The Provisions of Articles 5 and 6 of the International Treaty

LESSON 2

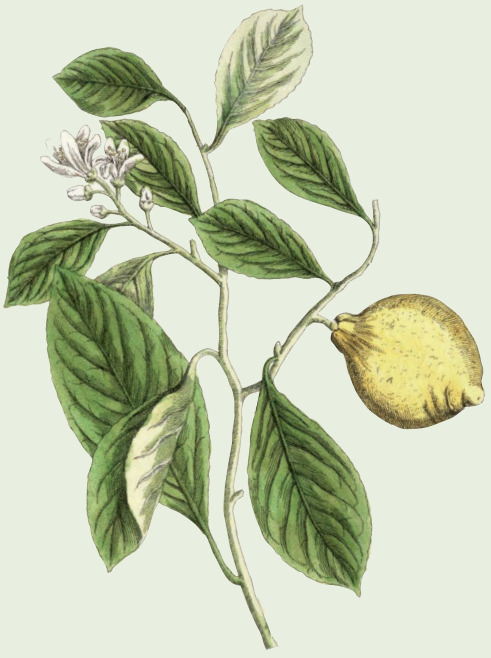
Learning objectives

At the end of this lesson, the learner will be able to:

- describe the International Treaty's provisions on conservation and sustainable use of crop diversity;
- identify appropriate policy, legal and technical measures for the promotion of conservation and sustainable use; and
- recognize the linkages between the Second Global Plan of Action and the International Treaty.

Target learner groups

Technical personnel including gene bank staff and plant breeders, as well as civil servants and other interested parties and institutions.



Citrus limon, lemon, by Elizabeth Blackwell (1739)

Table of Contents

© FAO/Rosetta Messori

2.1. Overview of the Lesson

The International Treaty on Plant Genetic Resources for Food and Agriculture (hereafter "International Treaty") is the internationally agreed legally binding framework for conservation and sustainable use of all plant genetic resources for food and agriculture (PGRFA). It carefully balances the interests of developed and developing countries as well as a broad range of further stakeholders involved in PGRFA conservation and use, such as, *inter alia*, public and private agricultural researchers and plant breeders, gene banks and farmers' organizations. The International Treaty requests Contracting Parties to promote measures for effective conservation and sustainable use of PGRFA and establishes transparent internationally accepted regulations for cross-border transfers of a number of the world's most important PGRFA for food security for research and breeding purposes.

This lesson explains the measures to promote conservation and sustainable use of crop diversity that are proposed in articles 5 and 6 of the International Treaty. It does so in particular for technical stakeholders engaged in conservation and sustainable use activities, to help them understand the legal framework they are working in. However, the lesson is also useful for political stakeholders whose task it is to translate the commitments their governments have made under the International Treaty into national policies. For each measure, the lesson points to the relevant guidance contained in the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (hereafter "Second Global Plan of Action").

The lesson highlights the International Treaty's complementary approach to *ex situ* and *in situ* conservation and links conservation to sustainable use. The priorities of on-farm conservation and sustainable use of the Benefit-sharing Fund of the Funding Strategy (hereafter "Benefit-sharing Fund") of the International Treaty are further illustrated by various initiatives that received funding under its first project cycle.

At the end of this lesson, the learner will be able to describe the International Treaty's provisions on conservation and sustainable use of crop diversity, and to identify appropriate policy, legal and technical measures for their implementation.

Cross-references:

- For the **text of the International Treaty** see: ftp://ftp.fao.org/docrep/fao/011/i0510e/i0510e.pdf
- For more details on the **objectives of the International Treaty**, an overview of the main advantages for countries of being a Contracting Party to the International Treaty, and a working definition of the concept of 'sustainable use' refer to lesson 2 of Module I (Objectives, Scope and Basic Concepts).
- To learn more about the **operation of the Multilateral System for Access and Benefit-sharing** and how it facilitates transfers of crop genetic resources refer to sub-section 4.2.3. of lesson 4 of Module I (Main Components and Governance of the International Treaty) and forthcoming Module IV.
- To learn more about the **technical aspects of conservation and sustainable use activities** refer to lesson 1 of this module (What is Conservation and Sustainable Use?).
- For more **illustrations of options to promote conservation and sustainable use** of crop diversity refer to lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).
- For the **text of the Second Global Plan of Action** see: http://typo3.fao.org/fileadmin/templates/agphome/documents/PGR/GPA/GPA2/GPA2_en.pdf
- Refer to sub-section 4.2.4. of lesson 4 of Module I (Main Components and Governance of the International Treaty) for more information on the **operation of the Benefit-sharing Fund**.
- For an in-depth account on the Funding Strategy and practical information for applicants on **how to apply for resources under the Benefit-sharing Fund**, refer to forthcoming Module V.

Box 2.1: The Provisions of Articles 5 and 6 of the International Treaty

Article 5 - Conservation, Exploration, Collection, Characterization, Evaluation and Documentation of Plant Genetic Resources for Food and Agriculture

5.1 Each Contracting Party shall, subject to national legislation, and in cooperation with other Contracting Parties where appropriate, promote an integrated approach to the exploration, conservation and sustainable use of plant genetic resources for food and agriculture and shall in particular, as appropriate:

a) Survey and inventory plant genetic resources for food and agriculture, taking into account the status and degree of variation in existing populations, including those that are of potential use and, as feasible, assess any threats to them;
b) Promote the collection of plant genetic resources for food and agriculture and relevant associated information on those plant genetic resources that are under threat or are of potential use;
c) Promote or support, as appropriate, farmers and local communities' efforts to manage and conserve on-farm their plant genetic resources for food and agriculture;
d) Promote in situ conservation of wild crop relatives and wild plants for food production, including in protected areas, by supporting, inter alia, the efforts of indigenous and local communities;
e) Cooperate to promote the development of an efficient and sustainable system of ex situ conservation, giving due attention to the need for adequate documentation, characterization, regeneration and evaluation, and promote the development and transfer of appropriate technologies for this purpose with a view to improving the sustainable use of plant genetic resources for food and agriculture;
f) Monitor the maintenance of the viability, degree of variation, and the genetic integrity of collections of plant genetic resources for food and agriculture.

5.2 The Contracting Parties shall, as appropriate, take steps to minimize or, if possible, eliminate threats to plant genetic resources for food and agriculture.

Article 6 - Sustainable Use of Plant Genetic Resources

6.1 The Contracting Parties shall develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture.

6.2 The sustainable use of plant genetic resources for food and agriculture may include such measures as:

a) pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources;
b) strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests;
c) promoting, as appropriate, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas;
d) broadening the genetic base of crops and increasing the range of genetic diversity available to farmers;
e) promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species;
f) supporting, as appropriate, the wider use of diversity of varieties and species in onfarm management, conservation and sustainable use of crops and creating strong links to plant breeding and agricultural development in order to reduce crop vulnerability and genetic erosion, and promote increased world food production compatible with sustainable development; and
g) reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution.

2.2. An Integrated Approach to Conservation and Sustainable Use

Conservation and sustainable use of crop diversity are two sides of the same coin in order to achieve the International Treaty's overall goal of global food security. Our continued ability to make use of crop diversity requires adequate measures for its conservation, while the purpose of conservation only remains valid as long as PGRFA keep being used - in a sustainable way. This linkage is reflected at various points in the text of the International Treaty, including most prominently in the chapeau of Article 5 which provides that Contracting Parties shall "promote an integrated approach to the exploration, *conservation and sustainable use*" of PGRFA. In this sense, the measures to promote conservation and sustainable use of PGRFA contained in articles 5 and 6 can be understood as a continuum.

2.2.1. Conservation (Article 5)

The Food and Agriculture Organization of the United Nations (FAO) describes 'gene resources conservation' as "the conservation of species, populations, individuals or parts of individuals, by *in situ* or *ex situ* methods, to provide a diversity of genetic materials for present and future generations".[1]

The full title of Article 5 reads "Conservation, Exploration, Collection, Characterization, Evaluation and Documentation" of PGRFA. By presenting characterization, evaluation and documentation as integral elements of effective conservation, the text of the International Treaty links conservation to sustainable use, as these are key for the subsequent use of collected and conserved PGRFA for agricultural research and

© FAO/Giulio Napolitano

[1] FAO (2001).

Cross-references:

- Refer to section 2.3. of lesson 2 of Module I (Objectives, Scope and Basic Concepts) for a working **definition of the concepts of sustainability and sustainable use** in the context of PGRFA.
- For the legal **definitions of the terms *ex situ* and *in situ* conservation** refer to sub-section 2.3.6. of lesson 2 of Module I (Objectives, Scope and Basic Concepts).
- For an in-depth study of **different *ex situ* and *in situ* conservation techniques**, including their respective advantages and disadvantages, refer to sub-section 1.2.2. of lesson 1 of this module (What is Conservation and Sustainable Use?).

breeding. As the above-mentioned elements relate to both *in situ* and *ex situ* conservation, they will be explained before we move on to an examination of the references to *ex situ*, *in situ* and on-farm conservation in Article 5 of the International Treaty.

Exploration (Article 5.1a)

The term 'exploration' is generally referred to as the act of searching a particular plant species to establish its range of variability and geographic distribution.[2] All rational attempts to conserve PGRFA, be it through *in situ* or *ex situ* conservation measures, are preceded by such exploration that typically includes surveying and inventorying PGRFA.

In the text of the International Treaty, exploration of PGRFA is covered by Article 5.1a), according to which Contracting Parties shall "survey and inventory plant genetic resources for food and agriculture, taking into account the status and degree of variation in existing populations, including those that are of potential use and, as feasible, assess any threats to them".

Contracting Parties need to know what PGRFA exist in their countries before being able to develop policies and strategies for their conservation and sustainable use. Surveys help identify areas with high natural plant genetic diversity and areas where diversity is at risk, as well as the state of *ex situ* and national collections. Inventories are needed to ensure complementarity between *in situ* and *ex situ* conservation.[3]

© FAO/Roberto Faidutti

[2] EAPGREN (2005).
[3] Moore and Tymowski (2005), p. 42.

Courtesy Flickr/Luigi Guarino

The emphasis that Article 5.1a) puts on the degree of variation in existing populations reflects the importance of both intra-species and inter-species diversity of PGRFA for plant breeding. Intra-species diversity refers to the number of different varieties within the same crop species, whereas inter-species diversity means the number of different crop species. In this context it is also to note that in its Article 5.1f) the International Treaty foresees that Contracting Parties shall "monitor the maintenance of the viability, degree of variation, and the genetic integrity of collections of plant genetic resources for food and agriculture". The reference to 'potential use' in Article 5.1a) evidences the precautionary approach adopted by the International Treaty.[4]

Since 1996, most countries have carried out specific surveys and inventories. Switzerland, for example, completed a national inventory of its CWR in 2009 in which 142 species were identified as being of priority for conservation and use. Most surveys, however, have been limited to small groups of species or to restricted areas. A particular need remains to improve inventories on landraces, CWR and other useful wild species, including forages, to better target conservation action.[5]

It is important to note that according to Article 5.1a) Contracting Parties are also to assess any threats to PGRFA. This can be read in connection with Article 5.2 which places a positive obligation on Contracting Parties to "take steps to minimize or, if possible, eliminate threats" to PGRFA. The assessment of threats to PGRFA provides the basis for adaptation and mitigation action. PGRFA collections in gene banks may be under threat where there is a lack of sustainable funding for the maintenance of facilities. There is a particular need for more studies on possible threats to existing diversity on farms and *in situ*.[6] It is the very aim of the International Treaty to counter such threats through conservation and sustainable use of PGRFA, both in gene banks and in natural and agricultural ecosystems. In this

[4] Moore and Tymowski (2005), p. 42.
[5] FAO (2010), pp. 31-32, 45-46.
[6] *Idem*, p. 46.

sense, Article 5.1a) provides the rationale for identifying the PGRFA to be collected under Article 5.1b). Box 2.2 lists the main threats to crop diversity as identified by the Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture (hereafter "Second State of the World Report").

Priority activity 1 of the Second Global Plan of Action contains policy guidance and recommends strategies for surveying and inventorying PGRFA, also with the aim to identify and asess threats to PGRFA, particularly from land-use and climate changes.

Collection (Article 5.1b)

The term 'collection' refers to the action of gathering together, assembling, or grouping similar things into one place, usually with a particular focus. In the context of the International Treaty it means collecting crop genetic resources from natural and agricultural ecosystems. A PGRFA collection brings together the germplasm of domesticated plants, and related wild or weedy species.[7]

Article 5.1b) requests Contracting Parties to "promote the collection of plant genetic resources for food and agriculture and relevant associated information on those plant genetic resources that are under threat or are of potential use".

Collection of PGRFA peaked in modern times in the early 1970s in the course of the Green Revolution. For the most part, PGRFA collections are held in gene banks, however collections are also held in other facilities such as botanical gardens and field gene banks, and important PGRFA varieties are also conserved *in situ*. Article 5.1b) highlights the importance of collecting PGRFA that are under threat and/or of potential use. This provides guidance to Contracting Parties to prioritize their collecting activities accordingly. However, this does not mean that exclusively threatened crop varieties should be collected. PGRFA that are not threatened and/or are under active use may equally be included in collections in order to facilitate their availability and exchange for further research and breeding.[8]

Box 2.2: Main Drivers of Crop Diversity Loss

The Second State of the World Report lists the following main drivers of crop diversity loss:[9]

- Climate change: *ex situ* conservation will become increasingly important as a safety net for conserving PGRFA, while PGRFA conserved in gene banks will become increasingly important in underpinning the efforts of plant breeders as they develop varieties adapted to the new conditions. *In situ* conservation, because of its dynamic nature, will also become more important in the future as a result of climate change.
- Habitat change: cultivated land already covers one-quarter of the Earth's terrestrial surface and a further 10-20 percent of land currently under grass or forest will be converted to agriculture by 2050. This poses a major threat especially to CWR.
- Invasive alien species: invasive alien species, including pest and disease organisms, constitute a remarkable threat to wild PGRFA. The problem has been exacerbated in recent years due to increased international trade and travel.
- Replacement of traditional with modern varieties: the replacement by farmers of traditional varieties with new, improved modern varieties, remains one of the main drivers of crop genetic erosion in many countries.

[7] De Vicente, López and Fulton (2004).
[8] Moore and Tymowski (2005), p.43.
[9] Box 2.2 is adapted from FAO (2010), pp. 43-44. The drivers are presented in the same order as they appear in FAO (2010).

Article 5.1b) further provides for the collection of 'relevant associated information' related to the PGRFA that are collected. This comprises mainly the information collected through characterization, evaluation and documentation, as suggested in Article 5.1e) of the International Treaty and described below, including also information provided by farmers.

Under the Convention on Biological Diversity (CBD), countries have agreed on certain principles for international transfers of genetic resources that have to be respected when germplasm is being collected. The two central conditions are that the prior informed consent of the party holding the genetic resources to be collected has been obtained, and that the terms upon which access to the material is granted, as well as for the sharing of the benefits between the parties, are mutually agreed-upon. In addition, the International Code of Conduct for Plant Germplasm Collecting and Transfer proposes minimum responsibilities of collectors, providers, gene bank managers and users of collected germplasm, in the collection and transfer of plant germplasm.

Such regulations are necessary, however they may add transaction costs to transfers and collecting missions of PGRFA. It is therefore important that governments establish clear and effective measures to comply with their international engagements and facilitate collection and transfer of genetic material for research and breeding. The Standard Material Transfer Agreement (SMTA) of the International Treaty is a standardized contract between providers and recipients in transfers of crop genetic material of 64 of the most important crops for food and agriculture that are listed in Annex I of the International Treaty. The SMTA facilitates access to PGRFA as it renders bilateral negotiations on the terms of access unnecessary, thereby lowering transaction costs. By using the SMTA, both providers and recipients in transfers of germplasm comply with the conditions of prior informed consent and mutually agreed terms.

The Second Global Plan of Action contains policy guidance and recommends strategies for supporting targeted collection of PGRFA in its priority activity 5.

Alexander von Humboldt

Characterization, Evaluation and Documentation

The term 'characterization' refers to the description of the essential properties of an organism or system.[10] In the context of PGRFA it involves systematic recording and categorization of data on plant traits that are highly heritable, easily recognizable by the eye (such as the colour of a flower), independent of environmental factors[11] and thus equally expressed in all environments.[12]

'Evaluation', on the other hand, relates to the assessment of the agronomic characteristics of the material, generally using descriptors of quantitative traits that are affected by the environment, such as disease or drought resistance.[13] Evaluation is carried out through measurement, observation and analysis of PGRFA, including by molecular technologies, usually with a view to detecting their potential use.[14]

'Documentation' of PGRFA is the procedure by which information on germplasm is identified, acquired, classified, stored, handled and disseminated.[15] The term documentation also refers to the totality of the information that should be kept available together with collected PGRFA samples.[16]

Characterization and evaluation data are of prime importance to subsequent users of collected material, primarily to breeders – including public, private and farmer breeders – who aim at developing new varieties by incorporating desirable traits, such as high yields and drought resistance, from different parent varieties. Often, characterization, evaluation and documentation may be carried out in collaboration between facilities that hold crop genetic materials and users; this allows sharing the costs between gene banks and breeders.

In its priority activity 8 the Second Global Plan of Action recognizes that the lack of adequate characterization and evaluation data and the capacity to generate and manage them, represent major constraints to the use of many germplasm collections, especially those containing underutilized species and CWR.

Key points to remember:

- The International Treaty presents exploration, collection, characterization, evaluation and documentation as integral elements of effective conservation, highlighting that they are key for promoting the sustainable use of PGRFA.
- All rational attempts to effectively conserve PGRFA are preceded by exploration activities that typically include surveying and inventorying of threatened PGRFA that are of potential use; there is a particular need to improve inventories on landraces, CWR and other useful wild species to better target *in situ* conservation action.
- PGRFA collections bring together the germplasm of domesticated plants and their related wild and weedy species.
- Characterization involves systematic recording and categorization of data on plant traits that are highly heritable, easily recognizable by the eye and equally expressed in all environments.
- Evaluation relates to the assessment of the agronomic characteristics of the material, generally using descriptors or quantitative traits that are affected by the environment, such as disease or drought resistance.

[10] FAO (2001).
[11] FAO (1999).
[12] De Vicente, López and Fulton (2004).
[13] Moore and Tymowski (2005), p. 47.
[14] CIAT (2007).
[15] *Ibid.*
[16] Moore and Tymowski, *Op. cit.*, p. 47.

Cross-references:

- For more **technical information on *ex situ* and in situ conservation** techniques, including their respective advantages and disadvantages, refer to section 1.2.2. of lesson 1 of this module (What is Conservation and Sustainable Use?).
- To learn more about the **Green Revolution** and its impacts on crop diversity, refer to sub-sections 1.2.1. and 1.2.2. of lesson 1 of Module I (A Global Treaty for Food Security in an Era of Climate Change) and sub-sections 3.2.1. and 3.2.2. of lesson 3 (History of the International Treaty) of Module I.
- For more information on the **relationship of the International Treaty with the CBD** and the International Code of Conduct for Plant Germplasm Collecting and Transfer refer to sub-section 5.2.2. of lesson 5 of Module I (The Legal Architecture Governing Crop Diversity and Partnerships for Implementation).
- For the **text of the CBD** see: http://www.cbd.int/convention/text/
- For the **text of the International Code of Conduct for Plant Germplasm Collecting and Transfer** see: http://www.fao.org/docrep/x5586E/x5586e0k.htm
- For the list of the 64 food crops and forages contained in **Annex I of the International Treaty** see: http://www.planttreaty.org/content/crops-and-forages-annex-1
- Refer to Box 4.2 of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective) for an **illustration of how partnerships can help reducing the cost of obtaining evaluation data**.

Ex Situ Conservation (Article 5.1e)

Under Article 5.1e) of the International Treaty, Contracting Parties commit to "cooperate to promote the development of an efficient and sustainable system of *ex situ* conservation, giving due attention to the need for adequate documentation, characterization, regeneration and evaluation, and promote the development and transfer of appropriate technologies for this purpose with a view to improving the sustainable use of plant genetic resources for food and agriculture".

This provision reiterates the need for adequate characterization, evaluation and documentation as a means for improving the sustainable use of PGRFA. In fact, the accessibility of germplasm and whether it can be readily used by agricultural

© FAO/Caroline Thomas

researchers, breeders and farmers, depends to a large extent on the availability and adequacy of this information.[17] It is crucial for sustainable conservation efforts that are linked to use, allowing breeders, for example, to identify desirable traits and breed them into new varieties. Information technology tools that help locate PGRFA samples and provide related passport data play an important role in enhancing the use of crop diversity. In partnership with Bioversity International on behalf of the Consultative Group of International Agricultural Research (CGIAR), and the Global Crop Diversity Trust (hereafter "Crop Trust"), the Secretariat of the International Treaty has therefore launched Genesys, a plant genetic resources portal that offers a single access point to information of about a third of the world's gene bank accessions.

Policy guidance and recommended strategies for promoting the characterization and evaluation of PGRFA collections is contained in priority activity 8 of the Second Global Plan of Action.[18]

The provision also stresses the need to develop an efficient system of *ex situ* conservation. It is estimated that over 7.4 million PGRFA samples are currently stored in over *ex situ* facilities worldwide. Almost 90 percent of the total is stored in national gene banks, with further important collections held by the International Agricultural Research Centers of the CGIAR (hereafter "CGIAR Centres"). This represents a 20 percent increase from 1996 to 2010. It may seem that the system of *ex situ* conservation is strong and has significantly strengthened over the past years. However, this is not necessarily enough as a lot of duplication occurs, i.e. samples of the same genetic material are stored in various different gene banks. Whereas a certain degree of duplication contributes to minimizing the risk of loosing a given PGRFA, the maintenance of duplicate collections also has a cost. The fact that over 70 percent of PGRFA samples held in *ex situ* gene banks worldwide are duplicates illustrates the scope for rationalization of the international gene bank system.[19]

© FAO/I. De Borhegyi

[17] Adapted from Moore and Tymowski (2005), p. 47.
[18] FAO (2011b), paras. 142-161.
[19] FAO (2010), p. 4.

© FAO/Giulio Napolitano

Rationalizing the international *ex situ* conservation system will improve the efficiency of gene bank management. Resources saved through cost reductions from such rationalizing, for example, could be used to maintain and expand conservation activities of new samples of different species and varieties, especially for developing countries facing funding problems that at times put their collections in danger.[20] According to the Second State of the World Report, efforts to rationalize collections have been reported by several gene banks and networks. One example is AEGIS, an initiative of the European Cooperative Programme for Plant Genetic Resources (ECPGR) to rationalize European PGRFA collections that are dispersed over approximately 500 holders and 45 countries. The identification of undesirable duplicates is an important component of the initiative.[21]

The Multilateral System of Access and Benefit-sharing (hereafter "Multilateral System") of the International Treaty contributes importantly to the strengthening of the international gene bank system. It does so by creating a global pool of a number of the world's most important crop genetic resources to which users based in countries that are Contracting Parties of the International Treaty enjoy facilitated access. Contracting Parties, the CGIAR Centres and other organizations up to date have included over 1.3 million samples of mostly *ex situ*-held PGRFA that they make available under the facilitated conditions of a SMTA. Being able to easily access PGRFA located in different gene banks around the world diminishes the need for maintaining large amounts of duplicates especially for smaller institutions.

Priority activity 6 of the Second Global Plan of Action contains policy guidance and recommends strategies for rationalizing, sustaining and expanding *ex situ* conservation of germplasm.

[20] Moore and Tymowski (2005), p. 46.
[21] FAO (2010), pp. 8-9.

Cross-references:

- For more **information on Genesys** refer to Box 5.3 of lesson 5 of Module I (The Legal Architecture Governing Crop Diversity and Partnerships for Implementation).
- **Access Genesys** here: http://www.genesys-pgr.org/
- For more **information on AEGIS** see http://aegis.cgiar.org/about_aegis.html
- Refer to sub-section 4.2.3. of lesson 4 of Module I (Main Components and Governance of the International Treaty) for **an introduction to the Multilateral System and the SMTA**.
- For an in-depth study of the Multilateral System refer to the forthcoming Module IV.

In Situ Conservation (Article 5.1d)

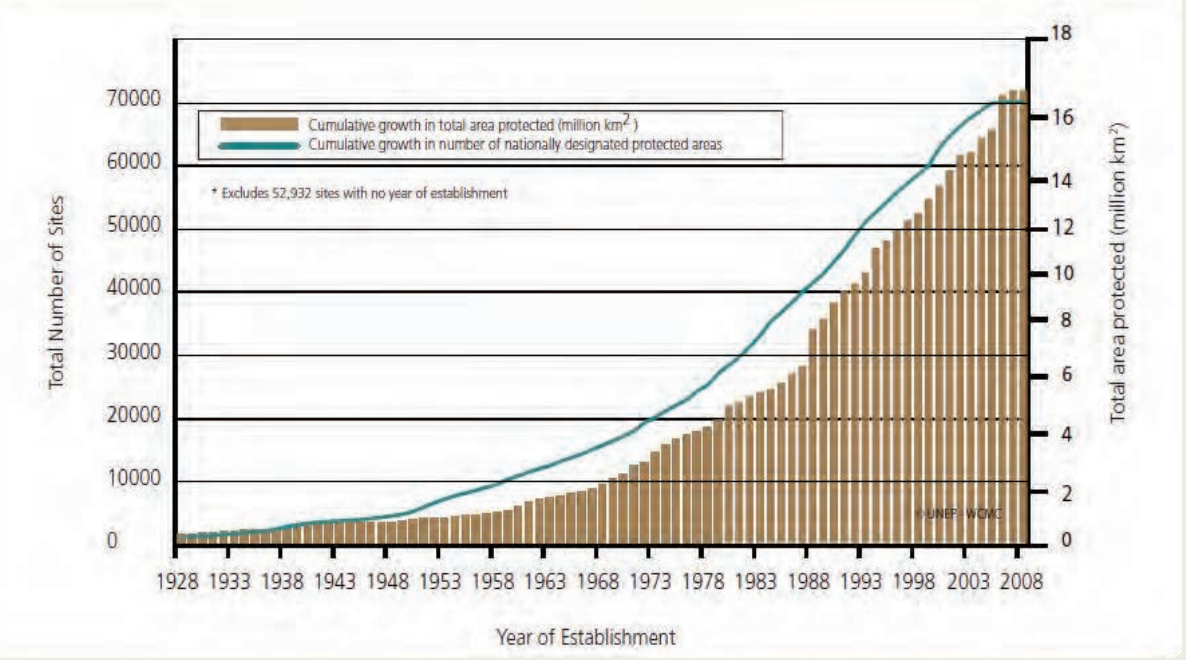
As illustrated in lesson 1 of this module, *in situ* conservation comprises two main methods of conservation: *in situ* conservation in the strict sense, which involves mainly conservation of wild PGRFA in natural surroundings, and on-farm conservation which can be understood as the conservation of mostly cultivated PGRFA in the agro-ecosystems where they have evolved. Article 5.1d) of the International Treaty refers to *in situ* conservation in the strict sense, while on-farm conservation and management is addressed in articles 5.1c) and 6.2f), and presented below.

According to Article 5.1d) of the International Treaty, Contracting Parties shall "promote *in situ* conservation of wild crop relatives and wild plants for food production, including in protected areas, by supporting, *inter alia*, the efforts of indigenous and local communities".

In situ conservation often takes place in protected areas of habitats, targeted at species or the entire ecosystem in which they occur. It is a particularly important conservation method for species that are difficult to conserve in gene banks, as is the case with many crop wild relatives (CWR). CWR are wild plants that are closely related to domesticated plants. Often they are wild ancestors from which crops are derived. Approximately 700 CWR species are considered of highest priority for the improvement of the world's most important food crops, and in particular their adaptation

© FAO/Giulio Napolitano

Figure 2.1 Growth in Nationally Designated Protected Areas (1928-2008)



Source: FAO (2010), p. 33

to climate change. *In situ* conservation of CWR is thus also important for plant breeding and food security. In addition, many plant species growing in wild ecosystems are valuable for food and agriculture, especially in developing countries and poor areas, as they can provide an important contribution to household incomes and a safety net when food is scarce.[22] This does not imply by any means that CWR cannot and should not in addition be conserved in gene banks. In fact, it is very useful to conserve CWR also under *ex situ* conditions, in order to make them more readily available for use in plant breeding, for example.

Figure 2.1 above shows the steady growth in nationally designated protected areas. However, in spite of this overall increase, the range of genetic diversity of target species within them remains inadequately represented and many of the ecological niches that are important for wild PGRFA remain outside of protected areas.[23]

There has been some progress over the last decade with initiatives at national and international level identifying specific sites especially suited for *in situ* conservation of CWR and priority areas where CWR are at risk. In Peru for example, farming communities have signed an agreement with the International Potato Center (CIP) to establish a park near Cusco where the genetic diversity of numerous potato varieties is protected by local indigenous people who own the land and who are also allowed to control access to these local genetic

[22] FAO (2010), p. 31.
[23] *Idem*, pp. 32, 34-35.

resources.[24] The Potato Park is also among the first projects to have received funding under the Benefit-sharing Fund. The main activities and achievements of the project are presented in Box 2.3 below.

The Second Global Plan of Action contains policy guidance and recommends strategies for the promotion of *in situ* management of CWR and wild food plants in its priority activity 4.

Box 2.3: Supporting the Efforts of Indigenous Communities to Promote *In Situ* Conservation - The Potato Park in Cusco

Peru's Potato Park, a unique 15 000 ha reserve high in the Andes, was established to conserve the region's potato biodiversity, a task that has become increasingly difficult as warming climates have altered the growing patterns of some of the area's local varieties. The reserve is home to six indigenous Quechua communities whose 8000 residents manage their communal lands jointly for their collective benefit. The communal activities are spearheaded by the organization known as the 'guardian of native potatoes', the Papa Arariwa Collective.

In the Potato Park, which is considered a centre of origin of potato, a typical farmer may grow more than 200 varieties, most of which are for local consumption or regional barter. Because of warming climate, local potato farmers now experiment at higher altitudes where the temperatures are lower. Ironically, they are using many varieties that had already disappeared from their fields but had been saved in the gene bank of the International Potato Center (CIP). The Benefit-sharing Fund project of the International Treaty is working with the local farmers as they repatriate varieties from the gene bank into their fields. More than 1345 varieties can be found in the Potato Park, of which 779 were collected locally, 410 were repatriated from CIP and 157 were received through seed exchanges.[25]

Cross-references:

- For more **technical details on *in situ* conservation**, refer to sub-sections 1.2.2. and 1.2.3. of lesson 1 of this module (What is Conservation and Sustainable Use?).
- For an **illustration of how *in situ* and CWR conservation can be linked to gene banks** refer to sub-section 4.2.1. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).
- For the **text of the Second State of the World Report** see: http://www.fao.org/docrep/013/i1500e/i1500e.pdf

[24] FAO (2010), p. 35.
[25] Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture (2011a).

© FAO/Giulio Napolitano

On-farm Conservation and Management (Articles 5.1c and 6.2f)

On-farm conservation and management of PGRFA is considered a form of *in situ* conservation, as crops are conserved in the agro-ecosystems where they have developed their distinctive properties or in systems where they are adapting to new conditions. In essence, on-farm conservation and management implies that PGRFA are being conserved by being cultivated, adapted and improved. This is a further concrete illustration of the linkage between conservation and sustainable use of crop diversity.

Two provisions of the International Treaty, one listed under conservation and the other under sustainable use, refer to on-farm conservation and management of PGRFA. Article 5.1c) of the International Treaty requests Contracting Parties to "promote or support, as appropriate, farmers and local communities' efforts to manage and conserve on-farm" their PGRFA, and Article 6.2f) proposes to Contracting Parties to support "the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops".

Farmers who produce in traditional farming systems generally rely heavily on local varieties and often diversify the crops they produce as strategies to reduce the risks that result from market fluctuations and volatile international food prices, as well as from weather, pests and diseases. In many traditional farming communities, women play a particular role in variety selection and as custodians of crop genetic diversity. The maintenance of genetic diversity within local production systems also helps to conserve traditional knowledge and *vice versa*.

However, throughout most of the developed world and increasingly also in many developing countries, the majority of food is now supplied by industrialized production, which has resulted in a considerable degree of uniformity in cultivated crop varieties. As a result, diversity in farmers' fields is still in decline at least for some crops and in certain countries. To counter these trends, promoting and supporting on-farm conservation and management of genetic resources in farmers' fields, home gardens, orchards and other cultivated areas of high diversity, has become a key component of many crop conservation strategies.

Consequently, on-farm conservation and management of PGRFA is one of the three first priorities of the Benefit-sharing Fund.[26] Box 2.4 below illustrates the on-farm conservation and management activities of a project in Senegal that received funding under the first round of the project cycle of the Benefit-sharing Fund.

One of the major findings of the Second State of the World Report with regard to *in situ* conservation, including both 'in the wild' and on farms, is that the involvement of local communities is essential and traditional knowledge systems and practices need to be fully taken into account.

Policy guidance and recommended strategies for supporting on-farm conservation and management of PGRFA is contained in priority activity 2 of the Second Global Plan of Action.

Box 2.4: A Participatory Approach to On-farm Management: A Project Supported by the Benefit-sharing Fund in Senegal

In Senegal, 90 percent of the farming area is dedicated to cereal production. Yet three of the main crops – millet, maize and sorghum – are facing progressive loss of genetic diversity in the fields and low variability which has dire effects on the abilities of farmers to achieve good results in their harvesting seasons. Thus, the Benefit-sharing Fund project of the International Treaty in Senegal pulled 340 samples of millet, maize and sorghum from a database to discuss their merits with local farmers. They specifically chose samples that still are found in farmers' fields, not those that only exist in gene banks. This allowed local farmers to offer practical advice as to which ones would be best to include in on-farm testing that would determine which ones were best adapted to climatic conditions and also which ones met the taste demands of consumers. The farmers chose 55 varieties.

The project offers a combination of research into and promotion of local varieties, in terms of raising the awareness of farmers and policy-makers of the need to conserve local cereal biodiversity. The focus is on increasing productivity by using a participatory, on-farm conservation approach with the ultimate goal of broadening the genetic base of local crops and increasing the diversity of plant genetic material available to farmers.

In addition to studying the 55 selected varieties in local farmers' fields, selected farmers worked in the experimental fields of two research stations which had planted the 55 selected varieties. This enabled the farmers to add their insight to production methods and their assessments of the crops' quality in terms of yield, water use and resistance to atmospheric conditions, disease and pests, as well as taste and ease of production.[27]

Cross-references:

- For more **technical details regarding on-farm conservation and management** refer to sub-section 1.2.2. of lesson 1 of this module (What is Conservation and Sustainable Use?).
- For examples of **activities that support on-farm conservation** of crop diversity refer to lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).

[26] 'On-farm *Conservation'* is partly adapted from FAO (2010), p. 4.
[27] Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture (2011b).

Key points to remember:

- Contracting Parties of the International Treaty are committed to adopting and maintaining an integrated approach to conservation and sustainable use of PGRFA, promoting both *in situ* and *ex situ* conservation in a complementary manner.
- The Multilateral System of the International Treaty strengthens the international gene bank system very importantly; however, there is still a need for further rationalization of the international *ex situ* conservation system.
- Involvement of local communities and due consideration of traditional knowledge systems and practices are essential for any *in situ* conservation and on-farm conservation and management effort.
- On-farm conservation and management of a diversity of traditional and local PGRFA in farmers' fields, home gardens, orchards and other cultivated areas of high diversity, is often used as a strategy to increase food security in traditional farming systems and has become a key component of many crop conservation strategies.

© FAO/Florita Botts

2.2.2. Measures to Promote the Sustainable Use of Crop Diversity (Article 6)

Article 6 constitutes an obligation for Contracting Parties to develop and maintain appropriate policy and legal measures to promote the sustainable use of PGRFA. This obligation is similar to the requirement under the CBD to develop national biodiversity strategies and action plans (NBSAPs), as presented in Box 2.5 below. Article 6.2 therefore contains a non-exhaustive list of measures Contracting Parties can adopt to achieve their commitments. Very much in the same way as the measures for conservation of PGRFA proposed under Article 5, Article 6 is largely based on the priority activities and recommendations of the Global Plan of Action.

Agricultural Policies that Promote Diverse Farming Systems (Article 6.2a)

The first measure that the International Treaty mentions in its Article 6.2a) reads "pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources".

The main focus of this paragraph is the promotion of farming systems that enhance the sustainable use of *agricultural biodiversity and other natural resources* through appropriate agricultural policies. This proposed measure thus reaches beyond the International Treaty's general scope of PGRFA, providing a sound base to Contracting Parties to promote a broad range of sustainable agricultural policies. By referring to the broader term of 'agricultural biodiversity', the provision accounts for the fact that also other components of agricultural biodiversity such as micro-organisms and pollinators, are of crucial importance for the sustainable use of PGRFA. Equally, any farming system depends on a range of natural resources including, *inter alia*, healthy soils and clean water. Micro-organisms can improve soil nutrients for plant growth and protect plants from diseases. Pollinators such as bees are indispensable for the cultivation of some 87

Box 2.5: National Biodiversity Strategies and Action Plans and their Relevance for the Implementation of Articles 5 and 6 of the International Treaty

The Convention on Biological Diversity (CBD) is the international legal framework for the conservation and sustainable use of biodiversity, comprising all (except human) genetic resources. The CBD requires its member countries to develop or adapt "national strategies, plans or programmes" to integrate conservation and sustainable use of biodiversity into sectoral and cross-sectoral activities. Consequently, a great majority of member countries of the CBD have developed so-called National Biodiversity Strategies and Action Plans (NBSAPs).

In many countries the elaboration of NBSAPs falls under the purview of environment ministries, which is why in some cases the specific needs of agricultural biodiversity have not been properly reflected. However, the importance of agricultural biodiversity as an integral part of larger biodiversity has been increasingly recognized also by the environment community and a programme of work on agricultural biodiversity was endorsed under the CBD in 2000.

With the adoption of the Aichi Biodiversity Targets for the period 2011-2020, the decision-making body of the CBD urged its member countries to revise their NBSAPs. For countries that have not done so yet, this provides a timely opportunity to integrate the measures proposed by the International Treaty and the policy recommendations of the Global Plan of Action in a mutually supportive manner into their NBSAPs.

© FAO/Roberto Faidutti

out of the 115 leading global food crops.[28] Services like pollination and the provision of clean water are also known as 'ecosystem services'. Article 6.2a) thus establishes a sound base for countries that wish to reflect an ecosystem approach in their agricultural policy. Box 2.6 below explains the concepts of ecosystems approach and ecosystem services. Figure 2.2 provides a general framework of possible relationships between agriculture and ecosystem services.

By referring to the farming system level, this paragraph even touches upon social dimensions of agricultural policies for the enhancement of agricultural biodiversity. This may require policy measures that allow smallholder farmers to remain profitable in order not to be driven out of the market. At the same time, it is to note that the reference to 'fair' agricultural policies points to the need to ensure that agricultural policies do not have distorting effects on trade through the granting of subsidies disguised as measures to promote traditional farming and sustainable agriculture.[29]

One methodology that aims at the local level that has been put forward by researchers to promote diverse farming systems through strengthened on-farm management and conservation is Community Biodiversity Management (CBM). CBM guides practices that contribute to the conservation and sustainable use of agricultural biodiversity, focusing on the process of enabling communities to secure their access and control over genetic resources through increased decision-making power. CBM is often applied in relation with participatory plant breeding (PPB), which is dealt with further below.

Cross-references:

- For **examples of policies that promote diverse farming systems** refer to sub-section 4.2.5. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).
- For an overview of selected **examples of legislation for the conservation and sustainable use of crop diversity** refer to Box 3.2 of lesson 3 of this module (Further Components of the International Treaty Supporting Conservation and Sustainable Use).
- To learn more about **NBSAPs** see: http://www.cbd.int/nbsap/training/

[28] TEEB (2010), p. 34.
[29] Moore and Tymowski (2005), pp. 51-52.

Box 2.6: The Ecosystem Approach and Ecosystem Services

An ecosystem is a dynamic complex of plant, animal and micro-organism communities and the nonliving environment interacting as a functional unit. Examples range from relatively undisturbed ecosystems, such as natural forests, to landscapes with mixed patterns of human use, to ecosystems intensively managed and modified by humans, such as agricultural land and urban areas.

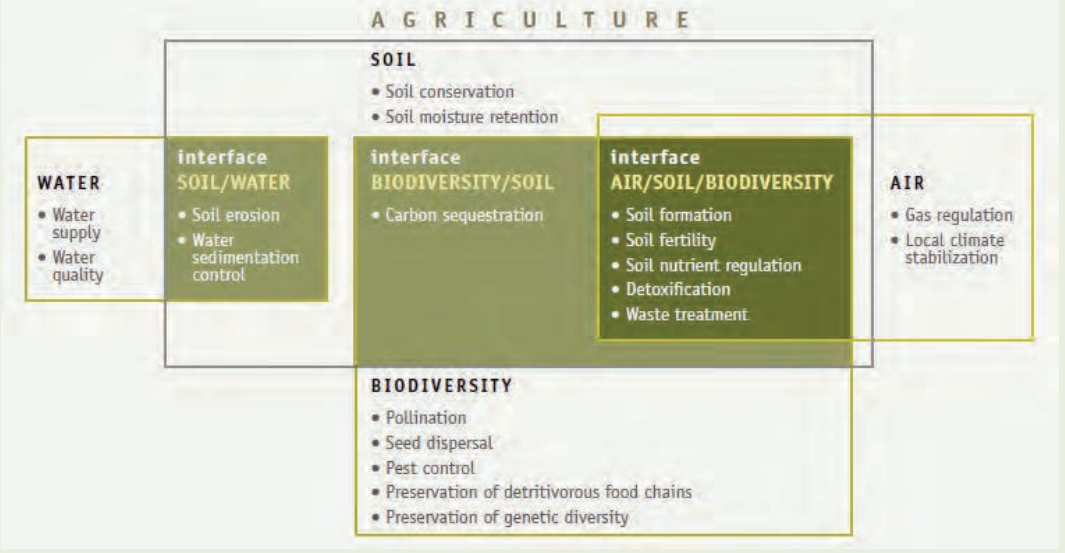
The ecosystem approach is a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. Application of the ecosystem approach involves a focus on the functional relationships and processes within ecosystems, attention to the distribution of benefits that flow from ecosystem services, the use of adaptive management practices, the need to carry out management actions at multiple scales, and intersectoral cooperation.[30]

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling.[31]

For example, the total economic value of insect pollination has been estimated at € 143 billion, representing 9.5 percent of world agricultural output in 2005.[32]

As illustrated, Article 6.2a) thus also exhibits linkages with some provisions on conservation of PGRFA under Article 5, especially those dealing with on-farm conservation and management and *in situ* conservation. In this sense, policy guidance and recommended strategies for implementing Article 6.2a) can be found in priority activities 2 and 4 of the Second Global Plan of Action.

Figure 2.2: Ecosystem Services, Occurring in Different Ecological Compartments (Air, Soil, Water and Biodiversity)



Source: FAO (2011c), p. 12.

[30] CBD (2000).
[31] MEA (2005), pp. v-vi.
[32] TEEB (2010), p. 8.

Research which Enhances Biological Diversity for the Benefit of Farmers (Article 6.2b)

Under its Article 6.2b) the International Treaty proposes the following measure: "strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests".

The main purpose of this proposed measure is to support research that contributes to the enhancement and conservation of agricultural biodiversity. This could be, for example, research that is carried out by international and national agricultural research institutes, gene banks and other institutions carrying out agricultural research. Research should facilitate the conservation and sustainable use of both the variation within a crop species (range of different varieties) as well as of the variation between crop species. It could also focus on crop improvement and adaptation to changing conditions. In addition, the primary beneficiaries of the research should be farmers, in particular farmer breeders that apply sustainable farming principles.

Diversity in cropping systems is often of particular importance from the standpoint of pest control. Traditional farming systems tend to be more agriculturally diverse and smallholder farmers – especially in developing countries – often rely on sustainable practices for soil improvement and pest management, as they lack the necessary financial resources for the procurement of chemical fertilizers, pesticides and herbicides.[33]

This implies that the research should focus on sustainable agricultural practices such as crop diversification and integrated pest management which support a wide range of beneficial insects, soil micro-organisms, and other factors that add up to overall farm health, and to making the research results available to farmers who apply such practices through farmer field schools and extension services.

The Second Global Plan of Action contains recommendations with regard to research and technology for supporting plant breeding, genetic enhancement and base-broadening efforts in its priority activity 9.

Cross-references:

- For working **definitions of terms** including 'biodiversity', 'agricultural biodiversity', 'species', 'varieties', please refer to section 2.3. of lesson 2 of Module I (Objectives, Scope and Basic Concepts).
- For **examples linking research to farmers** refer to sub-section 4.2.2. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).

[33] Moore and Tymowski (2005), p. 52.

Participatory Plant Breeding (Article 6.2c)

As a further measure to enhance sustainable use, Article 6.2c) proposes to promote "plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas".

As a minimum, farmers interact with breeders by buying the varieties they choose to cultivate in their fields. If they do not like the planting material that is offered by the seed sector they would stop buying it and thus there would be no incentive anymore for the seed sector to continue selling that material. This does not hold true, however, for countries where the seed sector is highly monopolized and where farmers do not have access to an efficient formal seed sector that would offer them better alternatives.

Particularly in developing countries formal seed sectors tend to be weak. In such situations, parastatal and commercial seed companies sometimes have difficulty supplying seed of varieties specifically adapted to unique and local conditions. Often they cannot offer the range of varieties, or seed of so-called 'minor' crops, on which many farmers, especially those producing on marginal lands, rely. There is thus a need to strengthen capacities among farmers and local institutions to produce and distribute seed of many crop varieties, including some landraces/farmers' varieties, that are useful for diverse and evolving farming systems.[34]

Therefore, PPB has the objective of developing improved cultivars that conserve adaptive and other traits of local importance. While presenting an effective strategy for promoting sustainable use of PGRFA especially in developing countries, PPB is at the same time a useful approach to on-farm conservation and management of PGRFA, illustrating once more the continuum of conservation and sustainable use. Box 2.7 illustrates the power of PPB by an example from Nepal.

Box 2.7: Participatory Rice Breeding in the Mid-hills of Nepal

An example of rice breeding in the mid-hills of Nepal illustrates the use of locally adapted germplasm and the importance of taking into account the needs of farmers and consumers. In this case, the breeding goal was to incorporate the good taste and yield potential of the most popular variety among consumers in the mid-hills, Khumal-4 (derived from the local landrace Pokhereli Masino and IR28) into the locally adapted landrace Mansara, which, however, is rather poor in taste. Resource-poor households grew Mansara rice despite its poor taste, low yield and poor market value, as it grew in marginal areas where no other rice varieties performed well.

For its excellent local adaptation, the Mansara landrace was thus chosen as a parent for the development of improved locally adapted varieties. This was only possible because the PPB process involved smallholder farmers in setting the breeding goals. The adaptive trait of the Mansara landrace was highly valued among local farmers for its performance in marginal lands. Consequently, the traditional knowledge related to this landrace has been used in the breeding process to develop the improved varieties Mansara-4 and Mansara-5, which grow well in the marginal rice fields of the Nepalese mid-hills, and in addition incorporate the good taste and yield traits of Khumal-4.

[34] Moore and Tymowski (2005), p. 59.

Courtesy Flickr/IRRI Images

Often, PPB and related activities such as participatory variety selection are carried out in the broader methodological framework of CMB that was introduced earlier. In this context, the major outcomes of PPB are increased utilization of on-farm diversity and empowering farmers and rural communities to promote on-farm conservation as part of national programmes on PGRFA. PPB could thus also be applied as a strategy contributing towards the implementation of certain aspects of Farmers' Rights, allowing farmers to actively participate in the scientific process of crop improvement and share in the results obtained.

Developing farmers' capacities to breed locally adapted crop varieties also falls in the purview of Article 13.2c) of the International Treaty. This article lists the strengthening of programmes for scientific and technical capacity development in conservation and sustainable use of PGRFA as an option for non-monetary benefit-sharing under the Multilateral System of the International Treaty.

Priority activity 9 of the Second Global Plan of Action contains policy guidance and recommends strategies for supporting plant breeding, including PPB.

Cross-references:

- For more information on **different methodologies and objectives for PPB**, refer to section 4.2.2. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).
- To learn about **how the International Treaty's provisions on Farmers' Rights support the provisions on conservation and sustainable use**, refer to sub-section 3.2.1. of lesson 3 of this module (Further Components of the International Treaty Supporting Conservation and Sustainable Use).
- For more information on how PPB can contribute to the realization of Farmers' Rights, refer to forthcoming Module III.

Broadening the Range of Genetic Material Available to Farmers (Article 6.2d)

The measure proposed under Article 6.2d) is closely linked to the one under 6.2b) and described above. It reads "broadening the genetic base of crops and increasing the range of genetic diversity available to farmers", which can be understood as increasing the intra- and inter-specific variation of crops.

Farmers over time have developed landraces that are particularly adapted to local social, economic and ecological conditions. This has led to a large degree of intra-specific diversity which, as we have seen above, is particularly important in enhancing crops' resistance to disease, pest or local conditions such as drought. With the large-scale introduction of high yielding improved varieties, locally adapted landraces have often been marginalized and disappeared.

Thus the need for broadening the genetic base of crops, including by incorporating some of the genetic traits present in wild species and landraces hitherto used, into the new improved varieties to allow them to respond better to particular local conditions and other current or future ecological challenges. Pre-breeding is one means to broaden the genetic base of crops, whereby breeders identify desirable traits from non-adapted materials and transfer these to an intermediate set of materials that they can use for breeding new varieties for farmers. Such so-called 'genetic enhancement' is necessary to allow putting to use much of the conserved germplasm. Public financial and policy support is necessary to promote such plant breeding efforts where the private sector has no interest in or cannot accomplish this on its own. Due to their local knowledge and access to locally adapted landraces, the participation of local farmers is also particularly useful.[35]

Again, PPB is a very valuable strategy in this regard as it encourages the creation of synergies between the formal breeding sector and farmers' breeding efforts. Other means to broaden the genetic base are the promotion of seed fairs where farmers and breeders can showcase and exchange their crop genetic materials and knowledge.

The Second Global Plan of Action contains policy guidance and recommends strategies for supporting base-broadening efforts in its priority activity 9.

Cross-references:

- For examples of **base-broadening efforts** and more information about **pre-breeding**, refer to sub-section 4.2.2. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).

[35] Moore and Tymowski (2005), pp. 54-55.

© FAO/Sailendra Kharel

Promotion of Locally Adapted and Underutilized Crops (Article 6.2e)

Under Article 6.2e) the International Treaty proposes "promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species".

Neither 'locally adapted' nor 'underutilized' crops are defined in the text of the International Treaty. Local and locally adapted crop varieties can be understood as varieties that have their origin and/or have developed their distinctive traits in the specific areas where they are cultivated, and are therefore particularly well-adapted to the agro-ecological conditions of this area. Underutilized crops can be understood as "plant species that are used traditionally for their food, fibre, fodder, oil or medicinal properties, and that have an under-exploited potential to contribute to food security, nutrition, health, income generation and environmental services."[36] Underutilized crops were once more widely grown but are falling into disuse for a number of reasons. Farmers and consumers are using these crops less because they are in some way not competitive with other crop species in the same agricultural environment. The decline of these crops may erode the genetic base and preventing the use of distinctive useful traits in crop adaptation and improvement.[37]

Article 6.2e), too, is closely linked to the preceding measures presented above. The use of locally adapted and underutilized crops can be promoted through adequate agricultural policies and by investing in agricultural research. PPB can be a means to promote the use of locally adapted crop varieties in a targeted way, and the expanded use of locally adapted and underutilized crops contributes directly to broadening the genetic base of crops and to increasing the range of the genetic diversity available to farmers. Plant breeding processes that aim at enhancing the capacities of grassroots institutions and farmers to assess existing diversity, select niche specific plant materials, produce sufficient quality seed, and distribute this within the communities, is also known as 'grassroots breeding'.

[36] ICUC (2006).
[37] Bioversity International (2011).

© FAO/Peter DiCampo

Many local and underutilized crops have potential for more widespread use, particularly in areas where the cultivation of major crops is economically marginal. The International Treaty strongly encourages programmes for conservation, research and development to promote these crops and varieties. An example from a project in India that has received financial support from the International Treaty's Benefit-sharing Fund is presented in Box 2.8 below. However, it is important to note that the expanded use of local and underutilized crops is not a goal in itself, especially in cases where such expanded use could jeopardize the food security, nutrition and health of the local populations.[38]

Box 2.8: Locally Adapted Crops Face Climate Change Conditions and Improve Nutrition and Incomes

The women who participated in the Benefit-sharing Fund project of the International Treaty in Kerala, India, have improved their family nutrition and food security through producing high-yielding and drought-resistant local varieties of cassava identified by the project. The women, as well as other farmers, had the benefit of project activities that ranged from identifying isolated farms that still cultivated local crops, to training in cultivation and propagation techniques and support in distributing planting materials of locally adapted varieties.

In 1964, Kerala farmer Ambakkadan Thommi noticed that one of his cassava tubers had an unusual skin colour. He boiled it, liked the taste and, the next season, planted 25 cuttings. When he found the variety was high yielding as well as drought tolerant, he gave cuttings to his neighbours. Now named for him, the Ambakkadan cassava remained popular among local farmers until the 1980s when it was replaced by hybrid and short-duration varieties. In the 1990s, with the increased price of food crops, local farmers remembered the Ambakkadan but found no planting materials available. In answer to this, the International Treaty's Benefit-sharing Fund project in India identified isolated farms still growing Ambakkadan and embarked on cultivating and disseminating the planting material. This will increase the ability of farmers in the region to face climate change conditions as well as improve their nutrition and incomes. [39]

[38] Adapted from Moore and Tymowski (2005), p. 58.
[39] Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture (2011c).

© Katia Covarrubias

One means to promote the use of locally adapted and underutilized crops is to create better market opportunities and supportive policies, to increase the incentive for farmers to continue to use these crops and varieties and thus to conserve crop diversity through its sustainable use.[40] Raising awareness among the general public on the health, nutritional or environmental benefits of consuming certain locally adapted and underutilized crops can also promote market opportunities. In this context, article 6.2e) can also provide a basis for developing marketing strategies that may help to increase consumer demand for local and underutilized crops and varieties.

Promoting the expanded use of such crops will also require the development of capacities for farmers, local communities, scientists and extension specialists in identifying underutilized crops with potential for increased sustainable use, the development of sustainable management practices, developing post-harvest processing methods and developing marketing methods.[41]

Policy guidance and recommended strategies for promoting the development and commercialization of farmers' varieties and underutilized species is contained in priority activity 11 of the Second Global Plan of Action.

Cross-references:

- For an illustration of how **acting on consumer choice** can be a means to enhance the use of traditional and locally adapted crops refer to sub-section 4.2.4. of lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).

[40] Moore and Tymowski (2005), p. 58.
[41] *Ibid.*

Support of On-farm Diversity and Agricultural Development (Article 6.2f)

The measure proposed in Article 6.2f) reads "supporting, as appropriate, the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops and creating strong links to plant breeding and agricultural development in order to reduce crop vulnerability and genetic erosion, and promote increased world food production compatible with sustainable development".

Again, the continuum of conservation and sustainable use of PGRFA is stressed in this provision. The provision notably focuses on broadening the use of crop diversity managed on farms, in particular as a strategy to promote increased world food production through sustainable agricultural development. In response to Article 5.2 which calls upon Contracting Parties to minimize and/or eliminate threats to PGRFA, Article 6.2f) proposes on-farm management, especially when linked to plant breeding, e.g. through PPB, as a way to reduce genetic erosion.

So in essence, the goal of the proposed measure is to enhance and create livelihoods by producing more food using a greater diversity of crops and varieties, through sustainable agricultural practices. This is completely in line with the new paradigm of sustainable crop production intensification (SCPI) advocated by FAO. SCPI is the first strategic objective of FAO. It has been defined as producing more from the same area of land while reducing negative environmental impacts and increasing contributions to natural capital and the flow of environmental services.[42] Box 2.9 elaborates the logic of SCPI.

Box 2.9: The Key Principles of Sustainable Crop Production Intensification

SCPI applies the basic principles of the ecosystem approach to the sector of crop production. It is characterized by a systemic approach to managing natural resources, and founded on a set of science-based environmental, institutional and social principles.

- **Environmental principles:** SCPI is based on agricultural production systems and management practices that include maintaining healthy soil to enhance crop nutrition; cultivating a wider range of species and varieties in associations, rotations and sequences; using well adapted, high-yielding varieties and good quality seeds; integrated management of insect pests, diseases and weeds; and efficient water management.

- **Institutional principles:** Translating the environmental principles into large-scale, coordinated programmes of action will require institutional support at both national and local levels. The formulation of policies and strategies for SCPI must be improved at national level. Smallholder farmers need access to efficient and equitable markets, and incentives that encourage them to manage other ecosystem services besides food production.

- **Social principles:** SCPI will require significant strengthening of extension services, from both traditional and non-traditional sources, to support its adoption by farmers. Mobilizing social capital for SCPI will require people's participation in local decision-making, ensuring decent and fair working conditions in agriculture and the recognition of the critical role of women in agriculture. [43]

[42] FAO (2011a), p. 9.
[43] Box 2.9 is adapted from FAO (2011a), pp. 11-12.

© FAO/Munir Uz Zaman

In order to achieve its objective of SCPI, FAO has endorsed the ecosystem approach in agricultural management. There is now widespread awareness that applying the ecosystem approach is an effective means that must underpin intensification of crop production. For example, a review of agricultural development projects in 57 low-income countries found that sustainable agricultural practices had led to average crop yield increases of almost 80 percent.[44]

Priority activity 10 of the Second Global Plan of Action contains policy guidance and recommends strategies for promoting diversification of crop production for sustainable agriculture.

Reviewing Breeding Strategies and Regulations Concerning Variety Release and Seed Distribution (Article 6.2g)

The last of the proposed measures to support the sustainable use of PGRFA listed in the International Treaty reads "reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution".

Seed regulatory frameworks aim to promote varietal and seed quality, and thereby to protect farmers from planting sub-standard seed. Seed laws commonly regulate variety testing and release, seed certification and seed quality control, and they establish the institutional framework of national seed councils and certification agencies. Seed laws are not usually intended to influence the direction of plant breeding, but often they are determined at least partly by economical management strategies. However, there are significant indirect effects of the variety release systems and of seed certification requirements on plant breeding methodologies and the resulting varieties. Breeders tend to target favourable farming conditions, wide adaptation and varietal uniformity as a result.[45]

[44] FAO (2011a), pp. 9-10.
[45] Moore and Tymowski, pp. 59-60.

There are a number of options for regulatory reform. Depending on national circumstances, government policies that provide an enabling environment for the development of different seed systems, including small-scale and specialized seed enterprises, may need to be formulated. Efforts may focus on crops and varieties needed by resource-poor farmers, and complemented by policies that facilitate the development of commercial seed companies to meet the needs of larger scale, commercial farmers. Where not already in place, legislative measures that create adequate conditions for the acceptance of varieties developed through PPB and for the deployment of farmers' varieties and underutilized species could be adopted. In plant breeding, more emphasis could be put on farmers' involvement, decentralizing variety testing, breeding for particular niches, and making site selection, trial management and analysis that is more representative of farmers' conditions.[46]

The Second Global Plan of Action contains policy guidance and recommends strategies related to breeding strategies, variety release and seed distribution in its priority activity 12.

Key points to remember:

- Article 6 constitutes an obligation for Contracting Parties to develop and maintain appropriate policy and legal measures that promote the sustainable use of PGRFA.
- Addressing PGRFA in their wider context of agricultural biodiversity and ecosystem services, Article 6 provides a sound basis to promote sustainable agricultural policies and to apply the ecosystem approach.
- Article 6 also foresees the strengthening of research on a wide range of factors that add up to overall farm health, and making results available to farmers.
- The International Treaty also promotes participatory plant breeding, which aims at developing improved cultivars that conserve traits of local importance.
- Broadening the genetic base of crops implies the incorporation of desirable genetic traits of landraces and CWR into new improved varieties, including through pre-breeding, thereby increasing the intra- and inter-specific variation of crops.
- Underutilized crops are plant species with an under-exploited potential to contribute to food security, health, income generation and environmental services; their use can be promoted by creating better market opportunities and supporting policies.
- The International Treaty suggests measures that increase world food production by reducing crop vulnerability and genetic erosion through on-farm management of PGRFA and plant breeding.
- Variety release and seed certification regulations tend to target favourable farming conditions and wide adaptation and therefore often favour varietal uniformity. The International Treaty thus suggests Contracting Parties to review seed laws and regulations, as appropriate.

Cross-references:

- For **examples of cases where more flexibility has been introduced into new seed laws**, refer to Box 4.11 in lesson 4 of this module (Implementation of Articles 5 and 6 from a Users' Perspective).

[46] FAO (2011b), para. 209.

2.3. Conclusive Summary

Conservation and sustainable use of crop diversity are intrinsically linked. This linkage is highlighted at various points in the text of the International Treaty and particularly in the measures proposed under its articles 5 and 6. These measures can be seen as a continuum.

Under Article 5 Contracting Parties commit to apply an integrated approach to conservation and sustainable use. Exploration, collection, characterization, evaluation and documentation of PGRFA are presented as integral elements of effective conservation efforts. In particular characterization, evaluation and documentation of PGRFA mark the connection between conservation and sustainable use. Agricultural researchers and breeders depend heavily on the availability of this information related to crop genetic resources in order to identify desirable traits for the development of new crop varieties. Strengthening databases on information related to conserved PGRFA and making this information available together with the crop genetic material is thus of utmost importance in order to promote the use of PGRFA.

All rational attempts to effectively conserve PGRFA are preceded by exploration activities that typically include surveying and inventorying of threatened PGRFA that are of potential use. According to the Second State of the World Report there remains a particular need to improve inventories on landraces, CWR and other useful wild species to better target conservation action.

Contracting Parties of the International Treaty further commit to promote the conservation of crop genetic resources in gene banks and on farms, as well as in protected areas. In this regard, the Second State of the World Report notably calls for further rationalization of the international *ex situ* conservation system. Particularly for *in situ* and on-farm conservation and management efforts the involvement of local communities is essential and due consideration should be given to traditional knowledge systems and practices.

Article 6 of the International Treaty constitutes an obligation for Contracting Parties to develop and maintain appropriate policy and legal measures that promote the sustainable use of crop diversity. The provisions under Article 6 propose a number of such measures which in turn draw from the priority activities of the internationally agreed Global Plan of Action. The measures range from strengthening agricultural research for the benefit of farmers to the promotion of participatory plant breeding and formal breeding, increasing the intra- and inter-specific variation of crops by broadening their genetic base, the promotion of the use of locally adapted and underutilized crop varieties, on-farm management of crop diversity, and the creation and adjustment of laws and policies that are supportive of biologically diverse and ecologically sound farming systems.

2.4. Bibliographic References

Bioversity International. 2011. *Neglected and Underutilized Species.* See: http://www2.bioversityinternational.org/Themes/Neglected_and_Underutilized_Species/index.asp (accessed 29 September 2011).

De Vicente, M. C., López, C. and Fulton, T. 2004. *Genetic Diversity Analysis with Molecular Marker Data: Learning Module.* Available at: http://irc.igd.cornell.edu/MolecularMarkers/14_Glossary2.pdf (accessed 23 September 2011).

Eastern African Plant Genetic Resources Network (EAPGREN). 2005. *A Glossary of Plant Genetic Resources Terms.* Available at: http://www.ibc-et.org/ibc/pubn/files/Glossary_of_PGR.pdf (accessed 23 September 2011).

FAO. 1999. *Glossary of Biotechnology and Genetic Engineering.* Available at: http://www.fao.org/DOCREP/003/X3910E/X3910E00.htm#TopOfPage (accessed 23 September 2011).

FAO. 2001. *Glossary of Biotechnology for Food and Agriculture – A Revised and Augmented Edition of the Glossary of Biotechnology and Genetic Engineering.* Available at: http://www.fao.org/DOCREP/004/Y2775E/Y2775E00.HTM#Contents (accessed 23 September 2011).

FAO. 2010. *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture*. Available at: http://www.fao.org/docrep/013/i1500e/i1500e.pdf (accessed 22 September 2011).

FAO. 2011. *Save and Grow.* Available at: http://www.fao.org/ag/save-and-grow/index_en.html (accessed 26 September 2011).

FAO. 2011. *Second Global Plan of Action on Plant Genetic Resources for Food and Agriculture.* http://typo3.fao.org/fileadmin/templates/agphome/documents/PGR/GPA/GPA2/GPA2_en.pdf (accessed 2 November 2011).

FAO. 2011. *Payments for Ecosystem Services and Food Security.* Available at: http://www.fao.org/docrep/014/i2100e/i2100e.pdf (accessed 29 November 2011)

International Center for Tropical Agriculture (CIAT). 2007. *Multi-Institutional Distance Learning Course on the* Ex Situ *Conservation of Plant Genetic Resources.* Available at: http://webapp.ciat.cgiar.org/ccc/pdf/Course_Ex_Situ/contents.pdf (accessed 23 September 2011).

International Centre for Underutilised Crops (ICUC). 2006. *ICUC Brochure.* Available at: http://www.icuc-iwmi.org/files/Publications/ICUC_Brochure.pdf (accessed 26 September 2011).

Millennium Ecosystem Assessment (MEA). 2005. *Ecosystem and Human Well-being: Synthesis.* Available at: http://www.maweb.org/documents/document.356.aspx.pdf (accessed 30 September 2011).

Moore, G. and Tymowski, W. 2005. *Explanatory Guide on the International Treaty on Plant Genetic Resources for Food and Agriculture.* Available at: http://data.iucn.org/dbtw-wpd/edocs/EPLP-057.pdf (accessed 22 September 2011).

Secretariat of the Convention on Biological Diversity (CBD). 2000. "Ecosystem Approach", *Decision V/6 of the Fifth Conference of Parties to the Convention on Biological Diversity*. Available at: http://www.cbd.int/decision/cop/?id=7148 (accessed 30 September 2011).

Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture. 2011. *Peruvian "Guardians" Lead Potato Park to a Secure Future.* Available at: http://www.planttreaty.org/sites/default/files/FACTSHEET%20PERUok.pdf (accessed 29 September 2011).

Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture. 2011. *Farmers Choose Best-adapted Varieties for Testing.* Available at: http://www.planttreaty.org/sites/default/files/FACTSHEET%20SENEGAL.pdf (accessed 29 September 2011).

Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture. 2011. *Women's Group Completes Food Chain from Field to Market.* Available at: http://www.planttreaty.org/sites/default/files/FACTSHEET%20INDIA.pdf (accessed 30 September 2011).

The Economics of Ecosystems and Biodiversity (TEEB). 2010. *Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB.* Available at: http://www.teebweb.org/LinkClick.aspx?fileticket=bYhDohL_TuM%3d&tabid=1278&mid=2357 (accessed 30 September 2011).