
FAO and the Management of Plant Genetic Resources

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Introduction

Biological diversity is usually associated with wild animals and plants, and there is generally little political awareness of the crucial importance of genetic diversity in agriculture for food security and human survival. As a result, little is being done to halt the rapid erosion of genetic diversity currently taking place in agriculture or to address the emerging problem of restricted access to available genetic resources.

This article is about *plant genetic resources for food and agriculture*¹ and the work being done within the FAO system to establish a regime for the management of these vital resources. Its purpose is to assess FAO's achievements and identify the limitations in this issue area, with particular focus on the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA).

The CGRFA has concentrated on the implementation of the International Undertaking on Plant Genetic Resources for Food and Agriculture (1983), the development of the Global Plan of Action (1996), and negotiations for an International Treaty on Plant Genetic Resources for Food and Agriculture (2001). Its interplay with other international regimes is fundamental to an understanding of its achievements and limitations, and will be highlighted accordingly. First, however, we turn to the structure of the problem, i.e. the challenges facing the CGRFA.

An Emerging Crisis for Food Security

Plant genetic diversity is crucial to the breeding of food crops and thus one of the central preconditions of food security. Access to diverse genetic resources is vital to modern plant breeding as it provides the genetic traits required to deal with crop pests and diseases, as well as with changing climate conditions.

Throughout history there have been many examples of the crucial importance of genetic resources for food security and human survival.² During the potato blight in Ireland in the 1840s, for instance, more than 1 million people starved to death and another 1 to 2 million migrated to America while the harvests rotted in the soil. The genetic resources that provided the necessary resistance to potato

blight were finally found in the Andes and in Mexico and subsequently brought to Ireland, putting an end to the crisis. In 1870 coffee rust wiped out the coffee industry in huge parts of Asia and Africa, thereby eliminating the economic basis for untold numbers involved in its production. Cotton was hit by epidemics in the 1890s. Rust struck the US wheat crop in 1904. Brown spot disease devastated the Indian rice crop, resulting in the disastrous Bengal famine in the 1940s. Corn blight struck the USA in the 1970s. These and many other examples have one element in common. The genetic resources needed to produce the necessary resistance against the various pests and diseases were found in the centres of diversity³ of the respective crops. Without these genetic resources, the battles would have been lost.

A further point regarding the need to have access to plant genetic diversity is that it is essential for traditional small-scale farming, on which 1.4 billion people world-wide depend for their livelihoods.⁴ Traditional small-scale farmers maintain the yields and qualities of their crop varieties by the exchange of seeds and seedlings over short and long distances, as they have done since the dawn of agriculture. Without genetic renewal, the yields will decrease and quality will deteriorate. Diversity between and among crops is also a means to spread the risk of crop failure due to pests and diseases or adverse climatic conditions, such as drought. Currently 75 per cent of the world's poorest 1.2 billion people live in rural areas and depend on farming.⁵ Access to adequate genetic resources is therefore vital in the fight against poverty.

Food crop genetic erosion is reportedly a serious problem in almost all countries of the world, and for several major crops the variety losses have been up to 80–90 per cent over the past century.⁶ In addition, legal restrictions on access to available genetic resources are emerging as an obstacle to plant breeding and to traditional farming.

The Roots of the Current Crisis

The single most important reason for genetic erosion is the replacement of traditional varieties with modern, high yielding, and genetically uniform ones.⁷ Whereas the

Green Revolution contributed to a substantial increase in food production, at the same time it decimated untold food crop varieties that were vital to small-scale farmers and the future of plant breeding. In an attempt to rectify the loss, domestic and international gene banks were established. Gene banks are now essential to conserving and maintaining the varieties that were—and are still being—saved.⁸ However, widespread genetic erosion is also taking place in some, perhaps even many, gene banks, as a result of poor management, poor maintenance, and scarce financial resources, as well as limited institutional capacities.⁹

In addition, legal restrictions on the access to still available genetic resources are emerging as an increasing problem. Two forms of legal restrictions have gained importance in this context: (1) intellectual property rights to plant genetic resources (plant breeders' rights and patents), and (2) acts and regulations at the national level in a range of countries governing access to genetic resources. The two are interrelated, as explained below.

The most common type of intellectual property rights to plant genetic resources is *plant breeders' rights*, which have been enacted in most industrial and an increasing number of developing countries. These systems have been established to provide incentives to plant breeders to come up with improved crop varieties that are novel, distinct, genetically uniform, and stable. The scope and coverage of the rights differ, as, consequently, does the way in which they restrict access. What they have in common is the exclusive rights of breeders to produce for commercial marketing the crop variety they have developed.

Most systems of plant breeders' rights are oriented towards, or are in compliance with, the provisions of the Convention for the Protection of New Varieties of Plants of the Union for the Protection of New Varieties of Plants (UPOV). The UPOV Convention was adopted in 1961 to provide uniform and clearly defined principles for the protection of plant breeders' rights. It was revised in 1972, 1978, and 1991. The main difference between the latest and the earlier versions is that farmers are no longer entitled freely to exchange and sell seeds they harvest from varieties protected by the respective plant breeders' rights. In addition, breeders are required to obtain authorization from the rights holder for the commercial marketing of a new variety if it is essentially derived from a protected variety, whereas there was earlier an unrestricted 'breeder's exemption' to encourage further breeding. The 52 members of UPOV¹⁰ are mainly OECD countries and a few developing countries that have ratified one of the versions of the Convention. So far 22 countries have ratified the 1991 version. As the 1978 version is no longer open for ratification, potential new members will have to ratify the 1991 version.

Plant breeders' rights do not stop farmers from using their traditional varieties, and did not usually stop them from using protected varieties in their traditional ways either. Protected varieties could be employed as an input to strengthen and improve own varieties, allowing parts of the harvest to be used for sowing, exchange, and sometimes sale, without paying royalties to the rights holders. Under UPOV 1991, governments may permit farmers to use protected varieties for propagating purposes on their own landholdings, but not to exchange or sell the seeds or harvest thereof. As the number of varieties protected by stricter plant breeders' rights increases and the number of traditional varieties falls, the total number of varieties available for traditional use by farmers—over time—obviously declines, affecting their ability to maintain yields and resistance of their own crop varieties.

Another effect of the introduction of plant variety protection in a country is that it encourages the sales of improved varieties. In Brazil, for example, Monsanto increased its share of the maize seed market from zero to 60 per cent between 1997 and 1999, following the introduction of legislation on plant breeders' rights.¹¹ Whereas the introduced varieties may have increased and improved production, at the same time they crowded out local varieties, contributing to further genetic erosion.

The *patent* represents the strongest form of intellectual property rights protection inasmuch as it limits the rights of farmers to sell or reuse seed they have grown, or of other breeders to use that seed for further research and breeding purposes. Patent systems are well established in the USA, Japan, and Australia. The WTO Agreement on Trade-Related Intellectual Property Rights (TRIPs) of 1994 defines minimum standards for intellectual property rights in the WTO member countries in order to strengthen, expand the scope for, and harmonize the national systems of patent legislation. Plant varieties are to be protected either by patents or—as a minimum standard—by an effective *sui generis* system, which means a system of its own kind.¹² What a system of its own kind is, however, has never been defined. That said, the UPOV and several OCED countries—fronted by the USA—suggested it meant legislation along the lines of UPOV 1991. This has formed the point of departure for the implementation of TRIPs in a range of developing countries.

There is a causal relation between intellectual property rights to genetic resources and the *acts regulating access to genetic resources* in a range of developing countries. The drive towards intellectual property rights on crop varieties has been, and is still, fuelled by the interests in many Western countries in the commercial use of these resources and the growing economic stakes of the new biotechnologies. Developing countries do not have the capacity in

terms of institutional systems and financial resources to make use of patent systems, and many of them may, for the same reasons, expect only limited benefits from plant varieties protection systems. On the other hand, the lands from whence most of the plant genetic resources for food and agriculture originate are located in developing countries. Since these new trends could be construed as a fresh wave of exploitation of the South by the North, the emerging intellectual property rights regimes made it more important than ever that developing countries work to secure a fair and equitable share of the benefits derived from the use of genetic resources. And this indeed represented a core motivation behind the developing countries' positions under the negotiations of the Convention on Biological Diversity (CBD). As the CBD was adopted with the objectives of conservation and benefit sharing,¹³ it was viewed as a victory for the South.¹⁴

In implementing the CBD, a range of developing countries developed legislation regulating access to genetic resources. With an emphasis on conditions enabling benefit sharing, the provisions on access to genetic resources set out in the first generation of such acts proved in many cases to be bureaucratic, overly restrictive, and time-consuming.¹⁵ This is one of several reasons for the decline in the international exchange of genetic resources for food and agriculture over the past ten years,¹⁶ and new national regulations have so far not brought about the expected monetary benefits in this area. Whereas the regulations may have a potential for benefit sharing with regard to wild plant genetic resources, the prospects for domesticated plants are not promising.¹⁷ With the current approach, regulations have restricted access to plant genetic resources for food and agriculture, so far without providing monetary benefits for developing countries.

How these Root Causes Affected the Efforts for International Regulation by the FAO

When the FAO International Undertaking was adopted in 1983, the USA opposed it because the developing countries were demanding that all types of genetic resources should be seen as a common heritage of mankind, freely accessible to everyone. There was an obvious clash with the intellectual property rights regime under development in the USA. Nine years later, however, the positions were reversed due to the emerging intellectual property rights regime being negotiated as part of the Uruguay round leading up to the WTO Agreement on TRIPs. In the parallel CBD negotiations, developing countries advocated the sovereign rights of states over their genetic resources and the sharing of benefits resulting from the use of these resources in an attempt to counterbalance the TRIPs process. The USA argued against any restrictions to access to

genetic resources under the CBD.¹⁸ At the same time the USA was in the forefront of establishing the TRIPs regime.

The CBD was the first international agreement ever to address the sustainable management of biological diversity world-wide. However, in seeking to encompass every aspect of global biological diversity, the negotiators could not solve all issues. Particularly, it was difficult to handle specific issues pertaining to plant genetic resources for food and agriculture. In the Nairobi Final Act of 1992, which was the document adopting the text of the CBD prior to its signing in Rio de Janeiro, outstanding issues were addressed and delegated to the FAO for further negotiations. These issues were: (1) access to gene bank collections acquired prior to the entry into force of the CBD; and (2) the question of farmers' rights. Both the FAO and the Conference of the Parties to the CBD called for a harmonization of the International Undertaking with the Convention, including solutions to these outstanding issues. This was the point of departure for the long-lasting negotiations leading up to the adoption in 2001 of the International Treaty on Plant Genetic Resources for Food and Agriculture.

The task of harmonizing the International Undertaking with the CBD was a challenging one. For the first time the CBD should be operationalized with regard to one particular component of biological diversity, with its particular characteristics and management needs. While there were no problems in adopting the overall objectives of the CBD, the rationales behind the two agreements had different weighting. The International Undertaking was born out of a need for facilitating access to genetic resources, whereas the CBD emphasized the need for fair and equitable sharing of benefits arising out of the use of genetic resources. As we have seen, the first generation of acts regulating access to genetic resources in order to achieve benefit sharing actually restricted access. This made harmonization between the two regimes difficult. An approach to benefit sharing that could work for crop genetic resources had to be found.

Another complication was that the CBD was based on a bilateral approach to the regulation of access and benefit sharing, with the country of origin of a genetic resource as the starting point. For wild resources it is normally possible to identify more or less their point of origin, and also when there is more than one country of origin. However, domesticated resources have been developed gradually via exchanges between farmers and breeders over short and long distances for hundreds and thousands of years, in several cases since the beginnings of agriculture. Determining the countries of origin of these resources, in accordance with the definitions set out in the CBD, i.e. the countries where they have developed their distinctive proper-

ties—and thereby which entities are rightfully authorized to manage them—is in most cases virtually impossible.¹⁹

These were some of the major reasons why the negotiations of the International Undertaking lasted for seven years, during which time genetic erosion continued unabated. As countries were awaiting the new agreement, little was done to implement the Undertaking at the national level. In this context it is important to mention that there was generally little political attention given to the management of plant genetic resources for food and agriculture and the FAO International Undertaking. The effect was a lack of political pressure for the finalization of the negotiations as well as the use of the negotiations as a scapegoat for postponing action in this issue area. A policy vacuum emerged.

It was not easy to find solutions to the problems outlined above while at the same time keeping the negotiation text in harmony with the CBD. The solution was a multilateral system for the facilitation of access and ben-

efit sharing established under the new treaty, covering 35 crops and 29 forage plants under public domain (see the section on the International Treaty, below). The fact that the negotiations finally resulted in a treaty that was legally binding was a positive effect of the interplay between the International Undertaking, which was not legally binding, and the CBD.

However, while negotiations continued within the FAO, the CBD and the TRIPs were being implemented in several countries, creating difficult conditions for the later implementation of the International Treaty. An important question in this regard is whether the new treaty will override legislation derived from the CBD and/or TRIPs at the national level. It could be argued that it offers more specific provisions for the management of plant genetic resources than the CBD, which would mean that it should override the Convention. When it comes to the TRIPs, the situation is more complicated, as the treaty states that it is not allowed to seek any form of intellectual property rights

Table 1. Summary of the way in which international regimes, through their interplay, have affected the management of plant genetic resources for food and agriculture

International agreements	Interplay	Effects
CBD and IUPGR	In 1992/3 the parties to both agreements called for the harmonization of the IUPGR with the CBD. The work took seven years inter alia because core provisions of the CBD were not suited to the management of food crop genetic resources, thereby complicating negotiations.	Policy vacuum with regard to policies aimed at halting crop genetic erosion: there was hardly any domestic implementation of the Undertaking and CBD in this area, as the States Parties to both agreements waited for the revision of the Undertaking, which finally resulted in the ITPGR.
UPOV and TRIPs	All WTO members have to implement the TRIPs and, as such, a patent system or an effective sui generis system, which means a system of its own kind, for the protection of intellectual property rights to plant varieties. Many OECD countries perceive it as a system based on UPOV 1991	Most of the countries in the world have adopted, or are currently in the process of adopting, legislation on intellectual property rights to plants and/or plant varieties. Such legislation contributes to restricting access. The extent to which they do so is determined by their coverage.
UPOV, TRIPs, and CBD	Because the growing demand for intellectual property rights to genetic resources originally stemmed from the South, developing countries called for fair and equitable benefit sharing under the CBD negotiations and won through with the demand.	Several developing countries adopted legislation to regulate access to genetic resources, in order to secure benefit sharing. The first generation of these acts have restricted access and contributed to the reduced transfer of crop genetic resources.

Source: Andersen, Regine (2002), 'The Time Dimension in International Regime Interplay', *Global Environmental Politics* 2: 3, 98–117.

on genetic material obtained from the multilateral system, in the form it is received. This would seem to conflict with the TRIPs. It could be argued that the new treaty should override the TRIPs in these cases, as the particular crops to which such provisions would apply are clearly set out in the treaty.

The Challenging Role of the FAO-CGRFA

The developments outlined above constitute the key challenges facing the Commission on Genetic Resources for Food and Agriculture (CGRFA) of the FAO that have emerged over the past two decades. The achievements and limitations of the CGRFA need to be understood against this backdrop.

The CGRFA is a permanent forum where governments discuss and negotiate matters relevant for the management of genetic resources for food and agriculture. The main objective is to ensure the conservation and sustainable utilization of these resources, as well as the fair and equitable sharing of benefits derived from their use, for present and future generations.

Mandate of the CGRF

The CGRFA was first established by the FAO Conference in 1983 as the *Commission on Plant Genetic Resources*, an intergovernmental body charged with ensuring the implementation of the International Undertaking and monitoring especially the operation of international arrangements pertaining to the management of plant genetic resources for food and agriculture.²⁰ In 1995 the Commission was renamed the *Commission on Genetic Resources for Food and Agriculture* (CGRFA) and its mandate broadened to cover all components of biological diversity of relevance for food and agriculture, including animal genetic resources, forests, and fisheries. Its advisory role for the FAO was strengthened, as was its co-ordinating function with regard to other multilateral institutions.²¹

According to the statutes,²² the CGRFA is to review all matters relating to the policy, programmes, and activities of the FAO pertaining to genetic resources for food and agriculture, and to recommend measures for the development of a comprehensive global system on these resources. Furthermore, the CGRFA provides an intergovernmental forum for negotiations, and a body overseeing interplay with other relevant international agreements, as well as with other international, governmental, and non-governmental bodies dealing with the conservation and sustainable use of genetic resources.

Organizational Structure and Operating Procedures

A total of 165 countries are members of the CGRFA as of February 2003. The *Commission* holds regular sessions

every second year, and extraordinary sessions when required. These sessions are also attended by observers from relevant technical assistance agencies, intergovernmental organizations, development banks, and non-governmental organizations. Two intergovernmental technical working groups have been established to assist the Commission in its work, one on plant genetic resources for food and agriculture and one on animal genetic resources. The *Intergovernmental Technical Working Group on Plant Genetic Resources* was established in 1997 and consists of representatives from 27 countries, elected by the Commission. The group meets upon the decision of the Commission. The CGRFA and its subsidiary bodies are supported by a *secretariat* of five staff.

As the CGRFA has worked on the management of plant genetic resources since its inception in 1983, this is the part of its work that is best developed. After the mandate was broadened in 1995, the Commission started working on animal genetic resources, developing and monitoring a global strategy for the management of farm animal genetic resources. However, it decided to postpone work on forest and fishery genetic resources due to capacity constraints, and activities in these issue areas have thus not yet commenced. When reviewing the achievements of the CGRFA, it is therefore most relevant to concentrate on its efforts pertaining to plant genetic resources for food and agriculture.

The FAO Global System on Plant Genetic Resources

This *Yearbook* provides an overview of the activities in which the CGRFA is engaged in the field of plant genetic resources for food and agriculture (see its sections on the FAO agreements). The common denominator for them all is the *FAO Global System on Plant Genetic Resources*. The Global System is mandated to ensure the safe conservation and to promote the availability and sustainable use of plant genetic resources by providing a flexible framework for sharing the benefits and burdens. Following the International Undertaking, the Global Plan of Action and the International Treaty are the cornerstones of the FAO Global System on Plant Genetic Resources.

The International Undertaking

At the time the *International Undertaking on Plant Genetic Resources for Food and Agriculture* was adopted in 1983 there was a split between those in favour of intellectual property rights to improved varieties of plants and those in favour of unrestricted access to all plant varieties.²³ The USA, together with representatives from the seed industry, was the leading proponent of the former stance and developing countries of the latter. The adoption of the Undertaking was a partial victory for the developing coun-

tries.²⁴ Soon more than 100 countries had adhered to the Undertaking, but compliance was voluntary—a major drawback. That said, it played an important role in framing the development of instruments aimed at these objectives, as well as providing an international arena for discussions.

Objectives under Crossfire

The objective of the International Undertaking, as stated in its original 1983 version, is to ensure that plant genetic resources for food and agriculture will be explored, preserved, evaluated, and made available for plant breeding and scientific purposes. Its two-pronged goal was clear: conservation and access. The Undertaking was based on ‘the universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction’ (Article 1). However, when the FAO Conference revised the Undertaking in 1989 and 1991, it changed in the process the understanding of that principle.

In 1989 a rights perspective was introduced when the FAO Conference adopted an annex to the Undertaking, which recognized plant breeders’ and farmers’ rights.²⁵ Plant breeders’ rights, as provided for under the UPOV,²⁶ were—in an effort to tempt more countries to sign up to it—not to be considered incompatible with the International Undertaking. Many developing-country representatives regarded the recognition of plant breeders as unfair, as they were responsible only for the last few chains in the development of a new variety. In an effort to reach consensus, an additional provision was tabled which recognized ‘the enormous contribution that farmers of all regions have made to the conservation and development of plant genetic resources, which constitute the basis of plant production throughout the world.’²⁷ The opponents of plant breeders’ rights thus gained recognition of farmers’ rights in exchange for something that already existed, i.e. plant breeders’ rights. The compromise was adopted by consensus.

A further annex to the Undertaking, approved at the same FAO Conference, outlined the concept and implications of farmers’ rights.²⁸ The international community was to ensure full benefits to farmers from the improved use of genetic resources and support the continuation of their contributions to the conservation and sustainable use of plant genetic resources by way of providing sufficient funds and assistance.

In 1991 a new annex to the International Undertaking was adopted. This time, the FAO Conference stated that the concept of genetic resources as the heritage of mankind, as applied in the Undertaking, was subject to the sovereignty of the States. Against this background the FAO members stated that the conditions for access to plant

genetic resources required further clarification.

After these revisions, the Undertaking’s original purpose to ensure unrestricted access to genetic resources was no longer that clear. The intentions were still the same, but new factors had been introduced which complicated the follow-up and limited its prospects of implementation.

The Tasks Addressed in the Undertaking

The main tasks of the Undertaking were as follows:

- exploration of varieties of crops, their wild relatives, and undomesticated food plants in the countries adhering to the Undertaking;
- preservation, evaluation, and documentation of plant genetic resources in the areas of their natural habitat in the major centres of genetic diversity as well as outside, in gene banks and living collections of plants;
- ensuring open access to the plant genetic material preserved.

These tasks were to be carried out by the States Parties to the International Undertaking, but also by multilateral actors such as the FAO and the institutions of the *Consultative Group on International Agricultural Research* (CGIAR). The implementation of the Undertaking required close international co-operation in the form of international gene bank and information-sharing networks, steps to enhance the performance and numbers of gene banks, and efforts to encourage financial support and capacity building.

Major Achievements at the International Level

The greatest achievement of the International Undertaking at the international level was the establishment of the *International Network of Ex Situ Collections under the Auspices of the FAO*. In 1994 the 12 centres of the CGIAR with gene banks²⁹ concluded a series of agreements to place their germplasm collections under the auspices of the FAO. The agreements constituted the cornerstones of the International Network. It meant that almost 450,000 accessions of plant varieties, including the information about them, were made available for plant breeding and direct use. Meanwhile, the accessions make up between 20 and 50 per cent of all genetic material conserved in gene banks.³⁰ To ensure continued availability the centres agreed to pass the obligation that any recipient of the genetic resources should not claim ownership to them or seek intellectual property rights over them or information relevant to them. An important instrument for the facilitation of access to the genetic resources kept in the CGIAR gene banks is the *System-Wide Information Network for Genetic Resources* (SINGER). SINGER was established by the CGIAR as a database with easily accessible information on the indi-

vidual collections in the gene banks with regard to identity, source, characteristics, and transfer.

Another achievement is the establishment of the *World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture* (WIEWS) to foster information exchange among FAO member States. WIEWS includes a global network of country correspondents who are officially nominated by their respective governments, a global repository of relevant documents, and an early warning system on genetic erosion. The development of WIEWS, given its scarce resources and high ambitions, has not been without problems, though it continues apace.

Finally, the *International Code of Conduct for Plant Germplasm Collecting and Transfer*, which was adopted by the FAO Conference in 1993, should be mentioned, as it has established a moral and professional standard on the collection of crop genetic resources.³¹

Minor Achievements at the National Level

Whereas there have been substantial achievements at the international level, nationally there are few of any real substance.

The most comprehensive review of the situation at the national level was finalized in 1998.³² It concluded that about 40 per cent of all countries (industrialized as well as developing countries) had national programmes and effective co-ordination mechanisms.³³ However, these programmes were focused mainly on *ex situ*³⁴ conservation, with poor institutional linkages to utilization efforts. Only 27 of 154 countries reported the inclusion of *in situ* conservation³⁵ in their national programme, and only 26 countries reported that utilization was an integrated part of the programme.³⁶ The major steps required to achieve the tasks set out in the International Undertaking were identified as:³⁷

- the establishment of national committees or other co-ordinating mechanisms to facilitate participation and co-operation between all stakeholders;
- the elaboration of national policies and strategies for PGRFA that are integrated with national development plans and encompass *ex situ* and *in situ* conservation as well as utilization;
- a clear legal basis for national programmes;
- capacity enhancement and sustainable funding.

Renewed Concerted Efforts for Implementation: The Global Plan of Action

It was already evident in 1996, when representatives from 150 countries met for the *Fourth International Technical Conference on Plant Genetic Resources* in Leipzig, Ger-

many (the so-called Leipzig Conference), that national implementation of the International Undertaking was behind schedule. In a declaration from the meeting, the representatives stated that major gaps existed in national and international capacities to conserve, characterize, evaluate, and sustainably use plant genetic resources.³⁸ They also stated that access to and the sharing of both genetic resources and technologies were essential for meeting world food security and the needs of the growing world population. On this basis, the representatives adopted the *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture*.

The Global Plan of Action was drawn up with the participation of 154 countries. Each country prepared comprehensive reports on the state of plant genetic resources for food and agriculture in their territories. These reports were compiled and analysed in a comprehensive and detailed report, covering biological, technical, and institutional concerns. This *State of the World's Plant Genetic Resources for Food and Agriculture*³⁹ represented not only the main edifice of the Global Plan of Action, and the most important reference work on plant genetic resources since Jack Harlan's *Crops and Man* in 1975,⁴⁰ but also a process galvanizing policy makers and practitioners for the management of these vital resources throughout the world. As such, the report must be regarded as a major achievement in itself.

For the purpose of implementation, the Leipzig Conference reaffirmed the commitments for new and additional funds made under Agenda 21 of the United Nations Conference on Environment and Development and by the Parties to the Convention on Biological Diversity (the Global Environment Facility, GEF).⁴¹ These funds were to be used to support developing countries and countries in transition in their efforts to implement the Global Plan of Action.

Objectives and Achievements

The Global Plan of Action provides a framework for the identification of priority areas by the countries, and the support for capacity enhancement towards these ends. The priority activities are to be identified within the areas of *in situ* conservation and development, *ex situ* conservation, the utilization of plant genetic resources, and institutional development and capacity enhancement.

According to a survey carried out in 2000,⁴² *in situ* conservation is still not receiving the necessary level of attention from the countries. There is a range of small initiatives, mainly taken by NGOs, but nothing of any appreciable scale. On the other hand, several countries have come far in compiling inventories of plant genetic resources for food and agriculture. The highest priority was given to *ex*

situ conservation and increasing the number of accessions. However, only half of the countries had properly trained their technical staff, a circumstance that could clearly threaten the quality of those missions. Only a few countries reported that they were regenerating threatened accessions. This is a substantial problem not least because of the huge backlog of accessions in need of regeneration. It poses a major threat of genetic erosion. When it comes to the utilization of plant genetic resources for food and agriculture generally little progress can be noted.

Little has been done to enhance capacities for the management of plant genetic resources for food and agriculture, and the funding situation is still a major bottleneck in the implementation of the plan. The Global Environment Facility, which was highlighted as the major financing facility for the plan at the Leipzig Conference, was, as of 2000, supporting only four small projects for on-farm conservation.⁴³

The Global Plan of Action is detailed and focuses on the actions necessary to reach sustainable management of the plant genetic resources for food and agriculture that are left. However, it has not yet thrived. Its potential as a catalyst for action is still largely underutilized. One reason seems to be the lack of awareness at the different political levels with regard to the issue at hand, and its implications for funding.

The policy vacuum that emerged as countries awaited the final revision of the International Undertaking may have compounded the lack of interest in the Global Plan of Action (see Introduction, above). Now that the International Treaty has been adopted, a major window of opportunity has opened up. The crucial question is whether this opportunity will be taken, whether it is still possible to revitalize the spirit and commitment of governments and NGOs present in 1996 now there is a binding international agreement on hand.

The International Treaty—at Last

When the *International Treaty on Plant Genetic Resources for Food and Agriculture* was finally adopted in November 2001, many observers had almost given it up. The negotiations were extremely difficult, core provisions in the text were in brackets right up to the last bell, and it seemed impossible to unite all fronts on joint solutions. As full consensus proved impossible, it was necessary to bring the matter to the vote. At the Conference, 116 countries voted in favour of the treaty and two countries abstained (Japan and the USA). The International Treaty could finally be adopted by the FAO Conference in November 2001 as the first legally binding agreement exclusively pertaining to plant genetic resources for food and agriculture. Since then the USA

has revised its policy and signed the treaty.⁴⁴ The International Treaty enters into force 90 days after it has been ratified, accepted, or approved by at least 40 countries.

Objectives and Main Elements

The objectives of the International Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture, and the fair and equitable sharing of the benefits arising out of their use—in harmony with the CBD—for sustainable agriculture and food security.

The provisions in the International Treaty on the conservation and sustainable use of plant genetic resources are similar to those in the Global Plan of Action, including the development of national frameworks and capacity building. In addition, one part of the treaty is devoted to the implementation of the Global Plan of Action, with provisions on the role of the countries as well as international institutions.

The article on farmers' rights is among the controversial provisions. Whereas the contracting parties recognize the enormous contribution of farmers to the heritage of plant genetic resources, it is left to the countries how they will implement the provision: 'each Contracting Party should, as appropriate, and subject to national legislation, take measures to protect and promote Farmers' Rights.' The provision comprises the rights to protection of traditional knowledge, to participate equitably in the sharing of benefits, and to participate in decision making pertaining to plant genetic resources for food and agriculture.

The core of the International Treaty is a multilateral system for facilitated access to a list of specified food and forage crops in the public domain of the countries that are parties to the treaty. A Governing Body, which is to be composed of all contracting parties, will take care of the facilitation of access. One cannot seek any form of intellectual property rights on genetic material obtained from the multilateral system, in the form it is received. We could say that this step represents a move back to the idea of a common heritage of mankind, as set forth in the International Undertaking 20 years ago, and that it provides a correction to the intellectual property rights regimes that tend to restrict access to plant genetic resources. On the other hand, the provision leaves wide scope for interpretation. It is not determined what, exactly, constitutes the 'public domain', or what the formulation 'in the form received from the multilateral system' means. These were some of the focal points in the heated debate before the adoption of the treaty, and they are still unsolved. The discussions will flare up again when the material transfer agreement for the multilateral system is to be formulated. An expert group has been established to propose recommendations for the agreement.⁴⁵

Table 2. The legal situation with regard to the facilitation of access to crop genetic resources

FAO ↓	CBD ⇔	Accessions acquired <i>before</i> the entry into force of the CBD	Accessions acquired <i>after</i> the entry into force of the CBD
Crops <i>listed</i> under the multilateral system of the International Treaty		1) Access is to be facilitated under the multilateral system of the International Treaty	2) Access is to be facilitated under the multilateral system of the International Treaty
Crops <i>not listed</i> under the multilateral system of the International Treaty		3) Access is not regulated by any international agreement	4) Access is regulated internationally by the CBD

The list of crops covered by the multilateral system for facilitated access contains 35 food crops and 29 forage plants, and includes important food crops such as rice, wheat, maize, rye, potatoes, beans, cassava, and bananas. But it excludes species such as soybean, oil palm, cotton, sugar-cane, cocoa, groundnut, most vegetables, and important tropical forage plants. The facilitation of access to the non-listed crops remains unclear. Access to genetic resources that have been acquired after the CBD entered into force will be regulated by the CBD. Genetic resources that were acquired before the CBD entered into force are not regulated by any international agreement. This situation is illustrated in Table 2.

This ‘division of labour’ ensures facilitation of access to the listed crops (see Table 2, nos. 1–2), but not to the non-listed ones. When access is regulated by the CBD (no. 4), it is questionable whether genetic resources will be as easily accessible as under the multilateral system, due to the problems outlined in the introduction to this article. When access is not regulated by any international body (no. 3), the situation is even more problematic. The crucial question then is whether countries that have jurisdiction over such genetic resources will provide access to them, and, if so, under what conditions.

Another important point in the International Treaty is the article on financial resources which sets out no funding obligations on the contracting parties, only provisions on the development of a funding strategy. This could well become another bottleneck.

The International Treaty represents a major step forwards with regard to a functional international regime for the management of plant genetic resources for food and agriculture and, as such, the first international agreement implementing the CBD for a particular component of biodiversity. Rapid ratification is due, as too much time has already been lost on the negotiations. The real implementation of the treaty cannot start until it enters into

force. It is crucial now that funds be made available, as shortfalls in resources have been a major constraint all the way, since 1983. Last, but not least, unsolved questions will need to be addressed, even though final solutions should not be anticipated as these questions are rooted in different basic interest. The contracting parties will need to find ways and means to handle them, making sure that differences between interest groups do not hamper the work more than absolutely necessary. The major challenge now is to get implementation under way.

Conclusions

Over the past two decades much has been gained—but also much lost—in the management of plant genetic resources for food and agriculture. Efforts within the FAO have had an important agenda-setting function and resulted in major achievements with regard to the sharing of genetic resources and information at the international level, and they have provided an arena for the discussions on this vital issue.

Meanwhile, however, a range of international agreements have come into force, affecting the management of plant genetic resources. These regimes have *inter alia* drawn attention to intellectual property rights and benefit sharing and contributed to the restriction of access to plant genetic resources for food and agriculture. The management situation is thus more challenging than ever. In this context, the International Treaty is an important balance. It has the potential to draw attention to the crucial challenges of halting genetic erosion and providing access to the genetic resources that are left—for present and future food security and human survival. Whether the International Treaty will succeed in this effort is up to the contracting parties. Strong support is necessary with regard to political priorities, implementation, and funding.

Notes and References

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1. Plant genetic resources for food and agriculture encompass the diversity of genetic material in traditional varieties and modern cultivars, as well as crop wild relatives and other wild plant species used as food, according to the prevailing FAO definition. See FAO (1998), *State of the World's Plant Genetic Resources for Food and Agriculture* (Rome: FAO).
2. All examples from Cary Fowler and Pat Mooney (1990), *Shattering: Food, Politics, and the Loss of Genetic Diversity* (Tucson: University of Arizona Press), 42–53.
3. The concept of centres of diversity goes back to the famous Russian plant explorer Nicolay Ivanovich Vavilov. Through wide-ranging field trips between 1924 and 1940 he and his assistants found support for the hypothesis that each of the main agricultural species could be traced back to a particular region of origin, or centres of origin as he called them. Other researchers developed these ideas further, most notably Jack Harlan. He distinguished between centres of origin and centres of diversity, as some crops had developed wide diversity in regions other than those in which they had originated and where they were sometimes extinct. See Nicolay Ivanovich Vavilov (1992), *Origin and Geography of Cultivated Plants* (Cambridge: Cambridge University Press); and Jack R. Harlan (1992), *Crops and Man*, 2nd edn (Madison, WI: American Society of Agronomy, Crop Science Society of America).
4. See Stephen B. Brush (ed.) (2000), *Genes in the Field: On-Farm Conservation of Crop Diversity* (Rome: International Plant Genetic Resources Institute; Ottawa, International Development Research Centre; and Boca Raton, FL, Lewis Publishers). In the foreword, Cary Fowler et al. state that approximately 1.4 billion people live in farm families that are largely self-reliant and self-provisioning when it comes to seeds and other planting materials. According to the FAO database, the total number of people depending on agriculture in 2001 was 2.48 billion, including persons depending on hunting, fishing, or forestry and their non-working dependants.
5. See IFAD (2001), *Rural Poverty Report 2000—The Challenge of Ending Rural Poverty* (Rome: IFAD).
6. There are few exact figures on the extent and pace of genetic erosion in agriculture. However, nearly all the 154 countries reporting to the FAO for the Leipzig Conference in 1996 (see section on the Global Plan of Action in this article) maintained that genetic erosion is a serious problem. In China an estimated 90 per cent of the 10,000 wheat varieties that were grown a century ago have been lost. In Mexico an estimated 80 per cent of the maize varieties that were grown in the 1930s are gone. See FAO (1998), *State of the World's Plant Genetic Resources*.
7. *Ibid.*, 33.
8. G. Kristin Rosendal (1995), 'Genbanker—bevaring av biologisk mangfold' ('Genebanks—conservation of biodiversity'), in Nils Christian Stenesh, Kjetil Paulsen, and Rolf Karlsen (eds.), *Afrika—natur, samfunn og bistand* (Oslo: Ad Notam Gyldendal), 375–92.
9. FAO (1998), *State of the World's Plant Genetic Resources*, 129.
10. By January 2003.
11. See Commission on Intellectual Property Rights (2002), *Integrating Intellectual Property Rights and Development Policy* (London: Commission on Intellectual Property Rights), 65.
12. TRIPs Article 27. 3(b).
13. In the CBD, benefit sharing includes appropriate access to genetic resources and transfer of relevant technologies, in addition to participation in monetary gains.
14. See G. Kristin Rosendal (2000), *The Convention on Biological Diversity and Developing Countries* (Dordrecht: Kluwer Academic).
15. Kerry ten Kate and Sarah A. Laird (1999), *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing* (London: Earthscan), 17–33 and 293–312.
16. See the database of the CGIAR System-Wide Information Network for Genetic Resources (SINGER) at <<http://www.singer.cgiar.org/SINGER/Overview/Distribution/User/user.htm>>, and enter 'transfer' by 'user type and year'. See also ten Kate and Laird (1999), *The Commercial Use of Biodiversity*, 312.
17. An estimate comparing the commercial seed industry with the pharmaceutical sector shows huge differences with regard to potentials for benefit sharing. The benefits to be returned to source countries from the commercial exploitation of plant genetic resources for food and agriculture would hardly cover the related transaction costs. The benefits to be returned to a source country of e.g. a medicinal plant could reach several million dollars under a bilateral agreement. See FAO (1998), *State of the World's Plant Genetic Resources*, 290.
18. Rosendal (2000), *The Convention on Biological Diversity and Developing Countries*, 190.
19. See Cary Fowler (2001), 'Protecting Farmer Innovation: The Convention on Biological Diversity and the Question of Origin', *Jurimetrics*, 41: 4, 477–88, and Regine Andersen (2001), *Why is it Difficult to Determine the 'Country of Origin' of Agricultural Plant Varieties*, FNI Report 7/2001 (Lysaker, Norway: Fridtjof Nansen Institute).
20. FAO Conference Resolution 9/83, Twenty-Second Session of the FAO Conference, Rome, 1983.
21. FAO Conference Resolution 3/95, Twenty-Eighth Session of the FAO Conference, Rome, 1995.
22. FAO Council Resolution 1/110, 1995.
23. Cary Fowler (1994), *Unnatural Selection: Technology, Politics, and Plant Evolution* (Yverdon, Switzerland: Gordon & Breach), 187–91.
24. It was a victory because the USA, which also chaired the FAO at the time, opposed the adoption of the Undertaking, but it was partial because the new agreement ended up as a legally non-binding undertaking.
25. FAO Conference Resolution 4/89, Twenty-Fifth Session of the FAO Conference, Rome, 1989.
26. The provision in the cited resolution to the Undertaking referred to the 1978 version.
27. FAO Conference Resolution 4/89.
28. FAO Conference Resolution 5/89, Twenty-Fifth Session of the FAO Conference, Rome, 1989.
29. One of them did not have a gene bank, but considered developing one.
30. FAO (1998), *State of the World's Plant Genetic Resources*, 280.
31. See FAO/CGRFA (2002), *Report on the Status of the International Code of Conduct for Plant Germplasm Collecting and Transfer. Ninth Regular Session, October 2002* (Rome: FAO/CGRFA).
32. FAO (1998), *State of the World's Plant Genetic Resources*.
33. *Ibid.*, 223.
34. According to the International Treaty, *ex situ* conservation refers to the conservation of components of biological diversity outside their natural habitats, where habitat means the place or type of site where an organism or population occurs naturally.
35. According to the International Treaty, *in situ* conservation means the conservation of plant species in the surroundings where they have developed their distinctive properties. In practice, it means

the maintenance of plant varieties in their natural or agricultural habitats, thus allowing the evolutionary process that shapes the genetic diversity and adaptability of plant populations to continue.

36. FAO (1998), *State of the World's Plant Genetic Resources*, 202.
37. *Ibid.*, 223.
38. FAO (1996), *The Leipzig Declaration* adopted by the International Technical Conference on Plant Genetic Resources in Leipzig, Germany, 17–23 June 1996.
39. FAO (1998), *State of the World's Plant Genetic Resources*.
40. Harlan (1975), *Crops and Man* (2nd edn 1992).
41. See FAO (1996), *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture*, adopted by the International Technical Conference on Plant Genetic Resources in Leipzig, Germany, 17–23 June 1996, 63.
42. Presented in FAO/CGRFA (2002), *Country Progress Report on the Implementation of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture*. Report prepared for the Ninth Regular Session of the CGRFA, CGRFA–9/02/6 (Rome: FAO/CGRFA).
43. *Ibid.*, 2.
44. The USA has also signed the CBD, but did not ratify.
45. See FAO/CGRFA, *Terms of Reference for the Expert Group on the Terms of the Standard Material Transfer Agreement*. Document prepared for the First Meeting of the CGRFA acting as the Interim Committee for the International Treaty on Plant Genetic Resources for Food and Agriculture, October 2002 (CGRFA/MIC–1/02/6).

