stakes changed. Important issues, such as recognition of the work and rights of livestock keepers, protection of commercial investments in animal genetics and breeding, and intellectual property rights pose new challenges to sharing genetic resources.

THE COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

A Time for action

In 2007, FAO unveiled *The State of the World's Animal Genetic Resources for Food and Agriculture,* a first-ever, global assessment of the status and trends of animal genetic resources. This work serves as an authoritative reference from which to plan management projects.

The State of the World's Animal Genetic Resources for Food and Agriculture was initiated in the late-1990s, when the Commission on Genetic Resources for Food and Agriculture requested that FAO coordinate a country-driven assessment of animal genetic resources. At that time, the Commission also established its subsidiary Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture. By 2005, 169 countries had submitted reports that, combined with reports from international organizations and input from highly recognized scientists and experts, formed the basis of the *State of the World*. The final report was presented to the International Technical Conference on Animal Genetic Resources for Food and Agriculture, held in September 2007 in Interlaken, Switzerland. The FAO Conference, the supreme governing body of FAO, welcomed the report as the first comprehensive worldwide assessment of the state of animal genetic resources.

The Interlaken Conference also adopted a *Global Plan of Action for Animal Genetic Resources*, a landmark international framework for the improved management of breed diversity. The *Global Plan of Action* contains strategic priorities for the sustainable use, development and conservation of animal genetic resources, as well as provisions for financing its implementation and follow-up.

- At the national level, governments shall assess the capability of existing institutions to manage necessary breeding and conservation programmes, and adapt policies as necessary to increase their capacities.
- At global level, the Commission has been charged with overseeing and assessing the implementation of the *Global Plan of Action* and developing the funding strategy for its implementation. A new era of collaborative involvement will require mobilization of financial resources, strengthening international networking particularly at the regional level, promoting the development and transfer of relevant technologies, and giving renewed impetus to training and capacity-building activities throughout the world. Guidelines for national action plans and for the management of animal genetic resources have been completed and are available to countries, with additional technical guidelines under development.

These are some of the many challenges that the Commission will tackle in the next decade through its Multi-Year Programme of Work.

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Plant genetic resources

USE THEM OR LOSE THEM

Ever since hunter-gatherers realized some 12 000 years ago that they could save and plant seeds from season to season, the sum of the world's plant genetic resources for food and agriculture has expanded. Over the millennia, farmers learned to save seeds of crops they deemed easiest to process or store, or those most likely to survive growing seasons or even those that simply tasted the best. As a result, more than 7 000 species of plants have been cultivated or collected. Many remain important to local communities where exploiting their potential is crucial to achieving food security.

It is estimated that nowadays only 30 crops provide 95 percent of human food energy needs and just four of them – rice, wheat, maize and potatoes – provide more than 60 percent. Given the significance of a relatively small number of crops for global food security, it is of pivotal importance to conserve the diversity within these major crops. While the number of plant species that supply most of the world's energy and protein is relatively small, the diversity within such species is often immense. For example, the number of distinct varieties of the rice species *Oryza sativa,* is estimated at more than 100 000. Farm communities in the Andes cultivate more than 175 locally named potato varieties. It is this diversity within species that allows for the cultivation of crops across different regions and in different situations such as weather and soil conditions.

Plant genetic diversity may also provide valuable traits needed for meeting challenges of the future, such as adapting our crops to changing climatic conditions or outbreaks of disease. A variety of Turkish wheat, collected and stored in 1948 was ignored until the 1980s when it was found to carry genes resistant to many disease-causing fungi. Plant breeders now use those genes to breed wheat varieties that are resistant to a range of diseases. Wild botanical relatives of our food crops – often found on the periphery of cultivated lands – may contain genes that allow them to survive under stressful conditions. These genes can add important traits to their cultivated relatives, such as robustness or frost resistance.

Plant genetic resources for food security

African farmers felt little need for alarm when the leaves of their cassava plants occasionally became patchy. However, in 1989, an aggressive strain of cassava mosaic disease, the virus that caused the patchiness, emerged, decimating harvests throughout the Great Lakes region. In Uganda, for instance, the virus-caused food shortages led to localized famine and major economic losses.

In response, national and international experts went into action. They tested some 100 000 cassava samples collected and exchanged among gene banks from around the world. Through a process of genetic selection, they identified a series of resistant varieties and set up nurseries in the affected countries to multiply disease-free cassava seedlings – enabling the recovery of cassava cultivation.

STEMMING THE LOSS OF PLANT GENETIC RESOURCES

Plant genetic diversity is threatened by "genetic erosion", a term coined by scientists for the loss of individual genes and of combinations of genes, such as those found in locally adapted landraces. The main cause of genetic erosion, according to FAO's *State of the World's Plant Genetic Resources for Food and Agriculture*, is the replacement of local varieties by modern varieties. As old varieties in farmers' fields are replaced by newer ones, genetic erosion frequently occurs because the genes found in the farmers' varieties are not all contained in the modern variety. In addition, the sheer number of varieties is often reduced when commercial varieties are introduced into traditional farming systems. Other causes of genetic erosion include the emergence of new pests, weeds and diseases, environmental degradation, urbanization and land clearing through deforestation and bush fires.

Traditional efforts to counter this genetic erosion concentrated on conservation of seeds in crop genebanks (*ex situ*). Today, it has become clear that the best strategy combines *ex situ* conservation with on-the-ground (*in situ*) conservation by farmers in their agro-ecosystems and of crop wild relatives in, for example, areas protected for their environmental value.

While such mechanisms to conserve plant genetic diversity are vital, sustainable utilization of plant genetic resources is likewise essential. Plant genetic diversity increases options and provides insurance against future adverse conditions, such as extreme and variable environments. However, exploiting this potential requires the capacity to improve varieties through plant breeding as well as partnerships and networks that encompass all relevant stakeholders, ranging from farmers to researchers to gene bank managers. This integrated approach is fundamental to developing mechanisms that will enable farming systems to adapt to changes, such as climate change, and to meet future needs.

THE COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Supporting global initiatives to support crop genetic diversity

The Commission on Genetic Resources for Food and Agriculture was established in 1983 as a forum to deal specifically with issues related to plant genetic resources. Within its mandate, the Commission has helped coordinate and guide a series of critical international initiatives – raising awareness in the international community of the rapid increase in genetic erosion and spearheading concerted policy-level conservation efforts. Early on, the Commission developed the Genebank Standards and the International Code of Conduct for Plant Germplasm Collecting and Transfer. These contribute to minimizing the loss of genetic diversity in seed collections and to guiding collecting missions of plant genetic resources.

In the 1990s, the Commission coordinated efforts in more than 100 countries to assess and report on the *State of the World's Plant Genetic Resources for Food and Agriculture*, and led negotiations that culminated in 1996, when 150 countries adopted the *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture*. As the first framework to succeed in integrating conservation and utilization activities, the *Global Plan of Action* also recognized the crucial roles played by farmers, seed curators and breeders in managing these resources.

Building on the *Global Plan of Action,* work proceeded on two other groundbreaking initiatives.

- **The International Treaty on Plant Genetic Resources for Food and Agriculture** – negotiated by the Commission, went into effect in 2004 and has been ratified by more than 120 countries. Through the Treaty, countries agree to establish a Multilateral System to facilitate access to genetic resources of 64 of our most important crops and forages, and to share the benefits in a fair and equitable way. The Treaty provides for sharing the benefits of using plant genetic resources through information-exchange, access to and the transfer of technology, and capacity-building. It also foresees a funding strategy to mobilize funds for programmes to help, above all, small farmers in developing countries. This funding strategy also includes the share of the monetary benefits paid under the Multilateral System.
- **The Global Crop Diversity Trust,** launched in 2004, spearheads international efforts to endow the world's most important collections of crop diversity. The Trust is an essential element of the Treaty's funding strategy, specifically supporting the *ex situ* conservation of crop genetic diversity.

The Trust, the Treaty and the Commission contribute in different but mutually supportive ways to ensure the conservation and sustainable use of plant genetic resources. The Commission and the Treaty's Governing Body cooperate to identify priority actions for the future. The Commission keeps a watchful eye on the threats to plant genetic diversity and the status and trends in its conservation and use, by guiding periodical updates of the *State of the World's Plant Genetic Resources.* As part of its Multi-Year Programme of Work, the Commission also oversees the implementation and facilitates the updating of the *Global Plan of Action*.

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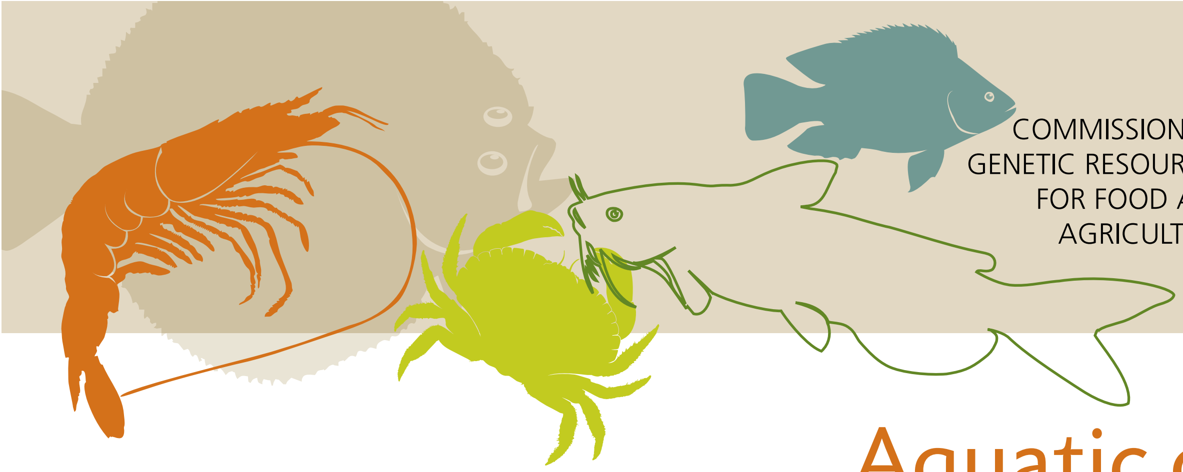
Encompassing all components of biodiversity for food and agriculture

In 1995, based on the increased awareness of the importance of biodiversity in achieving sustainable development, the Commission's mandate broadened. In addition to plants, its work now encompasses all other components of biodiversity for food and agriculture – animal, aquatic, forest tree, invertebrate and micro-organism genetic resources – through its Multi-Year Programme of Work.

Building respect for minor crops and diversifying our food basket

Oca, teff, fonio and canihua are underutilized crop species, but in certain parts of the world they are critical to household food and livelihood security. They are grains and tubers which although conserved and used by local communities are often overlooked by agricultural research and extension programmes. Yet, they and countless other neglected species have widespread potential to contribute to agriculture and diet diversification, bringing benefits to farmers and consumers. The *Global Plan of Action* has set the development and commercialization of underutilized crops as one of its priorities.



COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Aquatic diversity

UNDERWATER AND UNEXPLORED

Aquaculture and capture fisheries production make vital contributions to global food security and provide important livelihood opportunities and income for many subsistence fishing and farming families. The world's wealth of fish genetic resources provides great potential to enable the aquaculture and fisheries sector to further enhance its contribution to food security and meet future challenges in feeding a growing human population. Yet, despite estimates that an additional 40 million tonnes of fish per year will be required to meet global demand by 2030, the opportunities that fish genetic diversity has to offer remain largely unrealized and unexplored.

Capture fisheries: Maintaining aquatic biodiversity, including fish genetic diversity, in capture fisheries is fundamental to guaranteeing the productivity of fish stocks, their resilience and their adaptability to environmental change.

- Production of marine capture fisheries has increased to the extent that there is no room for further expansion, with more than 50 percent of the world's marine fish stocks fully exploited, 17 percent overexploited and 8 percent depleted or recovering from overuse.
- Production of inland water fisheries is often affected by heavy fishing but, more importantly, by the effect of environmental degradation and modification of river basins, which affect fish production potential and biodiversity. The Millennium Ecosystem Assessment found some 20 percent of the world's freshwater fish species have been listed as threatened, endangered or extinct, in just the last few decades.

A blue revolution in the twenty-first century

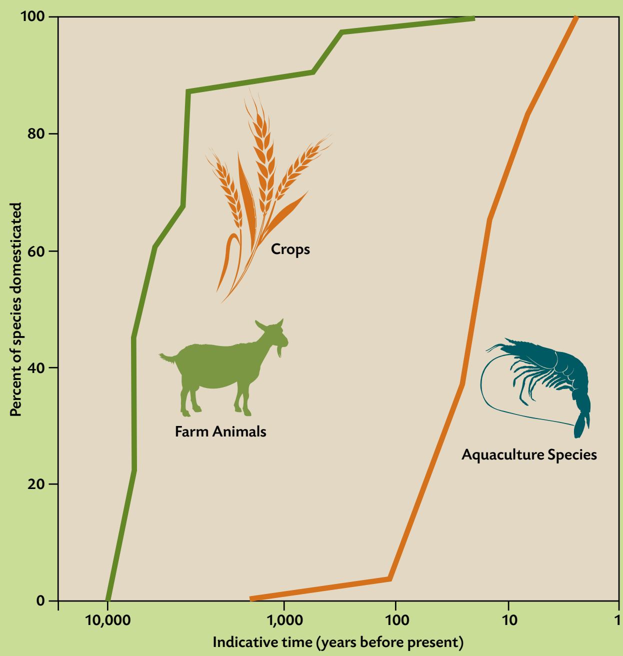
Although humans began to domesticate plants and animals for use in agriculture about 12,000 years ago, more than 90 percent of aquatic species presently in culture have only been domesticated since the beginning of the twentieth century. FAO estimates that 236 species of fish and aquatic invertebrates and plants are farmed around the world, many only domesticated in the last 25 years.

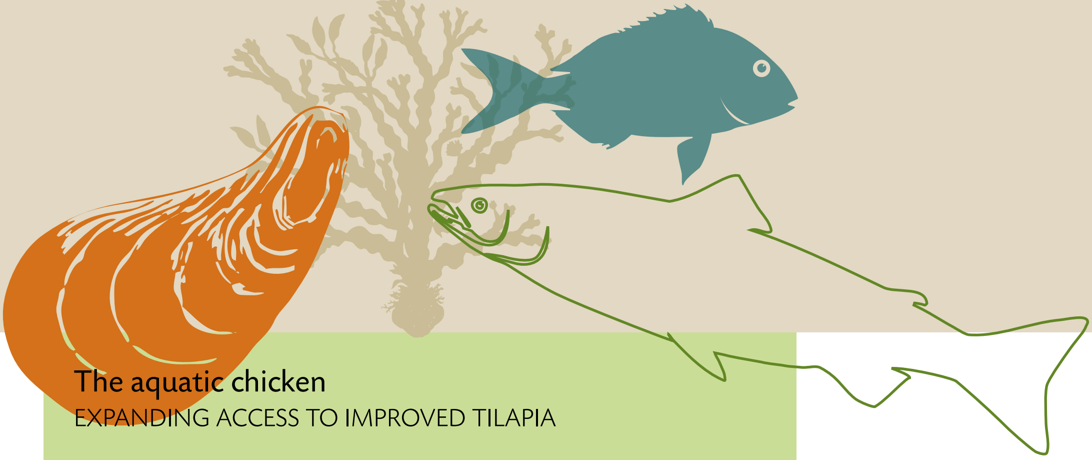
Domestication of additional species and genetic improvement will assist efforts to increase production and productivity and improve fish nutritional value, resistance to disease and ability to adapt to adverse conditions.

However, capitalizing fully on the enormous potential of fish genetic resources also requires recognizing and overcoming:

- the current lack of information regarding the genetic characterization, performance, location, threats and accessibility of fish genetic resources;
- inadequate national fish genetic resources programmes and information systems; and
- the lack of a global policy and management approach to fish genetic resources.

The challenge is to maintain a broad genetic base for the future, not just focus on improving a limited number of commercially viable fish strains.





The aquatic chicken
EXPANDING ACCESS TO IMPROVED TILAPIA

Nile tilapia, often called the “aquatic chicken” because it grows so easily, is a freshwater fish indigenous to Africa. In the early 1990s, several specimens were exported from Egypt, Ghana, Kenya and Senegal to Asia, beginning a highly successful breeding programme that resulted in improved fish stock with increased production, resulting in improved diets and enhanced income generation and employment in several countries. Understandably, African countries want access to the improved tilapia strains. However, there is a risk. If the new strains of tilapia escape from African fish farms into the wild, they could displace or cross-breed with the native tilapia. Comprehensive risk assessments will be required for each potential re-introduction that will both take into account the risk of genetic erosion in the centers of origin for tilapia, and potential opportunities to enhance income, employment and food security among low income African fish farmers.

Aquaculture: The contribution of aquaculture to world food fish production soared from 3.9 percent in 1970 to about 48 percent in 2006, with growth expected to continue. Aquatic genetic resources are of pivotal importance for the further genetic improvement of fish strains, to achieve sustainable development of aquaculture.

Aquatic ecosystems: Rising temperatures associated with climate change are threatening low-lying coastal areas of both island and mainland nations, affecting species distribution and creating conditions that are conducive to the introduction and spread of invasive alien species and the resulting loss of aquatic biodiversity, which will have potentially negative impacts on the type and size of catches.

AQUATIC GENETIC DIVERSITY
The need for conservation and responsible use

Collection of fish genetic resources has taken on a sense of urgency that reflects the pressures on the earth’s aquatic ecosystems and habitats. The process of conserving fish genetic resources is challenging, complicated and often expensive. Efforts are increasing, but gene banking of fish genetic resources is still at an early stage.

There are many potential strategies for the sustainable management of aquatic genetic resources. The FAO Code of Conduct for Responsible Fisheries promotes the conservation of aquatic genetic diversity, maintaining the integrity of aquatic communities and ecosystems, and responsible use of living aquatic resources at all levels, including the genetic level. Ecosystem approaches to the development of responsible aquaculture and capture fisheries also emphasize management of fish genetic resources. FAO has a long tradition of using an ecosystem approach in fisheries and, in 2007, published Technical Guidelines on Genetic Resource Management to support the Code of Conduct for Responsible Fisheries.

THE COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE
Taking steps to identify and sustain aquatic genetic resources

The Commission on Genetic Resources for Food and Agriculture considered the issue of managing aquatic genetic diversity for the first time in 2007, calling upon its Members to initiate steps to determine the current state of the world’s aquatic genetic resources. Initial results have found that valuable information that has the potential to contribute to improved management of fish genetic resources is scattered, kept in diverse assortment of incompatible formats, neither readily accessible nor archived in a secured manner.

Recognizing the urgency of the situation, and as a first step toward compiling the first State of the World’s Aquatic Genetic Resources for 2013, the Commission has launched a review of existing information systems, and will work to develop a more streamlined reporting system for national and international organizations. With the number of farmed fish strains, hybrids and other genetic resources increasing in aquaculture, information systems are needed to identify and determine their relative contributions to farmed fish production. Similarly, better information on the genetics of wild fish populations should contribute to better understanding the needs for conservation and sustainable use.

In addition, the Commission will identify and develop cooperative action and partnerships, which together with an enabling policy environment, will support the maintenance and conservation of a broad genetic base in aquaculture and capture fisheries. This will include working in cooperation with FAO’s Committee on Fisheries to expand upon the elements of the Code of Conduct for Responsible Fisheries that target the conservation and sustainable use of aquatic genetic resources.

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COMMISSION ON
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Cross-sectorial matters

TAKING A BROAD VIEW OF GENETIC DIVERSITY

A universe of thousands of individual species and their genetic variability provide the biological foundation for the world's food production. The genetic diversity of crops, farm animals, forest trees, aquatic organisms, micro-organisms and invertebrates – from bacteria invisible to the human eye that support agricultural soils to thundering yak that inhabit the highest elevations of the Himalayas – plays a critical role in achieving a world without hunger.

While the different components of biodiversity for food and agriculture have distinct characteristics, they also share common features. All contribute to meeting the basic needs of food and livelihood security and many, such as farm animals, depend on human management. The different components face both unique management challenges, as well as common threats, such as climate change.

Conserving and using the reservoir of genetic diversity can provide the options needed for coping with climate change. Yet, at the same time, climate change may also contribute to genetic erosion. Maintaining genetic diversity is therefore both important and urgent. The Commission on Genetic Resources for Food and Agriculture has officially recognized the need to address climate change and agriculture in its future work.

The Commission's Multi-Year Programme of Work

In a Multi-Year Programme of Work approved in 2007, the Commission expressed a long-term goal of producing an overview strategic assessment: the *State of the World's Biodiversity for Food and Agriculture*. This monumental undertaking will not only integrate state of the world reports produced for all components of biodiversity relevant for food and agriculture, it will address cross-sectorial and common themes, including the management of biodiversity in complex agricultural ecosystems. The reports on plant and animal genetic resources will be updated and activities are underway to develop assessments on forest, aquatic, micro-organism and invertebrate genetic resources for food and agriculture.

THE COMMISSION

Exploring cross-sectorial matters

The Commission is committed to addressing cross-cutting issues that can impact any or all components of biodiversity for food and agriculture, such as:

- policies for access to genetic resources and for the sharing of benefits derived from their utilization;
- application of biotechnologies in the conservation and utilization of genetic resources;
- targets and indicators for genetic diversity conservation; and
- ecosystem approaches to biodiversity management.

A number of international bodies deal with these issues. However, the Commission provides a permanent forum where Governments discuss all matters, including cross-sectorial matters, *specifically* relevant to genetic resources for food and agriculture. It follows carefully policy developments in other international fora and aims to ensure policy coherence through close collaboration with other international organizations. The Commission's mandate allows it to ensure that the specific needs and features of genetic resources for food and agriculture are adequately reflected in the development of international policies.

Access and benefit sharing

Two binding international agreements already exist that regulate access and benefit-sharing for genetic resources: the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture. Both are based on the premise that nations have the sovereign right over their natural resources. The Treaty, negotiated by the Commission and ratified in 2004, established a Multilateral System of Access and Benefit-Sharing that facilitates access to, and fair and

equitable sharing of benefits that arise from the use of 64 of the world's most important crops – 35 food crops and 29 forage crops.

The Commission has a long history of contributing to the debate on access and benefit-sharing. It is committed to ensuring that the special needs of biological diversity for food and agriculture are adequately reflected in international policy-making. The issue of access and benefit-sharing for genetic resources for food and agriculture is included in the Commission's Multi-Year Programme of Work.

Biotechnology

The Commission has a key interest in technical and policy developments regarding biotechnologies as they relate to genetic resources for food and agriculture. FAO undertook an overview survey of biotechnology issues and trends for the Commission in order to identify those relevant to FAO and the Commission, and to determine what remains to be done in terms of policy and technical assistance. A review of the application and integration of biotechnologies in the conservation and utilization of genetic resources is another milestone of the Commission's Multi-Year Programme of Work.

Targets and indicators

The Commission is working with FAO experts and members of the scientific community on determining indicators and targets that could best be used to characterize and monitor genetic diversity in terms of what is being gained and lost. The development of targets and indicators will make it possible to measure the effectiveness of programmes set up to slow down genetic erosion and improve conservation.

Ecosystem approach

The ecosystem approach is widely used to ensure that ecosystems are maintained in a sustainable manner. This means protecting their goods and services as well as maintaining their biodiversity. By promoting *in situ* conservation and sustainable farming systems, the ecosystem approach contributes to the conservation and sustainable use of genetic resources for food and agriculture. As the ecosystem approach has been particularly effective in efforts to achieve sustainable forest management, sustainable fisheries, and is being applied to specific aspects of agriculture, the Commission has included the ecosystem approach in its Multi-Year Programme of Work covering all relevant sectors.

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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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

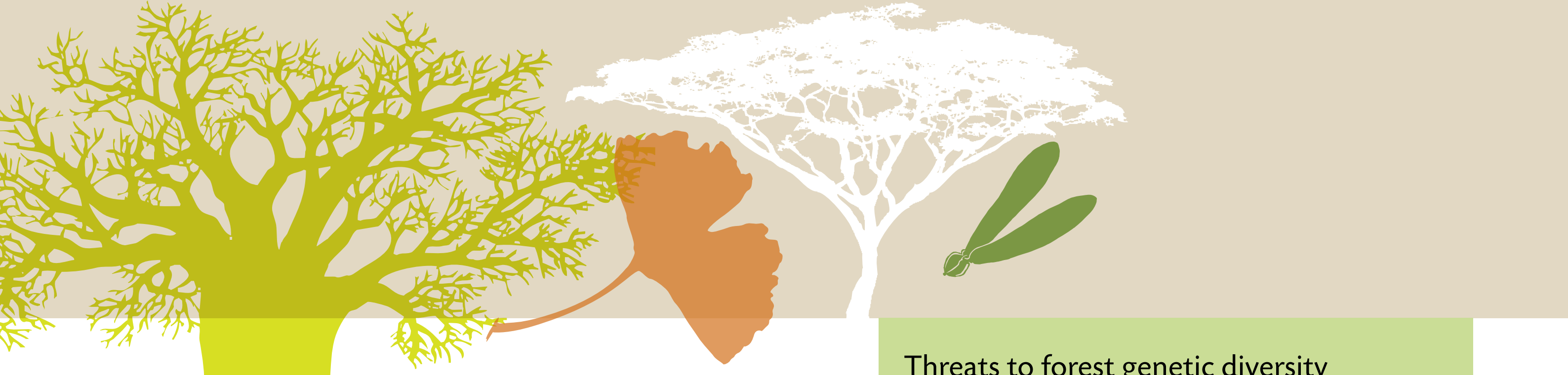
Understanding and managing forest tree genetic diversity is important in all types of forests. Monitoring the diversity of tree populations in primary forests can improve our knowledge on how ecosystem services and goods are being delivered. Intensive genetic selection and breeding takes place in plantation 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 km^2 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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