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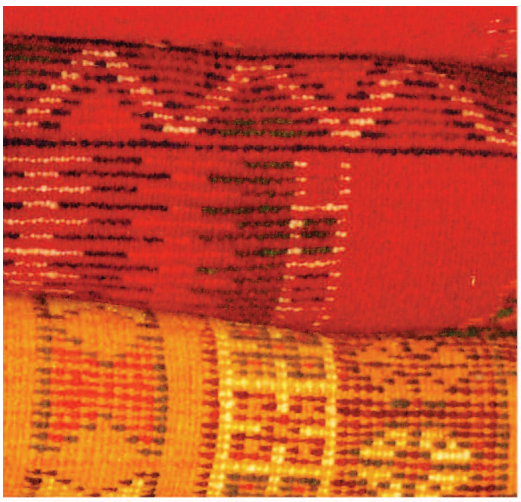
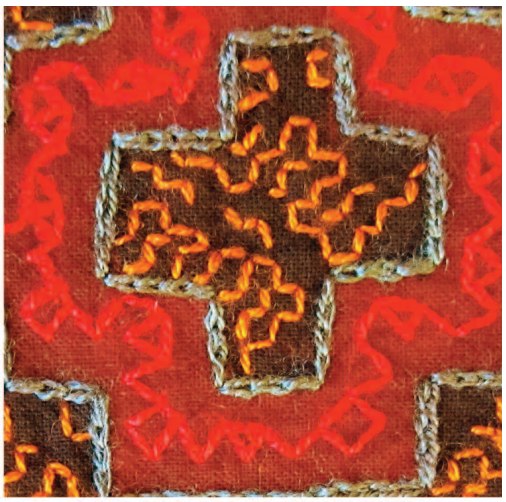

THE MULTILATERAL SYSTEM OF ACCESS AND BENEFIT SHARING

CASE STUDIES ON IMPLEMENTATION IN KENYA, MOROCCO, PHILIPPINES AND PERU

Edited by Isabel López Noriega, Michael Halewood and Isabel Lapeña

The multilateral system of access and benefit sharing

Case studies on implementation in Kenya, Morocco, Philippines and Peru

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Bioversity International is a research-for-development organization working with partners worldwide to use and conserve agricultural biodiversity to improve lives, sustain the planet and provide resilient, productive agricultural systems. Bioversity International is working towards a world in which smallholder farming communities in developing countries of Africa, Asia and the Americas are thriving and sustainable. Bioversity focuses on rain-fed farming systems, primarily managed by smallholder farmers, in areas where large-scale agriculture is not a viable option. Its research influences policy decisions and investment in agricultural research, from the local level to the global level. Bioversity International is a member of the CGIAR Consortium. www.bioversityinternational.org

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The Collective Action for the Rehabilitation of Global Public Goods in the CGIAR Genetic Resources System–Phase 2 (GPG2) project was a system-wide initiative supported by the World Bank to rehabilitate and enhance the CGIAR Centres' capacity to conserve and provide plant genetic resources and associated knowledge to users worldwide as Global Public Goods. The project was coordinated by the System-wide Genetic Resources Programme (SGRP) and focused on strengthening collective action across Centres in the consolidation of policies, practices, procedures and increasing efficiencies for the management of the in-trust collections and associated information and knowledge within the context of the emerging global system on conservation and use of genetic resources for food and agriculture. The GPG2 project was carried out by all of the CGIAR Centres involved in crop genetic resources activities (AfricaRice, Bioversity International, CIAT, CIMMYT, CIP, ICARDA, ICRISAT, IFPRI, IITA, ILRI and IRRI).

Photographs on the cover, from left to right: Pile of Moroccan carpets, by Tomas Zrna; detail of Shipibo Indian embroidery from Peru, by Elaine Lipson; detail of Kenyan fabric, by Nora Capozio; detail of a banig, by Francesca Gallo. All rights reserved.

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CONTENTS

INTRODUCTION

Introduction

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) was adopted in 2001, after eight years of negotiation, and came into force in 2004[1]. Its objectives are the conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA) and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity[2]. The Treaty creates the multilateral system of access and benefit sharing (multilateral system), through which contracting parties agree to provide facilitated access to genetic resources of sixty-four crops and forages that are crucial for food security worldwide. The multilateral system can be seen as the most advanced expression of countries' intention to co-operate in the conservation, distribution and use of PGRFA, and it constitutes a central element in a global system in which different types of PGRFA users around the world share both responsibilities and benefits in the conservation and use of plant genetic resources.

The multilateral system can be implemented only if countries' governments, international organizations and individual PGRFA users worldwide embrace its collaborative spirit and approach PGRFA conservation and use as a joint international effort. Effective collaboration depends upon understanding the perspectives of the different stakeholders involved in PGRFA conservation and use. The four national case studies presented in this volume – focusing on Kenya, Morocco, Peru and the Philippines – were commissioned as part of an effort of the centres of the Consultative Group on International Agricultural Research (CGIAR) to better appreciate the incentives and disincentives that countries and their constituent interest groups have to engage (or not) in the multilateral system. They are expected to help the CGIAR centres and other international organizations to orient their support towards the implementation of the global system, and the Treaty, in particular, with a wider vision of countries' expectations and constraints for international co-operation in PGRFA conservation and use. They should also be useful for other countries that are engaged in implementing the multilateral system domestically in order to see how the four countries highlighted in the volume 'frame' the challenges and identify options for effective participation.

These studies were part of an activity entitled the Analysis of the Elements, Functions and Promotion of an Integrated Global System, which fell under the second phase of the World Bank-funded project Collective Action for the Rehabilitation of Global Public Goods in the CGIAR Genetic Resources System (GPG2 project). The GPG2 project was a comprehensive program of work to upgrade the CGIAR centres' gene banks and standards of management in order to ensure efficient and sustainable long-term conservation and to facilitate access by users. Improving links with national programs and partners was considered to be an important part of this enterprise.

The national partners in Kenya, Morocco, Peru and the Philippines undertook the country case studies over a period of approximately one year from 2009 to 2010. All four teams followed similar methods, conducting a combination of literature reviews, surveys and interviews as well as specialized data collection and synthesis. The preliminary results of these studies were presented and discussed in national stakeholder workshops, where the national partners had an opportunity to collect further ideas regarding the incentives and disincentives for each country to implement the Treaty and its multilateral system. The revised papers were presented during the Workshop on National Programs and the CGIAR Centres' Co-operation to Implement the Multilateral System of the ITPGRFA in February 2010 (SGRP, 2010). The meeting included members of the national research teams, representatives of the CGIAR centres that are most active in the studied countries, the ITPGRFA Secretariat, the Global Crop Diversity Trust, and international experts concerning the conservation and sustainable use of plant genetic resource. The authors revised the papers again following input from this meeting.

The four case studies included in this volume highlight the incentives, disincentives, opportunities and constraints for Kenya, Morocco, Peru and the Philippines in the implementation of the Treaty's multilateral system and point out the measures that could be adopted at the national level to advance the Treaty's

implementation. The value of this compilation relies not only on the detailed description of these four countries' particular experiences but also on the fact that they illustrate common challenges faced by many parties to the Treaty.

The case studies show that the most important incentives for countries to actively participate in the multilateral system can be limited by policy and technical constraints, which sometimes hinder supportive actions by national authorities. The four case studies demonstrate that PGRFA users are generally convinced about the benefits of a multilateral system in that it allows countries to meet their need for PGRFA coming from abroad to support their agricultural research and development programs. At the same time, policy makers' lack of awareness about their own countries' needs for PGRFA and lingering uncertainties around how access and benefit sharing actually is, or should be, regulated discourage active implementation of the multilateral system. The studies also highlight other constraints to active participation, such as weak information systems and the limited capacity of national breeding programs to use the diversity of materials that is available through the multilateral system.

According to the experience of these four countries, the success of the multilateral system requires supportive and determined actions at the policy level, effective awareness-raising and capacity-building activities and the adoption of appropriate supporting technologies. The Treaty's multilateral system does not implement itself – it clearly needs support in the form of co-ordinated international projects to 'get up and running.' It is our hope that this volume offers national and international actors valuable information to design activities to support effective implementation.

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Photographs, from left to right: detail of Philippine banig, by Anson Yu; detail of Peruvian fabric, by robert j. mang photography; detail of Kenyan fabric, by Nora Capozio; detail of moroccan carpet, by Ondrej Cech. All rights reserved.

[1] *International Treaty on Plant Genetic Resources for Food and Agriculture, 29 June 2004, http://www.planttreaty.org/texts_en.htm.*
[2] *Convention on Biological Diversity, 31 ILM 818 (1992).*

INCENTIVES AND DISINCENTIVES FOR KENYA'S PARTICIPATION IN THE MULTILATERAL SYSTEM OF ACCESS AND BENEFIT SHARING

P.W. Wambugu, Z.K. Muthamia

1. Introduction

Numerous studies have documented the importance of plant genetic resources for food and agriculture (PGRFA) to humanity. In addition to being plant breeders and the most important raw materials for the development of new varieties, their proper maintenance gives plants the ability to adapt to a changing environment including pests, diseases, drought and new climatic conditions. Plant genetic resources are a unique form of biodiversity that attest to three particular claims:

- no country has developed a successful agricultural system without recourse to non-indigenous plant genetic resources;
- all countries are highly interdependent for their supply of PGRFA and
- no single country is home to the full complement of crop species and their diversity.

Due to these features, PGRFA have therefore been regarded as the 'common heritage for mankind' as reflected in the text of the International Undertaking on Plant Genetic Resources for Food and Agriculture, which was adopted in 1983[1]. The utilization and conservation of PGRFA was, and has been recognized as, a concern for humankind[2]. In an effort to systemize and link conservation efforts at both the international and national levels, the Food and Agriculture Organization (FAO) formed a global system for the conservation and utilization of PGRFA. The objectives of the global system were to ensure the safe conservation, and promotion, of the availability and sustainable use of PGRFA by providing a flexible framework for sharing the benefits and burdens[3].

The global system contains two key elements: the *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2010) and the Global Plan of Action (GPA)[4] for the conservation and sustainable utilization of PGRFA. The GPA provides the overall framework, or blueprint, for the global system, and the periodic State of the World reports provide a mechanism for monitoring progress and evaluating the system. In addition, the global system also includes: the non-binding International Undertaking on Plant Genetic Resources for Food and Agriculture; the code of conduct for germplasm collecting and transfer[5]; gene bank standards and guidelines; the draft code of conduct on biotechnology; the international network of *ex situ* collections; and the World Information and Early Warning Systems (WIEWS)[6]. However, since its development in 1983, the global system has been evolving with time. Currently, the original FAO list of components is obsolete and is under development in order to take into account recent developments in the PGRFA arena.

The basic agreement and intergovernmental policy that underpinned the development of the global system was, until 2004, the International Undertaking on Plant Genetic Resources for Food and Agriculture, which was superseded when the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) came into force[7].

The ITPGRFA is therefore one of the latest components of this evolving global system. The Treaty is the first legally binding international agreement focusing specifically on the conservation and sustainable use of PGRFA. It seeks to ensure the conservation of, access to and sustainable use of PGRFA in harmony with the Convention on Biological Diversity (CBD) for sustainable agriculture and food security. Among other provisions, the Treaty establishes a multilateral system of access and benefit sharing for facilitated access to a specified list of PGRFA, including 35 food crops and 29 forages balanced by benefit sharing in the areas of information exchange, technology transfer, capacity building and commercial development.

Currently, some of the FAO components of the global system are obsolete, and therefore the structure and elements of the global system, as originally envisaged, are fast changing. In view of this change and in the context of this study, this section adopts its own definition of the global system. The global system is hereby defined as the combination or sum total of all those activities, initiatives, agreements, processes and

institutions that take place, or operate, on the international scene and that are aimed at ensuring the safe conservation, availability and sustainable use of PGRFA, balanced by equitable sharing of benefits. The study will give special focus to the Treaty and especially the multilateral system.

2. Objective of the case study

The broad objective of this study was to identify incentives and disincentives for Kenya's participation in the global system. Specifically, the study aimed at assessing what stakeholders in Kenya think about the evolving global system of conservation and use, with a particular focus on the ITPGRFA's multilateral system; identifying the policies, procedures, management structures, cultural phenomenon and other factors in Kenya that support (or discourage) participation in the multilateral system and identifying ways forward to address and overcome the disincentives so identified.

This report has two main parts: the first part deals with background information and relevant facts concerning PGRFA conservation and utilization in Kenya as well as the institutional, regulatory and legislative landscape concerning PGRFA in Kenya. The second part contains a synthesis and analysis of information presented in the first part so as to identify incentives and disincentives for Kenya's participation in the global system as well as giving proposals of increasing participation by addressing disincentives identified therein.

3. Methodology

The study employed a combination of research techniques in collecting the necessary data and information. The study began with a detailed examination of relevant government of Kenya documents. These included laws, policies and regulations dealing with germplasm conservation and access and benefit sharing (ABS). This was meant to give detailed understanding of the current legal framework and institutional landscape in the country. A review of available literature was also undertaken. In order to assess the incentives and disincentives for Kenya's participation in the global system, an information gap analysis was conducted. Subsequently, a formal questionnaire survey was administered between June and July 2009 to 56 PGRFA stakeholders in the country with a view of gathering information on the identified information gaps. Specifically, the survey collected information on sources of germplasm, difficulties faced in accessing germplasm from both national and international sources, and the level of awareness of the ITPGRFA. A non-random purposive selection method was used to identify the stakeholders to be interviewed. The survey targeted mainly public and private sector plant breeders, staff in the lead PGRFA conservation and use agencies, farmers and relevant policy makers. In order to reinforce and complement the results of the survey, unstructured discussions were also held with a number of key stakeholders. Finally, the results were presented to the PGRFA stakeholders during a national stakeholders workshop, where they were discussed. Given the complexity of the global system, this study concentrated on the ITPGRFA's multilateral system as a proxy.

4. Agriculture and PGRFA in Kenya

Agriculture is the mainstay of Kenya's economy, and the growth of the sector is crucial to the country's overall economic and social development. The sector directly contributes about 26 percent of the country's gross domestic product and a further 27 percent through linkages with manufacturing, distribution and service-related sectors. About 68 percent of Kenya's population live in the rural areas and depend mainly on agriculture and fisheries for livelihood. In addition, 87 percent of poor households live in rural areas (Government of Kenya, 2003). Small-scale farmers account for about 80 percent of the farming community.

However, over the past decade, the performance of the sector has been far from satisfactory, with the agricultural growth rate lagging behind the population growth rate. This trend has led to increased incidences of food shortages, increased poverty levels, declining income, loss of employment and a shift from self-sufficiency to a reliance on importation and food aid. To date, Kenya's average poverty level exceeds the 50

percent population mark. It is estimated that about 56 percent of the population is food insecure at one time or another during the year. Of this total, some 2 million people out of a total population of over 33 million are food insecure and permanently depend on relief food. This figure usually rises to five million people during droughts. Those people who live in absolute poverty are estimated to be 53 percent and 49 percent of the rural and urban population respectively. Such food scarcity leads to a lack of physical and economic access to sufficient, safe and nutritious food for an active and healthy life.

According to the Strategy for the Revitalization of Agriculture 2004-14, the main constraints that have led to the dismal performance of the agricultural sector in the last decade include: unfavourable micro- and macro-economic environment, inadequate markets and marketing infrastructure, unfavourable external environment, inappropriate legal and regulatory framework, inadequate financial services and inadequate storage and processing capacity for perishable commodities (Government of Kenya, 2003). Other factors include weak and ineffective research-oriented-farmer linkages, poor coordination with other support sectors such as water, roads, energy and security, natural disasters such as floods, pests and disease outbreaks, poor governance in key institutions that support agriculture and declining soil fertility.

Kenya has a rich plant diversity in a range of habitats. According to International Union for the Conservation of Nature (IUCN), there is an estimated total number of 7,500 plant species in the country. Of these, about 475 are nationally endemic, while 258 are threatened. The main food crops in Kenya are maize (*Zea mays*), wheat (*Triticum aestivum*), beans (*Phaseolus vulgaris*), peas (*Pisum sativum*), bananas (*Musa sp.*) and potatoes (*Solanum tuberosum*). Maize (*Zea mays*) is the principal staple food of Kenya, and it is grown on 90 percent of farms. Maize is a strategic food security crop, and poor yields almost inevitably result in food shortage and famine in the country. It is also a major income-generating crop and accounts for about 25 percent of agricultural employment. Bananas are another important food security and cash crop in Kenya, particularly among small-hold farmers. Common beans are the most important legume and second to maize as a food crop. The main agricultural export products from Kenya are tea (*Camellia sinensis*), coffee (*Coffea arabica*), pyrethrum (*Chrysanthemum cinerariifolium*), sisal (*Agave sisalana*) and horticultural products (including fruits, vegetables and floricultural crops). Other crops that are gaining popularity due to their nutritional value and adaptability to marginal environments include sorghum (*Sorghum bicolor*), millet (*Eleusine coracana*) and cassava (*Manihot esculenta*).

The diversity of plant genetic resources (PGR), like the diversity of other life forms in Kenya has since the recent past been on the decline due to genetic erosion brought about by both biotic and abiotic factors. The factors include: drought, desertification, population pressure on land, changes in land use, changes in eating habits and over-exploitation. While the diversity in high potential areas is already severely diminished due to continued land cultivation and other forms of land exploitation, the decline in arid and semi arid lands (ASALs) is now at its peak being exacerbated by the effects of global warming. Immigration into these areas by people in search of cultivable land is causing untold damage to the existing diversity whose erosion is already worsened by desertification.

In response to this threat to the country's PGR, a concerted conservation effort of PGRFA is underway in Kenya. A National Plant Genetic Resources Programme exists, which was technically established in 1978. The program is a network of institutions undertaking the cultivation of PGR in the country and includes the National Genebank of Kenya (NGBK), the Kenya Forestry Research Institute (KEFRI), National Museums of Kenya (NMK), the Kenya Wildlife Service (KWS), the Kenya Forest Service (KFS), relevant government ministries and departments such as the Ministry of Environment and Natural Resources, the Ministry of Agriculture, local public universities, community-based organizations, non-governmental organizations (NGOs) and farmer groups. The key institutions have specific roles and responsibilities in line with their mandates and missions (see Table 1). However, the national program has remained largely uncoordinated, and this has affected its progress in several areas of PGRFA conservation and utilization. For instance, several initiatives aimed at developing a policy framework on ABS in the past have failed due to a lack of coordination and unclear institutional mandates.

Table 1: Some key institutions that form the National Plant Genetic Resources Programme in Kenya and their roles in PGR conservation and utilization

Organization	Role in Plant genetic resources conservation and utilization
Kenya Agricultural Research Institute (KARI) – National Genebank of Kenya (NGBK)[8]	KARI's mission is to contribute together with its partners, agricultural innovations and knowledge towards improved livelihoods and commercialization of agriculture through increasing productivity and fostering value chains while conserving the environment. The NGBK is involved in long-term conservation of PGR
Kenya Forest Service (KFS)	The KFS provides services to manage, protect, maintain and expand Kenyan forests in a way that ensures productivity, sustainability and profitability of the enhanced natural resource base for the benefit of all Kenyans
Kenya Wildlife Service (KWS)[9]	The KWS manages national parks, game reserves, sanctuaries and marine parks in the country.
Kenya Forestry Research Institute (KEFRI)[10]	The KEFRI carries out research and advisory services in the areas of natural forests, forest plantations, farmlands and dry lands. It also disseminates information on tree and forestry development.
National Museums of Kenya (NMK)[11]	The NMK manages the network of national herbaria, collects plant materials and manages national monuments.
National Environment Management Authority (NEMA)[12]	The NEMA regulates environmental management law and ensures compliance according to the regulations, rules and environmental impact assessment for development initiatives. It is charged with the responsibility of taking stock of the natural resources in Kenya and their utilization and conservation. It is also charged with the responsibility of regulating ABS on PGR in consultation with other lead agencies.
Kenya Plant Health Inspectorate Services (KEPHIS)[13]	The KEPHIS regulates the import and export of plant products by issuing phytosanitary certificates and ensuring health controls. It also hosts the Plant Variety Protection Office, which is the custodian of plant breeders' rights.
Local universities	Local universities enable research in natural resources and plant sciences as well as training in plant biodiversity, genetics and plant breeding. Some universities are actively involved in plant breeding in addition to their core activity of training and maintain their own collections.
Non-governmental organizations (NGOs) and community-based organizations (CBOs)	NGOs are mainly involved in lobbying for the conservation and sustainable management of PGR. CBOs are involved in the implementation of mostly conservation projects in collaboration with local communities.

Source: Wambugu and Muthamia (2009).

5. PGRFA conservation and utilization in Kenya: Where does the germplasm come from?

5.1. *Ex situ* conservation at the NGBK

Since the NGBK became operational in 1988, a total of 49,200 accessions of plant germplasm representing 165 families, 893 genera and 1,725 species have been assembled through both in-country collection missions and donations from within and outside Kenya. Over 60 percent of the accessions conserved are from Kenya, while the remaining ones are from more than 137 countries (Wambagu and Muthamia, 2009). Sorghum forms the bulk of the accessions with close to 6,000 accessions (see Table 2).

Table 2: Top 30 species conserved at the NGBK and their origin

Species	Kenya	Foreign	Country of origin unknown	Totals
Sorghum bicolor	3,642	1,005	1,003	5,650
Avena sativa	3	3,742	443	4,188
Phaseolus vulgaris	2,272	1,006	236	3,514
Eleusine coracana	1,829	500	523	2,852
Panicum maximum	1,370	567	1	1,938
Zea mays	1,227	34	531	1,792
Sesamum indicum	190	1,453	34	1,677
Cajanus cajan	433	848	2	1,283
Chloris gayana	899	291	0	1,190
Oryza sativa	859	12	133	1,004
Cenchrus ciliaris	621	375	0	996
Vigna unguiculata	740	64	71	875
Eragrostis superba	790	7	1	798
Sesamum sp.	106	658	2	766
Stylosanthes guianensis	108	641	0	749
Setaria sphacelata	586	68	1	655
Neonotonia wightii	355	79	1	435
Clitoria ternatea	365	28	0	393
Medicago sativa	33	344	0	377
Lablab purpureus	165	186	0	351
Vigna radiata	42	289	0	331
Leptochloa obtusiflora	308	5	1	314
Triticum aestivum	102	120	85	307
Saccharum officinarum	303	0	0	303
Gossypium hirsutum	255	23	0	278
Digitaria milanjiana	222	3	0	225
Crotalaria sp.	208	7	0	215
Panicum coloratum	151	62	0	213
Chloris roxburghiana	209	0	0	209
Lagenaria siceraria	182	1	0	183

Source: NGBK Database

In addition to being a service institution within the framework of KARI, the NGBK has regional and global mandates. Duplicate collections of sorghum and millet and world sesame collections from the International Crop Research Institute for the Semi-Arid Tropics are stored at the NGBK.

Data at the NGBK show a trend of more germplasm introductions being introduced into Kenya from other countries compared to germplasm flows out of the country. Out of the 49,200 accessions conserved at the NGBK, a total of about 15,222 accessions are introductions from other countries. This germplasm has been introduced from other countries, with the United States (3,405 accessions), Australia (2,137 accessions), Zimbabwe (1,437), Colombia (1,195), India (516) and Turkey (454) being the major source countries. These figures, however, have been disputed by some stakeholders who argue that most of these materials had been

collected earlier from Kenya and were simply being repatriated at the inception of the NGBK. The NGBK has sent out a total of about 5,085 accessions to other countries as well as to the International Agricultural Research Centres (IARCs) of the Consultative Group on International Agricultural Research (CGIAR) (see Table 3), which is again much less than it has received.

Table 3: Germplasm distributed from the NGBK to the CGIAR and the World Vegetable Center (1970–2009)

CGIAR Centre	Number of accessions distributed
World Vegetable Center (AVRDC)	61
International Center for Tropical Agriculture (CIAT)	866
International Centre for Maize and Wheat Improvement (CIMMYT)	254
International Potato Center (CIP)	5
International Center for Agricultural Research in the Dry Areas (ICARDA)	42
World Agroforestry Centre (ICRAF)	25
International Crop Research Institute for the Semi-Ari Tropics (ICRISAT)	2,429
International Institute of Tropical Agriculture (IITA)	203
International Livestock Research Institute (ILRI)	743
International Rice Research Institute (IRRI)	266
African Rice Center (WARDA)	4

Source: SINGER database, <http://www.singer.cgiar.org> (last accessed 11 July 2011).

5.1.1. Research and breeding

Although the bulk of the improved crop varieties (85 percent) in Kenya have been bred locally, the volume and sources of the genetic resources received by the public sector suggests heavy reliance on international collections, notably those from the IARCs.[14] Most of the germplasm introductions into Kenya's breeding programs are from the CGIAR with a smaller portion originating from individual countries. There is also evidence of local collections, but these are overshadowed by the germplasm from international sources. In fact, Kenya is in the top ten of the close to 200 countries that have received germplasm from IARCs from 1973 to 2008, having received a total of 23,614 accessions, which represents 1.2 percent of the total germplasm distributions from the CGIAR.[15] Available data on germplasm exchange with users outside the country for research and breeding purposes shows that there is less provision of germplasm to other countries as compared to germplasm receipt (see Tables 4 and 5).

Table 4: Germplasm received by Kenyan breeders and other scientists from outside the country (1960-2009)

Source	Crop species	Number of accessions
AVRDC	Solanum, *Cleome Gyanandra, Glycine maz*, Amaranthus, Malabar spinach, Jute mallow, Pumpkin, Spider plant, African Nitghsade, Sun hemp, Ethiopian mustard	69
CIMMYT	*Zea mays, Triticum aestivum*	401
CIAT	*Phaseolus vulgaris*	11
CIP	Sweet potato	30
ICRISAT	*Hordeum vulgare, Sorghum bicolor, Eleusine coracana*	114
ILRI	Napier grass	50
WARDA	*Oryza sativa*	36
United States (including US Department of Agriculture and several universities and research institutes)	*Sorghum bicolor, Triticum aestivum, Hordeum vulgare, Mangifera indica, Persea americanum, Carica Papaya, Apples, Pawpaw, Helianthus annuus*	885
Other providers (including gene banks and research institutes in Ethiopia, Brazil, South Africa, Belgium and the South African Development Community, and private companies such as Monsanto)	*Sorghum bicolor, Zea mays*, Cotton, banana, fruits, coffee, *Pennisetum purpureum,Manihot sculenta, Camellia sinensis*, Passiflora, *Vigna unguiculata,* Forage grass, White clovers, Eucalyptus spp, Pinus spp	267
Total		1,863

Source: SINGER database, <http://www.singer.cgiar.org> (last accessed 11 July 2011).

Table 5: Germplasm distributed outside the countries by Kenyan breeders and other scientists (1960–2009)

Providing institution	Crop species	Number of accessions
KARI	*Sorghum bicolor, Zea mays, Mangifera indica, Triticum aestivu*m	920
Tea Research Foundation	Tea	26
Maseno University	Finger millet, African nightshade, Spiderplant, Amaranthus	53
Coffee Research Foundation	Coffee arabica	7
Jomo Kenyatta University of Agriculture and Technology	Black night shade	2
Moi University	Cowpeas, beans	8
Total		1,016

Note: This information was obtained from the survey and covers the period from 1960 to 2009 but does not in any way represent all of the potential providers.

This finding brings to the fore the significant role of the multilateral system in access and exchange as the IARCs have always operated in a more or less defacto multilateral system. This finding also seems to corroborate with similar studies (for example, Lettington et al., 2004; Halewood et al., 2004). For some selected crops, examined over a period of 20 years (1974-2001), available data showed that Kenya accessed germplasm originally collected from other countries held at the International Livestock Research Institute (ILRI), the International Center for Tropical Agriculture (CIAT), the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), International Network for the Improvement of Banana and Plantain (INIBAP) and the International Institute of Tropical Agriculture (IITA) / Eastern and Southern Africa Regional Centre (ESARC) gene banks.[16] The numbers accessed through such arrangements outstrip by far those from within the country: on average, they seek 500 percent more materials from other countries than they do from Kenya (Halewood, Gaiji and Upadhyaya, 2004). Additionally, reports indicate that Kenya's breeding programs are 89-98 percent dependent upon the germplasm of its main food crops that originated from beyond its borders (Palacios, 1998). In fact, some of the successful and widely adopted varieties have been introduced from other countries. In conclusion, the foregoing analysis shows a consistent pattern of the country's great dependence on germplasm from other countries than it has on its own germplasm. This should be one of the guiding facts when designing policies on germplasm exchange in the country.

5.1.2. Difficulties in accessing germplasm

The survey conducted to collect information from breeders included some questions about the difficulties they face in accessing germplasm. Probably, the major challenges limiting germplasm exchange nationally is the reluctance by breeders to share materials, the unavailability of evaluation and characterization data and inadequate information on material conserved in various national sources such as the NGBK. Reluctance by breeders to share their materials therefore leads to the unavailability of the elite materials that are usually in their custody, a difficulty that was reported by the majority of respondents. Internationally, the process of germplasm exchange was reported to be long and bureaucratic especially in the case of bilateral arrangements. In addition, there is a lack of clear and conducive access policies, a reluctance by breeders to share materials as well as restrictive phytosanitary requirements. The greatest factor contributing to the reluctance by breeders in the country to share their germplasm internationally is the fear of biopiracy. Overall, it is worth noting that most respondents reported that it was easier to access germplasm from the IARCs, which now share their materials through the multilateral system, than from most national sources.

Table 6: Difficulties faced by breeders in accessing germplasm from national and international gene banks as well as breeding programs (n = 56)[17]

Difficulty	Nationally % of respondents	Internationally % of respondents
Unavailability of data on evaluation and characterization	82	59
Reluctance by breeders to share their materials	73	64
Inadequate information about the materials conserved	73	48
Unavailability of elite materials	73	67
Phytosanitary restrictions	48	73
Lack of conducive access policies	55	60
Material appropriate for the work is usually not available	32	35
Materials acquired previously had poor quality/germination	33	21
Long and bureaucratic process of obtaining germplasm	45	80
Too few accessions of species of interest are available	41	25
Size of samples supplied is not large enough for work	32	35
Low genetic diversity in germplasm of species of interest is available	45	25

In a survey conducted in 2005 with the support of Bioversity International (then the International Plant Genetic Research Institute), which attempted to document the constraints for effective utilization of genetic resources conserved *ex situ* and targeting all PGRFA users of the NGBK collections, it was revealed that despite knowledge of existence and functions of the NGBK, most potential users never acquired materials because they lacked adequate information about the material conserved or felt that the material appropriate for their work was not available. Other constraints identified included a lack of adequate information on performance or evaluation data, especially for biotic and abiotic stresses; poor linkages between the NGBK and potential users; inadequate information (taxonomy, passport and characterization data) accompanying the distributed material; small sample sizes offered to the clientele and complexity and long delays in obtaining germplasm from the NGBK. The majority of those people unaware of the existence of the gene bank were farmers. This was not unexpected because gene banks are mandated to primarily support the formal breeding program and rarely deal directly with farmers (Mbugua, 2005).

It is expected that demand for germplasm from other countries and the CGIAR by Kenyan breeders will continue to increase as the government and donors place an emphasis on crop improvement as one way of achieving self sufficiency in food production and, hence, fighting the persistent level of hunger in the country. However, there is a proliferation of policies and legislation at the national and international level that are designed to protect national genetic resources from unfair commercial exploitation, and there are fears that these regulations are making it more difficult for researchers to access genetic resources from other countries and institutions (Anonymous, 2004a). These regulations have the potential for reducing germplasm flows into and out of the country. In 2004, just as the ITPGRFA was coming into force, it was reported that Kenyan breeders were beginning to experience difficulties in accessing germplasm of certain crops as a result of the increasingly restrictive policies and regulations of countries of origin or diversity (Lettington, Sikinyi and Nnadozie, 2004). Although it would have been expected that this situation would have improved with the coming into force of the Treaty, it has not. The restrictive phytosanitary requirements and widespread use of intellectual property rights over PGR in many countries is partially responsible for the increasing difficulties in accessing germplasm from other countries. Considering that very few countries have implemented the Treaty, this situation is not entirely unexpected. It is therefore to be expected that germplasm flows will increase with the implementation of the multilateral system of the Treaty by countries. It is expected that breeders and other PGRFA users will request more material from the IARCs.

6. International collaboration on germplasm conservation and utilization

As noted earlier, it is an appreciated fact that all countries of the world are interdependent in so far as PGRFA are concerned. This interdependence therefore calls for collaboration both at the regional and international level. This international collaboration is essential if an efficient global system of conservation and utilization is to be realized. In the pursuit of this collaboration, Kenya has joined hands with a number of countries and institutions in the development of agriculture, environment and natural resources, which are important sectors relevant to the conservation and management of PGR. These collaborative efforts and arrangements have to a great extent helped the country improve its capacity in the conservation and sustainable management of PGR.

6.1. Participation in regional and international networks

The only network dealing exclusively with PGR, whose activities Kenya participates in, is the Eastern Africa Plant Genetic Resources Network (EAPGREN).[18] EAPGREN's mission is to harness, conserve and promote greater use of PGR for food security, improved health and the socio-economic advancement of the rural communities of the present and future generations. Through the support of the EAPGREN, Kenya has conducted germplasm collection missions, regeneration, characterization and germplasm distribution within the region. In addition, the network has also undertaken a wide range of other PGRFA-related activities including the exchange of information, human and infrastructural capacity building, raising awareness and policy advocacy. The network has further served as a link between the Kenyan national PGR program and the global system, thus giving visibility to ongoing PGRFA-related activities.

6.2. Participation in crop improvement and research networks

Kenya is a member of several crop improvement and research-based networks, the majority of which operate within the framework of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). Among the active crop improvement networks is the Maize Breeders for Africa Network (MBnet), which is a technical exchange initiative among maize scientists within the eastern and southern Africa region. The network works with members with active maize-breeding programs. The objectives of the network are enhancing access to germplasm, breeding new varieties, germplasm custody and public-seed company partnerships. The network was launched in April 2003 and comprises members from Kenya, Malawi, Uganda, Zimbabwe and Mozambique. Its activities are funded by the Alliance for Green Revolution in Africa.

6.3. Kenya's partnership with the Global Crop Diversity Trust (GCDT)

The GCDT aims to support a global system for the efficient and effective *ex situ* conservation of prioritized collections of globally important crops.[19] This effort, the GCDT hopes, will ensure the continued availability of PGRFA with a view to achieving global food security and sustainable agriculture. To achieve this goal, the trust is supporting the development of crop and regional conservation strategies, which have helped to guide the trust's priority areas for funding support. The GCDT is further supporting the rescue of globally and regionally prioritized crop collections, giving priority to globally important crops (that is, those in Annex 1 of the treaty). The country directly participated through the NGBK either by completing questionnaires or through meetings and expert consultations, in a number of strategies as key collection holders and stakeholders. Through these two approaches, the GCDT has prioritized five crops conserved at the NGBK for regeneration and subsequent safety duplication at the Svalbard Global Seed Vault (SGSV) and at any other gene bank that meets international standards. The prioritized crops include Sorghum bicolor, Eleusine coracana, Cajanus cajan, Vicia faba and *Vigna unguiculata*. Now in its third year, the program has seen about 1,000 accessions regenerated and a total of 1,324 accessions duplicated at the SGSV.

Under a GCDT initiative, a regional conservation strategy entitled Regional Strategy for the *Ex Situ* Conservation of Plant Genetic Resources in Eastern Africa has been developed in close collaboration with EAPGREN, the regional network.[20] The strategy is aimed at guiding the allocation of resources to the most important and needy crop diversity collections in the region, assisting them in meeting the criteria required for long-term conservation funding. Implementation of the regional strategy has, however, been slow probably because its completion coincided with the end of EAPGREN's phase one funding, which was spearheading its development and implementation. The strategy identified priority crops and collections that require support, areas and activities requiring regional collaboration and priority capacity building or upgrading needs. With the support of the GCDT and other funding agencies, Kenya is already implementing some of the priority areas/activities as identified in the strategy. As already stated earlier, the characterization and regeneration of *Sorghum bicolor, Eleusine coracana, Cajanus cajan, Vicia faba* and *Vigna unguiculata* is ongoing through the financial support of the trust. In regard to *in vitro* conservation, which was identified as one of the priority areas for intervention, the regional conservation strategy identified the NGBK as a possible hub for the conservation of cassava and sweet potato germplasm in the region. Under this arrangement, participating countries in the region will undertake germplasm collection missions in their countries and then send the germplasm for *in vitro* conservation at the NGBK, where these facilities are being established through the financial support of USAID through the ASARECA. To date, some of the participating countries, Kenya included, have conducted sweet potato and cassava germplasm collection missions. The tissue culture labs are currently being equipped at the NGBK in readiness for the conservation and production of clean planting materials for the region.

7. Information systems

One of the NGBK's key strategic objectives is to document and disseminate germplasm data and information to diverse users including germplasm managers, researchers and policymakers. In order to achieve this

objective effectively, the NGBK has embraced modern advances in information technology. A combination of manual and computerized data and information management systems are employed in gathering, storing and manipulating gene bank data. The manual system employs a set of data sheets that are used to organize and record raw data as it is generated. These data sets are therefore organized into specific gene bank operations – for example, passport data, seed testing data, characterization data and distribution data.

The computer system involves a PGRFA accession level data management system in the form of a computerized relational database. The Microsoft Access Relational Database Management System has been designed to hold and manage the various gene bank operation datasets as derived from the datasheets. The data, however, is not publicly available, but a seed list of materials conserved at the NGBK has been produced but is yet to be circulated to stakeholders. Failure by the NGBK to make data publicly available can mainly be attributed to a lack of technology as well as to a feeling that some of the data may be confidential and, hence, not appropriate to be shared. Lacking a web page for the NGBK also limits the foras available for making the data widely available to the public.

In pursuit of the identified need to develop a global accession level information-sharing mechanism as a way of enhancing the exchange of information, Bioversity International and the GCDT are supporting the development of GRIN-Global. The NGBK has participated as an observer in the Technical Steering Committees of the group of experts developing the system. Additionally, it has participated in the testing the effectiveness of the developed system, further reaffirming its interest and commitment in adopting the system. When fully developed, the NGBK will shift from the current Microsoft Access Relational Database Management System by migrating its data to GRIN-Global, which is limited in its capacity of handling gene bank data. By adopting GRIN-Global, the NGBK will be able to make its information and data available to regional, crop or global portals. GRIN-Global will be web based, which will therefore make it possible to make data publicly available.

Other collection holders, namely the Kenya Forestry Research Institute (KEFRI), the National Museums of Kenya (NMK) and breeders in universities and research centres routinely document their collections and activities using computerized systems primarily. However, there is no common data management program, and data storage is generally done using various computer programs such as Microsoft Word, Microsoft Excel, Microsoft Access or other institutional specific programs such as Botanic Research and Herbarium Management Systems (BRAHMS). BRAHMS is the most commonly used program at the NMK, especially in handling herbarium data and information (Wambugu and Muthamia, 2009). Information systems are not synchronized, and if this is to be done then the various collection holders will need to adopt the same data management systems.

The National Information Sharing Mechanism (NISM) is a tool that was designed to assist in monitoring the implementation of the GPA. A key element of the mechanism is that it is country driven and benefits from the involvement and participation of a wide range of national PGRFA stakeholders, thus helping in building stronger partnerships and networks. In addition to the national partnerships, the NISM also helps in identifying opportunities for international collaboration. In Kenya, the system brought together a total of 50 experts, representing 30 national stakeholder institutes. It is an essential element of the evolving global system in that it serves an important role in improving access to, and sharing of, information about PGR at the national, regional and global levels. Specifically, the mechanism provides information about germplasm conserved at the NGBK and other national sources. As stated earlier in this report and in previous ones, one of the reasons for the low uptake/utilization of materials conserved at the NGBK is a lack of information on what is conserved. The NISM therefore helps to raise awareness on the germplasm holdings at the NGBK, which is especially important for the implementation of the multilateral system. Accessibility of materials will depend in practice on the necessary information being available.

Through a highly consultative, participatory and interactive process on the NISM, Kenya produced a report on the state of PGRFA in the country. The report is a strategic analysis on the state of use, conservation and general management of PGRFA. This report provides a common framework for countries to report globally

on the state of PGRFA as well as on their needs and priorities. This report is crucial as it has helped in regional and global analysis and synthesis that was used in preparing the report on the Second State of the World's Plant Genetic Resources for Food and Agriculture (FAO, 2010) as well as providing a foundation for updating the GPA. The report is important especially in the implementation of the multilateral system as it will ensure that efforts, resources and investments in PGRFA are directed towards national, regional and global priorities such as the development of policies, laws and regulations on ABS under the multilateral system. In this regard, the *Second State of the World's Plant Genetic Resources for Food and Agriculture* identified implementation of the ITPGRFA and its multilateral system as one of the priorities that need to be addressed. Many countries had expressed the need for assistance in this area both in terms of advice and capacity building. Additionally, assistance is also needed in ensuring a proper interface between the ITPGRFA and the CBD. The need to raise awareness of the importance of the ITPGRFA among governments and to encourage wider participation therein was also identified (FAO, 2010).

8. National policy framework on ABS

8.1. ABS laws, policies and regulations in Kenya

At the national level, there is a raft of legal, administrative and policy instruments dealing directly or indirectly with PGR. However, most of these are silent on access to genetic resources. The main policy framework that deals with ABS is the Environmental Management and Co-ordination Act (EMCA)[21] and its concomitant regulations, the Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations (EMC Regulations).[22] The EMCA, which is the principle legislation to give a general framework on ABS is a general environmental management law. Section 7 of the act establishes the National Environment Management Authority (NEMA) as a body corporate with perpetual succession.[23]

The EMCA provides for the regulation of biological resources and genetic resources for ensuring sustainable management and protection of such resources. Section 53 stipulates that the authority shall issue guidelines and prescribe measures for the sustainable management and utilization of genetic resources in Kenya for the benefit of the people of Kenya. The act further states that guidelines shall be issued specifying the issues of fees and licenses for non-citizens accessing PGR, regulations on imports and exports of germplasm and sharing of benefits derived from PGR in Kenya. As stipulated in the EMCA, NEMA developed the EMC Regulations in 2006. According to the regulations, any person intending to access genetic resources for any purposes must apply to NEMA by filling application forms for an access permit. Such an application must be accompanied by the necessary fees as specified in the regulations. The regulations also require the application to be accompanied by evidence of prior informed consent (PIC) from interested persons and relevant lead agencies as well as a research clearance certificate from the National Council for Science and Technology (NCST). Upon receipt of the application, NEMA shall give notice thereof by publication in the national gazette and at least one newspaper with nationwide circulation or in such other manner as the authority may consider appropriate. Based on the representations or objections from the public, the authority shall review the application and subsequently determine its outcome. The authority shall, within sixty days of receipt of an application for an access permit, determine the application and communicate its decision in writing to the applicant. Section 18 states that no person shall transfer any genetic resources outside Kenya unless such a person has executed a material transfer agreement (MTA).

Although a lot of efforts have been made in developing a regulatory framework on ABS, the framework is still unclear. Due to the unclear regulatory framework, it is reported that a lot of genetic resources may have been moved out of the country with no ABS agreements, and, hence, no benefits have been shared with the local community or Kenyan organizations (NEMA, 2006).

8.2. Institutional and administrative structures on germplasm exchange

There is a multiplicity of lead agencies that have some mandate of relevance to genetic resources, and many of these also have powers more often *de facto* than *de jure* to authorize and facilitate access (Lettington, 2003).

Specifically, these institutions include KARI, the NMK, the National Council for Science and Technology (NCST), NEMA, KEFRI, the KFS, and the KWS. Although NEMA plays some sort of a supervisory role, there is generally no institution clearly mandated to handle all of the matters relating to the exchange of germplasm or that play a coordinating role. Authority to access and share germplasm in Kenya is mandated through a permit system with NEMA being the authority granted powers to issue such permits. In addition to NEMA, there are other lead agencies that are authorized to issue permits, depending upon the exact circumstances, principally geographic (Manek, 2001). Each of these institutions works within its own mandate with overlaps sometimes occurring, thus leading to institutional conflicts. For example, the relationship between NEMA and the NGBK is not clear. Traditionally, the NGBK has had the mandate to exchange germplasm without seeking authority from any other institution. With the new regulations, it is not clear whether germplasm distribution from the NGBK is subject to the permit system of NEMA. Similarly, while KWS serves as the focal point for ABS in national parks and protected areas, these responsibilities and their relationship to those of NEMA have been unclear since the new regulations were propagated in December 2006. Discussions, however, are ongoing to address the confusion about respective mandates and jurisdiction (Secretariat of the CBD, 2008).

Several meetings and workshops have been organized with the aim of discussing ways of amending the EMCA and its concomitant regulations so as streamline institutional mandates and hence avoid institutional conflicts. One proposal put forward was to have NEMA act as a clearinghouse where it would receive all of the applications for access to genetic resources and then forward them to the respective lead agency. The concerned lead agency would then inform NEMA of the outcome of the application, which would be subsequently communicated to the applicant by NEMA (Government of Kenya, 2009).

Article 9(1) of the EMG Regulations requires that 'the application shall be accompanied by evidence of Prior Informed Consent from interested persons and relevant lead agencies, and a research clearance certificate from the National Council for Science and Technology.' This requirement for multiple access permits from, for example, NEMA, the KWS and the NCST, in addition to getting PIC from other sources such as local communities, land owners and others, has the potential to make the process long, expensive, bureaucratic and time consuming. This factor has the potential of discouraging participation in the multilateral system. On the other hand, the multilateral system provides for an alternative system that is less complicated and bureaucratic and should therefore overcome the disincentives for stakeholders to participate, if only the mechanisms can be put in place within the country to implement the ITPGRFA.

Many of the lead institutions do not have clearly articulated policies governing the exchange of germplasm. The NGBK, for example, although it is a key institution dealing with germplasm exchange, has no policy on ABS. It has continued to respond to germplasm requests on a case-by-case basis with no laid down rules and regulations that guides decision making on, for example, what grounds a germplasm request should or should not be honoured.

Legislative and policy measures on access to genetic resources have long been an issue of discussion in the country. Although the country has shown commitment in developing regulations on ABS, the process has been long and has in most cases been characterized by institutional conflicts due to overlapping mandates. Due to these conflicts and a lack of proper coordination, several initiatives that were put in place by different institutions aimed at developing appropriate policy regulating ABS have in the past failed. The first of these was started by the NCST due to its mandate in research and has led to the formation of a cross-sectoral expert group on ABS. The group consists of representatives of NGOs, ministries, lead agencies and has progressed to the point where it is a formal committee that oversees the development of a future regulatory system, which was given legal recognition in 2000. At the same time, the NMK under the mandate of the East African Herbarium formed the Plant Genetic Resources Working Group. This initiative was largely driven by the interests of the Kew Royal Botanic Garden, who had plans of entering into a collaborative project aimed at germplasm collection in the country. The initiative led to the drafting of regulations that were presented to the stakeholders in 1999 and 2000. Efforts at unifying the two initiatives did not succeed, and both of them failed to develop a regulatory framework. In 1999, the EMCA, which is the key statutory instrument

regulating access to genetic resources in Kenya, was enacted. This was followed by the preparation of the National Biodiversity Strategies and Action Plan (NBSAP) in 2000 by NEMA.

This fragmented process in policy making can be attributed to contradictions between the mandates of different government departments and, as a result, contradictions between the existing national laws and regulations and contradictions between initiatives to develop further laws and regulations. In addition, there has been a lack of central coordination at the national level, fragmented political ownership of potential policy-making initiatives and suspicion on the part of policymakers.

8.3. Weaknesses of the current ABS regulations

Legal Notice 160, which forms the current regulatory framework, has several weaknesses that act as impediments to its successful implementation. Below is a highlight of some of them:

- Scope of the regulations: First, it is not clear whether the regulations cover just genetic resources or biological resources in general. While the citation and majority of the sections of the regulations refer to access to genetic resources, there are others such as section 6, 7 and 8 that refer to biological diversity. ABS policies with broad scope covering non-human genetic, biological and biochemical resources found in *in situ* and *ex situ* conditions causes confusion among the users and providers of genetic resources about the type of activities that should be regulated by these policies.
- The relationship between NEMA and the various lead agencies is not clear.
- The weak link between access to plant genetic resources and conservation has been also identified as a weakness in the current regulations. There is need to explore in detail the measures that encourage conservation through ABS.
- Apart from a requirement that the access permit holder furnishes NEMA with quarterly reports, the regulations lack provisions for monitoring the use to which materials accessed from the country are put. Even if the provisions existed, a major concern of the responsible agencies in Kenya has been on their ability to enforce provisions further down the research and development pipeline, where activities are conducted outside the country's jurisdiction.
- The regulations do not give any standard form/provisions of the contents of the PIC or the MTA. This may be a problem for some ABS arrangements but not for the multilateral system since it is expected that the country will soon start using the Standard Material Transfer Agreement (SMTA).
- Overlapping mandates between different institutions have not been addressed.
- It is difficult to draw the line between when research ends and commercialization starts, thus leading to the dilemma of enforcement.
- Difficulties in distinguishing between institutional and individual research have been noted.
- The regulations do not address the issue of ownership to genetic resources, which is not clear in Kenya just like it is not clear in some other countries. This may however not be a problem under the multilateral system since the multilateral system includes materials in the public domain and management and control of the contracting parties.
- It is unclear as to which stakeholders are supposed to give PIC. Local communities should be recognized, and they should be the people who give the PIC when their resources are shared.
- There is a lack of coordination of permit procedures and conditions, thus making the process of getting permits long and tedious.
- Presumed right of ownership should not be based on citizenship. The regulations seem to make the nationality of the applicant the distinguishing issue instead of focusing on the activity that needs to be regulated. Currently, the regulations give more rights of access to Kenyan citizens than foreigners.
- Criteria for acceptance and rejection of an access permit seems to be unclear and not transparent.

Some of these weaknesses have the potential for jeopardizing the country's full participation in the multilateral system and hence need to be addressed.

9. Public awareness and debate on PGR

The public awareness campaign on issues of PGRFA has mainly been undertaken through the academic sector, print and electronic media and by some selected lead agencies. At the primary and secondary levels, the government has requirements for environmental-related courses (with some component of PGRFA), particularly where these intersect with agricultural concerns. Similarly, all public universities offer at least some training courses of relevance to PGRFA. The national media tend to provide extensive coverage of environmental issues mainly on destruction of water catchment areas, deforestation and destruction of wetlands, among others. However, PGRFA related issues have been given very little coverage in both the electronic and print media – less than five articles in the last 24 months. The last time issues related to the ITPGRFA were covered in the media was during the opening of the SGSV in Norway, where some Kenyan journalists had been invited to cover the event. This was given unusually greater coverage in the country due to the fact that Kenyan Nobel Laureate, Wangari Maathai, a worldwide reknowned conservationist, had been invited to the ceremony as a guest and is on the Board of the GCDT. In addition, Kenya was one of the few developing countries that had agreed to duplicate their germplasm at the facility, and, hence, it was important to cover the arrival of the Kenyan germplasm. Lead agencies also conduct extensive public education and awareness programs in fulfilment of their mandates.

The other PGRFA-related issues that have been given wide coverage deal with alleged cases of biopiracy. In most cases, these have been blown out of proportion, and at times there have been misrepresentation of the facts by civil society and NGOs. An example of this is the Seeds for Life Project case[24] and the *KWS v. Genencor International saga* (All Africa New Agency, 1999).[25] While this coverage on cases of biopiracy and bioprospecting have served to increase awareness on PGRFA, it has unfortunately led to a wrong perception that other countries are taking advantage of Kenya's genetic resources and hence benefiting more from the germplasm than are Kenyans. However, despite all of these efforts, the awareness of genetic resources issues among the public is extremely low. Awareness of general issues of access to germplasm is negligible to non-existent (Lettington, Sikinyi and Nnadozie, 2004).

10. Kenya and the ITPGRFA

10.1. Ratification of the ITPGRFA and the first steps in its implementation

Although Kenya was among the first African countries to ratify the Treaty in 2004, reasons for ratification remain unclear since there was no consultation regarding the accession/ratification to the Treaty. The main form of interface between teams negotiating for international agreements, scientists and other interested stakeholders is by way of representation on committees and participation in consultative meetings and stakeholder workshops. By and large, the participation of Kenya, just like many developing countries in the negotiations, has been somewhat fragmented and largely uncoordinated (Nnadozie and Lettington, 2004). The institutions that spearheaded negotiations for the Treaty did not make a deliberate attempt to consult the research community as a constituency that has a stake in the Treaty. Limited evidence of consultation in the development of national negotiating positions was identified, and this was largely limited to the senior staff of public institutions with some minor and sporadic involvement of very few selected plant breeders. Most lead agencies were not even aware that the negotiations were taking place, and the accession came as a surprise even to many mid-level officers in the Ministry of Agriculture (Lettington, Sikinyi and Nnadozie, 2004). As a result of this apparent lack of consultation, there is a general feeling that Kenya was poorly represented during negotiations for the Treaty.

With the ratification of the ITGRFA, one would have expected that measures would be put in place in order to review existing legislation including Legal Notice no. 160 and to enact new ones in order to domesticate the Treaty. However, little progress has been achieved in this respect. Just like in other countries, development of national ABS measures has proven difficult for Kenya due to a number of factors, including a lack of technical expertise, budgetary constraints, weak government structures and political support, local social conflicts and conflicts over ownership of genetic resources (Ad Hoc Open-Ended Working Group on Access

and Benefit-Sharing, 2005; Carrizosa et al., 2004; Nnadozie et al., 2004). To date, the only development that has taken place towards the implementation of the Treaty in the country is the constitution and inauguration of a National Plant Genetic Resources Committee (NPGRC) by the Ministry of Agriculture. The committee is multidisciplinary and multi-sectoral, drawing its membership from the KEPHIS, KARI, NEMA, the NMK, the Kenya Industrial Property Institute, the University of Nairobi, the State Law Office, the Seed Traders Association of Kenya and KEFRI, among other stakeholders. The establishment of the NPGRC was a deliberate attempt to fulfill the obligations of the Treaty. Among other mandates, the committee is expected to prepare a program for domestication of the Treaty and to liaise with other relevant national program / stakeholders in implementation of the national agendas on PGRFA. The constitution of the NPGRC with broad membership was a positive development. Unless there are mechanisms at the country level for inter- and multi-sectoral dialogue and collaboration, the Treaty will not benefit from a broad ownership and use within the country, and its potential will be hindered (Nnadozie et al., 2004).

The committee held a one-day training workshop in May 2009 on the ITPGRFA, with the objective of introducing and sensitizing the committee members on the salient elements of the Treaty, the SMTA and its implementation. During this workshop, the committee came up with an action plan of the activities that it intends to undertake in the short term. Under this action plan, there were five main activities to be undertaken and, judging from this, it is clear that the first item of the Treaty that will be focused on will be the multilateral system. Some of these activities include:

- Notification of the Treaty's Secretariat of the materials to be included in the multilateral system.
- Contact the Treaty's secretariat exploring possibilities of getting software to save records of SMTA in an easily retrievable format.
- Establish process of approval of SMTAs in the country.
- Establish procedures for simplified internal transfers/in-country germplasm exchange to reduce delays and bureaucracies. In order to achieve this, it was agreed that there is need to explore possibilities of amending or harmonizing the current regulations.
- Develop plans for a funding strategy in order to support the committee's activities. It is expected the annual budget will be drawn from a ministerial department (Wambugu, Atsali and Muthamia, 2008).

Prior to the notification of materials to be included in the treaty, the committee agreed to first identify and compile a list of these materials. It was unanimously agreed that materials conserved at the NGBK will automatically be included in the multilateral system. The committee therefore requested the NGBK to prepare a list of Annex 1 materials in its custody and make it available online. This exercise, however, is yet to be undertaken probably because the committee has never met again, which would have accorded it an opportunity to exert pressure on the NGBK to undertake the task. The committee needs to ensure follow up on some of the proposed activities in order to expedite them. There was no agreement on whether materials held by the public universities and individual breeders in public institutions, especially KARI, should be included in the multilateral system. Concerning these materials, it was agreed that there was a need to create awareness among the collection holders and other stakeholders on the importance of the ITPGRFA and more specifically on including materials in the multilateral system. To date, this awareness creation has yet to be initiated.

10.2. Awareness and perceptions of the ITPGRFA in Kenya

Responses to the survey conducted for this study show that the level of awareness of the existence of the ITPGRFA is high (86 percent) among the surveyed stakeholders. Similarly, knowledge on the purpose and intent of the Treaty in Kenya was also relatively high (70 percent). However, as found in a previous study (Lettington, Sikinyi and Nnadozie, 2004), as investigation moved into more substantive issues – for example, on ratification status and knowledge of some of the materials included in Annex 1 of the Treaty – the levels of awareness deteriorated quite rapidly. Awareness of the global system and especially the multilateral system was highest among plant breeders in both public and private institutions, followed closely by policy makers.[26] The policy makers were mainly heads of departments in key institutions dealing with PGR, namely KARI,

KEFRI, the KWS, the NMK and public universities. Surprisingly, some staff in PGR lead agencies had very little awareness of the Treaty, with a substantial number of them having never heard of the Treaty. The lowest level of awareness was recorded among farmers, with none of the farmers' representatives having ever heard of the Treaty. Although there was some appreciation that the Treaty would lead to greater access to PGRFA by Kenyan scientists and institutions, most stakeholders felt that foreign nations, especially the developed ones, would use the Treaty to access germplasm from poor nations, thus benefiting more especially in view of their better capacity to use these resources.

In Kenya, however, unless a lot of awareness creation is done in order to get stakeholders to appreciate the importance of the ITPGRFA, germplasm flows out of the country are expected to either reduce or just marginally increase. Due to reported high profile cases of biopiracy and an increased awareness of the importance of PGR, ABS is now viewed with a lot of suspicion and has become the subject of intensive criticism. Results of this study show that the greatest fear about the Treaty among stakeholders, mainly breeders, is that the Treaty will be abused through biopiracy. Over 80 percent of the respondents were skeptical about the Treaty and felt that it was a tool designed to help developed and technologically rich countries access germplasm from technologically poor but biodiversity rich nations. However, looking at the responses, it is clear that most of them were made from a point of ignorance. Additionally, this issue appears to carry with it a lot of colonial baggage, which unfortunately leads to wrong perceptions and misinformed conclusions. This has the potential of limiting germplasm exchange as scientists operate in an environment of fear and uncertainty. However, it would be important to note that the implementation of the Treaty could work to reverse this prediction since the multilateral system provides for an alternative system that is less complicated and bureaucratic and that provides a clear ABS framework for Annex 1 materials.

10.3. Incentives for Kenya's participation in the multilateral system

10.3.1. Facilitated access to PGR

It is now well recognized and appreciated by scientists and breeders that facilitated access to genetic resources is the main benefit of participating in the multilateral system. Unlike other bilateral frameworks, the ITPGRFA establishes a PGR commons to lower transaction costs for conservation, research, breeding and training and to redistribute back to the commons some of the financial benefits derived from the commercial exploitation of these resources (Halewood and Nnadozie, 2008). The multilateral system saves time and resources that would have otherwise been spent on potential long and time consuming negotiations on ABS agreements. With the multilateral system, there is no need for individual negotiations and terms of access, as these questions are settled within the text of the Treaty.

The Treaty itself also serves as a powerful tool in addressing some of the challenges related to the establishment of clear legal framework for the exchange of germplasm, in that it has established very clear procedures for ABS of Annex 1 materials. It is therefore expected that upon domestication and implementation of the Treaty, there will be more clarity in legislation and mandates at least for Annex 1 materials. Indeed, during a recent workshop held in October 2010 on Treaty implementation, proposals on how to implement the Treaty were put forward, which, if implemented, will reduce or bring to an end the institutional conflicts between NEMA and the various lead agencies, especially KARI and the NGBK, which is expected to be the administrator of the multilateral system (Wambugu, Muthamia and Kathuku, 2009). It is hoped that this will streamline the ABS regulatory framework in the country.

10.3.2. Capacity building: Upgrading of collections through germplasm regenerations and improving germplasm conservation standards

The ITPGRFA gives priority to programs for scientific education and training in the conservation and use of PGRFA, to the development of facilities for conserving and using PGRFA and to the carrying out of joint scientific research. In addition to the support being given to the NGBK to upgrade its collections through germplasm regeneration, the GCDT is also considering provision of support in procuring key pieces of

equipment required for proper seed handling and processing. It is expected that more support for capacity building will be forthcoming in future.

Through the financial and technical support being given to the NGBK by the GCDT for germplasm regeneration and characterization, conservation standards will be improved by ensuring the conservation of high quality materials in terms of viability. Due to the limited capacity of the NGBK, there have been regeneration backlogs, and this has been one of the greatest challenges facing operations at the NGBK, thus compromising germplasm conservation standards. The GCDT will therefore assist in putting the NGBK collections in a safe long-term facility.

10.3.3. Increased efficiency and effectiveness in germplasm conservation

As already noted earlier, facilitated access to genetic resources is probably the greatest benefit of participating in the multilateral system. Consequently, there is a realization that one does not necessarily have to conserve PGRFA in order to have access to it. As a result, gene bank managers and breeders are expected to conserve only those genetic resources for which they have enough capacity to conserve and manage and then access the rest from other sources through the multilateral system. In so doing, there will be better utilization of available facilities and resources, thus leading to more efficient conservation. This is especially important noting that many short- and medium-term gene banks, especially in the universities and IARCs in the country, still lack adequate facilities, funds or management systems to meet their *ex situ* conservation needs and obligations, and, as a result, a number of collections are at risk. Similarly, the sharing of germplasm conservation responsibilities as envisaged, for example, in the Regional Strategy for the *Ex Situ* Conservation of Plant Genetic Resources in Eastern Africa will also lead to more efficient and effective germplasm conservation. Moreover, duplication of materials, which is being supported by the GCDT, will lead the greater safety of the collections.

10.3.4. Monetary benefit sharing

Article 13.2 (d) provides for the sharing of both monetary and non-monetary benefits arising from the commercialization of Annex 1 materials. Monetary benefits include payment into a special benefit-sharing fund of the multilateral system of a share of the revenues arising from the sale of PGRFA products that incorporate material accessed from the multilateral system. Such payment is mandatory where the product is not readily available for further research and breeding – for example, as a result of patent protection. In the SMTA, which was adopted by the Governing Body at its first session in 2006, the payment is set at 0.77 percent of the gross sales generated by the product. The financial benefits arising from commercialization form part of the Funding Strategy under Article 18 of the ITPGRFA. Through funds from the benefit-sharing fund, countries will be supported to undertake projects that support the conservation and sustainable utilization of PGRFA. A call for such project proposals was made by the Treaty's Secretariat in 2009 where about five concept notes from Kenyan scientists were selected for development into full proposals. Subsequently, one proposal entitled the Characterization, Genetic Enhancement and Revitalization of Finger Millet in Western Kenya, which came from Kenya was among the eleven that were approved and finally fully funded.

10.3.5. Access to and transfer of technology

In addition to facilitated access to PGRFA and exchange of information, another benefit of participating in the multilateral system is the facilitated access to technologies for the conservation, characterization, evaluation and use of PGRFA. Among the various means by which the transfer of technology is to be carried out is participation in crop-based or thematic networks and partnerships, commercial joint ventures, human resource development as well as through making research facilities available. Kenyan scientists now have access to modern facilities for research thanks to regional and international collaboration. In addition, the country is accessing important technologies from CGIAR centres, especially in regard to the conservation and utilization of PGRFA. Access to technology, including that protected by intellectual property rights, is to

be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed.

10.3.6. Increased regional and international collaboration

Interdependence of countries over PGRFA calls for collaboration both at the international and regional levels. The ITPGRFA has served to give prominence to the need for greater international collaboration. Many programs set up to promote various aspects of the Treaty involve collaboration among multiple partners. For example, the creation of the multilateral system under the Treaty has greatly strengthened awareness of the needs and opportunities in the area of international collaboration. Participation in the multilateral system as well as in regional and crop-based networks leads to strengthened international collaboration. This collaboration and the resulting partnerships are important for germplasm exchange, access to scientific information as well as conservation and sustainable utilization of PGRFA, among others.

10.4. Disincentives and proposals to increase Kenya's participation in the multilateral system

The realization of these highlighted benefits may however be hindered by several disincentives, which mainly centre around the ABS regulatory framework in Kenya, institutional and administrative structures on germplasm exchange as well as the cultural phenomenon of Kenyan scientists, breeders and the public.

10.4.1. Regulatory, institutional and administrative framework for access and exchange of germplasm

The current ABS regulatory framework as well as the institutional and administrative structures on germplasm access and exchange has various shortcomings that act as impediments in the country's participation in the multilateral system. Some of the key shortcomings include a lack of clear ABS regulations, fragmented ABS legislation as well as overlapping and conflicting institutional mandates. In the absence of clear ABS measures and procedures, many institutions are reluctant to engage in ABS arrangements (Secretariat of the CBD, 2008). There is therefore an urgent need for the current ABS regulatory framework to be reviewed. In addition to addressing weaknesses of Legal Notice no. 160, this review should also aim at developing a regulatory framework for implementation of the multilateral system. The current regulations, though promulgated after the coming into force of the Treaty, have no reference to it. This regulatory framework largely implements the provisions of the CBD, and there is therefore a need to put in place a regulatory regime that implements the provisions of the multilateral system, taking into account the peculiar needs of the agricultural sector. Opinion is however divided among stakeholders on whether implementation of the multilateral system will require another instrument or whether it can be done by amending Legal Notice no. 160.

Moreover, the review should focus on harmonizing the mandates of different ministries and government institutions in germplasm exchange as this remains one of the difficulties faced during the development and implementation of the ABS regulations. Genetic resource issues are multi-sectoral and therefore stretch across the vertical boundaries that generally define departmental and ministerial jurisdictions. The implementation of the ITPGRFA normally requires coordination between the Ministry of Agriculture and that of the environment as well as coordination with the ministries responsible for trade, land, forests, and national parks where access to PGRFA *in situ* is concerned (Tumushabe and Mugoya, 2004). The vertically arranged structure of government ministries is not well adapted to dealing with essentially horizontally defined issues *(ibid.)*. Overlapping institutional mandates create confusion and suspicion between the concerned institutions, thus leading to ineffective undertaking of respective institutional mandates.

The uncertainty in existing legislation, poorly defined institutional administrative measures and coordination responsibilities over germplasm exchange is undermining the confidence of relevant institutions and individual scientists, hence discouraging them from engaging in mutually beneficial exchange arrangements (*ibid.*). There

is therefore a need to form an inter-ministerial and multi-sectoral committee or task force with the mandate of harmonizing the mandates of various government ministries and departments in relation to germplasm exchange. For example, in view of the apparent overlap in the mandates of NEMA and the NGBK on germplasm exchange, several proposals have been put forward in the past. It has been recommended that the mandate of PGRFA should be moved from NEMA to KARI. Other proposals have recommended the formation of a biodiversity centre that should play a central coordination role in all matters of PGR in the country. Subsequently, the mandate of biodiversity should be moved entirely from NEMA to that centre.

There is a clear need to designate a single national institution that has appropriate legal authority to take responsibility for handling applications for incoming and outgoing germplasm, monitoring the use of Kenyan germplasm abroad, collecting and storing relevant data that can be used in decision making and spearheading the negotiations for benefit sharing for use of Kenyan germplasm. In an attempt at streamlining the mandates of the various institutions, the proposed task force should have the mandates of reviewing previous proposals, collating views from stakeholders in the PGR sector and learning from the experiences of other nations.

Lack of knowledge on the existence of ABS regulations has also been identified as a major challenge in germplasm exchange. Over 90 percent of the stakeholders interviewed in this study were not aware of any law or regulation governing ABS of PGRFA. Lack of knowledge on regulatory frameworks creates fear of abuse and of personal responsibility, thus leading to protectionist tendencies. While some of the stakeholders have heard about the regulations governing exchange of PGR, they have no detailed knowledge or understanding of the actual content or requirement of the regulations. Consequently, they suffer from the 'fear of the unknown,' which keeps them from engaging in ABS arrangements for fear of contravening the regulations that could lead to legal or administrative consequences or criticism. Indeed, during a recent national ABS workshop organized by NEMA, it was noted that the level of compliance is very low among those who engage in ABS arrangements. The limited knowledge on the regulations has been caused by NEMA's failure to undertake awareness campaigns due to limited technical and financial capacity. The biodiversity section of NEMA is constrained in terms of personnel to undertake the awareness campaigns (Government of Kenya, 2009). There is therefore a need to institutionalize a system of regular public awareness and sensitization campaign on the current regulations as well as general ABS principles. In order to overcome this 'fear of the unknown,'NEMA and other lead agencies such as KARI and the KWS need to undertake public awareness campaigns on the current regulations through the media, both print and electronic, and through workshops. Public awareness can also be done through well-designed brochures (preferably translated into local languages) to enlighten people on the importance of genetic resources and, by extension, on the policies, regulations and laws affecting their conservation, use and exchange. Different communities should be encouraged to consult each other when resources are shared.

The lack of clearly articulated institutional policies to guide scientists in germplasm exchange has created significant uncertainty among the scientific research community on how they should approach the issue of germplasm exchange. Individual scientists contend that even if they are willing to share their germplasm, they are reluctant to do so because of the fear of potential legal or even administrative implications. For example, due to the absence of a clear policy on germplasm exchange, it is not clear to scientists and other gene bank staff whether they are supposed to honour germplasm requests whose intended purposes are commercially inclined as compared to breeding and research-related activities. It is therefore important and strategic for research institutions and gene banks to develop and adopt their own institutional policies and procedures on germplasm exchange in order to reassure those managing these resources. Such efforts would help to build national confidence in germplasm exchange among institutions and the scientists working in them. The institutional policy so developed should be consistent with the national one.

10.4.2. Limited capacity for germplasm conservation and utilization in the country

Kenya has made great strides in its efforts to improve its capacity in germplasm conservation and utilization. This is evidenced by the country's establishment and maintenance of a leading gene bank in the region as well as a well-established dynamic formal crop improvement sector that combines conventional plant

breeding techniques with advanced state of the art methodologies and skills. However, despite these efforts, the country still faces several challenges, of which the primary one is the inadequate capacity for conservation and utilization. At the NGBK, effective management and enhanced use of the existing *ex situ* collections are hampered by various constraints. The inadequate scientific knowledge on seed storage behaviour of some wild species, shortage of scientific staff with specialized training in various core disciplines on gene banking, inadequate capacity to regenerate stored germplasm to raise viability levels and inadequate sample sizes are some of the identified constraints. Others include inadequate information on the diversity and potential value of the conserved germplasm, lack of information on appropriate seed-testing protocols and limited capacity to conduct seed germination tests. There is also inadequate capacity to meet international germplasm demands mainly due to limited financial capacity to meet shipment and other related costs. As the major provider of PGRFA in the country and as the proposed administrator of the multilateral system in Kenya, the NGBK's challenges seriously hamper the country's capacity to access and share germplasm.

It is imperative that Kenya strengthen its technical and physical capacity both at the NGBK and at other collaborating national institutions if a vibrant national PGR program that has the capacity to efficiently conserve and exchange germplasm is to be assured. While the country is making some efforts to address these constraints, the ITPGRFA also has some mechanisms of addressing some of these challenges related to the country's capacity to conserve and exchange germplasm. These mechanisms are expected to act as incentives for the country to domesticate and implement the Treaty and include the following improvements.

10.4.3. Lack of information on germplasm

The lack of publicly available information on germplasm conserved at the NGBK is also another major challenge. A total of 73 percent of the respondents reported that they have no information about germplasm conserved in various national sources such as the NGBK. Information on the NGBK collections is not accessible to stakeholders since it is not publicly available. Information on other national and international sources is also considered fragmented and inaccessible. While the ITPGRFA itself does not clearly and explicitly place an obligation on contracting parties to disseminate information on the material included automatically or voluntarily in the multilateral system, it is clear that the accessibility of such material will depend in practice on the relevant information being available. In the absence of such information, participation in the multilateral system is greatly inhibited. There is, therefore, a need to ensure that information on germplasm holdings in various national sources is made publicly available. Accessibility to this information can be enhanced through the development of a NGBK web page where information on Annex 1 materials conserved therein could be made publicly available, together with any conditions for access. An online ordering mechanism should also be put in place.

Additionally, sharing of such information, especially for Annex 1 materials, could also be done by notifying the ITPGRFA's Secretariat on the placement of materials in multilateral system. So far, as national collections are concerned, Article 11.2 of the Treaty provides that PGRFA of crops and forages listed in Annex 1, which are under the management and control of the contracting parties and in the public domain, be included automatically in the multilateral system. While the Treaty itself does not clearly and explicitly place an obligation on contracting parties to disseminate information on the material included automatically or voluntarily in the multilateral system, it is clear that the accessibility of this material will depend in practice on such information being available. For this purpose, it is important for the country to notify the Treaty Secretariat of collections that have been placed in the multilateral system. Such notification will increase the awareness of materials conserved in various national and international sources as well as of those that have been placed in the multilateral system. Moreover, the Treaty identifies the exchange of information as one of the mechanisms for sharing the benefits arising from the use of PGRFA. In addition to catalogues and inventories, other relevant information that needs to be shared includes information on technologies and the results of technical, scientific, and socio-economic research on PGRFA, including data on characterization, evaluation, and information on use. Genetic resources may be inaccessible since their potential is unknown to an interested user, thus reaffirming the need for sharing characterization and evaluation data (Smith and Jacob, 2005).

10.4.4. Climate of suspicion and mistrust of Kenyan breeders, scientists and public relating to germplasm exchange

The development of the global system has seen the evolution of a climate of distrust and a lack of cooperation, which is threatening the sharing and use of a wide range of genetic resource (Anonymous, 2004a). As a result of this phenomenon, there is increasing reluctance by breeders to share their materials. The results of this study show that one of the biggest challenges in the implementation of ABS regulations in the country and therefore in the participation in the global system is the reluctance by breeders to share their materials. Table 6 shows that 73 percent of the respondents reported that the reduced germplasm exchange especially outside the national jurisdiction is caused to a great extent by the refusal of breeders to share their materials. However, due to the relatively low number of respondents in this study, it may be necessary to validate this finding in another study. Breeders' reluctance to share germplasm with their counterparts can be attributed to a variety of factors including professional pride (that is, stewardship of varieties they have developed), misperceptions that the marginal value of a single germplasm exchange is generally high, unclear and uncertain institutional, national and international protocols governing exchanges and a lack of awareness about the benefits of a multilateral system of germplasm exchange (Anonymous, 2004a).

In Kenya, widespread claims of biopiracy, especially concerning the high profile case between the KWS and Genencor, have led to a wrong perception/attitude about germplasm exchange among the public, civil societies and even researchers (Anonymous, 2004b). Even when due process of law is followed in exchanging materials outside the country and the benefits shared appropriately and equitably, the exercise is always viewed with a lot of suspicion especially by NGOs and civil society organizations (CSOs). There is a widespread perception that other countries, especially the developed ones, are taking advantage of the country's PGR (Rosenthal and Katz, 2004). Partially, this situation can be blamed on the increasing unbalanced and inaccurate quality of reporting on alleged cases of biopiracy. On a regular basis, the media reports include allegations of biopiracy – for example, assertions that Western scientists have appropriated biological specimens without adequate compensation for developing countries or their indigenous peoples. These assertions resonate with the public, but they unfortunately create a misleading and incorrect impression about the prevalence of this activity (Finston, 2005). An academic researcher in the United States explained that both academic researchers and companies today are reluctant to access genetic resources overseas for fear of 'becoming part of a very dangerous socio-political environment in which anyone can claim they are bio-pirates at any time, and slander them without any legal recourse' (Secretariat of the CBD, 2008). As noted earlier, these cases are usually blown out of proportion and sometimes reported on a shaky factual foundation due to the vested interests of activist groups. Unfortunately, this increased media attention on cases of biopiracy has led to developing countries feeling exploited, which has led to protectionist tendencies in germplasm exchange. This has taken the form of increased bureaucratization of ABS obligations *(see Table 6)*. This 'bad image' created by the media is now considered a great impediment to research and germplasm exchange (*ibid.*).

Just like it was in 2004 when the ITPGRFA came into force, stakeholders' appreciation of possible benefits of the Treaty are overshadowed by their fears. There is no recognition or appreciation of the fact that for Kenya to achieve food security it has to use PGR from other countries as there is no country that is independent in so far as PGR are concerned. Even in other parts of the world, projects on germplasm exchange remain the focus of fierce and intensive criticism by advocacy groups that have great influence among indigenous organizations, government actors and environmental groups. This suspicion and controversy has threatened to derail and almost halt the Seeds for Life Project.[27] These kinds of suspicions are made worse by the country's lack of capacity to monitor the use to which materials exchanged outside the country are being put. Faced with this suspicion, scientists are hesitant to engage in ABS arrangements, as they are likely to be put on the spotlight at some stage.

In order to overcome the challenge of reluctance by breeders and other scientists to share materials under their custody and control and reduce the suspicion surrounding ABS arrangements in the country, there is a need to build confidence in germplasm exchange. Building trust is an important component in developing an effective ABS system (Smith and Jacob, 2005). Changing this trend requires a series of confidence-building

measures at the national level. These confidence-building measures may include establishing and strengthening national institutions to monitor the use of Kenyan germplasm abroad as well as building legal capacity to challenge unauthorized uses of Kenyan germplasm by other recipients. Once in a while, Kenyan organizations have had to institute legal processes to challenge the authorized access and use of Kenyan germplasm. At the moment, there is a limited capacity to handle these kinds of legal tussles. Although a lot of progress has been made in this area in the recent past with some of the lead institutions such as KARI and NEMA having recruited legal officers to advise in legal matters, there is a need for more capacity building. Knowledge in international law is a prerequisite in these kinds of cases, and, hence, capacity in this area should be enhanced. Since the NGBK may become the possible administrator of the multilateral system in Kenya, it will need to develop its capacity in this area.

It is possible that some of the opposition to the ITPGRFA is because not all PGRFA users see their interests reflected in the Treaty and other international instruments of the global system, and, consequently, they feel they cannot benefit much from their implementation at the national level. Part of the problem comes from the fact that the focus of the global system and the Treaty has been on conservation and exchange of *ex situ* material among scientists and breeders. These aspects may not be properly understood or appreciated by grassroots organizations and local CSOs. Perhaps these stakeholders would appreciate the global system and the multilateral system of the Treaty more if they could see how these international instruments benefit users other than breeders – for example, farmers, seed traders and entrepreneurs in general. This observation points to the need to undertake awareness-creation campaigns on genetic resource issues. It should be recognized that a successful ABS system will only work in an environment of well-sensitized stakeholders, communities and policy makers. Since the study notes the low level of awareness of genetic resources issues in the country, it would be important to put in place measures to increase the level of awareness. One way to do this would be to develop and put in place a strategy to use 'success stories' regarding the use of PGRFA. This would assist in creating incentives among relevant policymakers and other stakeholders such as breeders, NGOs, farmers and other holders of germplasm outside KARI for Treaty implementation and the facilitated exchange of germplasm. An example of a success story would be the increased yield of a certain crop species after the use of PGRFA in breeding or the inclusion of a certain desirable trait such as early maturity through a breeding program.

Other measures that can help to address the challenge of mistrust and suspicion would be to undertake valuation studies on PGRFA. In order to overcome the popular and exaggerated perception that PGRFA has great commercial value, which has been used as the motivation behind restricting access to genetic resources, there is a need to conduct valuation studies. Economic valuation studies will therefore be necessary to impute a market value for PGRFA in the country. While such studies may have been done for other countries, it may be necessary to do an extrapolation for materials from Kenya. Background information on the valuation of genetic resources used during the negotiation of the Treaty may prove very vital and may need to be used for this purpose. Such valuation will be important not only for the general public but also for policy makers who may have held the perception that enormous economic gains may accrue as a result of restricting access to PGRFA.

The establishment of a national or regional PGRFA user's forum such as a plant breeders' association or network has been proposed as one platform that can provide both virtual and face-to-face opportunities for breeders and other users to interact directly with one another, thus reducing mistrust and suspicion among the users. Such a forum can also serve as a venue for the users to learn about policies, regulations, laws and treaties that can affect their own activities. Such a forum could also provide the users with an opportunity to collectively discuss and influence relevant processes, such as international treaty negotiations or the formulation of institutional or national policies that affect germplasm exchange. To be effective, such platforms would have to bridge national boundaries, given the sometimes significant reluctance for users from one country to exchange germplasm with colleagues in other countries (Anonymous, 2004a). Currently, Kenya has a plant breeders' association, but it appears to have done little in to organize forums where breeders can meet and interact. The association needs to be strengthened and linked with others in the region in order to enhance regional germplasm exchange. There are also crop specific user networks such as MBNet, which comprises maize breeders from across the region.

Although it appears not to have been very successful in overcoming these fears, mistrust and negative perceptions, the ITPGRFA attempts to address some of these challenges through several mechanisms. In order to overcome the reluctance by breeders to share materials, as well as other protectionist tendencies, the Treaty provides facilitated access to germplasm, and this is probably the greatest incentive for participating in the multilateral system. From the analysis presented earlier in this section, it is clear that Kenya relies more heavily on germplasm from other countries than it does on its own germplasm. It therefore also has an obligation to share its germplasm with other interested users. As a result of this facilitated access, it is now well appreciated that there will both direct and indirect benefits for the diverse groups of stakeholders that will be using it, such as consumers, farmers and the scientific community (Smith and Jacob, 2005).

10.4.5. Limited capacity to monitor the use of materials exchanged by the country

Due to capacity constraints, it is unlikely that countries can effectively and comprehensively regulate or adequately track and monitor the use of the resources they provide to users (Secretariat of the CBD, 2008). In the absence of such monitoring and in light of the numerous reported cases of biopiracy, there is a risk of some countries – especially developing ones ¬– seeing potential grounds for abuse and exploitation, which could thus lead to a lack of confidence in germplasm exchange. The perpetuation of fear has the potential to discourage participation in the multilateral system by causing protectionist tendencies. This lack of capacity by Kenyan institutions heightens the suspicion among scientists, policy makers and the general public that exchanged germplasm may be used for other purposes than what it is intended for.

During a recent Workshop on Intellectual Property and Evaluation of NEMA, *vis-à-vis* the Seeds for Life project (the discussion earlier in this report), a concern was raised on the mechanism that the Seeds for Life project has in place for enforcing the conditions ensured in the MTA[28] and on whether the Seeds for Life project is able to mark the seeds for tracking purposes in case they are used for purposes that are not allowed by the MTA. It was reported that this had been recognized as a challenge even during the MTA negotiation. It was clarified that partner institutions had no capacity to undertake molecular marking of the seeds that would be prohibitive in terms of cost, and it was hence noted that the Seeds for Life project operated on trust Kamondo, Oyieke and Gaya, 2008).

Addressing the issue of monitoring points to the need to establish and strengthen national institutions to monitor the use of Kenyan germplasm abroad. The capacity of the country to monitor the use of Kenyan-sourced germplasm outside the country's borders is limited or non-existent. There are widespread fears that, for example, shared germplasm may be commercialized rather than being used for research purposes, as happened with Genencor and the KWS case cited earlier where some enzymes were collected for Ph.D. research but later commercialized without the knowledge, consent and clearance of the country of origin through the issuance of necessary permits. Capacity should therefore be enhanced and mechanisms put in place in order to ensure that some form of monitoring is being undertaken.

In addition to building a legal capacity to challenge unauthorized uses of Kenyan germplasm by other recipients, there is a need to build national capacity to understand and use the SMTA for materials within the multilateral system. With regard to the multilateral system where negotiations on ABS are limited or non-existent, capacity is required to advise scientists on issues such as the use of the SMTA and the associated benefits. The results of this study indicate that the number of respondents who were aware of the SMTA is extremely low. Except for one case in which the NGBK was used to exchange materials in Sudan, none of the other respondents have ever used it. Enhanced capacity in this area is considered to be essential in building the confidence of government institutions and the scientific community in the international legal system (Tumashabe amd Mugoya, 2004).

Through its provision for a third party beneficiary representative, the ITPGRFA attempts to address the issues of monitoring. After realizing that germplasm providers lacked the incentive to enforce the SMTA since the benefits were not getting to them directly, the Governing Body created a legal representative for the third

party beneficiary interests of the multilateral system. This representative can bring legal actions to enforce benefit-sharing violations under the SMTA. Although the creation of the third party beneficiary was done in an attempt to address concerns and allay fears about possible abuses of the multilateral system, it seems not to have changed the situation in Kenya. To a great extent, this can be attributed to the fact that these fears and concerns stem not from the exchange of multilateral system materials but, rather, to other types of genetic resources, principally the loss of enzymes from Lake Bogoria as highlighted earlier. It is therefore correct to say that the lack of confidence in the multilateral system and the fears about its possible abuse stem not from its weaknesses but, rather, from past experiences in the country relating to biopiracy.

10.4.6. Varied interpretations of the ITPGRFA

It is now well known that the ITPGRFA is not perfect and has several ambiguities (Gerstetter et al., 2007; Fowler, 2004). For example, Article 12.3(d) states that 'recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System.' Due to its ambiguity, this clause is subject to varied interpretations when developing national policies. It is recommended that this clause should be interpreted as broadly as possible to prevent, or discourage, restrictive intellectual property rights. In light of these ambiguities, there is a risk that if improperly interpreted and implemented at the national level, it could result in reduced germplasm exchange, thus jeopardizing the multilateral system (Anonymous, 2004a).

Instead of having funds be paid into a benefit-sharing fund, it has been suggested that institutions or individual breeders sharing their germplasm should receive that money and hence benefit directly. As a result of this suggestion, some breeders and institutions indicated during the survey that they were now not keen on sharing their materials, thus expressing a major concern for the global system. Some breeders felt that it was improper for them to be expected to share their germplasm without restrictions, while they were the ones who would incur all of the costs of breeding and maintaining their germplasm. This feeling points to a lack of proper understanding of the ITPGRFA in that as developers of improved PGRFA, the Treaty provides for the transfer of materials as PGRFA under development, with additional terms and conditions. In this kind of transfer, although they must use the SMTA they are at liberty to charge fees or other forms of compensation.

These sentiments stem from the fact the government, which is the contracting party to the ITPGRFA, does not provide any funds in some cases to support these activities. Most breeding and germplasm conservation activities, except those at the NGBK, and most breeding programs in KARI, are conducted in the framework of projects funded by various donors, which are in most cases competitively sourced. It is the current view of the authors that germplasm from these kinds of activities should be treated by the breeders as private property that is not in the control and management of the government. This view, however, is contestable since, although the government may not support these activities directly, it does so indirectly by paying the salaries of those involved in these activities, for instance. Some breeders went to the extent of inquiring as to what legal action could be taken against them if they refused to share their materials once the country has ratified the Treaty. Although a good number of breeders hold this view, this study did not quantify their number since such sentiments were raised during informal discussions and were not a question in the survey questionnaire. This is however a myopic way of looking at the Treaty since facilitated access to germplasm is recognized as the major benefit of the Treaty. These kinds of views and feelings can be attributed to professional pride and the failure to fully recognize that the country has to use germplasm from other sources if it is to successfully develop an agricultural system that has the capacity to ensure self-sufficiency in food production.

11. Conclusions

Although the ITPGRFA represents a huge step forward in creating a multilateral system for ensuring ABS for PGRFA and for keeping ABS in the public domain, it is clear that it still has a lot of unresolved issues that

act as impediments for participation in the multilateral system. While the Treaty provides for facilitated access to PGRFA as the greatest benefit for participating in the multilateral system, it is now clearly evident that there is a palpable reluctance by breeders, scientists and gene bank managers, especially in government institutions, to share germplasm.

This study shows that there is widespread lack of confidence over germplasm exchange among breeders, scientists and gene bank managers in Kenya. This reported reluctance to share germplasm represents a significant, and arguably the greatest, obstacle to a successful global system and especially to the Treaty's multilateral system, a situation that is certainly a growing concern among the proponents of an effective global system. This lack of confidence can be attributed to, inter alia, increased cases of biopiracy, unclear ABS regulatory framework, a lack of clearly articulated institutional policies on germplasm exchange, leading to a fear of possible legal and administrative repercussions as well as a lack of awareness of current ABS laws and regulations, leading to a fear of abuse. ABS legislations in Kenya have a tradition of fragmentation, conflicts and overlapping mandates. There is also an inadequate capacity to monitor the use of Kenyan-sourced germplasm, thus leading to fears that it may be misappropriated.

As a result of these and other weaknesses, it is believed that a lot of germplasm may have been moved out of the country without any benefits being shared with the country. It is imperative that these issues are addressed so as to create an ABS environment that instills confidence among both germplasm providers and users. Consequently, there is a need to streamline the existing ABS regime by harmonizing the access procedures. It is also fundamentally important that roles and responsibilities in ABS should be explicitly specified in a well-structured institutional framework. Creating proper awareness of the ITPGRFA is also needed as it is clear that some opposition to the Treaty is largely caused by a lack of proper knowledge about the Treaty's provisions. Failure to do instruct people in this way will significantly reduce the benefits that the country derives from its participation in the multilateral system.

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[25] Between 1984 and 1986, at Lake Bogoria and Lake Nakuru, to its south, scientists took samples as part of a Ph.D. research project to be undertaken at University of Leicester. They found 'extremophiles' and subjected them to a battery of tests. Genencor International, a California-based company, subsequently purchased the enzyme samples, patented them and cloned them on an industrial scale for textile companies and detergent manufacturers. Kenyan officials learned in 1994 that the company was profiting from materials taken from the lake and started pursuing compensation. The point of contention has been that, according to the KWS, the research permit that was granted to the candidate by the Ministry of Education and Technology in Kenya with the recommendation of the NCST did not include any commercial involvement of the research findings whatsoever. If any such additional prospecting was intended, neither the candidate nor the University of Leicester ever expressed such intention. If they had done so, that would have required a new and different kind of permit.

[26] Most of the policy makers included were members of the recently constituted National Plant Genetic Resources Committee (NPGRC), which has the mandate of laying down strategies and structures for implementing the ITPGRFA in the country. The high level of awareness on the Treaty can be attributed to the fact that after inauguration, the NRGRC had been given training on the salient features of the treaty hence raising their level of awareness on the same.

[27] See note 25 in this section.

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INCENTIVES AND DISINCENTIVES FOR MOROCCO'S PARTICIPATION IN THE MULTILATERAL SYSTEM OF ACCESS AND BENEFIT SHARING

Mohammed Sadiki, Amar Tahiri and Isabel Lopez Noriega

1. Introduction

All countries are heavily dependent on plant genetic resources coming from other countries. No country is independent in plant genetic resources, which provide the biological underpinning for agriculture and food production (FAO, 1998). Policy barriers that limit the access to germplasm conserved abroad may have a negative impact on germplasm flows and ultimately on agriculture production. The International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) was established to overcome these barriers.[1] Recognizing the 'sovereign rights of States over their own plant genetic resources for food and agriculture,' the Treaty establishes a multilateral system that facilitates access to plant genetic resources for food and agriculture (PGRFA) that are important for food security and sets up the rules for sharing the benefits arising from the use of such genetic resources. The objective of the ITPGRFA is '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 Convention on Biological Diversity (CBD), for sustainable agriculture and food security.[2]

The implementation of the ITPGRFA presents a series of challenges for Morocco, which was one of the first signatory countries (DPVCTRF, 2008; INRA, 2007). Although it has developed a series of significant actions towards organizing the national plant genetic resources system, serious questions remain about the state and accessibility of the actual system. Collections are scattered under different research and development institutions, and, in many case, they are unrelated. Documentation and information-sharing systems are not correctly established to meet the Treaty's requirements, and access is often problematic. Information about individual accessions in the existing *ex situ* collections is often poor or inaccessible, which therefore has reduced the frequency and efficiency of their use and the ultimate benefit of these collections.

Significant progress has been achieved by establishing scientific bases for *in situ* conservation and on-farm maintenance of crop genetic diversity (Sadiki, 2010). However, measures for *in situ* conservation of important crops and agro-ecosystems have not been clearly set up in a long-term national strategy. Without a strong linkage between *ex situ* and *in situ* conservation, accessions found *in situ*, along with related information and local knowledge, have not been not systematically collected and documented. This has hindered access to, and use of, important local materials. More importantly, full adhesion and implementation of the ITPGRFA in Morocco still depends heavily on the adaptation of the current policy framework and legislation as well as on government leadership and the coordination between different stakeholders at the national level.

By analyzing the incentives and disincentives for Morocco's participation in the multilateral system of the ITPGRFA, this report will identify the weaknesses and strengths as well as the opportunities and the obstacles that currently exist in the country. It will also help the country move towards implementation of the Treaty with a better awareness of its situation. This report will focus on reaching the following objectives:

- identifying the factors that support (or discourage) participation in the ITPGRFA's multilateral system of access and benefit sharing;
- identifying the ways to address and overcome the various disincentives currently in existence and
- advancing the implementation of the Treaty's multilateral system by providing base-line information in different relevant areas.

This report is based on a study that employed a multidisciplinary, participatory stepwise process that used the following sources of information:

- working documents and recommendations from the National Stakeholder's Workshop, which was held in Rabat in July 2008 and which dealt with the implementation of the ITPGRFA in Morocco;
- existing literature and documents on activities related to genetic resources in Morocco with a special focus on *ex situ* and on-farm conservation and the use of crop genetic diversity;
- international and national policy documents relevant to PGRFA;

- consultations with experts from a project entitled Strengthening the Scientific Basis of *In Situ* Conservation of Agricultural Biodiversity On-Farm, who identified key policy issues on the conservation and use of plant genetic resources based on the experiences of last five years and
- formal and informal interviews with a sample of important stakeholders from governmental institutions, public research and development institutes, the private sector and farmers' communities in some sites where *in situ* conservation initiatives have been implemented.

2. Agriculture and biodiversity in Morocco

Morocco is located in the northwest region of Africa. It is bordered by the Mediterranean Sea in the north, the Atlantic Ocean in the west, Algeria in the east and Mauritania in the south. The total amount of arable land in the country equals about 9,000,000 hectares, and the population is around 30 million. The country is divided into five agro-climatic zones: (1) favourable: with more than 400 millimetres of rainfall per year (30 percent of the total useful land area); (2) intermediate: with 300 to 400 millimetres of rainfall per year (24 percent of the total useful land area); (3) unfavourable: with 200 to 300 millimetres of rainfall per year (24 percent of the total useful land area); (4) mountain, with 400 to 1,000 millimetres of rainfall (15 percent of the total useful land area) and (5) Saharan: with less than 200 millimetres of rainfall (7 percent of the total useful land area).

The Moroccan economy depends heavily on agriculture. This sector represents up to 18 percent of the gross domestic product, accounts for 30 percent of export earnings and is characterized by the predominance of cereals (68 percent) and horticultural crops (12 percent). The major constraints to Moroccan agriculture are drought, salinity, diseases, pests and a shortage of arable land due to erosion and desertification. Despite the enormous efforts deployed in agriculture development – including its modernization and the development of irrigated areas, covering more than 1.2 million hectares – Morocco still imports 40 percent of its needed quantity of grain, 50 percent of sugar, 75 percent of table oil and 15 percent of dairy products. Alternatively, the country exports significant quantities of citrus fruits, vegetables (mainly tomato) and fish.

As a result of its localization and its agro-climatic diversity, Morocco has a rich and diverse biodiversity and is the centre of origin and domestication for a number of crop species. The country has the second richest biodiversity in the Mediterranean basin after Turkey with about 40,000 fauna and flora species. Of these species, 71 percent live in terrestrial ecosystems. However, more than 2,280 species are threatened, and a high number are in a very vulnerable situation, due to natural and anthropological pressures, including the overexploitation of natural resources, deforestation, over-pasturing, urbanization and pollution.

In order to further prevent this loss of biodiversity and continuing genetic erosion, actions have been taken at different levels across the country. National development strategies have attempted to progressively integrate biodiversity – in particular, agro-biodiversity – and plant genetic resource-related issues into agriculture development strategies. It is worth looking briefly at some of these individual projects.

2.1. National agriculture development strategy: The Green Morocco Plan

In Morocco, the national strategy for agricultural and rural development aims at finding an equilibrium between human activities and the preservation of natural resources – that is, biodiversity and plant genetic resources. The current strategy was adopted in 2008 for the 2020 horizon. It is called the Green Morocco Plan, and it articulates two central pillars. The first pillar is related to high margin agriculture – that is, the modern sector using high investments and modern technologies. The second pillar concerns low margin agriculture and small landholders. This pillar is referred to as 'solidarity agriculture' and is often concentrated in regions with vulnerable climatic and soil conditions. In this sector, the preservation and valorization of natural resources are given high priority. In addition, the participation of the local population is a key element in the success of the strategy, and, thus, farmers are encouraged to participate directly in the decision-making process. It also enables a legal framework that aims to valorize and make better use of local varieties, thereby allowing *in situ* conservation and the use of plant genetic resources and related local knowledge.

2.2. National strategy on the environment

In Morocco, even though the environment and its protection has always been a priority at different policy-making levels, it is only in the last decades that the government has explicitly addressed environmental protection as a priority. Sustainable development is now a driving force in the creation of employment and wealth as well as in the struggle against vulnerability, primarily in rural areas. The government's strategy for the environment comprises the following goals:

- following up on the state of the environment in different regions in order to gain more reliable and precise environmental information with which to better coordinate a program of actions;
- protecting resources and natural ecosystems in order to better face climatic changes;
- adopting operational plans that are aimed at improving the general condition of the population;
- establishing the necessary conditions to gradually integrate sustainable development into different regional and local development programs;
- mobilizing local stakeholders for the accomplishment of environmental projects that contribute to local development and
- reinforcing institutional and legal frameworks to more closely manage the environment.

The environmental strategy includes a National Programme for the Protection and Valorization of Biodiversity for the protection and sustainable use of Morocco's biological patrimony. This programme is based on five general objectives:

- the rational management and sustainable use of biological resources;
- the improved knowledge of biological resources;
- increased awareness and education;
- a strengthened legal and regulatory framework and
- strengthened international cooperation.

3. Plant genetic resources conservation and use in Morocco

The Moroccan plant genetic resources system is still not entirely organized. Activities related to plant genetic resources in general, and PGRFA in particular, have been for a long time the exclusive affair of scientists and specialists and have not received attention at the political level until recently. Before the 1970s, plant genetic resources activities in Morocco were limited to scattered inventories and plants collections that were led by international institutions and that involved few scientists from national research institutions. With the development of research and training programmes in plant conservation and breeding by national institutions, intensive plant research activities were developed, including surveying, collecting, characterizing, evaluating, and conserving. Particular attention was given to local genetic resources. Most of these activities were largely supported by international organizations. However, due to the limited success of these activities, they did not manage to convince the decision makers about the need for long-term investment in the field of plant conservation and research, which prevented the establishment of the necessary foundation for the system to develop.

The evolution of the international discussions on biodiversity and the eventual adoption of international conventions and treaties increased the awareness about the importance of plant genetic resources among different stakeholders in Morocco. Morocco's involvement in the negotiations of the ITPGRFA and its later ratification has generated a new impulse for consolidating the national system and has contributed to creating a sense of ownership over the process and the system among the different stakeholders. Currently, actions oriented towards plant diversity conservation and use have taken place in the following areas.

3.1. Support at the local level

Most of the support provided to community-based activities for the management, conservation and use of plant and animal genetic resources consists of actions aimed at adding value to local and 'niche products.'

Important actions include assisting the producers in adapting to new market regulations; organizing seed fairs; supporting on-farm management of plant genetic resources and maintaining local seed networks that broaden the diversity of traditional crops available at the community level and also recognize the value of gender in maintaining diversity.

3.2. Reform of policy and legal frameworks

One of the weaknesses of the current legal framework is the lack of national legislation devoted specifically to PGRFA. The convergence of the following elements will probably result in a new and more comprehensive legal scenario for plant genetic resources:

- Discussions are taking place on the possibility of reviewing national seed policies and regulations in order to allow the use, exchange and local marketing of farmers' varieties. The purpose of the reform would be to create a relaxed seed system that would accommodate local farmers' needs.
- Seed production and distribution is being decentralized by strengthening public departments and encouraging private industry.
- The capacity of public institutions to develop and implement legal instruments within the framework of the national agricultural strategy is being strengthened.
- Intensive work on on-farm management of crop genetic diversity has demonstrated the importance of small-hold farmers as custodians of agro-biodiversity and related knowledge (Anderson, 2006; Brush, 2007; Sadiki, 2010). The scientific and technical data coming out from on-farm research projects has provided scientific basis for the development of policies and laws to protect and recognize farmers' rights over plant genetic resources (Sadiki, 2010).
- In governmental and scientific bodies, there is a strong debate around the need to create a law on access and benefit sharing. This debate will eventually reach all stakeholders.

3.3. Education, training and public awareness

Recently, the education system in Morocco has undergone significant reform, particularly at the university level. This reform has created a historical opportunity for the agricultural education and training scheme, under the lead of the Hassan II Institute of Agronomy and Veterinary Medicine (IAV Hassan II), to introduce several changes to the system as well as to a variety of fundamental aspects related to crop genetic diversity. Some of the most significant points of the reform are:

- a significant shift towards a more participatory and inclusive approach that takes into consideration the actual experience of the farmers;
- the integration of farmers' knowledge, innovation and practices in research and extension services and
- the development and mainstreaming of the curriculum at all levels (primary, secondary and tertiary grades and community schools) in order to incorporate agro-biodiversity throughout.

3.4. Marketing and adding value

National and local development programmes have focused on adding value, and facilitating access, to local products derived from niche-specific crop species and underutilized plant species, as a way of increasing farmers' income. Significant progress has been achieved in the following areas:

- adding value to genetic resources through characterization, domestication, participatory breeding, quality enhancement, product development, labelling and so on;
- identifying market niches and market tools such as certificates of origin and quality marks and assisting the communities to adopt these tools and include their products in these niche markets;
- increasing awareness within communities on value-added products and
- supporting farmers in engaging in small-scale entrepreneurial activities such as credit facilities (for example, through the National Initiative for Human Development).

3.5. Impact-oriented research on plant genetic resources

Public research institutions under the Ministry of Agriculture have recently started to focus on mainstreaming research results that are relevant to both *ex situ* and *in situ* conservation. Recognizing the importance of on-farm management of plant genetic diversity has also led to the creation of sub-regional and national initiatives for participatory research designed to involve local stakeholders in the national research system. Moreover, these initiatives have allowed scarce resources to be used more efficiently for research and development by exploiting the synergies that exist between similar agro-ecologies and farming systems.

4. *Ex situ* conservation

The first collection of local germplasm in Morocco began in the 1920s and was organized primarily to meet the specific needs of foreign breeding programs. Thus, these collections were sporadic and not systematic. It has only been since the 1980s that systematic and planned surveys and collecting missions have been organized by national institutions. These concern, in particular, cereals, fodder crops, food legumes and fruit trees. They have been carried out either jointly with foreign institutions and international centres or as initiatives of specific national programs. The national collections are preserved either in the form of collections in the fields (orchards, fodder species, and perennial species) or in the form of seeds in cold storage. These collections comprise cultivars, populations, clones belonging to species that are economically and socially important or species of various origins (indigenous, locally bred or imported). The largest collections consist of cereals, grain legumes, forage and pasture species and fruit tree species. Generally, the local germplasm is not sufficiently sampled. However, for certain species, the collections cover a large part, if not all, of their distribution area, which is the case for date palm and certain fodder species (*Medicago* and *Trifolium*).

In 2002, with the help of the Food and Agriculture Organization (FAO) and the technical assistance of the International Plant Genetic Resources Institute (IPGRI) (which is now known as Bioversity International), Morocco created a central gene bank under the management of the French National Institute for Agricultural Research (INRA) to coordinate *ex situ* conservation activities in the country. This gene bank is located in Settat and was built according to international standards. The capacity of the gene bank is 60,000 accessions, which is far beyond the needs of the country and the region. This important infrastructure has allowed the *ex situ* conservation of 20,644 accessions (see Table 1). However, the characterization of these accessions is not always sufficient, and the computerization of the data that are available is not systematic, therefore the collection is underutilized by breeders.

Table 1
Collection of plant species and microorganisms conserved in the central gene bank in Settat

Crop species	Species	Varieties	Populations	Total number of accessions
Fall cereals	9	94	4,974	5,068
Spring cereals	3	1,009	152	1,161
Forage crops	282	137	9,047	9,184
Fibre species	6	6	–	6
Oil crops	4	36	52	88
Food legumes	8	18	3,146	3,164
Vegetables	5	104	–	104
Pastoral species	192	166	974	1,140
Micro-organisms	4	–	166	166
Total	504	1,515	17,529	20,644

Source: INRA (2007).

Apart from some improved lines of certain species, the genetic material maintained in the Settat gene bank mainly consists of local accessions collected throughout Morocco. Part of the collection has been regenerated through systematic multiplication.[17]

Other institutions that hold substantial collections of plant genetic resources are:

- IAV Hassan II (around 5,000 accessions);
- Centre of Production of Pastoral Seeds (1,400 accessions);
- Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification (around 150 species and more than 1,000 accessions) and
- Office National de la Sécurité Sanitaire Alimentaire (more than 2,000 accessions).

Most of these collections are managed according to the short-term objectives of selection and breeding for the valorization of the species. This situation generates two types of problems: (1) the programmes conserve redundant samples and (2) many rare resources are lost or threatened because most of the efforts concentrate on genetic resources that are exploitable in the short term and neglect the other genetic resources. In defence, the mission of these research institutions does not include the conservation of plant genetic resources per se, but only as these plants are part of the research and development projects. This is why these institutions do not manage their collections according to international standards for long-term conservation and why the regeneration of the samples is very limited. However, a copy of the duplicated materials from these smaller collections and their passport data are currently being transferred to the central gene bank. This operation will take place during the next few years. In the future, the central gene bank will apply techniques for the conservation of recalcitrant seeds and cryo-preservation.

Most of the collections of fruit trees are in the experimental stations of INRA. Even though the number of accessions is high and the collection is very difficult to manage, it only represents a small portion of the total diversity in existence in Morocco (see Table 2). The most efficient long-term conservation option for these resources is cryo-preservation, for which the technology is not yet available for many species. In the past, the field collections also included the perennial gramineae species, forage shrubs and medicinal and aromatic species. Unfortunately, these collections were not transferred to places where they could be protected against drought and the rapid development of urban areas, and, as a result, they were lost.

Table 2
Collections of perennial species maintained in the field

Crop species	Species	Varieties	Clones/Genotypes
Fruit trees	12	665	172
Olive trees	1	200	15
Citrus	11	250	750
Palm dates	1	42	1,131
Sugar cane	1	133	–
Forage small trees	20	5	29
Spontaneous species	700	–	700
Total	746	1,295	2,797

Source: INRA (2007).

Experimental gardens, botanical gardens and nurseries, such as those in Rabat belonging to INRA and those in the municipalities of Salé and Rabat, conserve exotic and ornamental species. Other gardens, which are used for pedagogical purposes and are located at the National School of Forestry and IAV Hassan II, contain species that are considered rare or prone to extinction. Except for certain pastoral and forage species that are

of interest for breeders and geneticists, the *ex situ* conservation of the biodiversity of wild species is very limited in these botanical gardens.

Nurseries have contributed largely to the renewal of many different species, and such cultivation has been conducted in Morocco since the beginning of the twentieth century. Nurseries throughout the country annually produce 30 to 40 million plants of different species for diverse uses. Most of these nurseries are owned by the private sector, while a few belong to individual municipalities. A national network of 40 arboretums for testing autochthon and exotic species was created in the 1940s. In addition, 11 species and 114 populations are maintained *ex situ* by INRA and a public-private partnership derived from the previous state company Société de Développement Agricole. These populations constitute the basic material used in plant propagating programmes for the production of seed and reproductive material.

5. *In situ* conservation

In situ conservation of crop genetic diversity is practised by farmers in traditional and subsistent agro-ecosystems. Morocco was one of the partners in the project entitled Strengthening the Scientific Basis of *In Situ* Conservation of Agricultural Biodiversity On-Farm, which was coordinated by Bioversity International. In establishing a scientific basis for supporting on-farm maintenance of crop genetic diversity, the project concentrated on faba beans, barley, durum wheat, and alfalfa as four model crops. Linking research to development was central to the project. Research was implemented through a participatory approach at all stages of the process, in collaboration with farmers and communities. Information from participatory research was complemented by household, market and seed system surveys, field trials that took place on station and on farm and genetic diversity measurements in the field and in laboratories. The project benefitted national conservation programmes, partner institutions and, most importantly, the participating farmers (see Box 1).

Box 1

Strengthening the Scientific Basis of In Situ Conservation of Agricultural Biodiversity On-Farm

The project provided a knowledge base to support in situ conservation on-farm. Hence, substantial progress was made in answering four main questions: (1) what is the extent and distribution of the genetic diversity maintained by farmers over space and over time; (2) what are the processes used to maintain the genetic diversity on-farm; (3) who maintains genetic diversity within farming communities (men, women, young, old, rich, poor, certain ethnic groups) and (4) what factors (market, non-market, social, environmental) influence farmers' decisions on maintaining traditional varieties.

Participatory approaches have been instrumental in understanding the amount and distribution of genetic diversity on-farm and the processes used to maintain this diversity by farmers. Community participation in on-farm conservation has been enhanced.

The work has created a portfolio of options to add value to local crop resources. The information collected from the farmers' knowledge on their units of diversity was integrated into participatory plant breeding efforts of the target crops (wheat, barley, faba bean and alfalfa). Knowledge on the role of informal and formal seed networks has been used to help increase farmers' access to a reliable seed supply.

The Moroccan national framework, which includes government and non-government sectors, has been created and strengthened to support farmers in in situ conservation on-farm. In situ conservation has been adopted into the national conservation action plan.

Training, which includes degree and non degree training, short courses, group courses and workshops for national policy makers, researchers, development workers and farmers, has resulted in an increased capacity to support the implementation of in situ conservation on-farm. The project has also helped to build gender awareness in the national genetic resources programme.

6. Stakeholders involved

Morocco has a complex array of institutions involved in planning and implementing activities related to plant genetic resources, including the dissemination of technology options to the relevant public and private stakeholders. In addition to governmental agencies, national agricultural research institutes, universities and extension services, which, historically, have been publicly funded, there are various other sources that are predominantly funded from private sources, including the private industry, farmer organizations, non-governmental organizations (NGO) and community-based organizations (see Table 3). All of these stakeholders are part of the national system of plant genetic resources. However, they largely act independently of each other. The minimum coordination among them takes place mainly in the form of individual contacts and informal exchanges. Historically opportunistic, the private seed industry has been growing in the last decades with increased organization.

Thus, in addition to the various stakeholders, the national plant genetic resources system is characterized by a management arrangement that involves a multitude of institutions and their associated bodies (ministerial departments of agriculture and fisheries, interior, education, Islamic affairs, justice, trade, foreign affairs and cooperation, finances and the administration of customs, among others). The advantages of this approach is that, by involving all of the interested governmental departments, resources and expertise are pooled together and genetic resources problems are addressed from different perspectives. However, the lack of coordination at the management level generates risk of disengagement and unclear responsibilities and makes decision making time consuming.

Table 3
Actors involved in plant genetic resources management in Morocco

National level	Regional and local level
Ministerial departments of agriculture and fisheries, interior, education, Islamic affairs, justice, trade, foreign affairs and cooperation, finances and the administration of customs	Representatives (elected through direct vote and from local, provincial and regional counsels)
Institutions of agricultural training, education, research and universities	Local authority (representatives from the Ministry of the Interior at the regional, provincial and local levels, including *walis*, governors, *caïds* and so on
NGOs, farmers and local communities	Technical ministerial representatives: at the regional, provincial and local level
Private sector (mainly those involved in seed activities as producers, processors, distributors and marketers and users). This involvement is done mainly through Confédération Marocaine de l'Agriculture et du Développement Rural, Federation Nationale Interprofessinnelle des Semences et Plants, Association Marocaine des Multiplicateurs des Semences and Association des Multiplicateurs des Semences et Plants.	Farmers and farmers' organizations (unions, chamber of agriculture, cooperatives, associations and NGOs) Public and private seed companies and dealers collecting and/or selling local varieties or improved varieties produced locally or imported

Source: DPVCTRF (2008).

7. Seed systems in Morocco: Provenance and the use of seeds in agricultural production

In Morocco, the seed and seedling market are characterized by the coexistence of the formal and local (informal) sectors. Each sector has its own specificities regarding the species, the areas, the end use of the products, the kind of technologies used, the population involved and so on. The importance of each of these two sectors depends on the species. Table 4 shows the rate that certified seed is used in the formal sector for the major crops in Morocco. For most of the species, this rate of usage is very low and generally involves only those areas with high precipitation levels or elaborate irrigation systems.

Table 4
Need, rate of usage and source of supply for certified seeds, 2009

Species	Area (in 1,000 hectares)	Need (in 1,000 quintals)	Quantity (in 1,000 quintals)	Rate of use (as a percentage)	Source of supply
Durum wheat	1.125	1.687	214	13	
Soft wheat	1.428	2.142	421	20	Local production
Barley	2.195	2.195	24	1	
Total for wheat soft wheat and barley	4.748	6.024	660	11	
Maize	400	80	8	10	Imported
Rice	7	14	0,28	2	Imported
Food legumes	420 360	340 280	7 28	2 10	50 percent imported 50 percent local production
Forage crops					40 percent imported 60 percent local production
Pastures	-	–	0.3	–	Local production
Sugar beets	65	9.4 polygermes (+ 4,000 units of monogermes)	9.4 polygermes (+ 4,000 units of monogermes)	100	Imported
Sunflowers	120	12	1.2	10	50 percent local production 50 percent imported
Potatoes	56	1360	365	27	96 percent imported 4 percent local production
Vegetables	174	3.7	2.4	65 (standard)	70 percent imported 30 percent local production

Source: ONSSA (2009).

The informal sector extends to most of the species and cultivated regions in Morocco and, in particular, the marginal areas and areas with low levels of precipitation. In this sector, the main sources of the seeds are: farmers' own saved seeds, family, neighbours, neighbouring villages and local markets (*souks*). In certain regions and for certain species, there are local farmers that specialize in local seed production (alfalfa seed in the oases, for example). In some areas, the formal and the informal seed systems overlap since the farmers use their local varieties for the most part but use seed purchased from the market and from seed companies during certain seasons.

The official seed system is governed by a well-established set of legislative and policy texts with the aim of ensuring the quality of the seeds and the seedlings, the security of the producers, the protection of the breeders' rights and the organization of the sector. The registration of the varieties, as well as the production,

certification and marketing of the seeds and seedlings, are regulated by legal texts that were promulgated during the 1970s, 1980s and 1990s. The official catalogue of certified varieties and most of the technical regulations for different species were issued in 1977. In 1983 and 1987, the technical regulations for olive and citrus were passed, and in 1993 the government approved the regulation overseeing seed import and trade. These legal provisions concern the principal crop species cultivated in Morocco, and they have been developed in accordance with international standards in order to facilitate Morocco's adhesion to several international seed systems and markets, such as the International Seed Tasting Association and the seed certification schemes of the Organisation for Economic Co-operation and Development and the European Union.

For the protection of breeders' rights, Law 9/94 on the Protection of Plant Variety Release and Breeders' Rights was promulgated in January 1997, and it came into effect in October 2002. Currently, 79 species are eligible for protection. Morocco has been a member of the International Union for the Protection of New Varieties of Plants (UPOV) since 8 October 2006.

The varieties that are registered in the Moroccan catalogue, and that therefore are exchanged as part of the formal seed system, are improved varieties designed for modern intensive agriculture (see Table 5), while the local varieties produced and exchanged through the informal sector involve traditional production systems in vulnerable areas with extreme climatic conditions. The risk that these two types of varieties may get mixed up in a cross-pollinated species is low due to the fact that they are cultivated in very different environments.

Despite the significant efforts to promote the development, release and use of plant varieties within the existing legal framework through direct and indirect incentives, the formal sector does not meet Moroccan seed needs for most of the plant species. In cereals (wheat species and barley), which are the crops for which the formal system was initially created, contributions from the formal sector make up, on average, approximately 10 percent, while 90 percent of the need for seed is covered by the informal system (see Table 5). These figures will be surely be adjusted once the framework of the Green Morocco Plan is put into play.

Table 5
Number of varieties per species and number of breeding institutions, as registered in the official Moroccan catalogue (1982 to September 2009)

Crops	INRA (public)	Private	Total
Durum wheat	33	33	66
Wheat	23	43	66
Barley	21	34	55
Triticale	7	6	13
Secale	3	0	3
Rice	17	23	40
Mais	15	326	341
Oats	17	14	31
Small-seeded faba beans (minor)	3	4	7
Large-seeded faba beans (major)	3	14	17
Alfalfa	3	70	73
Annual medicago	3	7	10
Vetch	9	11	20
Fodder peas	4	14	18
Fodder beets	0	13	13
Lentils	9	0	9
Chickpeas	6	10	16
Peas	2	60	62
Cotton	9	0	9
Sugar Beets	0	230	230
Soybeans	7	26	33
Rape (cannola)	2	29	31
Sunflowers	4	121	125
Safflowers	1	2	3
Potatoes	0	263	263
Melon	0	244	244
Lettuce	0	40	40
Feggous (local cucumber)	0	1	1
Legum beets	0	19	19
Total	201	2,085	2,286
Percentage	8.79	91.21	100

Source: ONSSA (2010).

New varieties of different species are continuously being introduced in Morocco with the aim of fulfilling internal and external market requirements (see Table 6). For certain species, including sugar beets, potatoes and vegetables, Morocco is totally dependant on foreign varieties, while for other species, such as cereals, legumes and forage crops, there is an abundance of varieties coming from the national breeding programmes, which are conducted primarily by INRA.

Table 6
Number of varieties registered in the Moroccan catalogue per country of origin (1982 to September 2009)

Crops	Fall cereals	Spring cereals	Food legumes	Forage crops	Industrial crops	Oil crops	Potatoes	Vegetable crops	Total	%
Morocco	89	32	25	39	9	19	–	–	213	9.3
France	54	217	48	19	43	70	61	136	648	28.3
Netherlands	1	1	6	4	39	2	110	284	447	19.5
United States	2	68	9	36	10	25	–	128	278	12.2
Spain	20	38	8	11	–	39	–	21	137	6
Germany	–	6	1	3	68	3	27	5	113	4.9
Sweden	25	–	8	–	16	8	7	–	64	2.8
Denmark	–	–	–	1	14	8	13	7	43	1.9
U. Kingdom	–	–	–	1	8	9	20	–	38	1.7
Australia	–	–	–	33	–	–	–	–	33	1.4
Italy	5	12	1	2	1	5	–	5	31	1.4
Belgium	–	2	–	2	25	–	–	–	29	1.3
Poland	–	–	–	–	6	–	5	–	11	0.5
Others	7	5	10	9	–	4	20	146	201	8.8
Total	203	381	116	160	239	192	263	732	2,286	100

Source: ONSSA (2010).

Since the entry into force of Law 9/94 on the Protection of Plant Variety Release and Breeders' Rights in 2002, 236 applications have been received, 147 varieties have been protected and 62 varieties are still under examination. More than 66 percent of those varieties are from foreign breeding programmes (see Table 7).

Table 7
Distribution of the number of requests for protection certificates in Morocco and the number of certificates granted per country

Country	Demands	Number of protected varieties
Morocco	84	64
Netherlands	35	18
France	28	23
United States	31	10
Spain	25	14
South Africa	12	01
Ireland	12	11
United Kingdom	4	4
Brazil	1	–
Cyprus	1	1
Hungry	1	1
Italy	1	–
Total	236	147

Source: ONSSA (2010).

8. Information systems

Information-sharing tools concerning PGRFA are not well established in Morocco. The first initiative involving information sharing was developed under the framework of the CBD when the Centre of Exchange of Information (CHM) was created. The CHM is a platform for communication and information on Moroccan biological diversity. It is managed by a national committee of biodiversity, which includes government ministries, research and higher education institutes, and NGOs. Among its objectives, the CHM seeks to strengthen and reinforce the national agricultural research system through information sharing and communication. However, it is hindered by a lack of up-to-date information and the reluctance of its partners and primary stakeholders to provide the necessary information.

In 2004, INRA established a national information-sharing mechanism (NISM) as part of the FAO's Global Plan of Action and based on a list of indicators recommended by the FAO's Commission on Genetic Resources for Food and Agriculture. This mechanism was aimed at monitoring the implementation of the Global Plan of Action in Morocco as well as the situation of PGRFA in Morocco, in general. Internally, the idea was that the NISM would provide updated information about PGRFA in Morocco for the national committee on PGRFA as well as for other national institutions in order that they could make informed decisions when developing strategies and plans. It would also offer the participants the opportunity to evaluate their efforts, strength the cooperation between them and extend their visibility at the national and international levels. With these goals, the NISM website was created (<http://www.pgrfa.org/gpa/mar/descrip.htm>). However, the system suffers from a lack of efficient coordination and is incapable of mobilizing the partners in an effective manner. As a result, information sharing is not well organized, and the NISM is not being effectively supported by its partners. The NISM has the potential of being the primary tool used by national collections to provide information about PGRFA in the multilateral system, but since it is currently not under the mandate of the ITPGRFA it has been difficult to exploit this potential.

A strategic report on the country's PGRFA was developed for the second conference on the *State of the World's Plant Genetic Resources for Food and Agriculture*. The report presents, in detail, the state of the implementation of the CBD at the national level and puts forward the difficulties, as well as the priorities, that concern the conservation and maintenance of agricultural biodiversity in Morocco. It provides a comprehensive analysis on the trends and changes regarding PGRFA over the last decade and describes the main factors influencing the management and use of PGRFA. This report as well as the NISM represent two ways that Morocco has become more involved in the FAO's global system of conservation and use of PGRFA. The most reliable information regarding PGRFA accessions and their use is maintained by the collection holders. Technical reports and project databases are a good source of information. However, it is not usually available to people outside of these institutions.

9. Movement of germplasm from, to and within Morocco

9.1. Introduction of germplasm

As a result of the deficiently coordinated system that currently exists in Morocco, germplasm exchange is not well documented nor is information easily available since it is often scattered between institutions and users. Germplasm summaries that are well documented are those coming from the centres of the Consultative Group on International Agricultural Research (CGIAR), particularly the International Centre for Agricultural Research in the Dry Areas (ICARDA). This centre is the main provider of genetic resources for the national research programmes (INRA, IAV Hassan II and the universities). The number of accessions sent to Morocco since 1984 is summarized in Table 8.

Table 8
Number of accessions introduced in Morocco, 1984-2009

Year	Cereals	Faba beans	Forages	Lentils
1984	0	0	39	0
1987	0	0	264	0
1988	0	0	75	0
1989	4,625	0	0	0
1990	74	0	0	0
1991	1,275	0	0	0
1992	1,059	0	25	9
1993	1,167	14	30	3
1994	11	0	251	4
1995	0	35	1,081	5
1997	0	21	44	3
1998	0	0	373	0
1999	0	0	133	189
2001	43	0	0	0
2003	1,389	0	569	0
2004	0	0	1,830	504
2006	29	0	30	0
2007	96	0	0	12
2008	719	0	0	0
2009	0	0	105	0
Total	10,487	70	4,849	729

Source: INRA (2008).

The main purpose for the acquisition of these genetic resources is diverse. For cereals, grain legumes and forages, 827 of the introduced entries were used in breeding programmes, 1,935 in screening for stresses, 9,619 in research activities and 3,753 for conservation purposes. The genetic material used in the breeding programs has different origins. Most of it comes from local genetic resources and from international centres (mainly ICARDA and the International Centre for Maize and Wheat Improvement (CIMMYT)). During the 1980s and early 1990s, there were intensive exchange programmes between the international centres and the national research institutes, particularly INRA. Most of the exchanged material was segregating material that had to be evaluated under Moroccan agro-climatic conditions. The parental material used in the crosses that took place at the international centres derived from germplasm from Morocco as well as from other origins. The exchange programs concerned mostly cereals (wheat and barley), food legumes (faba beans, chickpeas and lentils) and forage crops (Lathirus). Morocco has also initiated several repatriation programs of its plant material using different sources in the world. Hence, 3,722 accessions were reintroduced from ICARDA to the INRA-Morocco gene bank in 2003 and 2004 (see Table 9).

Table 9
Number of accessions reintroduced in Morocco from international collections

Crops	Number of accessions
Aegilops	59
Barley	769
Bread wheat	275
Durum wheat	275
Primitive wheat	7
Wild *Hodeum*	4
Faba beans	162
Chickpeas	231
Lentils	105
Lathyrus	134
Medicago	616
Other forages	378
Pisum	32
Trifolium	306
Vicia	369
Total	3,722

Source: INRA (2009).

Other ways that plant genetic material was introduced include: (1) the introduction of new varieties, mainly by the private sector, for testing, release and registration in the National Catalogue of Registered Varieties or for the purposes of plant breeders' rights and (2) the introduction of entries of germplasm for research purposes. Table 10 provides an example of the number of sets and entries of germplasm under development that were received from ICARDA from 2002 to 2009.

Table 10
Number of entries of germplasm under development received from ICARDA, 2002-9

Year	Number of sets	Approximate number of entries
2002	75	2,250
2003	112	3,360
2004	54	1,620
2005	38	1,140
2006	62	1,860
2007	83	2,490
2008	72	2,160
2009	92	2,760
Total	588	17,640

Source: INRA (2007).

9.2. Distribution of germplasm

Due to its vast array of genetic resources, Morocco has always represented a privileged destination for collecting crop and wild relative germplasm in the Mediterranean area. During the last few decades, several international surveys have identified 6,673 accessions originating from Morocco that have been conserved in different gene banks throughout the world (see Table 11).

Table 11
PGRFA originating in Morocco and conserved in different countries

Country	Organization		Number	
	Acronym	Name	Crop species/ genera	Accessions
Australia	ATFCC	Australian Temperate Field Crops Collection	7	80
	CIIA	Crop Improvement Institute Agriculture	1	229
Netherlands	CGN	Center for Genetic Resources	3	96
Mexico	CIMMYT	International Centre for the Improvement of Maize and Wheat	1	52
Syria	ICARDA	International Centre for Agricultural Research in the Dry Areas	25	4,130
Germany	IPK	Institute of Plant Genetics and Crop Plant Research	1	31
Czech Republic	Ruzyne	Research Institute of Crop Production	9	63
USA	NSGC	National Small Grains Collection, Idaho	6	704
	RPISTA	Regional Introduction Station, Iowa	20	77
	USDA	USDA-ARS, Pullman, WA	142	1,211
Total				6,673

Source: INRA (2007).

So far, no provision of a legal, administrative or other nature has been put into place to control access to these national genetic resources. Similarly, no framework regulating sharing the advantages and benefits resulting from the exploitation of these resources has been developed. It is apparent that this situation is completely untenable, especially when the international evolution of access and benefit sharing under the framework of the CBD and the ITPGRFA is taken into consideration.

Since the approval of the ITPGRFA in 2001, Morocco has ceased distributing genetic resources abroad until the required PGRFA legislation is implemented in accordance with the Treaty. The only exception to this rule has been the materials jointly collected under specific bilateral agreements or donor projects. Therefore, there is an urgent need for national legislation so that this situation can be overcome. By doing so, Morocco would succeed in enhancing the exchange of PGRFA in a manner that would permit it to benefit from its national resources while still establishing clear procedures and mechanisms with all of its partners either through the multilateral system or through bilateral agreements.

9.3. Difficulties in accessing germplasm

A survey conducted among a sample of Moroccan users of PGRFA, particularly breeders and scientists, shows that they have experienced numerous difficulties in accessing germplasm and the associated information due to constraints from both national and international sources. In the absence of an established legal and agreed upon national regulatory framework with clear mandates and responsibilities, users of plant genetic resources have had difficulties accessing germplasm. Indeed, national germplasm sources are maintained by different independent government or private institutions. Under these conditions, exchanges of germplasm within the country have been mainly conducted on a person-to-person basis. In addition, most

collections are not documented or, when they are documented, the information is not freely available. Moreover, the availability of seeds in appropriate amounts is another problem that often affects users of PGRFA when they request seeds from different collections. Indeed, most collections are not organized according to the established standards so that the generation or multiplication of seed is not carried out systematically and often does not even meet the needs of the host institution.

With respect to accessing PGRFA from international sources, the most frequently declared constraints are related to issues over quarantine, the availability of seeds from the requested accessions or difficulties in paying airport fees. A number of interviewees said that their requests often receive no responses from the gene banks and international collections in question. Additionally, adequate information on the plant material is usually lacking.

9.4. Qualitative assessment concerning germplasm flows into and out of Morocco

Since more than 14 percent of its species are endemic, Morocco is recognized as an important centre for genetic diversity for a number of cultivated species and their wild relatives. The balance between the import and export of germplasm depends on the species. For some species, opinion is unbalanced and is in favour exporting locally collected material and for other species opinion lies in favour of importing improved and elite lines.

10. Regulatory aspects

Despite the importance of PGRFA for people's livelihoods, there is no overall policy for its sustainable utilization and conservation (Iwanga, 1993). Thus, there is an urgent need for the adoption of a legal framework that would regulate this sector at the national level. First, it would be necessary to harmonize the different legal texts that, in one way or another, affect the conservation and use of plant genetic resources. Existing policies and legislations have been developed over time for different purposes. Several laws and regulations are aimed at protecting Morocco's natural resources. They include the establishment of the Comité National de la Biodiversité in 1996; the protection of nine natural areas in different zones of the country as well as a trans-continental region between Spain and Morocco and the protection of endangered flora and fauna pursuant to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which was ratified by Morocco in 1975.[3] In regard to endemic species, a ministerial decree was adopted in 2009 to regulate and restrict the exportation of argana and saffron material for reproduction and propagation. The Moroccan 'arganeraie' was designated by the UN Education, Scientific, and Cultural Organization as a biosphere reserve in 1999. To preserve the palm date area known as 'palmeraie,' which is facing major difficulties due to the spread of the Bayoud disease and other biotic or abiotic stresses, Law 01-06 Related to Sustainable Development in the Palm Date Areas 'Palmeraies,' Phoenix dactylifera, was adopted in 2006.

Since the beginning of twentieth century, Morocco has been adopting an important legal and regulatory phytosanitary system that is based on several international directives and standards that cover various aspects of importation, exportation and quarantine. To prevent the introduction of new pests and diseases, a quarantine system has also been established for citrus and sugar cane. In keeping with activity, Morocco has signed different regional and international agreements and is a member of several key organizations (including Sanitary and Phytosanitary Measures at the World Trade Organization, the International Convention for the Protection of Vegetables under the FAO, the European and Mediterranean Plant Protection Organization and so on). A National Biosafety Committee, chaired by the prime minister, was created in April 2005 and a draft law on genetically modified organisms (GMO) is under approval. Currently, the introduction, production and use of GMOs are not allowed in Morocco.

Particularly relevant are the recently approved laws (and related measures) for the creation of niche markets for local products. The preservation of PGRFA cannot be possible unless there is a substantial involvement of the local populations. However, these people cannot be fully involved unless they can take advantage of their local resources in such a way that they can increase their income and improve their general way of life.

With this in mind, Morocco adopted in 2008 a Law on the Appellation of Controlled Origin (ACO) and Geographical Indication (GI). The first applications of this law are under study. The system will first be applied to argana, olives and saffron, and then it will be progressively extended to other species and products (dates, for example). The local populations will be able to get involved in the production, labelling and marketing of ACO and GI products through cooperatives of production and various NGOs. The Ministry of Agriculture has created a division that is fully dedicated to dealing with GI, organic farming and labelling, and it is also currently considering a draft law on organic farming in order to enlarge and complement the scope of ACO and GI products. In addition, a number of programmes on the valorization of local production were initiated in 2004 by INRA and other research institutions in order to create markets for agricultural biodiversity. These programs have focused on certain species including durum wheat, cactus, barley, saffron, dates, figs and olives.

However, all of these actions do not make up for the absence of a general legal text on PGRFA, and a specialized governmental committee is currently overseeing the implementation of such a document. A pre-draft law on the collection, conservation and use of PGRFA was prepared by the focal group on the ITPGRFA, in coordination with other ministerial departments and institutions involved in PGRFA conservation and use, mainly INRA and IAV Hassan II. The pre-draft law was discussed during the workshop organized in Rabat in July 2008, in cooperation with Bioversity International, the FAO, ICARDA and the Secretariat of the ITPGRFA. These discussions have stalled over the last few months due to significant organizational changes within the Ministry of Agriculture. Recently, it has been pinpointed as an area of priority for the ministry.

This legislation was very much inspired by the CBD and did not take the multilateral system into much consideration. The main reason for this bias was a lack of understanding of some of the key concepts in both of these international instruments and the relationship between them. This understanding has slowed down the legislative process, but it is expected that with the approval of an international regime on access and benefit sharing at the tenth Conference of the Parties to the CBD, the negotiations will result in a common understanding on access and benefit-sharing issues, which will therefore facilitate the translation of international commitments into national laws (Wynberg and Burgener, 2003). In addition, a prime ministerial circular has introduced the idea of creating a national committee for PGRFA, and it has been submitted for approval. The committee will be made up of representatives of the public administration, the private sector and NGOs. One of the main tasks of the committee will be to follow up on the implementation of the ITPGRFA in Morocco.

11. Public awareness on PGRFA

Over the years, many different stakeholder groups have initiated actions to raise awareness of PGRFA-related issues in Morocco. However, mechanisms for wide consultation, debate and public participation have been limited until very recently. Raising awareness has taken place using different national and local communication means. Radio programmes, flyers and training materials, which have been developed by different stakeholders, have focused on agro-biodiversity in general and on PGRFA in particular. From time to time, governmental authorities have organized training courses or have produced documents relating to the environment and biodiversity that are aimed at journalists in order to educate them about environmental problems as well as agricultural biodiversity. Some ministries have created their own departments for communication, public awareness and education – most notable are the Departments of Forestry, Agriculture and Environment. What is missing is a comprehensive national campaign focusing on the vital importance of PGRFA, its conservation and its continued use in the economy of the country (Iwanga, 1993).

Educating stakeholders at the local level is mainly carried out by local NGOs, which have become very active in various areas of Morocco. The website of the Department of the Environment lists some of the NGOs involved in public awareness and education campaigns. Technicians from the extension services of the regional offices also play a role in public awareness and education by helping farmers to optimize the use of their resources in agriculture production and forestry. Although there is no adequate means to measure the level of awareness of agricultural biodiversity throughout the population, it would seem that this topic is

becoming increasingly significant. To date, the ITPGRFA has only been discussed in governmental notes, correspondence, internal reports and technical papers, and it has not appeared in general media publications. In the last two years, no newspaper has included an article on the Treaty. However, in recent months, there are journalists in Morocco who seem to have taken an interest in covering biodiversity and agricultural biodiversity issues, but without paying attention to the Treaty.

12. Morocco's participation in international agreements and partnerships

Morocco is involved in regional and international cooperation in the area of PGRFA through bilateral, regional and international collaborative programs, linkages and networks. The bilateral collaborations that Morocco entertains in the area of PGRFA are sometimes established within the framework of the CDB, but are often more extensive. In this regard, PGRFA stakeholders in Morocco believe that a valuable sub-regional expertise exists and that it is currently being under-utilized (including countries of the North Africa region). Networking based on this expertise will allow governments, organizations and the negotiators of these sub-regions to better approach the international fora on PGRFA management (ICARDA, 2008; Zehni, 2007).

Cooperation with organizations active in this sub-region has been developed by different Moroccan institutions in the area of PGRFA. For example, the Arab Centre for Studies on the Arid Zones and Lands currently holds an important collection of fruit trees in an *in situ* gene bank and is therefore an important partner in several cooperation agreements with Moroccan institutions. The Arab Organization for the Agricultural Development plays an important role in developing technical, logistical and human capabilities for contributing to the effective management and use of genetic resources for productivity improvement.

The European Union funds projects in the Mediterranean basin through the Euro-Mediterranean partnership. PGRFA stakeholders in Morocco consider that the European Union could provide financial and technical support for implementing the ITPGRFA and the CBD in the region (DPVCTRF, 2008).

Morocco became a full member of the CGIAR in 2003 and thus undertook cooperative programs, research projects, transfer and exchanges of genetic resources as well as continuous training and exchange of experts with ICARDA, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), CIMMYT and Bioversity International. Indeed, collaboration with the CGIAR had a major impact on the development of PGRFA activities in Morocco. National breeding programs extensively began to use plant material and segregating material introduced from centres such as ICARDA, CIMMYT, ICRISAT and the International Potato Center. Materials provided by the CGIAR include elite lines that are directly usable in advanced stages of the improvement process by hybridizing them with local germplasms. A large number of Moroccan varieties of cereals (wheat, barley, corn and grain legumes (chickpeas and lentils) were directly selected from this advanced material. ICARDA, in particular, has largely contributed to the development of the INRA gene bank in Settat by providing technical, logistical, financial and human resources assistance to establish long-term conservation and promote the use of PGRFA. In addition, Morocco is among the first beneficiaries of the results of ICARDA's original experiment in the improvement of barley for marginal environments.

With Bioversity International (originally the International Plant Genetics Resources Institute), Morocco has developed a strong partnership and has carried out a series of cooperative projects. These include collecting missions, training sessions, and research projects. Under the lead of IAV Hassan II, Morocco was one of the partner countries in the global collaborative project entitled Strengthening the Scientific Basis of *In Situ* Conservation of Agricultural Biodiversity On-Farm. Currently, the UN Environment Programme / Global Environment Facility / Bioversity International project, Using Local Diversity to Control Pests and Diseases, includes Morocco (IAV Hassan II as the executing agency) as one of the four country components (China, Ecuador and Uganda are the other partner countries). The results of these two projects have had an impact on the PGRFA used in breeding programs and have shown the importance of linking *in situ* and *ex situ* conservation (Iwanga, 1993). Furthermore, they have provided scientific and technical bases for policy formulation and also integrated farmers into the national PGRFA system. The cooperation with Bioversity International also includes the conservation and management of other PGRFA, including medicinal plants,

fruit trees such as almond, fig, pomegranate and pistachio trees. Through a memorandum of understanding, INRA and Bioversity International have undertaken to develop a national strategy for conserving PGRFA. Another additional agreement has been established to support the gene bank in Settat.

13. The global system and the ITPGRFA: Situation in Morocco

Improving the management and protection of PGRFA constitutes one of the main components of the national strategy to strengthen food security and ensure sustainable development in Morocco. This principle led the country to sign and ratify the ITPGRFA in 2006. The particular reasons for ratifying the Treaty were because it:

- aims to preserve PGRFA, which is in accordance with the national strategy on conservation and sustainable use of natural resources as tools against poverty, mainly in rural areas;
- gives priority to the discovery, conservation, use and access of PGRFA for breeders and researchers, which has economical and social interests for the agricultural sector;
- stipulates clearly and for the first time in history an obligation to recognize and protect farmers' rights, which is the responsibility of all parties to the Treaty and
- creates the multilateral system, which includes the exchange of information, the transfer of technologies and an enforcement of benefit sharing that is derived from the commercialization of PGRFA and targeted primarily at the farmers for their enormous efforts in conserving and preserving PGRFA.

Since the adoption of the ITPGRFA, a clear separation is developing between the National Competent Authority and the research institutions involved in genetic resources activities as well as the various gene banks and germplasm collections. Until recently, the National Competent Authority, which was designed to be a focal point for the ITPGRFA, was the directorate of plant protection, technical controls and fraud and hosted by the Ministry of Agriculture and Marine Fishery. Recently, this responsibility has been transferred to the National Office for Sanitary Security of Agricultural Products (ONSSA), which was established in 2009 under the Ministry of Agriculture and Marine Fishery. ONSSA was constituted as an institutional device set up to support the strategic orientations initiated by the new agriculture development strategy, Green Morocco Plan. From now on, ONSSA will be in charge of developing policies and regulations related to PGRFA and ensuring coordination between different PGRFA activities conducted nationally. This coordination role will also include other aspects related to seed multiplication and certification and varieties testing and registration. As a result of these new agricultural development strategies, efforts in the implementation of the ITPGRFA will more likely involve the following priorities.

Capacity development

Stakeholders firmly believe that capacity development is an important issue that should be a priority in the actions required for implementing the ITPGRFA. Indeed, there is a strong belief that to benefit from the multilateral system the country needs the capacity to use and conserve germplams. This capacity, or lack thereof, concerns coordination, management, harmonization of national regulations as well as technical and technological capacities.

Multilateral system of access and benefit sharing

The central element of the ITPGRFA is the multilateral system of access and benefit sharing for the Treaty's Annex 1 crops. Awareness is increasing among the users and conservers of PGRFA that exchange can be used as a way of increasing availability for breeding programs and strengthening use and conservation. Therefore, the multilateral system is an important means of implementing the Treaty in Morocco. However, benefit sharing has yet to be clearly and concretely defined and expressed through a legal framework. Apart from information exchange, access to, and transfer of, technologies, training, monetary resources and other benefits arising from commercialization as well as the related procedures in sharing such benefits have to be clarified. Most of the partners interviewed during the preparation of this study consider that the monetary benefits are the most important product of the multilateral system, followed by the development of infrastructures at the regional and local level, the transfer of technology and, finally, full participation in the process of decision making.

At this stage of the implementation of the Treaty, the competent authorities have not yet identified the materials in various collections under public institutions that are to be included in the multilateral system. The process is underway, but it needs to be accelerated. Private collections are important for some crops species that are not necessarily in Annex 1 but might be preferably placed in the multilateral system. However, no measure has been taken to involve the concerned partners and encourage them to join the multilateral system. For certain specific species that are endemic to Morocco – such as the argana species and safran, the export and exchange of seed and propagating material is subject to prior authorization. This kind of species will therefore not be included in the lists of PGRFA subject to multilateral system dispositions.

Sustainable use

The sustainable use of PGRFA is an important issue in development strategies. It is specified in the new agricultural strategy, the Green Morocco Plan. It is also an important link between the implementation of the ITPGRFA and these ongoing strategies.

Conservation

Generally, conservation has been developed by the collection holders, who are predominantly the PGRFA users. It requires a national strategy and an implementing agency with a clear mandate. INRA's current gene bank at Settat may serve as an initial nucleus for conservation, but it will need to be developed and expanded.

Farmers' rights

'Farmers' rights' are still not a well-understood concept among stakeholders, and their implementation requires much planning and preparation (Brush, 2007). Instigating these rights will be even more difficult in the absence of clear and well-documented cases internationally. A serious debate about appropriate technical data will be required to provide a foundation for formulating guidelines to implement farmers' rights.

13.1. Arguments in favour of implementing the ITPGRFA

Morocco has an enormous potential for the genetic improvement of PGRFA, and it is currently developing research capacity to this end through the integration of efforts by public organizations, private enterprises, NGOs and farmers' associations. Breeding programs serving Moroccan agriculture will need the intensive introduction of genetic resources – in particular, elite germplasm – to develop varieties that are resistant to pests and diseases and that are tolerant to abiotic stresses. Unlike the traditional movement of plant genetic resources outside the country, which has been viewed by a number of stakeholders as 'biopiracy,' improved material needs to flow into Morocco. Current patterns show that Morocco may be a net recipient of improved PGRFA for a number of species, particularly from the CGIAR centres. Stakeholders strongly believe that proposals to restrict gene flows may reduce the benefits accruing to the country from PGRFA exchanges.

The stakeholders' consultations conducted during this case study provided insights on the various incentives that might strengthen Morocco's participation in the multilateral system. Such incentives include:

- facilitated access to PGRFA by national breeding programs in order to respond to continuous requests from both local and international markets seeking solutions to problems of biotic (diseases and insects) and non-biotic stresses (drought, salinity, frost and so on) and wanting to improve quality;
- direct and indirect advantages derived from benefit sharing, including monetary and non-monetary benefits (ratifying the ITPGRFA is seen as an opportunity to get funding, and stakeholders have an increasing hope that the ITPGRFA will facilitate funds for promoting an efficient national system for PGRFA in general and for *ex situ* conservation in particular);
- improved *ex situ* conservation of PGRFA as a result of the safety back-up of samples exchanged through the multilateral system (the duplicates can be used to regenerate the national gene bank);
- access to updated information on PGRFA, mainly from the information related to exchanges in the multilateral system;
- ability to participate in the decision-making processes that take place in different bodies of the ITPGRFA, which would help to serve national interests;

- national coordination that is enhanced and eventually consolidated at different levels, including among farmers and local communities who are preserving and managing PGRFA (PGRFA holders will increase their interest in the decision-making process by preserving and valorizing their local species);
- opportunity to develop a national system for the management of PGRFA, including the adoption of a national strategy and regulatory framework related to conservation and use of PGRFA;
- opportunity to improve the characterization and valorization of PGRFA, which would permit a better knowledge of the existing resources and enable the preservation and use of PGRFA and
- stronger regional and international cooperation, which eventually would result in a better exchange of experiences, expertise and technologies as well as an increased capacity in the different PGRFA-related domains.

13.2. Arguments against implementing the ITPGRFA

For many stakeholders, access to PGRFA is not enough of a reason to support the ITPGRFA. The capacity to use genetic resources is the main issue to be considered (Iwanga, 1993). Development of research and technology capacities is as important as accessing PGRFA. Although an enormous effort has been made during the last decades, the number of scientists and technicians directly involved in activities related to PGRFA are very limited and clearly insufficient to get the most out of the genetic diversity in Moroccan PGRFA. Only limited financial resources have been invested in the breeding programs of a couple of species that are important to the Moroccan economy and only because they have a direct impact on the local populations' incomes, such as the palm date. Reluctance in joining the multilateral system also comes from a lack of understanding on how small-hold farmers living in marginal agricultural areas who are recognized to be the custodians of agricultural biodiversity will benefit from the multilateral system.

A lack of favourable experience with germplasm exchange has made many stakeholders feel that Morocco will draw little benefit from implementing the access and benefit-sharing scheme of the Treaty. On the contrary, they are afraid of putting Moroccan genetic resources at the disposal of the international community without first having a national law that is able to protect such resources from possible misappropriation. In this regard, stakeholders feel that one of the main gaps in the current legislation is the lack of a national catalogue of PGRFA that would record and protect the national diversity of crops, fruits and forages.

The ITPGRFA is not well understood by many of the concerned stakeholders. Furthermore, the interaction between the ITPGRFA, the CBD and the Agreement on Trade-Related Aspects of Intellectual Property Rights and how they affect the conservation and use of PGRFA is still uncertain (Garforth and Frison, 2007).[4] The diversity and complexity of international principles and rules governing genetic resources and intellectual property rights issues create a complicated patchwork for national policy makers. In the middle of this confusion, there is a need for a common understanding on farmers' rights and how they can be realized under the ITPGRFA. The national government is waiting for specific indications from the Governing Body of the ITPGRFA about how to achieve farmers' rights at the national level.

Although the basis for implementing the ITPGRFA has been established, there is a need to further develop nationals plan of action with clear coordination responsibilities and commitments for all stakeholders and partners. The plan of action should be adopted at a high political level. Furthermore, the financial and technical resources needed to conduct the activities are badly lacking, and, so far, no specific resources have been allocated to the implementation of the Treaty. National authorities fear that the financial and human resources mobilized to help country members implement the Treaty are very limited and that the benefit-sharing fund will not be able to meet even the minimum amount of the national need in PGRFA conservation. As an example, out of the ten projects submitted by Morocco to the Governing Body of the Treaty, only one was granted financial assistance through the Treaty's benefit-sharing fund. This general lack of financial resources has discouraged many Moroccan stakeholders.

Finally, the absence of a clearly defined national strategy on PGRFA and on the mechanisms to facilitate dialogue and coordination between actors; the insufficient involvement of farmers, NGOs and local communities in initiatives coordinated by national authorities; and the lack of clarity in attributing responsibility has made the implementation of the ITPGRFA very difficult in practice.

14. Recommendations

The ITPGRFA is a comprehensive international agreement in harmony with the CBD (Garforth and Frison, 2007). It aims at promoting the conservation, exchange and sustainable use of the world's PGRFA as well as the fair and equitable benefit sharing arising from its use. It recognizes farmers' rights, and the realization of these rights is a cornerstone in its implementation and a precondition for the conservation and sustainable use of these vital resources *in situ* as well as on-farm. However, the interpretation of farmers' rights is not the same across the board, and it is still being debated at the international and national levels (Brush, 2007).

An effective and transparent multilateral system that facilitates the access to PGRFA and the sharing of benefits in a fair and equitable manner implies a strong and sustainable national system for *ex situ* conservation where responsibilities among institutions are clearly stated. In Morocco, it can be assumed from various different stakeholder consultations that the ITPGRFA will succeed only if its implementation is the result of a country-driven, self-sustained and broad-based process. The following recommendations were formulated from different participatory workshops, national forums, seminars, and meetings organized on PGRFA as well as through interviews of key stakeholder representatives. The formulation of these recommendations has benefited considerably from insights and comments from many of the stakeholders (PGRFA leaders, scientists, farmers, and policy makers). There was unanimous agreement and consensus achieved among the participants at the workshop held in July 2009 on the need to put into practice these recommendations as a way of moving towards the implementation of the Treaty.

14.1. Empowering governance and coordination in the treaty's implementation

To avoid past shortcomings, the implementation of the treaty should be more focused, orderly and professionally executed with clear leadership from the government. To this end, the newly established ONSSA, which will be hosting the focal point of the treaty, is the central lead authority for the ITPGRFA. It should be given all of the authority that is necessary to undertake all of the operational and legal steps leading to the implementation of the treaty.

Although it is recognized that genetic resource conservation and management is a public agenda, the ONSSA should take the lead and work with other relevant government departments and authorities to identify areas that overlap between the public and private sectors and facilitate negotiation of flexible agreements to manage joint design, conduct and financing of PGRFA activities. Mechanisms for equitable benefit sharing need to be developed in a manner that encourages Moroccan entrepreneurs to engage in enterprises that result in new income-generating opportunities involving PGRFA activities. To this end, the following actions were identified at the stakeholder consultations and by different national reports.

- Facilitate interaction between the stakeholders and promote a common understanding on the specific policies. It is important to define and determine the limits between the Moroccan public and private sectors in the area of PGRFA. Since the concepts are ambiguous, international expertise is needed. In all of its activities, the ONSSA needs to ensure that governmental and private institutions are considered to be the critical audience, alongside the investors and scientific community. The communication strategy and action plan of the ITPGRFA's focal point must be expanded beyond the traditional donor and specialized research community to include high-level policy makers, the private sector and knowledgeable institutions.
- Organize coordination for the conservation and use of PGRFA in order to avoid duplication of actions and programmes and establish priorities and goals to be achieved in the short, middle and long term.

- Develop a strategy for the mobilization of necessary resources. This strategy should identify potential partners and donors based on projects that will be advantageous, that will have a direct and positive effect on the country and that already have the commitment of different stakeholders concerned with PGRFA.
- Clarify the concepts related to the rights of farmers and their communities. This strategy will give priority to the implementation of the plans and the programs adopted in favour of the farmers who preserve PGRFA.
- Organize and implement the multilateral system by setting up a national infrastructure in accordance with the legislation, policies, needs and interest of the country and create a new network of institutions allowing for the operationalization of the multilateral system.
- Modify and adapt national legal frameworks for the implementation of the ITPGRFA and establish functional procedures of implementation for national plans and strategies. Hence, the stakeholders must ensure that the appropriate laws pass approval expediently in order to ensure their implementation in harmony with the existing national legal framework.

14.2. Enhancing research and development capacities

Along with strengthening national research and development capacity, it is strongly recommended that the national agricultural research and training institutions reposition themselves with respect to their work and focus on the PGRFA system. These institutions include those under the umbrella of the Ministry of Agriculture and Marine Fishery as well as the universities with research and training programmes relevant to PGRFA and its associated domains.

Despite the significant progress that has been achieved, the required strategic research agenda on PGRFA is unmet in Morocco. While the existing institutions need to assume better leadership in research to ensure the better use of PGRFA, there is considerable merit in developing a Moroccan Centre for Agricultural Research from the existing national agricultural research institutes and universities. This centre of excellence would provide a focal point for mobilizing additional resources for PGRFA research on local problems. It would allow economies of size and reduce the risk of duplicated effort among the current programs, which are often small and fragmented. It would promote technology for the utilization of PGRFA, including techniques for pre-breeding, use orientated sub sets, breeding activities and for the development of new PGRFA or new varieties as well as seed technology.

Focus should be given to reinforcing research capacity through expertise, improved competence and expanded infrastructures. This focus can be achieved not only through mobilizing the available national resources but also by developing international cooperation and partnership (Zehni, 2007). In this regard, the cooperation with international institutions on PGRFA should be coordinated to facilitate engagement with national agricultural research systems and the PGRFA system as a whole and act as a custodian for reporting progress on the developments.

More specifically, collecting capacities need to be reinforced to fill gaps through new and systematic collecting missions. These activities should be organized in a way that permits coverage of major species and major regions. Along the same lines, an *ex situ* gene bank network should be developed with central units as well as regional and local units dedicated to specific purposes (Zehni, 2007). Private sector and local communities should be involved.

The country also needs to strengthen human resources in the field of conservation and sustainable utilization of PGFRA. Participatory diagnostic, on-farm research approaches and information management techniques using information and communications technologies are strategies that should be encouraged to support entrepreneurial tools. In this regard, the national agricultural research systems should play a more significant role in the selection process of the research and training grants dedicated to PGRFA.

Recommendations providing guiding principles for improving the conservation and valorization of genetic resources are summarized in the following points.

- Collections: there is a need to extend the sampling of eco-geographical variability as broadly as possible based on the present state of art.
- Conservation: it is necessary to develop an adequate infrastructure and a national centre for PGRFA conservation and use. The similarities between *in situ* and *ex situ* conservation should be considered and taken advantage of through the implementation of linkages between the two approaches.
- Evaluation and characterization: it is necessary to standardize the methods and approaches that need to be taken by the national organizations and international centres. Given the large number of germplasm collections, it is necessary to divide them into core collections and to establish priorities by species as well as within the same species.
- Training: it is important to reinforce education at the university level in PGRFA and its associated domains.

14.3. Exploiting synergies

There are currently many weak linkages between the national agricultural research institutes and the universities in the area of PGRFA – often these connections are non-existent or are operating on an informal person-to-person basis. Such a situation represents a failure to exploit the synergies that are potentially available financially and with respect to technical know how to develop effective PGRFA activities in the national agricultural research systems. One difficulty is that such sources are often positioned in different ministries (agriculture and higher education), and thus a national perspective is necessary. Obviously, there is a significant role for the national authority to help address such issues.

14.4. Improving participation

The most challenging action in implementing ITPGRFA is to make PGRFA activities more client-oriented and client-driven through stakeholder participation. There is a general tendency to equate stakeholders solely with farmers. However, consumers, industry, NGOs and community-based organizations are also important stakeholders that may wish to influence the agenda on PGRFA conservation and use. The three possible levels of stakeholder participation in PGRFA can be identified as:

- those that are consulted in the determination of priorities as well as often in the activities themselves;
- those that actually control the allocation of the research budget and
- those that participate in the funding of agricultural research and, hence, have a strong incentive to control proper allocation and use of the resources.

Most of the stakeholder participation in Morocco involves the first category – that of voluntary consultation. The second type of participation is still relatively rare but is being increasingly promoted by a few donors. The third type of participation is quite common for certain types of activities, particularly for research activities on commercial crops.

Farmer participation is taking place in the problem-identification and priority-setting phases of *in situ* research and development activities on PGRFA as well as increasingly during the implementation and evaluation phases. Participatory research is an improvement on the supply-driven linear research models and tends to work well for Moroccan farmers who are integrated into the market, well organized and capable of articulating their needs. Participatory research approaches have been promoted throughout Morocco. However, these approaches are not entirely effective as a technology transfer mechanism because they only reach a small fraction of the farmers, and tacit knowledge does not readily and systematically extend to other farmers. In this regard, small-hold farming organizations should be encouraged to ensure that they have full participation in national PGRFA priority setting as key stakeholders. Hence, there is a need to revise the role

of cooperatives and farmers' associations and ensure that they have sufficient scope to be able to improve the efficiency of their markets for input and output, achieving economies of scale in purchasing, sales, credit delivery and extension.

Ensuring the participation of stakeholders means developing more efficiently run custom systems, Ministry of Environment, Ministry of Interior and other departments as well as partners from the private sector and civil societies that have become more involved in the protection of the environment and the valorization of local genetic resources.

14.5. Increasing available resources

The implementation of the ITPGRFA deserves a sustained increase in resources. These resources can be of various origins: public, private or international. The allocation of resources to support activities related to PGRFA should be considered as mid- and long-term investments in the agricultural sector and Moroccan economy. Structural budgets dedicated to PGRFA should be identified at the level of government that is in charge of coordinating the ITPGRFA's implementation. Mechanisms and procedures of funding activities facilitating the implementation of the Treaty and mobilizing relevant partners around such activities should be put in place.

The role of the private sector in PGRFA can be enhanced by innovative public-private partnerships. Intellectual property rights remain a significant constraint in these actions, and they should be successfully addressed. To facilitate public-private partnerships beyond this level, there is a need to invest in basic communications infrastructure as well as to cultivate a climate of trust between the two sectors.

14.6. Adequate access to information and technology

Currently, the PGRFA information system is weak in Morocco. Improving stakeholders' access to information is an urgent task that can be accomplished by:

- disseminating information about the ITPGRFA and its specific details in forms that are best suited to the target audiences;
- ensuring that existing information, technology and capacity is put to a more effective use;
- ensuring that breeding-relevant information on PGRFA is accessible for all users;
- reinforcing the national coordination of activities related to the exchange of germplasm and information with foreign countries and international centres and
- elaborating an *ex situ* inventory under the mandate of the central authority (the constitution of databases is a high priority in order to take advantage of the existing information as well as enable scientists and breeders to use the available information).

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CHALLENGES AND OPPORTUNITIES FOR THE PHILIPPINES TO IMPLEMENT THE MULTILATERAL SYSTEM OF ACCESS AND BENEFIT SHARING

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1. Introduction

The Philippines is a signatory to the most important international agreements, treaties, conventions and trade agreements that impact biodiversity conservation in general and plant genetic resources conservation and use in particular. The country is a party to the Convention on Biological Diversity (CBD); the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA); the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA); the International Plant Protection Convention (IPPC); and the World Trade Organization's (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement).[1] The country and its relevant institutions actively participate in the following international programmes on PGRFA: the Agricultural Technical Cooperation Working Group to the Asia-Pacific Economic Cooperation (APEC); the International Network for Genetic Evaluation of Rice (INGER) of the International Rice Research Institute (IRRI); the International Network for the Improvement of Banana and Plantain (INIBAP); the Banana and Plantains Network (BAPNET); the International Coconut Genetic Resources Network (COGENT); and the Asian Vegetables Network, among others. The Philippines's involvement in these international conventions and initiatives shows the country's will to enhance international collaboration for a better conservation and use of biodiversity in general and of plant genetic resources for food and agriculture in particular.

A central element of such international collaboration is the FAO's Global System for the Conservation and Utilization of Plant Genetic Resources for Food and Agriculture (PGRFA). The global system was developed with the main objectives of ensuring the safe conservation of PGRFA and promoting its availability and sustainable utilization, for present and future generations, by providing a flexible framework for sharing the benefits and burdens. Its main components are international agreements, global instruments, global mechanisms, codes of conduct and international standards. The ITPGRFA is the most recent and progressive element of the global system. During the negotiations that led to the adoption of the Treaty, country representatives considered many components of the global system and their potential contribution to the implementation of the Treaty.

Countries' active engagement in the different components of the global system and, in particular, their participation in the multilateral system of access and benefit sharing of the ITPGRFA relies on the collaboration and mutual support between countries and international agencies, including the centres of the Consultative Group on International Agricultural Research (CGIAR). One of the objectives of the project, Collective Action for the Rehabilitation of Global Public Goods in the CGIAR's Genetic Resources System: Phase 2 (GPG2), which is coordinated by the System-Wide Genetic Resources Programme of the CGIAR and funded by the World Bank, is the promotion of international collaboration on conservation in the context of the evolving global system. For this reason, one of the activities of the project focused on identifying countries' incentives and constraints to participating in the global system and, in particular, in the multilateral system of the ITPGRFA. As part of this activity, four countries were identified to serve as models for analyzing the incentives and constraints. The Philippines was one of these four countries.

The present article is the result of an analysis of incentives and constraints for the Philippines to actively participate in the global system and, in particular, in the multilateral system of the ITPGRFA. In the following sections, we will: (1) present relevant information with regard to plant genetic resources conservation and use in the Philippines that shows the country's own capacities and level of dependence on other countries' resources; (2) discuss the level of awareness of different stakeholders in relation to different elements and aspects of the global system and of the Treaty's multilateral system of germplasm exchange; (3) analyze the current legal framework and how it affects conservation and use of PGRFA and (4) present some conclusions with regard to the identified incentives and disincentives and propose some recommendations for the country's effective participation in the global system.

2. Methodology

To generate the information needed, different research tools were used: a survey of relevant institutions and persons, interviews, desk studies and a review of current literature in the Philippines. The data generated from these surveys, desk studies and interviews were collated and analyzed. To validate the results of such analysis, a draft report was sent to the respondents and presented during a national workshop held on 11 September 2009. The draft report was revised based on the results of this workshop, which was attended by a total of 31 participants.

2.1. Stakeholder survey and interviews

The survey and the interviews aimed to assess the degree of knowledge of, and perceptions about, the global system as well as the multilateral system of access and benefit sharing under the ITPGRFA and also to identify the incentives and disincentives for the country to actively participate in these international instruments. We first discussed the criteria necessary to select the stakeholders to participate in a survey questionnaire and decided that organizations with significant germplasm collections, those involved in PGRFA policy formulation and implementation, and plant breeding organizations should be included. We then classified the stakeholders according to four different categories: head of office; breeder; gene bank curator; and staff in charge of policy and assigned only one category for each respondent in order to prevent multiple counting.

Two sets of questionnaires were developed and circulated. The first aimed at assessing the awareness level of the respondents on the ITPGRFA and its important provisions. The second focused on: (1) the perceptions of the respondents on the multilateral system; (2) the difficulties encountered in accessing germplasm and related information; (3) the information systems to document PGRFA conservation, exchange and use in the Philippines and (4) international cooperation and partnerships on PGRFA activities in which the Philippines is involved. In the actual conduct of the interviews and surveys, the project team provided a brief overview of the GPG2 project. A fact sheet highlighting the salient features of the Treaty was also used as reference material for the respondents in completing the survey questionnaire.

2.2. Desk studies and a review of literature

Desk studies were carried out to obtain benchmark data on the use, distribution and exchange of germplasm during the last 20 years. Information from manual and computerized records of germplasm introduction, breeding histories, crosses (hybridization) conducted that include details of pedigrees and sources of parents and germplasm distributed (including breeding lines) were gathered. This approach was applied as a means of assessing the access, use and distribution of PGRFA materials by various Philippine institutions. While conducting these desk studies, we consulted genebank curators and breeders in order to understand the difficulties that were encountered when accessing PGRFA materials and related information from national and international sources during the period covered by the study. We also reviewed and analyzed national legislation, policies, procedures and structures that have affected the ability of organizations within the Philippines to receive or supply germplasm internationally. In order to understand the level of public awareness on PGRFA in general, and the global system in particular, existing literature was consulted.

3. Agriculture and plant genetic diversity in the Philippines

The agriculture sector comprises approximately 19 percent of the gross domestic product in the Philippines. The leading crops are rice, maize, sugarcane, coconut, bananas, mangoes, pineapples, cassava, coffee, sweet potatoes and eggplant. In terms of the amount of land cultivated, the most important crops are rice, coconut, maize, sugarcane, bananas, cassava, coffee, mangos, sweet potatoes and Manila hemp (Altoveros and Borromeo, 2007).

The Philippines is part of the centre of diversity for rice, bananas and coconut. There is at present a total of over 5,500 collected and documented traditional varieties of rice and four wild relatives of *Oryza*, which are

currently being used to broaden the genetic base and incorporate resistance genes in improved varieties. The diversity of ecosystems, cultural management practices, preferences and use in the Philippines contribute to the diversity of rice. A total of 224 varieties (most of them traditional) of coconuts have been documented. For bananas, more than 90 varieties have been identified. In the case of maize, a number of native varieties of both white and yellow maize show unique characteristics that can be found throughout the maize-growing areas of the country (Altoveros and Borromeo, 2007).

Rice is the staple food of over 89 percent of the Philippine population, and rice farming is the source of income and employment to 12 million farmers and family members. Despite the huge domestic production of rice (around 15 million metric tons per year), the Philippines is one of the world's biggest importers of rice. Around 12 percent of the domestic consumption is satisfied with imported rice (Dawe et al., 2006). Among the export crops, bananas, coconuts and pineapples are at the top of the list (FAOSTAT, 2009).

Several inter-related factors have contributed to the loss of plant genetic diversity in Philippine agriculture, including habitat loss and degradation; biological, chemical and environmental pollution; displacement of indigenous crop species and varieties by modern varieties; natural disasters; abiotic stresses; late recognition and development of an *in situ* conservation system of indigenous crop species and fragmented institutional activities on plant genetic resources conservation (Altoveros and Borromeo, 2007).

4. Overview of PGRFA conservation, research and use: Where does the germplasm come from?

4.1. Conservation and research

There are 44 governmental and non-governmental organizations that hold *ex situ* germplasm collections in the Philippines, totalling 64,000 accessions. The largest collections are those held by the National Plant Genetic Resources Laboratory (35,492 accessions), the Philippine Rice Research Institute (PhilRice) (5,861 accessions), the National Crop Research and Development Centres under the Bureau of Plant Industry (2,472), PhilRootCrops (2,013) and the former Department of Agronomy (1,394). In addition, the International Rice Research Institute holds 117,000 accessions. The national collections were acquired through direct collecting by researchers from different parts of the country (60 percent of all accessions), through exchange with local and foreign institutions (18 percent) and through donations (22 percent) (Altoveros and Borromeo, 2007).

Breeding activities in the Philippines are mainly conducted by state colleges and universities, agriculture research institutions, private companies (particularly for rice, maize and vegetables) and, to some extent, civil society organizations (CSOs) that are affiliated with farmer breeders. Some of the breeding programs, including those run by CSOs and farmers' organizations, involve all stakeholders from the setting of the breeding objectives to the selection of parental lines as well as in the selection of segregating generations through participatory approaches. Most crop breeding programs, however, only involve farmers in setting breeding priorities and in the selection of varieties (see Table 1).

Table 1: Breeding Institutions in the Philippines and Crops

Name of breeding institution	Location	Crop/s
Allied Botanicals	Pangasinan	Maize, vegetables
Bureau of Plant Industry – Baguio National Crop Research and Development Center (BPI-BNCRDC)	Baguio City	Potatoes, strawberries, citrus fruits
BPI-BNCRDC	Los Baños, Laguna	Cowpeas, yardlong beans, mungbeans
Benguet State University (BSU)	La Trinidad, Benguet	Common beans
Central Mindanao University	Musuan, Bukidnon	Maize
Corn World		Maize
Crop Science Cluster (CSC), College of Agriculture,, University of the Philippines Los Banos (UPLB)	College, Laguna	Maize, rice, sweet potatoes, cassava, mungbeans, cowpeas, vegetables, tropical fruits
Cagayan Valley Integrated Agricultural Research Center	Ilagan, Isabela	Maize
East West	Lipa City, Batangas	Vegetables
Mariano Marcos State University (MMSU)	Batac, Ilocos Norte	Yams, fruits, vegetables
Monsanto	General Santos City	Maize
Northern Philippines Root Crops Research and Training Center (NPRCRTC), BSU	La Trinidad, Benguet	Sweet potatoes, potatoes, common beans
Philippine Coconut Authority – Zamboanga Research Center (PCA-ZRC)	Zamboanga City	Coconuts
Philippine Rice Research Institute (PhilRice)	Munoz, Nueva Ecija	Rice
University of Southern Mindanao Agricultural Research Center (USMARC), University of Southern Mindanao (USM)	Kabacan, North Cotabato	Maize
Visayas State University	Baybay, Leyte	Sweetpotatoes, cassava, yams, taro, maize, coconuts

Breeders from public breeding institutions obtain the materials used for crop improvement from several sources. The CGIAR centres and their crop networks are the main sources of breeding lines for many of the major crops such as rice, maize, sweet potatoes, potatoes, cassava, coconuts, bananas, mungbeans, peanuts, and pigeon peas, among others. Other sources of material are local and foreign research institutions. Many breeders also source their materials from colleagues in the national and international research community. For fruits, the varieties produced are generally seedling selections both from local materials and foreign introductions.

Systematic crop improvement programs managed by farmer organizations are a relatively recent development in the Philippines, although farmers have been practising selection for years. The efforts are mostly within farmers' organizations affiliated with the Southeast Asian Regional Initiatives for Community Empowerment (SEARICE), Farmer-Scientist Partnership for Development (MASIPAG) and the National Initiative on Seed and Sustainable Farming in the Philippines (PABINHI). The materials used include early and advanced segregating generations, elite lines and varieties. These may come from local breeding institutions, fellow farmers or breeding institutions from other countries through exchanges facilitated by CSOs.

Desk studies based on germplasm introduction and pedigree records (unpublished Crop Pedigree Records from 1989 to 2009) show the following data regarding germplasm flowing into the Philippines for research, conservation and cultivation purposes. Over 20 years from 1989 to 2009, 94 countries were sources of germplasm used in crop improvement, incorporated in *ex situ* gene banks or for direct use (that is, cultivation), and 58 countries served as donors of germplasm used in the crop improvement of nine crops. The highest number of introductions recorded is for rice (1,384 introductions from 47 countries), followed by maize, potatoes, *Vigna* sp., *Phaseolus* sp., sorghum, bananas, eggplant, *Brassica* and sweet potatoes, in order of decreasing number of introductions. Although sorghum and eggplant have fewer introductions, the number of countries that provided their sources of germplasm were higher compared to other crops, except for rice and maize. The CGIAR centres were major providers of germplasm. Peru is the top donor country (mainly of potatoes) while the United States, South Korea, Taiwan, India, China, Nigeria and Japan provided at least six types of crop germplasm to the Philippines. Table 2 summarizes the origins of the germplasm introduced in the Philippines for the mentioned crops.

Table 2: Sources of Germplasm Utilized in Crop Improvement in the Philippines

Crop	Provenance
Rice	*IRRI, Indonesia, Australia, China, Iran, Ivory Coast, Thailand, India*
Maize	*International Centre for Maize and Wheat Improvement (CIMMYT), South Korea, United States*
Potato	*International Potato Center (CIP), United States, Netherlands*
Vigna spp (mainly mungbeans)	*Asian Vegetable Research and Development Center (AVRDC) (note that the collection held at the Institute of Plant Breeding's National Plant Genetic Resources Laboratory(IPB-NPGRL) serves as the AVRDC's duplicate collection)*
Phaseolus spp (mainly *Phaseolus* vulgaris)	*United States*
Bananas	*Regional Musa Collection in Papua New Guinea, International Transit Centre in Belgium, Indonesia, Honduras*
Eggplant	*Turkey, India, Nigeria, Iran, AVRDC, Sudan*
Brassica	*South Korea*
Sweetpotatoes	*China, Malaysia*
Peas	*South Korea, United States*
Citrus fruits	*United States, Spain, AVRDC*
Sunflowers	*South Korea*
Chickpeas	*Nigeria*

Published pedigree records from the National Seed Industry Council (NSIC) show that 422 out of 609 (69 percent) formally released crop varieties (that is, those registered with the NSIC) have utilized foreign germplasm. Maize and rice have the highest number of varieties developed using introduced germplasm (mostly from Mexico and Indonesia, respectively). Released varieties of cassava, potatoes and mungbeans were developed using germplasm from Colombia, Peru and Taiwan, respectively. In addition, all of the rubber varieties were derived from germplasm coming from Malaysia, while cacao and tobacco were developed from US and South American materials. Eight coconut varieties were bred from materials from the Ivory Coast, Solomon Islands and Thailand, while citrus-released varieties were developed from germplasm

coming from the United States, Spain and Taiwan. Parent materials for sweet potatoes were from Peru, China and Japan and for Phaseolus and pea varieties, the origins are found in Colombia and the United States, respectively. Based on pedigree records of the rice varietal improvement program at UPLB, 3,508 out of 5,457 (64 percent) rice crosses conducted from 1989 to 2009 utilized IRRI breeding/stable materials. In conclusion, foreign germplasm has contributed greatly to the development of improved and high-yielding varieties in the country.

Most of the foreign germplasm goes to university-based research institutions that have active research or breeding programmes in collaboration with the CGIAR centres or other institutions that maintain germplasm collections. Prior to the adoption of the CBD, the transfer of germplasm to Philippine organizations for crop improvement and production took place through inter-country exchanges. After the CBD came into effect, access to germplasm was facilitated by collaborative undertakings such as crop networks and through the international gene banks of the CGIAR and the AVRDC. Some plant breeders declared that they found it easy to access germplasm from foreign national gene banks and seed companies before the CBD came into force. A letter of request was sufficient to obtain the materials. After the CBD, access became more difficult. In fact, national foreign gene banks often sent no responses to the breeders' requests. There is a perception that some countries have become very 'restrictive' in terms of germplasm sharing.

Some breeders from research institutions have expressed difficulty in accessing seeds from abroad particularly after the ITPGRFA came into force, compared to pre-CBD period. The difficulty encountered by these breeders was due to a lack of response from the agencies from where the germplasm materials were requested. Other common difficulties encountered in accessing germplasm include the long processing of documents for quarantine requirements and the complexities involved in transport and custom requirements.

Baseline data show a decline in germplasm introduction from other countries in the last 20 years. The greatest amount of germplasm used in crop improvement occurred during the pre-CBD period and decreased significantly after the ITPGRFA came into effect. The most likely reason for this shift is the low priority and reduced funding that has been provided for public research, including the breeding of root crops, vegetables and field legumes.

Local plant breeders generally do not encounter problems in accessing germplasm from local sources except for some cases where some institutions have not provided segregating materials or have only provided advanced breeding lines of rice. Farmer-to-farmer seed exchanges, both domestic and international, pose no problem according to CSOs.

It is evident from the above findings that the major research institutions and researchers working on crop improvement, crop and seed production have extensively utilized foreign germplasm in their research activities. This is manifested in the participation of various researchers and research institutions in the major international crop networks, and the continued exchange of germplasm among foreign donors and research institutions over the last 20 years. This is also a clear indication that access to foreign germplasm is an incentive for the Philippines to participate in the global system and the multilateral system of the ITPGRFA in particular. However, the recent experiences of some breeders who have had difficulty accessing foreign germplasm may deter the participation of Philippine organizations.

Data on the distribution of varieties from the Philippines to foreign countries are inadequate partly because most of the distributions and requests are solely based within the Philippines and some institutions do not systematically record whether distributions are done locally or internationally. In addition, some records have been destroyed by fire or typhoon. Based on available records, 256 accessions were distributed to 13 countries from 1989 to 2009. *Vigna*, rice and *Phaseolus* were the highly distributed crops among the18 crops surveyed, and South Korea, mainly through the Rural Development Administration (RDA), received the highest number of samples of these two species. The *Vigna* distributed to Australia was mainly requested by a company called the Desert Seed Company. These crops were mainly distributed by the IPB-NPGRL, except rice where CSOs and government non-academic institutions were involved.

The annual average amount of germplasm sent to other countries decreased after the CBD came into effect and increased after the ITPGRFA. The effect of the adoption of the Standard Material Transfer Agreement (SMTA) is not yet felt because no local institution has used it for germplasm exchange. The decrease in the distribution of germplasm is in part due to the exercise of the Philippines's sovereign rights over its genetic resources through Executive Order 247 on Prescribing Guidelines for Bioprospecting. The increase in distribution after the ITPGRFA coincided with the approval of the Wildlife Resources Conservation and Protection Act and Joint Administration Order no. 1, which exempt PGRFA that is to be used in conservation and research activities from the regulations on bioprospecting. However, It is not possible to draw a conclusion on the distribution of germplasm in the Philippines because of inadequate records. There are many institutions in the country that did not systematically keep track of all of the germplasm distributed. For example, it was a common practice not to keep records of materials given to walk-in visitors. This is also a common practice among farmers.

5. Information technology

All the 18 institutions with germplasm collections surveyed maintained manual records of their collections and crosses. In addition to their manual records, 12 of these institutions also used Microsoft Excel, Word, Access or other in-house computerized documentation system to store their data. The manual records as well as Microsoft Office records are both open to the public upon request. One CSO uses what it calls a simplified evaluation system database for its own use only. Farmers' organizations maintain manual records that are open to network members and fellow farmers only. PhilRice uses an in-house germplasm information system called Germplasm Management Systems, a Filemaker-based program that operates on Apple computers. Only trained staff can store and retrieve data, but the database is open to 'walk-in' researchers.

Of the eight institutions that have not computerized their records, two are farmers' organizations that do not have access to computers. The remaining institutions do not maintain large collections, and the existing manual system can adequately take care of their documentation needs. The eight institutions without computerized documentation systems hold less than 5 percent of the total national germplasm collections in the country. Only one of them (the Bureau of Plant Industry's Los Baños National Crop Research and Development Center (BPI-LBNCRDC)) holds over 1,000 accessions, of which the majority are duplicated in the IPB-NPGRL. Therefore, the lack of computerized documentation systems in the remaining institutions most likely will not have any appreciable effect on national efforts towards PGRFA conservation and use.

PhilRice has plans to make documentation systems available online, although no definite timetable has been given. Its implementation, however, has been hampered by funding constraints and the institutions' determination that it is a low priority activity. There are two online databases open to the public to which Philippine institutions contribute, namely the International Network for Genetic Evaluation of Rice (INGER) and the Musa Germplasm Information System (MGIS). One online database called the Coconut Genetic Resources Database (CGRD) is open for COGENT member countries only. The online databases of the CGIAR centres and the national gene banks are of course available to all users.

Most of the information associated with the germplasm collections is in manual form due to lack of staff and computers. Documentation and information management usually are additional responsibilities of the staff involved in crop improvement and, hence, are not prioritized. In addition, the availability of computers mainly dedicated to this activity is wanting. The bigger problem is the difficulty of accessing these computerized documentation systems. The banana and coconut collections of the Bureau of Plant Industry's Davao National Crop Research and Development Center (BPI-DNCRDC), the IPB-NPGRL and the PCA-ZRC are documented in the databases of INIBAP and COGENT and are therefore available online. For the remaining crops, the databases are not available online, and this is especially true for accession-level documentation. Users will therefore have to make the effort to personally go to these institutions to access the information.

These limitations can definitely affect the use of PGRFA held by Philippine institutions since the information about individual accessions is not easily accessible. The information on Philippine germplasm collections available on the NISM website is summary information, not accession-level information. The information from the NSIC and the Plant Variety Protection Office (PVPO) that is available online is limited to recommended and protected crop varieties only. The non-availability of information online will limit the use of available conserved germplasm in institutions.

The documentation from *in situ*/on-farm activities that has been conducted by research institutions in the Philippines also presents important limitations. These activities were normally part of students' theses on rice and coconut aimed at identifying the factors that promote or discourage the maintenance of crop diversity on-farm. Information on the populations and the variety diversity maintained on-farm was documented as part of the research methodology. Information generation is one-off –that is, there is no follow-up or continuity after the research is completed. The information is therefore valid only up to the time that the research was completed. There are two cases currently in operation in which farmers' varieties maintained on-farm are being documented manually by the farmers themselves and overseen by CSOs. MASIPAG collaborates with another CSO, BAKAS, and maintains manual records of its collection of traditional rice varieties. A farmers' organization in Bohol, the Campagao Farmers' Research Association, which collaborates with SEARICE and the CVSCAFT, has a community biodiversity registry where materials conserved on-farm are recorded. SEARICE initially uploaded the information from the community registry on their website, which was later removed in order to comply with Executive Order no. 247 (discussed in detail later in this article) that states that it is necessary to secure the farmers' prior informed consent before information about their materials can be accessed.

6. Access to germplasm by farmers: Formal and informal seed systems

Germplasm flows and the national seed supply system in the Philippines have two major components, the formal and the informal systems. The formal seed system is administered and regulated by the government according to the 1992 National Seed Industry Development Act (Republic Act 7308). It is through this system that most of the products of the plant breeding institutions are channelled. Formal institutions (breeding centres, the seed certification agency, seed producing units, and distribution centres) are part of this system. The breeding centres could be private seed companies or government research agencies. The BPI is the mandated seed certification agency for the country. Seed production and distribution units or centres may also be government or private institutions. There are also occasions when farmers serve as seed producers themselves under a contract-growing system with the government or private seed agencies.

Prior to the entry into force of Republic Act 7308, the Philippine Seed Board was in charge of national variety testing and the recommendation of certain crop species, including rice, maize, soybeans, mungbeans, cotton, sweet potatoes, cassava, tomatoes, eggplant, yard-long beans, cowpeas and tobacco. For other crop species, such as ornamental species and fruits, the Seed Board implemented variety registration. After Republic Act 7308 was enacted, these functions were taken over by the NSIC.

The procedures for variety testing and recommendation adopted by the Seed Board and the NSIC are the same. These procedures were developed by the technical working groups of the different crop species. The National Seed Quality Control Services (NSQCS) of the BPI controls and supervises field inspections, seed and plant material certification and seed quality testing. The materials produced must meet standards of purity (true to type) and quality set by the NSQCS, after which they are issued certification tags according to the set criteria. Certified seeds and planting materials, as well as good seeds, are those that are sold in the formal system. Seed-planting materials marketed by traders range from products from the public sector's breeding programmes (for example, rice, maize, mungbeans, peanuts and vegetables), private seed companies in the Philippines (hybrid rice, maize and vegetables) and foreign introductions (vegetables and fruits).

In the informal seed system, the farmers are the main players. The volume and value of this system cannot be calculated accurately, but in the Philippines it is estimated to account for about 80 percent of the total seed

supply system. For farmers' traditional varieties, the government does not certify the seeds or the methods of their reproduction/multiplication, yet they are sold in the seed shops and markets all over the country. However, without government certification, there is no certainty of the identity and purity (quality) of the varieties. On the other hand, the informal system of distribution ensures the continued use and cultivation of traditional varieties and therefore their conservation. Even without support from the government (such as crop loans and crop insurance offered only in the formal seed supply system), farmers continue to plant these varieties because there are regular consumers. Without the informal seed supply system, therefore, there would be no mechanism to reproduce the seeds of traditional varieties of crops.

In practice, the formal and informal seed systems are not mutually exclusive. Products of the informal system may become part of the formal system and vice-versa. The most common examples of farmers' varieties entering the formal seed system are tropical fruits, vegetables and one variety of rice. In the case of formal varietal releases that become part of the informal system, farmers continue to derive their planting materials from the succeeding harvests and exchange or sell their seeds with other farmers. They do this until the varietal purity has deteriorated and then they go back to the formal sources of planting materials for fresh batches of seeds. The research and government agencies may indirectly facilitate farmers' exchanges by providing small quantities of initial planting materials for newly developed varieties by the formal system. Generally, farmers go to research institutions in the Philippines to obtain planting materials of improved germplasm. Farmers can then exchange seeds after the first planting. Simultaneously, there are farmer-breeders associated with some CSOs who also request traditional varieties for use in their breeding activities. There are no difficulties associated with this mode of access to germplasm. However, users frequently complain about the limited number of accessions and the poor germination of the seeds that are received.

There have been examples of international exchange of traditional varieties among farmers. In the 1980s, the regional CSO SEARICE facilitated exchanges of varieties among farmers through a global program entitled Seeds of Survival, in which the heads of participating institutions accessed and exchanged seeds from partner institutions and distributed them to farmers. In 1995, farmer-to-farmer exchanges were facilitated through cross-country visits throughout Southeast Asian countries as well as through 'farmers' field days,' in which farmers were allowed to select desired varieties directly from the farmers' fields. The cross-country visits and field days were capacity-building components of a variety of global programs, including the Community Biodiversity Development and Conservation program (CBDC) and the Biodiversity Use and Conservation in Asia Program (BUCAP) under SEARICE. There were also exchanges of farmer-developed varieties during regional meetings. MASIPAG facilitated farmers' exchanges by requesting farmers to bring seeds for exchange during meetings, conferences and conventions. Peoples' organizations such as Sustainable Ecological Education Diversity Seeds (SEEDS) and the Pinagkaisang Magkabalikat ng Kabanatuan (PMK) were able to acquire and exchange traditional planting materials of rice, vegetables and root crops through farmer-to-farmer exchanges and the distribution of seeds by CSOs through their regional networks in Bangladesh, Cambodia, China, Vietnam and Indonesia.

We have no knowledge of farmers' organizations that access materials from gene banks outside the country except for those with links to CSOs such as SEARICE and MASIPAG. The CGIAR centres provide genetic materials (pure lines and breeding lines) for crop improvement and for the dissemination of products (variety) through networks such as INGER, COGENT, BAPNET, and Taro Genetic Resources (TAROGEN), among others. However, in order to access these materials the farmers would have to sign a SMTA, and there is a sense of reluctance among farmers to do this since the SMTA is a lengthy technical and legal document that farmers often may not understand fully.

In addition to these options, farmers may also access international and improved germplasm through collaborative projects between formal research institutions and CSOs that represent farmers. The Department of Agriculture collaborates with CSOs on the implementation of integrated pest management in the rice sector through the Kasakalikasan programme. Other institutions that are collaborating with CSOs include the Philippine Council for Agriculture, the Forestry and Natural Resources Research and Development (PCARRD) and the Federation of Free Farmers, which collaborate on a project on Science and Technology-

Based Farms that studies production technologies for cacao trees and banana plants that are cultivated under coconut trees; the CVSCAFT, SEARICE and the Farmers' Consultative Council, a federation of farmers' organizations in Bohol, which are studying the characterization and conservation of traditional and farmers' rice varieties; and the Ifugao State College of Agriculture and Forestry, in collaboration with the Commission on Higher Education (CHED) and Save the Ifugao Terraces Movement (SITMo), which are working on a project entitled Nurturing Indigenous Knowledge Experts among Young Generation of Ifugaos on indigenous knowledge systems associated with the Ifugao rice terraces. Overall, these collaborations are effective in that they are facilitating local institutions' access to foreign germplasm, thus enhancing variety development in the country. Hopefully, these collaborations will be further enhanced once the Philippines fully initiates local implementation of the ITPGRFA.

7. International collaboration

The Philippines is a member of the following networks, programmes and initiatives:

- the Regional Cooperation in Southeast Asia on Plant Genetic Resources, which has participated in the crafting of proposals for the conservation and use of PGRFA in the region;
- the Southeast Asia Banana Germplasm Resources Center, which is based at the BPI-DNCRDC and which, together with national germplasm centres, retrieves and collects all banana cultivars within the southeast Asian region;
- BAPNET, which enhances regional collaboration activities in the following areas: germplasm management, information development and exchange, banana resource development and strategic planning;
- the Asian Network for Sweet Potato Genetic Resources(ANSWER), which focuses on the conservation of sweet potato genetic resources (for example, *ex situ*, *in vitro*, cryopreservation and others) and has also initiated capacity building among member countries with regard to the maintenance, characterization, evaluation and documentation of their respective sweet potato genetic resources;
- the Users' Perspectives with Agricultural Research and Development group of the CIP, which collaborates with the national programme to conduct field research projects, co-organize training and workshops and support publishing and information-sharing activities;
- COGENT, which has a regional network in Southeast Asia including the Philippines (the coconut accessions of Southeast Asia are listed in the CGRD);
- the Agricultural Technical Cooperation Working Group of APEC, which plans and implements information and knowledge exchange, workshops, training, the safe exchange of genetic resources and the harmonization of policies on PGRFA and intellectual property rights (IPRs) among member economies and
- INGER, which facilitates the unrestricted, free and safe exchange of rice germplasm and the free sharing of information not only among the National Agricultural Research and Extension System and the International Agricultural Research Centre partners but also with the private sector in the Philippines for the organized dissemination of improved rice germplasm and information.

During the last ten years, the Philippines has ratified or subscribed to the following international agreements, treaties, conventions, and trade agreements: the CBD, the ITPGRFA, the IPPC and the TRIPS Agreement. The CBD aims to conserve biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. It provides rules for access and benefit sharing for materials accessed after it came into force. It is legally binding and requires ratifying countries to adopt appropriate legislation to be in harmony to the convention. The member states are required to implement measures to ensure the *in situ* conservation of genetic resources. In the Philippines, the National Integrated Protected Areas System Act allows for the conservation of all levels of biodiversity *in situ*.

Since the CBD entered into force in 1993, its implementation has proceeded slowly. It seems difficult to bring together the many disciplines and policy measures necessary to achieve its objectives. The Philippines has so far enacted Executive Order no. 247, which regulates bioprospecting in the country, and Republic Act 9147

(or the Wildlife Act), which implements the provisions of the CBD with respect to access and benefit sharing of genetic resources. There are also provisions on access and benefit sharing in two other laws, the Republic Act 8371 (or the Indigenous People's Rights Act) and Republic Act 7611 (or the Strategic Environmental Plan for Palawan).

The ITPGRFA considers the particular needs of farmers and plant breeders and aims to guarantee future availability of the diversity of PGRFA. The Treaty will facilitate access to PGRFA and the sharing of benefits derived from their utilization. It covers all PGRFA and addresses diverse topics such as conservation, use, international cooperation, technical assistance and farmers' rights. It also establishes a multilateral system and sets rules for access to materials both *ex situ* and *in situ*. The Treaty entered into force on 29 June 2004, with the Philippines acceding to it on 11 December 2006.

The IPPC is legally binding and addresses phytosanitary issues with the transfer of plants and animals. Signatories agree to establish national plant protection organizations that shall regulate the movement of plants and plant products to prevent the spread and introduction of pests and to cooperate with one another to achieve the aims of the convention.

The Philippines, as a member of the WTO's TRIPS Agreement, must comply with the minimum standards of protection of intellectual property, which should ensure the protection of microorganisms, non-biological and microbiological processes and plant varieties that meet protection criteria. In compliance with this agreement, the Philippines enacted Republic Act 9168 (or the Plant Variety Protection Act).

The Philippines' participation in the global system of conservation and use of PGRFA can be assessed by observing the level of engagement of its stakeholders in its key elements, including the GPA, the Code of Conduct on Germplasm Collecting and the National Information Sharing Mechanism. The GPA is a non-legally binding programme that was formally adopted by the representatives of 150 countries including the Philippines during the fourth International Technical Conference on Plant Genetic Resources in 1996. The conference also adopted the Leipzig Declaration, which focuses attention on the importance of PGRFA for world food security and commits countries to implementing GPA. The main aims of the GPA are: (1) to ensure the conservation of PGRFA; (2) to promote sustainable utilization of PGRFA; (3) to promote a fair and equitable sharing of the benefits arising from the use of PGRFA; (4) to assist countries and institutions responsible for conserving and using PGRFA to identify priorities for action and (5) to strengthen national, regional and international programmes. One of the commitments of the Philippines regarding the GPA is that the country will implement programmes and projects in line with the GPA's priority activities and will report periodically on the progress of implementation. There is a general lack of knowledge on the GPA among stakeholders in the Philippines, which means that the priority activities are not considered when conceptualizing and implementing programmes and projects on PGRFA conservation and use. The Philippine's reports to the GPA notwithstanding, the nature and quantity of programmes and projects being conducted prior to, and during, the GPA have remained the same. The code of conduct on germplasm collecting has never been used by germplasm collectors in the Philippines. A code of conduct was developed and incorporated into the implementing guidelines of Executive Order no. 247 on Prescribing Guidelines for Bioprospecting (discussed later in this chapter). To our best knowledge, the FAO's Code of Conduct was not used in the drafting of Executive Order no.247's Code of Conduct. The NISM in the Philippines was developed with the cooperation and full participation of heads of units, policy staff and germplasm curators of government and non-government organizations (NGOs). However, the assessment is that no stakeholders in the country have made use of the information contained in it (or even in the World Information and Early Warning System (WIEWS).

With respect to the international arrangements for the regeneration of unique Philippine materials, three institutions are regenerating the materials of priority crops with the support of the Global Crop Diversity Trust (GCDT). The IPB-NPGRL started the regeneration and characterization of local germplasm of cowpeas, pigeon peas and sweet potatoes in May 2008 and of maize, rice, yams and taro in November 2008. The BPI-DNCRDC is also regenerating local cultivars of bananas with the support of the GCDT. The yam collection

from the VSU is also being regenerated and, at the same time, introduced into *in vitro* conservation at the NPGRL. In addition to this activity, the IPB-NPGRL has collaborated with the AVRDC in regenerating materials collected from the Philippines and from part of the Asian collection of indigenous vegetables. The crops regenerated include amaranth, squash, okra, pigeon peas, *Vigna* spp. and eggplant.

Government-based academic institutions (mostly SUCs) have research collaborations with international research institutions for germplasm exchange (collection), conservation, characterization, evaluation and breeding. For sweet potatoes, yams and major aroids, collaboration has been with the International Development Research Centre of Canada and the CIP; for maize, with the CIMMYT, for cassava, it is with the Centro Internacional de Agricultura Tropical and the International Institute for Tropical Agriculture; for beans and legumes, research collaboration is with the ICRISAT and the AVRDC and for bananas, the cooperation is with Bioversity International's INIBAP. A different collaboration between the IPB-NPGRL and the GCDT was made to support the *in vitro* conservation of banana collections, including long-term conservation for part of the country's banana collection through cryopreservation, as part of the in-trust global banana collection in Belgium. This process aims to strengthen the network of collections in order to improve access to a wider diversity and to safeguard threatened banana cultivars.

Conservation of traditional rice, maize, and sweet potato varieties is the major concern of SEARICE, MASIPAG and. SEARICE is mainstreaming on-farm conservation and participatory plant breeding involving multi-sectoral agencies locally and internationally. There are farmer-to-farmer networks and inter-CSO collaborations as well as government-CSO cooperation. Regional networks include CSOs, government organizations and peoples' organizations in the Philippines, Bhutan, Vietnam, Lao Peoples Democratic Republic, Thailand, Timor Leste, Cambodia, Myanmar, Tanzania, Liberia, Sierra Leone and Congo Democratic Republic. MASIPAG has local collaborations, but the exchange of traditional rice germplasm is through farmer-to-farmer exchange, collaborations and linkages with international peoples' organizations and CSOs. SITMo's activities are limited to the Ifugao province only.

8. Policy, normative and institutional framework

The Philippine Constitution, in its declaration of state principles and policies, affirms that the Philippines 'shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature,' recognizes and promotes the rights of indigenous cultural communities within the framework of national unity and development' and 'shall encourage non-governmental, community-based, or sectoral organizations that promote the welfare of the nation.' These policies serve as the foundation for support for biodiversity (and PGRFA) conservation and sustainable use as well as the participation of civil society, people's organizations and indigenous cultural communities in decision making.

Many national legislations, dating back to 1932, have been enacted to protect and conserve the environment and certain important species; to protect indigenous peoples and their ancestral domains; to establish protected areas, national parks and reservations; to regulate and conduct plant quarantine; to develop crop improvement; to improve PGRFA conservation; to conduct variety testing; to regulate and conduct seed testing and certification; to increase crop production and to enable access to PGRFA and the sharing of benefits, among others.

8.1. Executive Order no. 247 on Prescribing Guidelines for Bioprospecting

Executive Order no. 247 on Prescribing Guidelines for Bioprospecting, which was signed in 1995, regulates access to biological and genetic resources in the Philippines by requiring prior informed consent of local or indigenous communities prior to prospecting as well as an academic or commercial research agreement covering any bioprospecting activities, depending on the purpose of the research. The research agreement requires benefit-sharing arrangements, through royalties and technology transfer, between the Philippine government and the communities from where the biological resources were obtained. The access and benefit-sharing provisions of the Executive Order no. 247 were subsumed under the more comprehensive provisions

of the Joint DENR-Department of Agriculture-Philippine Council for Sustainable Development (PCSD)-National Commission on Indigenous Peoples (NCIP) Administrative Order no. 1. Bioprospecting provisions of Executive Order no. 247 have now been superseded by the Administrative Order no. 1.

Since the enactment of the Executive Order no. 247 in 1995 until the formulation of the Administrative Order no. 1 in 2005, there were only four research agreements approved, all with the University of the Philippines as the access seeker. One applicant (the IRRI) was not able to get its application approved due to the confusion within the national committee that approves applications. The representative from the Department of Health, who sits on the committee, felt that it was outside his department's competency to rule on an application for non-medicinal plants. Other universities and research institutions did not apply for research agreements, but research reports show that germplasm collecting was done after 1995. The National Museum has argued that its research activities do not fall under Executive Order no. 247.

There were also concerns that the procedure to obtain a research agreement was too onerous and burdensome. Some of those in government academic and research bodies – for example in the UPLB – felt that Executive Order no. 247 was discouraging the advancement of research on biological resources. One example cited the case of the locust infestation in Central Luzon in 1996. Executive Order no. 247 requires 60 days for approval of the application to collect locusts (which are classified as a biological genetic resource), with target collecting areas specified. By the time the application would have been approved, the locust swarm would have moved to another location. There is no provision in Executive Order no. 247 for emergency procedures for bioprospecting.

Based on data obtained from the survey, Executive Order no. 247 had no appreciable effect on the participation of Philippine stakeholders in regional and international crop networks. Germplasm of PGRFA continued to be exchanged by national researchers through crop networks. The effect was perhaps felt more by those entities collecting germplasm from farmers' fields and natural habitats, since under these situations the prospective collaborators have had to undertake commercial research agreements and obtain prior informed consent from the communities. Prospective collaborators have also had to contend with many institutions, organizations and persons as well as with the prospect of dispelling the negative publicity of biopiracy, which has been a major concern for civil society. Different institutions responded in different ways to regional and international collaboration in PGRFA research. The UPLB opted not to engage in two collaborative research projects on tropical fruits and indigenous vegetables that have bioprospecting components. Others have continued to collect without research agreements.

8.2. Republic acts

Republic Act 9147, which is known as the Wildlife Resources Conservation and Protection Act, was enacted in 2001 and has access and benefit-sharing provisions limited to the collection of wildlife. Taken on its own, the law follows the ITPGRFA on access to wild species – for example, wild relatives of Annex 1 crops (rice and banana are examples). However, the access and benefit-sharing provisions of this law are addressed, together with all of the other laws, in Administrative Order no. 1.

Republic Act 8371, which is known as the Indigenous People's Rights Act (IPRA), was enacted in 1997 and grants to indigenous cultural communities and indigenous peoples the right to special measures to control, develop and protect their genetic resources and indigenous knowledge. The IPRA requires free and prior informed consent when accessing biological and genetic resources and indigenous knowledge related to the conservation, utilization and enhancement of these resources within ancestral lands and domains. There is no specific provision on benefit sharing in Republic Act 8371.

Republic Act 7611, which is known as the Strategic Environmental Plan for Palawan, grants to the province of Palawan the responsibility for the preservation and protection of biological diversity within that province. Access and benefit sharing to these biological resources are not explicitly stated in the law but are implied in some of its provisions.

8.3. Administrative Order no. 1

To consolidate the different provisions on access and benefit sharing of these and other organic laws, Administrative Order no. 1 was signed in 2005. The guidelines apply to bioprospecting activities conducted by any user, including government agencies, of any biological resource found in the Philippines. The guidelines also apply to all *ex situ* collections of biological resources sourced from the Philippines, except for collections currently accessed under international agreements where the Philippines is a party. The guidelines apply to bioprospecting in all areas, including protected areas and on private lands, as well as to ancestral domains and ancestral lands.

Administrative Order no. 1 spells out in some detail the benefit-sharing arrangements when accessing biological resources, but the mechanisms outlined are more applicable to bioprospecting *in situ* (that is, in natural habitats such as forest ecosystems). Mechanisms and arrangements for accessing PGRFA, whether *ex situ* or on-farm, are not addressed by the guidelines. Administrative Order no. 1 is also very explicit in exempting *ex situ* collections currently accessed under international agreements to which the Philippines is a party, such as the ITPGRFA, thus indicating that the access and benefit-sharing provisions of the international agreements will apply to these *ex situ* collections. However, Administrative Order no. 1 provisions on access and benefit sharing apply to PGRFA that are not in *ex situ* collections (such as materials on-farm and in the natural habitat) and *ex situ* collections of non-Annex 1 crops since Administrative Order no. 1 is silent on this matter. On this basis, we conclude that there is no legal impediment for local institutions and persons to be providers and recipients of germplasm of Annex 1 crops. However, it is our assessment that most holders and users of germplasm in the country are not aware that there is no legal impediment to the access and provision of germplasm. This lack of awareness serves as a disincentive.

In at least four legal instruments (Executive Order no. 247, Republic Act 9147, Republic Act 8371 and Republic Act 7611), the prior informed consent (PIC) of the local and indigenous cultural communities is an important provision. The process of obtaining the PIC, which is based on public notification and sector consultation of all stakeholders in the area, and may entail cooperation with local government units, CSOs and peoples' organizations on-site, can be rather complex and has discouraged potential users. In the four years that have passed since Administrative Order no. 1 was signed, there have been two approved applications for bioprospecting for organisms with medicinal and therapeutic uses. There has been no application for PGRFA.

9. Public awareness

Various CSOs and governmental organizations conduct different activities and mechanisms aimed at raising awareness of PGRFA-related issues in the Philippines. For instance, SEARICE actively runs farmers' field schools, where some sessions focus on PGRFA policy issues. It also holds roundtable discussions, seminars and other events related to PGRFA issues such as World Food Day, PGRFA Day and summer camps.

SEARICE's PGRFA-related advocacies also include publications (technical and policy papers) and other popular forms of information products such as news briefs, comics and posters. Some of its recent publications have been on sustainable conservation and the use of PGRFA and on the protection of PGRFA, especially farmers' varieties, from misappropriation. The publications also deal with the vision and realization of farmers' rights, focusing on on-farm conservation and sustainable use by farmers. SEARICE also publishes popular papers on the Plant Variety Protection Act of the Philippines and on the ITPGRFA. These are also distributed to farmer-partners at conferences and meetings inside and outside the country. They are also available on SEARICE's website.

The BPI counts on different tools and initiatives to create awareness and disseminate information on PGRFA, including the NISM's GPA and the programme entitled Gulayan sa Masa (Vegetable Gardens for the People), in which indigenous vegetables are given priority. However, at present, there is no conscious and systematic effort to raise awareness and spread knowledge about PGRFA. In regard to the multilateral system of the ITPGRFA, in particular, the BPI, in coordination with the TSWG, conducted a Workshop on the Multilateral

System on 16-17 April 2009,at which activities and issues related to the multilateral system, fair and sustainable use, and farmers' rights were discussed. Participants at the workshop included representatives from CSOs, academia and institutions with germplasm holdings. Moreover, through the TSWG, the Philippines was able to get the FAO's approval and funding for the implementation of a project entitled Legal and Technical Assistance Implementing the ITPGRFA with Particular Reference to the Multilateral System of Access and Benefit Sharing. From June 2009 to April 2010, the project will conduct three zonal consultations and one national consultation workshop in order to come up with a draft legal policy/administrative mandate that is related to the implementation of the Treaty.

The Department of Science and Technology's (DOST) research council in charge of the agriculture, forestry and natural resources sectors employs various means for creating awareness, which involves publications, posters, participation in exhibits, radio interviews and news articles (which are also published on its website). Moreover, its capacity-building activities have benefited a total of 140 researchers, curators and policy makers through the following events:

- Training on Plant Genetic Resources Conservation and Management, which was held from 29 May to 2 June 2006 and on 21-25May 2007;
- Training on Plant Genetic Resources Documentation and Information Management, which was held on 5-9 June 2006 and on 4-8 June 2007;
- Training on Plant Genetic Resources Characterization Using Standard Descriptors, which was held on 21-25 April 2008 and
- Consultative Meeting on PGRFA in the Philippines and the Workshop on Laws and Policies Governing PGRFA, which were held on 17-19 October 2007.

An indicator of the level of interest on biodiversity issues in the Philippines is the number of articles published in print that focus on biodiversity issues. Through a media scanning, we yielded 40 agricultural biodiversity-related articles from five national newspapers from August 2007 to July 2009. These newspapers and the number of articles published include *Malaya* (1), *Manila Bulletin* (3), *Business Mirror* (7), *Philippine Star* (16) and the *Philippine Daily Inquirer* (13). Of these, five news articles were published in 2007, 17 in 2008 and 16 in 2009.

Only three news articles mentioned the ITPGRFA: in the *Business Mirror* in October 2007, which reported on the consultative meeting and the Workshop on Laws and Policies Governing Philippine PGRFA, and the two *Philippine Daily Inquirer* articles on 24 February 2008, entitled 'Biodiversity "doomsday vault" comes to life in Arctic' and 'Battle over biological resources.' The rest of the articles featured updates on special research and development projects (for example, a conservation farming village, the conservation of indigenous orchids and the promotion of indigenous vegetables), bilateral agreements on germplasm exchange, new species found, the launching of biodiversity projects and reports and promotional campaigns of the government, international organizations and CSOs, among others.

So far, no local journalist has written regularly or extensively on the ITPGRFA. There were hundreds of articles written on biodiversity in general, mostly focusing on wildlife and forest conservation. These articles have mainly emanated from the efforts of the Association of Southeast Asian Nations's (ASEAN) Centre for Biodiversity, which is based in the Philippines, and the Haribon Foundation. These articles mainly provide information dissemination on activities in national parks, newly discovered and endangered species and announcements on project outputs, among others.

In at least three provinces in the country (based on first-hand information gathered by project staff during field visits and interviews), the focus of the debate has been on misappropriation and plant variety protection, patents and biopiracy. CSOs are active in the information campaign and advocacy in these provinces, and they have influenced the nature of the debate. One peoples' organization based in the Ifugao province has felt that there should be clarification on the link or relationship between the ITPGRFA and the provisions of the IPRA. The great attention paid by the media to certain cases of misappropriation of medicinal plants (such as *Blumea balsamifera, Lagerstroemia speciosa* and *Cananga odorata*) in the 1990s has increased the mistrust between the stakeholders, particularly the CSOs, the peoples' organizations and farmers.

10. The ITPGRFA and the Philippines

10.1. The process of ratification and the first steps towards the implementation of the Treaty in the Philippines

On 24 January 2005, President Gloria Macapagal Arroyo, in a letter dated 29 December 2004, endorsed the ITPGRFA to the Philippine Senate for ratification. This is pursuant to the Philippine Constitution, Article VII, section 21, wherein '[n]o treaty or international agreement shall be valid and effective unless concurred in by at least two-thirds of all the Members of the Senate.' A position paper prepared by a group of scientists from academia and policy staff of a CSO was sent to the Department of Agriculture, the DOST and the Department of Foreign Affairs (DFA). The paper listed the advantages of the Philippines ratifying the Treaty. The secretaries of the Department of Agriculture, the DOST and the DFA sent a joint endorsement letter to the Senate Committee on Foreign Relations recommending concurrence with the Treaty, based on the points raised by the position paper.

The committee then conducted a hearing on 2 February 2006, which was attended by representatives from government organizations (the DENR, the Department of Agriculture, the DOST, the Department of Trade and Industry, the Department of Health, the DFA, the UPLB, the PCARRD, the BPI, PhilRice), the IRRI, CSOs and farmers' organizations. The group strongly supported the Senate's concurrence with the ITPGRFA. Committee Report no. 57 was submitted to the Senate on 15 March 2006, recommending its approval without amendment.

On 14 August 2006, Senator Miriam Defensor Santiago, chair of the Committee on Foreign Affairs, sponsored Senate Resolution no. 412 entitled Resolution Concurring in the Accession to the International Treaty on Plant Genetic Resources. The resolution went through the normal three readings in the Senate. During the deliberations conducted in the Senate hearing, one senator acknowledged the ITPGRFA as a very vital international agreement, while another said it would place developing countries on a more even playing field.

There were questions as to why the negotiations for the ITPGRFA have taken such a long time, and it was explained that contentious issues among the country negotiators included IPRs, access and benefit sharing, and the final list of Annex 1 crops. In regard to the concern that the Treaty would be another WTO-type of debacle, the debates during the negotiation period of the Treaty indicated that developing countries have realized what they have lost to the WTO and have become more militant over their rights. Clarifications were requested on the crops that were to be included in Annex 1 of the Treaty, how they were to be selected, why other important crops have been left out, and why other crops that are not of interest to the Philippines (such as oats and beets, among others) have not been included. It was explained that Annex 1 crops were identified based on food security and interdependence and that while other crops are not important to the Philippines, they are a staple food and/or highly important in other countries.

With respect to the interests of farmers, it was stressed that the Philippines should ratify the ITPGRFA to become a member of the governing body that would propose specific rights for the country's indigenous farmers and to possibly influence the expansion of the crops listed in Annex 1.It was pointed out that the Treaty would guarantee the following benefits for the Philippines: (1) access to crop biodiversity from other parties to the Treaty, which could be useful in improving the Philippine's agriculture and crops; (2) it would provide the country with an equitable share in the benefits arising from crop biodiversity, including financial benefits, capacity building and technology transfer; (3) it will provide access to a standard solution negotiated between governments suitable for crop biodiversity, which substantially reduces the cost of exchange and (4) it will enable participation in all decisions, improvements and revisions to the Treaty starting 90 days after ratification.

On the contrary, it was noted that the ratification would not necessarily compel the Philippines to share its fruits and vegetables unless it is according to the terms of the SMTA. Furthermore, sharing access to the Philippines' genetic resources would be on a benefit-sharing basis – that is, the foreign country will pay the Philippine government part of the profit it makes from the access to the genetic resource.

In regard to the role that the ITPGRFA would play in the implementation of the guidelines for genetically modified organisms (GMOs), it was clarified that GMOs are covered by the CBD's Cartagena Protocol on Biosafety, while the Treaty is focused on PGRFA, including the transfer of technology.[2] The resolution was adopted by the Senate on 28 August 2006 with 17 senators in favour, none against, and no abstentions.

To understand the intricacies of implementing access and benefit sharing for PGRFA within the government in the Philippines, an examination of the structure of state institutions, laws and regulations of relevance for PGRFA management is taking place, and it is expected that the results of this examination will lead to the drafting of the legal framework needed for the domestication of the multilateral system in the Philippines.

The focal agency for the ITPGRFA's implementation is the Department of Agriculture, and it has delegated this responsibility to its line agency, the BPI, with the exception of policy concerns, which are the responsibility of the Policy and Legislative Services Division (PALSD). Agricultural research (including germplasm collection, crop improvement, production and distribution) is done by agencies attached to the Department of Agriculture and by SUCs. The major germplasm collections are held by institutions within or attached to the Department of Agriculture (for example, the BPI, PHILRICE, the PCA-ZRC, the Fiber Industry Development Authority and the Sugar Regulatory Administration), by state universities under the CHED (the VSU and the USM) and the UPLB, which is directly under the Office of the President of the Philippines. The country's largest national germplasm collection is in the UPLB, at the IPB-NPGRL, which is the national gene bank. The UPLB and the other state universities operate with a great degree of autonomy and can enter into contracts independently. They work with, but are not under the control of, the Department of Agriculture. In addition, the PCARRD is the central coordinating agency for agriculture and forestry research (and also a major funding agency) and is under another government department, the DOST, which is a co-equal with the Department of Agriculture.

According to the national focal person, the main benefits that the country can hope to derive from the ITPGRFA include the following:

- The country can take advantage of benchmark information on PGRFA conservation and sustainable use, which will be made available through the country's participation in the Treaty, especially the exchange of information and access to, and transfer of, technology as provided in Article 13.
- The country also stands to benefit from the facilitated access to genetic materials by prospective recipients in the country as provided for in Articles 12.1 and 12.2. It is the understanding in the Philippines that facilitated access to PGRFA in the multilateral system will only be accorded to contracting parties or natural and legal persons that are under the jurisdiction of any contracting party, which offers a concrete advantage for being a signatory to the Treaty.
- In addition, the country could benefit from accessing materials that will answer future needs, especially in light of food security concerns and the threat or opportunities that might occur from climate change.

It is the focal person's belief that the multilateral system may well be a source of options or solutions for the earlier-mentioned concerns.

The main concern of the Department of Agriculture's PALSD regarding implementation of the ITPGRFA is that the Department of Agriculture cannot unilaterally make a policy on PGRFA. It has to coordinate with the other governmental departments and autonomous institutions before a national procedure or mechanism can be implemented and followed by government agencies. This will be an integral part of the domestic legal framework that has to be put in place to access PGRFA through the multilateral system in the Philippines.

In 2008, the Department of Agriculture created a Technical Support Working Group (TSWG) composed of key holders of PGRFA and policy staff of the Department of Agriculture for the implementation of the ITPGRFA. The TSWG has the following responsibilities:

- to formulate the modalities of implementation for the ITPGRFA through plans, programmes, projects and activities;
- to serve as technical experts and advisers for the Philippine representative to the Governing Body of the ITPGRFA;
- to recommend guidelines and necessary institutional measures on access and benefit sharing for PGRFA not included in Annex 1;
- to serve as a temporary clearing-house for material transfer agreements entered into by natural and legal persons and
- to invite the private sector and/or NGOs to meetings of the TSWG, as necessary.

The interests of individuals playing a role in PGRFA management (including farmers and farming communities, indigenous cultural communities, CSOs and the private sector) will need to be included in the domestic legal framework. Such inclusion can be attained by inviting a CSO representative to be part of the national team. The procedure that is usually followed is that the representative receives input from concerned CSOs, farmers' and people's organizations through round-table discussions. This information is then taken to the committee for consideration.

The Department of Agriculture has placed a priority on the multilateral system in implementing the ITPGRFA. However, there have been numerous processes initiated by individuals, as well as by farmers' and peoples' organizations, on other elements of the Treaty. There have been regional consultations and roundtable discussions on farmers' rights and the sustainable conservation and use of PGRFA through participatory plant breeding. The roundtable discussions have focused on one provision of Article 9 of the ITPGRFA – namely the right for farmers to participate in decision making at the national level on matters related to the conservation and sustainable use of PGRFA. Farmers' organizations, people's organizations and SEARICE, which participated in the roundtable discussion, called upon countries to find ways to support farmers' efforts in on-farm conservation, securing local seed systems and managing local biodiversity for sustainable food production and local livelihoods. On-farm conservation and sustainable use by farmers are important operational aspects of farmers' rights. The roundtable discussions were also aimed t providing spaces for farmers' discussions and deliberations in order to help them define what farmers' rights really mean (CBDC Network, 2009; SEARICE, 2008; SEARICE, 2007; CBDC, 2006; Breen, 2009; La Viña et al., 2009).

10.2. Level of awareness of, and perceptions on, the global system and the ITPGRFA in the Philippines

In this section, we have summarized the results of the survey we conducted as part of this study. The survey aimed at (1) assessing the level of knowledge on the global system and the Treaty and (2) understanding stakeholders' perceptions on the Treaty's multilateral system. A total of 93 stakeholders participated in the survey, including private seed companies (PSCs), CSOs, farmers' organizations, people's organizations, government organizations such as SUCs and various agencies of the Department of Agriculture. The staff chosen for the survey consisted of unit/agency heads, breeders, curators and staff from these institutions and organizations involved in policy studies, research and advocacy.

Table 3: Name of Institutions and Agencies and Corresponding Number of Respondents

Institution type	Name of Institution	Number of responses
Government organization-based academic (4)	CSC's Institute of Plant Breeding, UPLB	10
	USMARC, USM	5
	NPRCRTC, BSU	2
	MMSU	9
Government organization-based non-academic (8)	PhilRice	14
	BPI- BNCRDC	6
	BPI- LBNCRDC	6
	BPI-DNCRDC	2
	BPI's Central Office	6
	Department of Agriculture'sPALSD	2
	PCA-ZRC	4
PSC (1)	East West Seed Company	4
CSOs (7)	SEARICE, Manila	7
	SEARICE, Bohol	2
	SEARICE, Mindanao	2
	MASIPAG	1
	PMK*	1
	SEEDS*	6
	SITMo**	2
Total	20	93

*Notes: * Farmers' organization; ** People's organization*

The total germplasm holdings of these institutions amount to 46,179 accessions or almost 89 percent of the total national germplasm collection. All of the major plant breeding institutions in the country, with the exception of one, are in the respondent agencies. The exception, the Visayas State University, did not reply to our request to visit and interview its staff. The three most active CSOs and peoples' organizations in PGRFA conservation, use and advocacy in the Philippines, with the exception of one, together with the farmers' organizations, are also represented. The exception, the Tebtebba Foundation (a CSO), was requested to participate in the survey but declined because they said that they are only in the planning stages of PGRFA conservation and use. In addition, their advocacy concerns are in the general field of indigenous peoples' rights over biodiversity, and they have not initiated activities on PGRFA.

Responses were grouped according to (1) the type of institution and (2) the designation of the respondents (head of office, breeder, gene bank curator and staff in charge of policy). This organization helped us assess the trends in perceptions, opinions, concerns and recommendations. In turn, the assessment will be useful in identifying target stakeholders (institutions and designations) for future strategies designed to promote the participation of the stakeholders from the Philippines in the global system of PGRFA conservation and use and the multilateral system of the ITPGRFA.

10.2.1. General awareness of the ITPGRFA

Thirty-eight percent of the respondents declared that they had limited awareness of the ITPGRFA. Of these, 42 percent were from government institutions, 15 percent from CSOs and 50 percent from PSCs. Among the respondents, 71 percent of those who were not aware were breeders, 14 percent were curators, 11 percent were heads of agencies and 4 percent were in policy. Therefore, awareness campaigns on ITPGRFA will need to target breeders, heads of agencies and gene bank curators.

While almost 50 percent of the respondents were aware of the Treaty, most of the respondents showed a limited or lack of understanding of the scope and provisions of the multilateral system. If we arbitrarily set the acceptable score at 16 correct answers out of 26questions (62 percent of the respondent provided correct answers, based on the standard used in academia in the Philippines), while of the respondents who indicated that they were aware of the ITPGRFA, only 46 percent actually have good understanding of the provisions of the Treaty. If those who do not have a good knowledge of the Treaty are added to the respondents who initially indicated that they were not aware of the Treaty, then 72 percent do not have a good understanding of the Treaty. This percentage is significant, considering that the target respondents are the individuals who are actually involved in PGRFA conservation, use and policy in the Philippines. If, among this target group (who are expected to have more extensive knowledge on PGRFA), the level of knowledge is very low, then we can safely assume that the level will be even lower among the rest of the population, including lawmakers and those outside the fields related to PGRFA. The lowest level of understanding was from the PSCs followed by government organization-based academic institutions. By designation, the lowest level is among the breeders, followed by the curators, which presents a clear indication of where information should be targeted.

Most respondents, however, were knowledgeable about the purpose for the materials that were accessed from the multilateral system (that is, for research, breeding and training) and about the fact that Annex 1 included crops important to global food security and interdependence. Most respondents did not respond correctly about what crops are included in the multilateral system and to whom the commercial benefits should accrue for materials accessed through the system. This inaccuracy means that we need to focus on these aspects of the Treaty if an information campaign is to be conducted.

10.2.2. Perceptions of the global system of conservation and use of PGRFA

To gather a general perception of the global system in the Philippines, the respondents were asked to rank the characteristics, components and activities under the global system for the conservation and use of PGRFA. Rankings were assigned weight (one being the most important), and their overall scores were computed in order to arrive at a final ranking. Based on the assessment of the project team, the respondents have a general lack of knowledge about the global system, with the exception of certain components. Respondents from CSOs and their partner farmers' organizations have a good knowledge of the GPA since it is part of their information campaign, and some of them have participated in discussions about it. The majority of government researchers were not aware of the GPA, or, if they had heard of it, they were not familiar with its provisions.

Heads of units, plant breeders and curators from institutions collaborating with regional and international crop networks had a good knowledge of the workings of the crop-specific networks, including the INGER, COGENT, the INIBAP and the ANSWER, among others. The researchers also have a good knowledge of the *ex situ* collections of these specific crops. Stakeholders from the government and from CSOs who participated in the NISM had been exposed to, and were therefore familiar with, this aspect of the WIEWS. The majority of researchers in the government have not heard of the WIEWS. CSOs and at least two government institutions (the BPI and the Department of Agriculture's PALSD) had knowledge of the state of world's PGRFA, while the majority of the researchers from other government institutions were not familiar with it.

In regard to the activities of the global system, comprising (1) survey and collection; (2) conservation and management; (3) utilization; (4) exchange and (5) capacity building, the respondents gave the highest rankings to the survey and inventory of PGRFA; the promotion of diverse farming systems; the promotion of plant-breeding efforts and the promotion of information exchange. On the other hand, respondents placed less importance on promoting the collection of PGRFA, on *ex situ* conservation, on the expanded use of local and under-utilized crops and on the exchange of technology.

We can then conclude that knowledge of some components of the global system – for example, international agreements – is limited to a few individuals, specifically those who attend negotiations in international

forums, which limits the full understanding of the country's obligations. The lack of information about these components limits the full participation of the country in the global system as well as its ability to fully realize the benefits that can be derived from such participation.

10.2.3. Perceptions of the multilateral system on access and benefit sharing

The respondents were asked to rank the following characteristics of the multilateral system according to the importance they gave to each characteristic:

1. to be used only for food and agriculture;
2. no IPRs can be claimed on requested material in the form received;
3. not for non-food/non-feed and industrial uses and
4. no tracking of individual accessions.

The respondents considered 'to be used only for food and agriculture' as the most important characteristic of the multilateral system. 'No tracking of individual accessions' was ranked the least important, which is consistent with the result of the survey on access and benefit sharing. If institutional affiliation is considered, 'no tracking of individual accessions' and 'not for non-food/non-feed and industrial uses' were ranked as being equally least important.

Similarly, respondents were asked to rank the following components of the ITPGRFA:

1. recognition of farmers' rights;
2. facilitated access through the SMTA;
3. thirty-five crops of importance to global food security and interdependence, and 29 forage grasses and legumes;
4. sharing of benefits from commercialization of products derived from materials obtained from the multilateral system;
5. *ex situ* collections held by the CGIAR centres are included in the multilateral system;
6. private contract between provider and recipient and
7. promotion of diversified farming systems through sustainable use.

The respondents considered 'recognition of farmers' rights' and 'facilitated access through the SMTA' as the most important components, and 'private contract between provider and recipient' and 'promotion of diversified farming systems through sustainable use' as the least important.

The respondents were also asked to provide their opinion on the key features of the access rights under the multilateral system:

Access will be provided for the purpose of utilizing and conserving resources for research, breeding and training

There is general agreement (94 percent) across respondent groups that access is provided for use or conservation for the purposes of research, breeding and training. While 79 percent agreed completely, 15 percent raised some concerns. There was reservation in some CSO respondents that the provision may exclude direct use by farmers – that is, farmers may be prevented from planting in their farm for production purposes any material that they access from the multilateral system. This may serve as a disincentive for farmers to put their materials in the multilateral system. One respondent mentioned that access should also include development of new medicine for new health threats and incurable diseases such as HIV. Two respondents noted that in cases where direct utilization for commercial use is allowed, there should be a separate agreement among parties on benefit sharing.

The management of PhilRice felt that their institution should simply be used as a custodian of the rice collections held at their gene bank and that the authority to place the collections in the multilateral system should emanate from the communities and not from PhilRice. It acknowledged, however, that it will abide by the implementation guidelines that the Philippine government, specifically the Department of Agriculture, will establish. For the time being, they will be using the material transfer agreements that are found in bilateral agreements with other parties with respect to the exchange of germplasm.

For most breeders, the provision is beneficial and will facilitate the use of diverse materials for as long as countries will share their materials as part of the multilateral system. One respondent pointed out that direct utilization for commercial use may be allowed, provided a separate agreement between the parties outlines an agreed plan on benefit sharing. Access should be for commercial varieties. There is misconception among the heads of agencies and breeders that benefit sharing is directly tied to access – that is, the provider or the country gets the direct benefit.

Concerns expressed by policy staff include the need for proper documentation of materials being accessed, a sound monitoring system, the commercialization of materials derived should be subject to conditions and data and varieties derived should be provided to the country of origin. It is thought that no patents should be accorded on multilateral system materials. It is clear that most of the concerns expressed deal with the issues of tracking materials as well as commercialization and intellectual property concerns.

Access will not be provided if materials will be used for chemical, pharmaceutical and non-food/non-feed industrial uses

Sixty percent of all respondents agreed with the statement that access will be refused for non-food/non-feed purposes. It is interesting to note that there is a higher percentage of government respondents disagreeing (42 percent of all responses) compared to CSOs (36 percent of all responses) and PSCs (none disagreeing).

There is disagreement among groups about whether access should be provided for non-food/non-feed uses. Among the heads of agencies, the majority (five out of nine) favoured granting access for these uses. Reasons given include the fact that there may be benefits to humankind for uses other than food and agriculture (for example, pharmaceutical/therapeutic uses) and that this use maybe limiting the potential of the PGRFA. This explanation puts into focus the need for information on mechanisms, means and legal schemes for access and benefit sharing for all crops (Annex 1 or non-Annex 1) if they are used for purposes other than food and agriculture. What are the possible options that countries can pursue? Countries can still access the global system, although not necessarily through the multilateral system's pathway. For example, they can enter into bilateral agreements for non-Annex 1 crops they can expand the list to include other crops not listed in Annex 1 and present it to the ITPGRFA's Governing Body.

Some groups expressed concern that prior informed consent is strictly implemented and that the exclusive use of the resources for food and agriculture is dependent upon the 'goodwill' (truthfulness and honesty) of the recipient. They also wondered how the standard for exclusive use for food and agriculture will be monitored. One respondent who did not indicate agreement or disagreement (neutral) stated that the provision should be given a second look. This provision may be an obstacle for stakeholders to fully engage in the multilateral system, as a substantial percentage of them favour granting access for non-food/non-feed use.

Access will be provided without the need to track individual accessions

Fifty-three percent of respondents expressed the need to track individual accessions. One respondent stressed that the ITPGRFA states that '[a]ccess shall be accorded expeditiously, without the need to track individual accessions.' It can be interpreted as not forbidding or restricting the tracking of individual accessions when access can still be accorded expeditiously, even while tracking individual accessions. One of the respondents expressed the idea that the challenge will be to facilitate access, especially for farmers, without making it too easy for vested interests to exploit materials for their own commercial ends.

Heads of institutions (64 percent), curators (73 percent) and breeders (44 percent) that were interviewed did not agree to provide access without tracking individual accessions. Tracking is important to determine the performance, the source and the history of the accessions. One curator recommended the use of modern technologies to facilitate tracking the accessions. Farmer-breeders expressed the need to track individual accessions. One breeder said that it was their right to monitor their contribution. Government organization-based non-academic and academic institutions, respectively, indicated that tracking was necessary to determine the origin and performance of the individual accessions and to document their performance. While they agree to provide access without tracking, they also added that tracking could facilitate benefit sharing since they thought that the benefits would go directly to the providers. There are, thus, misconceptions about benefit sharing under the multilateral system of the Treaty.

Tracking the accessions is particularly an issue for CSOs and peoples' organizations, whose representatives emphasized that tracking was important for monitoring and for determining whether the materials were used for purposes other than what was declared. They also mentioned that the contributions of the breeders may be lost, and they feared that contaminants such as GMOs would be difficult to trace if there was no tracking. Two out of three respondents from the PSCs argued that tracking was important in order to be able to identify the source, especially when comparing the performance of the materials and facilitating their control.

Forty seven percent of the respondents completely agreed that access can be provided without the need to track individual accessions. They stressed that tracking would be costly and that monitoring the accessions will be difficult. Some concerns were raised over the likelihood of accessions being used and exploited for purely commercial purposes (such as IPRs and non-food uses) without the knowledge and consent of the sources of these materials. While they agree to provide access without tracking, they also added that tracking could facilitate benefit sharing. Therefore, the lack of tracking under the multilateral system found some opposition from the Philippine stakeholders.

Recipient shall not claim any IPRs on the requested materials in the form received

The majority of respondents and stakeholders (93 percent) agreed with this provision that the recipient of materials from the multilateral system shall not claim any IPRs on the requested materials in the form received. While agreeing with the provision, respondents did express their concerns. Respondents commented that the recipient of the materials should still not claim IPRs even for derivatives from the original form and that no further development such as recombination breeding should be pursued. Breeders are quite concerned and pointed that this is a controversial provision, especially in light of genetic engineering technologies or even certain breeding techniques – if one received a composite population and 'extracted' a particular line from the composite, then the IPRs could already be claimed for the extracted material or a gene from the material could be used for breeding and then IPRs could be applied for. In practical terms, how will benefit sharing be accorded for such uses in order to grant access?

There is a need to clarify what 'in the form received' can mean. Does it cover only the actual form of the material when received or will it also include the actual genetic parts and components of the material in the form in which it is received? Present technologies can already allow for genetic modification of PGRFA or the use of only specific genetic traits of a material for the purposes of IPRs. In this way, materials are no longer 'in the form received' and therefore they are open to an IPR application. On the other hand, a small percentage of the respondents disagreed, stating that it is not fair to the breeder who developed the variety. Therefore, in general, the stakeholders supported the obligation to not claim any IPRs on the requested materials in the form received. This provision may well allay part of the fear of misappropriation of materials accessed through the multilateral system.

Access to PGRFA under development, including materials by farmers, shall be under the discretion of the developer

Ninety percent of the respondents and stakeholders agreed with this provision, although concerns were raised. The developers or farmers can set their own criteria or guidelines before their PGRFA, which is under development, can be accessed. The criteria that was suggested by some of the respondents for access included provision of data, tracking of materials, payment for the development of materials, determination of type of user (for example, small versus commercial farmer). Another respondent expressed the idea that this provision is aimed at protecting the rights of breeders who have invested resources in developing a new plant variety. On the other hand, farmers are generally known to share their materials freely with other farmers even from other countries, including materials under development (such as breeding or segregating lines).

Concerns from the CSOs highlighted the fact that this provision gives an option to not include certain materials that farmers are developing under the multilateral system. This provision can also be interpreted to mean that the inclusion of all farmers' materials will be up to the discretion of the farmers (since these materials are in a perpetual state of development). This provision could also potentially restrict farmers from exchanging breeding materials between countries. Another respondent pointed out that the exchange of materials should be among farmers only. A breeder from the government stated that these materials should be provided for free to small-scale farmers.

The respondents who did not agree said that materials under development should not be included because other users should have the first option of acquiring them for protection or use. Others said that these materials should be put in the multilateral system for public or common use. One respondent from an indigenous peoples' organization expressed the idea that this provision promotes individual rights over collective rights, which should not be the case.

Facilitated access shall be provided using the SMTA.

The majority of respondents (97 percent) across institutions agreed with this provision, although not without various concerns. According to one respondent, if the materials came from the Philippines, they should receive more protection. Furthermore, the SMTA should be simplified without sacrificing the key elements and provisions. Another respondent expressed the idea that for documentation purposes there should be guidelines about access. The quantity of materials to be provided should be specified in the SMTA. Other issues raised included the fact that materials from the Philippines should be for the Philippines only; that information should be provided regarding the status of the requested materials; that the SMTA provisions need to be reviewed in relation to utility and appropriateness in the Philippines as well as in relation to farmers and farming communities; that it needs to be decided how the SMTA will be adapted at the level of farmers and farming communities and it is necessary to outline how the 'codification' of farmer exchanges (using the SMTA) will impact on farming communities. The CSOs stated that with this provision the SMTA is not necessary, especially for farmers who traditionally exchange seeds. Furthermore, some people can get away with accessing PGRFA without signing material transfer agreements.

Following the provisions on access, the respondents were asked to provide their opinions on the key features of the benefit-sharing options under the multilateral system:

Exchange of information – the contracting parties agreed to make available information on technologies and the results of technical scientific and socio-economic research, including characterization, evaluation and utilization, regarding PGRFA

Ninety-nine percent of all respondents agreed with making available information related to exchanged material, with 15 percent expressing concerns regarding farmers' access to information. It was perceived that the current global system of information sharing is inaccessible to farmers and farming communities, and it

may therefore be discriminatory against them. It was suggested that local consultation among stakeholders on how the information could reach farmers and farming communities should be conducted. Others commented that providers of materials should be informed of the results generated from the materials/research and that information dissemination should be simple and easily understandable. Hence, a suggestion was expressed that a mechanism should be established to assist gene banks in the development of information exchange, adding, however, that the compilation of information or inventories is a long process.

Some respondents, on the other hand, expressed their observation that farmers' values have been equated to the values of companies and institutions because of 'crop economy,' and thus the traditional value of crops for communities is not being adequately considered. They also suggested that social and cultural implications should be integrated to enhance the ITPGRFA's provision. Further, there should be a balance between access and the benefit of the information that is achieved from this access. Other respondents disagreed with the idea of exchanging information, stating that information should be withheld until the materials are registered with the PVPO.

Access to, and transfer of, technology – the contracting parties agreed to provide and/or facilitate access to technologies and genetic material for the conservation, characterization, evaluation and use of PGRFA

Ninety-eight percent of all respondents agreed with this provision, with some stakeholders expressing concern. It was suggested that the transfer of technology should not be limited to conservation and use of genetic materials. Some stakeholders opined that certain technologies that have been developed maybe inappropriate for farmers' conditions, particularly with regard to the manner in which these technologies were developed. Moreover, it was suggested that there should be more farmer participation in technology development. To address farmers' concerns in regard to this provision, the government needs to develop consultative mechanisms with farmers to help identify technological needs that can be addressed appropriately through the multilateral system.

Other concerns that were raised included the valuation of the product to ensure that the donor receives the benefits accrued to the technology. There is, however, an emerging issue that farmers have other values that should be considered equal to the values of companies, and several respondents referred to the long-held tradition of the communal values of crops. In cases where technology was protected by IPRs, it was seen as a limitation to access of technologies because of the IPR conditions as well because of the strict IPR regime or enactment of plant variety protection laws. It was suggested that technology should be withheld until the materials are registered in the PVPO.

Capacity-building – the contracting parties agreed to establish and/or strengthen programmes for scientific education and training in the conservation and sustainable use of PGRFA

Ninety-seven percent of all respondents agreed with this statement since it will facilitate the exchange of information, education, training and strengthening of research facilities for PGRFA. It will also help to keep the multilateral system operational. Some respondents expressed concerns regarding the provision of financial resources for capacity building, which will include the participation of farmers, farming communities, indigenous peoples and women. One respondent from a CSO disagreed with this provision, stating that it is not what farmers want.

Sharing of monetary and other benefits of commercialization – the contracting parties agreed to take measures in order to achieve commercial benefit sharing, through the involvement of the private and public sectors in activities identified under the ITPGRFA

Ninety-seven percent of all respondents agreed with this provision. However, questions were raised on who really receives the monetary benefits from the exchange: must the real owner or source of germplasm be identified and are there direct benefits to farmers or researchers? It was suggested by some respondents that

the fee of 1.1 percent for benefit sharing should be increased and that the payment mechanism should be clearly defined so that the intended beneficiaries actually receive the benefits, especially farmers and researchers. Furthermore, the stakeholders should be consulted on the payment mechanism. Two respondents disagreed with this provision, stating that the benefits will not go directly to the farmers or the breeders.

The results generated by this section were indicative of a lack of awareness and understanding of the ITPGRFA provisions on benefit sharing. The respondents' general agreement with the provisions serves as an incentive, and this incentive can be further raised with increased awareness and understanding of the said provisions.

10.2.4. Debates over the material in the multilateral system of the ITPGRFA

According to Article 11.2 on the Coverage of the Multilateral System, Article 12.3 (e) on Materials under development and Article 12.3 (h) on *In Situ* Materials, it is clear to the Department of Agriculture that the PGRFA of Annex 1 crops, which are not subject to IPRs, cannot be considered to be under development and are held by government institutions, are to be included in the multilateral system. The same holds true for the NPGRL of the UPLB, which is the largest holder of the national collection of Annex 1 PGRFA in the country. However, this particular policy is not clear to other holders – for example, academic institutions.

With regard to private collections, there is still no clarity about which ones have the potential to be placed in the multilateral system, and there are as yet no initiatives being undertaken by the government to bring these materials into the multilateral system. When the survey was conducted, there was a statement from a PSC that it would be willing to place its materials in the multilateral system if other PSCs agreed to do the same.

There is also a debate on whether on-farm/*in situ* material is actually in the multilateral system. From SEARICE's point of view (based on the survey), farmers' materials are in perpetual state of development – farmers experiment and evaluate every season. SEARICE's interpretation is that the inclusion of all farmers' materials (including traditional varieties being grown in farmers' fields) in the multilateral system, therefore, will be at the discretion of the farmers. The underlying assumption is that all PGRFA being grown by farmers are under development. In addition, SEARICE considers that there are no farmers' varieties in the public domain, including traditional varieties that are commercially traded, so long as they are being grown in farmers' fields. However, based on Philippine law (Republic Act 9168 or the Philippine Plant Variety Protection Act), varieties are commonly known (and therefore in the public domain) if they have been sold or disposed of in the Philippines for more than one year without application for variety protection. The ability of farmers, farming communities, indigenous peoples and indigenous communities to be providers under the ITPGRFA will therefore hinge on the legal interpretation of this issue by the Philippine government, on one hand, and by the farming communities and indigenous cultural communities, on the other. At the present time, there is as yet no initiative, either from the government or from civil society, to seek clarification on this matter.

The status and disposition of PGRFA *in situ*, especially that which is grown in farmers' fields, are not yet clear to all implementers. This lack of clarity is due to the fact that there are national legislations that deal with specific subsets of *in situ* materials – that is, Republic Act 9147 and Republic Act 8371 and their implementing guidelines, Administrative Order no. 1. The provisions of these pieces of legislation regarding *in situ* materials are not in harmony with the ITPGRFA. There are two options that can be followed: (1) harmonize Administrative Order no.1 with Article 12 of the ITPGRFA, in concordance with Article 12.3h; or (2) apply the legal principle that the latest enacted legislation is the one that is in force, which would be, in this case, the ITPGRFA, which became the law of the land when it was ratified by the Philippine Senate at a later date than the enactment of the other pieces of legislation. The latter would require an extensive information dissemination campaign targeting stakeholders, which will be affected by the implementation of the provisions of the ITPGRFA and may also require the drafting of specific Implementing rules and regulations.

10.3. Incentives for the Philippines to implement the multilateral system

The participation of the Philippines in the multilateral system will facilitate access to more diverse germplasm and useful information for crop improvement and production. Assured access to important germplasm is sufficient motivation for breeders in both public and private sectors to invest their expertise, skills, time and resources in the conservation and development of PGRFA primarily to ensure food security. This will lead to greater opportunities to develop varieties that are adapted to various production concerns including those for adverse environments. In addition, the Philippines will have access to information, including catalogues, inventories and technologies as well as the results of technical, scientific and socio-economic research, technology and capacity building. The country can also take advantage of the monetary benefits to support activities for the conservation and sustainable use of PGRFA, including endemic PGRFA. The Philippines can also address the concerns of, as well as uphold the rights of, small farmers in relation to PGRFA, which will promote harmony and economic development in the countryside. Access and control over seeds is an indispensable component of farmers' rights.

10.4. Disincentives for the Philippines to implement the multilateral system

A very low percentage of stakeholders involved in PGRFA conservation, use or policy have a satisfactory knowledge of the global system for conservation and use of PGRFA and of the ITPGRFA. This ignorance may well be the single biggest issue in regard to the full participation of Philippine stakeholders in the global system. It is assumed that an even lower percentage of the populace and of law or policy makers who are not within the PGRFA loop but who influence PGRFA conservation and use in the Philippines (for example, the National Economic Development Authority, the Department of Budget and Management, the Department of Interior and Local Government, the Department of Foreign Affairs, the Department of Trade and Industry and the DENR) have sufficient knowledge of the global system, the ITPGRFA and the multilateral system.

There is a palpable reluctance in stakeholders from the government to provide germplasm, most likely due to the fear that they may later be charged with violating a law or policy or be charged with biopiracy. This fear has been in existence since the implementation of the Executive Order no. 247, the bioprospecting law, in 1995. It is also an indication of a lack of understanding of the various provisions on access and benefit sharing in the ITPGRFA.

An important concern among stakeholders and particularly farmers' organizations and CSOs is how monetary and non-monetary benefits will trickle down to farmers and farming communities. They also feel that benefit sharing through information exchange and access to technology maybe inaccessible or inappropriate for farmers. A way to prevent this issue is by ensuring that farmers participate in decision making with respect to benefit sharing. There is a clear indication that accession-level information in the country regarding PGRFA, while available, is very difficult to access. The usefulness of PGRFA may, therefore, not be fully exploited.

The strict interpretation that PGRFA can only be accessed 'for the purpose of utilization and conservation for research, breeding and training' may be a disincentive to farmers who may want to access PGRFA for actual use, consumption, production and marketing. In addition, respondent farmers were afraid that due to the Treaty's implementation in the Philippines they will have to enter into a complex contract under the SMTA. They have been exchanging materials without the need for contracts and feel that they should be exempted from this requirement.

Another source of concern in the Philippines is that contracting parties to the ITPGRFA may provide access to PGRFA to both parties and non-parties. Article 12.2 of the Treaty specifies that '[t]he Contracting Parties agree to take the necessary legal or other appropriate measures to provide such access to other Contracting Parties' and that 'such access shall also be provided to legal and natural persons under the jurisdiction of any Contracting Party.' However, the first case in which facilitated access was granted using the alternative payment scheme under the SMTA was to a natural person under the jurisdiction of a non-contracting party.

The logic is that indiscriminate access puts legal and natural persons from the contracting parties at a disadvantage compared to those from non-contracting parties. Users from signatory countries get access to multilateral system materials and the PGRFA from a non-contracting party are effectively barred from the scope of the multilateral system, whereas the latter materials, as well as those from the multilateral system are both available to natural and legal persons from the non-contracting party. This concern becomes more serious in light of the policy of the CGIAR centres to provide access to all users, whether they are from contracting or non-contracting parties, using the SMTA.

Another concern that was aired by many stakeholders is related to the tracking of individual accessions. It is accepted that tracking will be too cumbersome for the third party beneficiary or the Governing Body to do. Nevertheless, they feel that the provider should have the option and the means to track the fate of the PGRFA that they have provided to the users. Many stakeholders felt that there was a gap in the present coverage of crops in the multilateral system. It was felt that certain crops that were not contained in the multilateral system, but that were important to food security and interdependence, should be included – for example, soybeans, peanuts, tomatoes, onions and sugarcane, among others.

11. Conclusions and recommendations

There are three major thematic ways to address the disincentives: (1) an information, education and communication campaign; (2) access to PGRFA for actual use, consumption, production and marketing by small-scale farmers and (3) the development of a domestic framework.

11.1. Information, education and communication campaign

Based on an earlier discussion, there is a need to package and conduct a systematic and comprehensive education campaign, targeting as top priorities the PSCs and government-based academic institutions and, among them, their breeders and curators. The next priority would be to raise awareness of stakeholders who influence the crafting of PGRFA-related policies. Such a campaign may be able to address the misconceptions that stakeholders have on benefit sharing, IPRs and other concerns that respondents have about the ITPGRFA.

The BPI, the Department of Agriculture, the DOST, the DENR and other concerned agencies should embark on enlisting science writers from the various national newspapers to regularly write informative articles on the global system in general, and on the ITPGRFA in particular in order to increase awareness. These agencies have a pool of writers among their staff who can prepare the articles to be provided to the media. Their activities should include media forums, consultations among stakeholders, technical training and workshops and tri-media (radio, print and television) educational and promotional activities, which should sometimes enlist local personalities for visibility and credibility. The information and education campaign that is directed towards civil society should focus on the positive aspect of the multilateral system and the SMTA to facilitate access and increase the number of materials that can be accessed by farmers.

There is a plethora of international commitments, including republic acts, executive orders, department administrative orders and memoranda and institutional intellectual property policy, that have to be acknowledged and understood before one can confidently assume that any germplasm exchange that is undertaken in the future will not result in disastrous repercussions. Information/education/communication materials that set out the rules, options and procedures on how to undertake germplasm exchange would allay the fear of many stakeholders by providing them with clear guidance on what actions to take. National guidelines would be best, although institutional mechanisms would also be welcome.

In regard to recipient's compliance with the food-or-feed-only condition, the stakeholders should be made aware, in information campaigns, of the responsibility of the Governing Body or the third party beneficiary to make sure that the recipient follows this condition being imposed by the SMTA. Conversely, although the ITPGRFA does not provide facilitated access to Annex 1 PGRFA for non-food/non-feed purposes, member states can still provide access to them for such purposes through bilateral agreements. Again, an education campaign can address this lack of understanding.

Other stakeholders thought that the benefits derived from the use of PGRFA could go directly to the provider and cited this as a major reason why they favour granting access. The information campaign should address this issue by targeting holders and users of PGRFA in the country. The campaign should also focus on the long-term benefit of providing access to the country in general and to farming communities in particular. The actual condition of benefit sharing that is specified in the SMTA should be made explicitly clear. In addition, documentation systems should be made available online.

11.2. Access to PGRFA for actual use, consumption, production and marketing by small-scale farmers

Article 12.3a of the ITPGRFA states that access shall be provided solely for the purpose of utilization and conservation for research, breeding and training purposes for food and agriculture and thus implies that direct use for consumption, production and marketing will not be allowed. Stakeholders in the Philippines, especially small-scale farmers and civil society, believe that small-scale farmers should be allowed access for actual use, consumption, production and marketing. It is recommended that, in its future meeting, the Governing Body rules that access should be granted to small-scale farmers for the purpose of actual use, consumption, production and marketing.

Farmer-to-farmer seed exchange, at present, is largely limited to farmers' organizations that work with CSOs. The exchanges operate with no formal contracts or agreements regarding IPRs or benefit sharing. The sense that we got from the interviews is that this mechanism will continue to be maintained in tandem with the multilateral systems. How this mechanism impacts the multilateral system, whether it provides a viable alternative for farmer-to-farmer exchange and whether its coverage should be encouraged to include other farmers, should be studied in more detail.

11.3. Development of a domestic framework

The Philippines has been a signatory to the ITPGRFA since 2006, but the domestic framework for the implementation of the Treaty is not yet in place. This framework will include mechanisms for implementing the rules and regulations of the ITPGRFA, which will consist of administrative mechanisms, policy guidelines and information, communication and education to support the targeted potential users and providers. The timeframe for framework development provided by the Philippines' Department of Agriculture is before the meeting of the Governing Body in June 2011. Initially, the domestic framework was planned to cover Annex 1 and non-Annex 1 crops. Below are some of the issues that should be considered by the domestic framework:

- options for mechanisms, means and legal schemes for access and benefitsharing for all crops (Annex 1 or non-Annex 1) if used for purposes other than food and agriculture;
- provisions stating that the Department of Agriculture should develop and implement an action plan to encourage holders of these PGRFA to place them in the multilateral system;
- the establishment of a clearing-house for the SMTAs that are entered into by stakeholders and that will be reported to the Governing Body;
- mechanisms (or a compromise) on how to address farmer-to-farmer exchanges without the SMTA even across country boundaries (if warranted, the country representative may opt to propose that this issue be a discussion point in future Governing Body meetings);
- declaration that under the Philippine law, the traditional right of small-scale farmers may be applied to materials obtained from the multilateral system – that is, the right to use, re-use, sell and exchange seeds in the farmed land;
- concrete mechanisms of implementation from the national level to the farming community level, which should also spell out how these benefits will be effectively utilized by the formal sector and
- mechanisms for access and benefit sharing with special reference to the interests of civil societies who play a role in PGRFA management (including farmers and farming communities, indigenous cultural communities, CSOs and the private sector) and for determining how the benefits will reach the farmers and farming communities at the national level.

In crafting the domestic legal framework, there should be an enhanced and active involvement of civil society in decisions regarding monetary benefits, capacity building, information exchange and technology to ensure that their concerns and needs are considered. The framework should include a participatory mechanism to determine benefit-sharing arrangements in the country.

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INCENTIVES AND DISINCENTIVES FOR PERU TO PARTICIPATE IN THE MULTILATERAL SYSTEM OF THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Isabel Lapeña, Manuel Sigüeñas

1. Introduction

Agriculture in Peru goes back 10,000 years, and, as a result of this ancient history, the tradition of seed production is both rich and varied. The special geographic conditions and climate heterogeneity, ranging from the desert plains of the coast *(Costa)*, the central Andes *(Sierra)* and the eastern lowlands of Amazonia *(Selva)*[1] have fostered variability in crops and the settlement of a wide range of cultures.[2] Peru comprises 84 of the 104 world life zones and shelters a plurality of 45 different ethnic groups and 14 linguistic families. It is estimated that the country has approximately 17,000 plant species, of which over 5,200 are endemic (Brako and Zarucchi, 1993).

In Peru, the Andes and the Amazon represent two important centres for the origin and domestication of a wide range of crops. These areas are also the centres of diversity for other crops that were introduced but that have managed to adapt to a variety of climates and ecosystems. Approximately 182 species of native domesticated plants were introduced many centuries ago, of which 174 are of Andean, Amazonian, and coastal origins and seven are of Mesoamerica origin. Of those species that have originated in Peru, the most important ones worldwide are potatoes, tomatoes, sweet potatoes, cassava, cotton, achiote, shiringa and papaya.

Although Peru is a centre of origin and diversity, it is dependant on other countries for much of its plant genetic resources for food and agriculture (PGRFA). According to Flores Palacios (1998), this interdependence on crops that do not originate in Peru may be as great as 80-93 percent. Thus, the people of the country are very dependent for their nutrition on crops that do not originate in the region, namely wheat, sugar, rice, corn, soybeans and bananas. It is not surprising, therefore, that Peru has signed and ratified the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).[3] The Treaty entered into force in June 2004 with the aim of providing for concerted action at the international level to achieve the objectives of conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA) as well as the fair and equitable sharing of the benefits arising from their use. According to the Treaty, countries recognize that it is vital to guarantee the flow of PGRFA that are most important for world food security and on which countries are most interdependent. With such an aim, it creates a multilateral system of access and benefit sharing that facilitates exchange by setting out the terms and conditions on which this exchange will take place. Thus, the multilateral system provides for an efficient and transparent mechanism for facilitating access to PGRFA and sharing the benefits that result from their use (Halewood and López, 2008).

The objective of this study is to identify the users of PGRFA in Peru, to analyze its origin and how it is used and to study how these users participate in international initiatives aimed at facilitating the access, flow and exchange of these resources. The importance of the analysis lies in identifying the national opportunities that are offered by the international exchange of genetic material and to consider what Peru can offer to the multilateral system in order to achieve better use and conservation of its PGRFA.

The research was based on a thorough analysis of the current literature on the subject, complemented with consultations with experts in the field. A group of experts was established that was made up of specialists from various institutions (the National Institute for Agrarian Innovation (INIA, in translation), the International Potato Center (CIP), the Secretariat of the Consultative Group on International Agricultural Research (CGIAR), the Ministry of the Environment, Universidad Nacional Agraria La Molina, and the non-governmental organization (NGO) Coordinator of Science and Technology of the Andes), which acted as a platform to exchange information and prioritize criteria geared at its own development). Moreover, a questionnaire was developed with multiple choice and open questions, which was circulated among the relevant stakeholders in agricultural research, NGOs, agricultural enterprises and others. A total of 34 questionnaires were received from the following sources: 12 NGOs, nine universities and research centres; seven national research programmes from the INIA, four companies and two officials from the Ministry of Environment. Interviews with nine users were conducted and these included visits to the research programmes of some national universities. The results of the study were discussed at a national workshop that brought together the most relevant users and stakeholders in the area of PGRFA in Peru. At this workshop, the participants addressed specifically the incentives and disincentives to participate actively in

the multilateral system of the ITPGRFA as well as the obstacles and opportunities that may present themselves in the future. Finally, the conclusions reached in the process were compared to the results of the expert group that was initially established.

Research difficulties lie in the weakness of the national agricultural information system and the obsolete nature of some of vitally important sources – for instance, the last agricultural census dates back to 1994 (*La Revista Agraria,* 2009a). No reliable information is available after this date that identifies the dimension of the agricultural units, the importance of the improved varieties and native crops per region, the adoption of technology, the level of market access and the number of producers involved in different crops, among other issues. These factors complicate the task of determining authentic PGRFA in an agricultural context where very opposite and distinctive types of agriculture coexist in the same country. Similarly, national research centres do not keep strict records on the entry and exit of foreign genetic material nor of those crops produced nationally. Thus, the information that would indicate the dependence of national and international plant genetic material is dispersed in many literature sources and is often incomplete.

2. Agriculture in Peru: An overview

In Peru, between 24 percent and 35 percent of the population lives in a rural area. Agriculture is an important sector for the country's economy and food security. The agricultural sector accounts for 7.7 percent of the gross domestic product and ranks first in the creation of jobs, representing about 20 percent of the economically active population in the country. According to the Centro de Planeamiento Estratégico (2009), the contrast between these figures and the low level of technology used by this sector in Peru indicates, in general, its poor performance.

In Peru, 36.2 percent of the population lives in poverty and 12.6 percent in extreme poverty. In rural areas, the incidence of poverty reaches 59.8 percent of the population. Chronic malnutrition among children under the age of five years is 21.5 percent nationally and 36 percent in rural areas. In the highlands (Sierra), figures are higher: 88 percent of the population is rural, and 76 of these people live in poverty, while 46.5 percent lives in extreme poverty. The poorest households are the ones that most depend on agriculture. Extremely poor people in rural areas are farmers that only own a half-hectare of land and perform as unpaid family workers to supplement their income by selling their labour (Trivelli, 2007). Finally, there is a correlation between being indigenous and being poor. In general, the main sources of energy and protein in Peru are rice and wheat, which leads to a nutritional imbalance with a high intake of carbohydrates (CEPLAN, 2009, 49). Areas with high poverty levels report the highest rates of social conflict. Dissatisfaction among the people is a result of a sense of injustice and state absence, a distrust of the democratic system and the perception that the high economic growth that the country has enjoyed since 2002 has not been redistributed to the people themselves, thus harming in particular the areas of the southern Andes and the Amazon (Panfichi and Coronel, 2009).

The area with agricultural potential covers around 5.9 percent of the national territory (7.6 million hectares out of a total of 128.5 million hectares). Currently, the total agricultural area harvested is 2,595.979 hectares, of which the domestic market accounts for 86 percent and the export market accounts for 14 percent. The availability of arable land per capita is only 0.13 hectares, compared with an average of 0.44 hectares per capita in other South American countries. Approximately 1.75 million hectares have irrigation infrastructure, but only 1.2 million are irrigated annually (Pérez, 2006).

According to official government literature, one of the problems in the agriculture sector is the predominance of small land holdings since the average farm unit is 3.1 hectares. In 1994, 92 percent of the agricultural units were less than 20 hectares, and 72 percent of farmers managed units under five hectares (MINAG, 1994). More recent data for 2006 show that the figures have not changed much in 15 years, indicating that 80 percent of the agricultural units have less than five hectares. The main crops per area harvested are, following this order, rice, coffee, potatoes, hard yellow corn, maize, barley and wheat (*La Revista Agraria,* 2008).

Peru needs to import large quantities of crops in order to satisfy the national consumption, even for crops that are native to Peru such as hard yellow corn and potatoes (see Table 1). Moreover, these two crops represent the largest category of imports, totalling approximately 95 percent and 3 percent respectively of the total amount of imported seed for planting.

Table 1
Seed imports for planting (tonnes)

Year	Rice	Beans beans	Broad	Corn	Potato	Wheat	Carrots
2005		0.21		756.00		1.64	14.73
2006	0.05	0.08	26.00	924.00		0.05	51.16
2007	0.01	0.30	1.00	1,225.00		0.03	27.99
2008	0.07	0.86	6.50	2,039.00	200.00	0.06	37.91

Source: SENASA (2009).).

In general, the trend shows an increased dependence on imported crops (CEPLAN, 2009). According to some experts, the foundations are being laid for a serious situation of food insecurity in the future. Since the country is increasingly dependent on imports and more land is being devoted to export products and biofuels, there is a further marginalization of small farmers that are the main food suppliers in Peru and there is less control over food production for the population (*La Revista Agraria*, 2008).

The agricultural trade balance has shown positive figures in Peru since 2004. Imports have registered an average annual growth of 18 percent during the period from 2000 to 2008. The main products to be imported have been hard yellow corn, soybean cake, durum wheat, soybean meal, apples, among others.[4] Agricultural exports have shown a steady increase and diversification. At present, the focus has been on crops such as coffee (76 percent of the total cultivated area for export), asparagus, paprika peppers, artichokes, mangoes, grapes and other fruits, and cocoa. Coffee and asparagus, which in 2004 accounted for almost half of the total exports of the country, represent the main export value.[5] The organic-product market ranks third in exports and comprises crops such as coffee, bananas, cocoa, mangoes, cotton, Andean grains, chestnuts and maca. Some new emerging crops that have gained importance include quinoa, amaranth, avocadoes and Amazon fruits. It is worth mentioning that both the limited diversity of crops present in the organic market as well as the narrow base of agricultural crops for export indicate the need to diversify this production base (see Table 2).

Table 2
Food products consumed in Peru (kilograms per capita) and percentage of the national demand satisfied by imports, 2007

Food	Production	Consumption	Imports	Dependence (%)
Crops and food products on which Peru depends heavily on imports				
Wheat	6.4	50.0	54.2	108.4
Soybean cake	0.0	24.0	29.3	122.1
Vegetable oils	7.2	19.0	12.2	64.3
Hard yellow corn	39.8	90.0	55.3	61.5
Crops and food products on which Peru depends to a medium-large extent on imports				
Processed rice	59.5	59.0	2.7	4.6
White sugar	32.3	38.0	8.7	22.9
Crops and food products on which Peru depends very little on imports				
Potatoes	119.9	73.0		0.0
Cassava	41.0	28.0	0.1	0.2
Starchy corn	8.7	10.0		0.0
Beans	2.9	3.0	0.3	9.7
Sweet potatoes	6.5	5.0		0.0
Quinoa	1.1	1.0		0.0

Source: Ministerio de Agricultura (2007); CEPLAN (2009), 38.

Certain threats may hinder the demand for PGRFA in the country. Peru not only has a considerable biological wealth, but it also has a variety of ecological niches and climates (84 of the 104 climates represented worldwide) as well as a wide range of latitudes that allows for long harvest periods offering plenty of farming opportunities. Almost all of planted species worldwide can be planted in the country. However, this diversity of microclimates leads to the development of new biotypes that often cause a variety of diseases and necessitate the need to set up permanent crop improvement processes.

Adverse natural events pose a threat to agriculture in the country. The high incidence of natural disasters in Peru is nearly twice the figure for Latin America. Major climatic events include earthquakes, floods, landslides, frost, heavy rains and winds. The effects have been particularly severe in the years since 'El Niño' occurred. Many of the impacts of these disasters have been exacerbated by human activities that affect the environment such as soil erosion and deforestation (Perry, 2006). Soil erosion and salinity are major problems affecting the productivity of a scarce resource. In Peru, around 18.9 million hectares present a level of moderate to severe erosion, and this situation has resulted in the loss of 300,000 hectares per year for agricultural use. This situation is especially critical in the Sierra region, where about 60 percent of the land is affected at different levels (40 million hectares). Moreover, salinity has had an impact mainly in the coastal valleys, restricting the yields of arable land by as much as 40 percent (World Bank, 2007).

These trends show an increased incidence of natural disasters due to climate change. During the period 2000-4, natural disasters increased by 300 percent. During the period 2003-8, emergencies and damages affected 694.175 hectares and resulted in the destruction of a total of 151.219 hectares of cultivated land. The departments most affected by environmental emergencies during this period were primarily those of the Sierra (that is, there were 2,765 emergencies in Apurimac; 1,879 in Cajamarca and 1,818 in Puno) and the rainforest area (there were 1.878 emergencies in Loreto).[6]

According to the 2008 Lima Declaration on Food Security, the crops most affected by climate change and natural disasters over the last twelve years are strongly associated with the Peruvian population's diet, which consists of potatoes, rice, bananas, cassava, maize, beans and broad beans.[7] The regions with higher poverty suffered the greatest impacts due to, among other things, their limited capacity to adapt and take measures to prevent crop losses. In these cases, lacking the basic seeds to cultivate the staple crops the following seasons ended up being one of the biggest problems, and the state seemed to be unable to cope with this situation.[8]

In addition, climate change has resulted in the reduction of mountain glaciers, an ensuing shortage of water resources, the displacement of ecological altitudinal ranges towards higher ecological levels and the emergence of new pests and radical temperature changes. These circumstances have created an urgent need to enhance genetic diversity in crops, to improve the resilience of farmers and to make it imperative that new crops are genetically developed to adapt to these new climate conditions.[9]

3. PGRFA conservation, exchange and use in Peru

It is crucial to identify the existing capacity in research and breeding and the level of dependence and international exchange with respect to PGRFA production in order to try to delineate the country's ability to participate in the multilateral system of the ITPGRFA.

3.1. *Ex situ* conservation

In Peru, approximately 54 institutions are involved in PGRFA research. This figure represents 25 universities, 12 experimental stations of the INIA, 13 NGOs, one foundation and three research institutes (Sevilla, 2008a). The greatest potential for research in PGRFA lies with the universities, the INIA, the Research Institute of the Peruvian Amazon (IIAP, in translation) and other private research institutes. The research centres are located in strategic regions and cover the different country ecosystems. The INIA, for example, has 12 agricultural experimental stations and more than 40 substations located in areas ranging from sea level to 4,200 metres above sea level. The country is divided politically into 23 departments or regions, and each department has a public university. There are about 20 faculties in agronomy, and the main areas of research

are represented by the conservation and use of plant genetic resources. No formal mechanism of coordination exists between the different conservation and research centres in the country, but bilateral alliances at the national level play a critical role in the exchange of genetic material and knowledge. However, these partnerships are weak because they are based on individuals' research projects that do not end up in team building and whose results lack continuity.

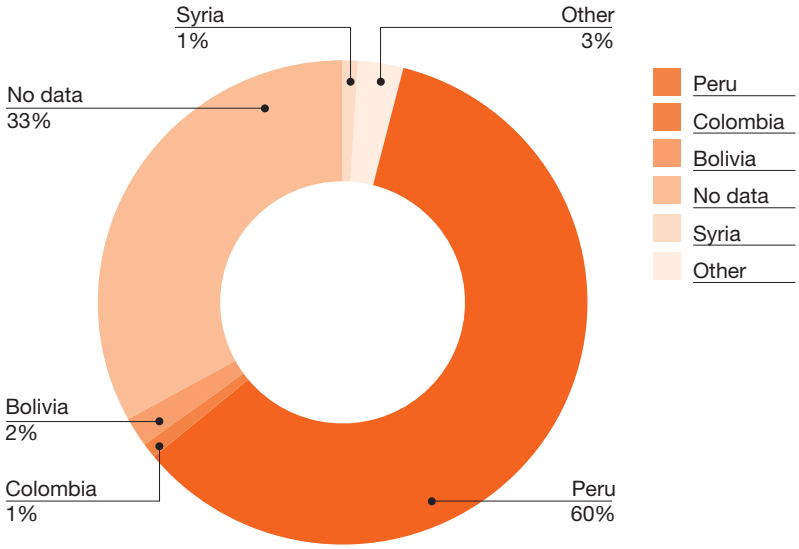
In regard to the private sector, farmers' associations and companies have gained importance, especially those related to certain export products. In relation to Annex I crops of the ITPGRFA, it is worth mentioning the Farmers Association of Ica, the Peruvian Institute of Pulses, the Promenestras program, the Association of Producers of Maize and Sorgo and the Institute for Agrarian Development of Lambayeque (IDAL), which has an excellent rice breeding program. Some NGOs carry out research work on PGRFA with local communities. An example is the native potato conservation work done by the Asociación Andes through an agreement with the Potato Park Communities Association. Initially, these organizations were engaged in local gene bank conservation activities and participatory breeding, but currently there is a trend to move away from such activities towards the establishment of productive and marketing chains.

One of the common features of the national PGRFA research programme is it's limited commitment to formal breeding programs (Sevilla, 2008b). The majority of institutions only develop morphological characterization – molecular characterization is very limited, and a systematic agronomic characterization has not even been attempted. Another common feature is the similarity in the scope and matter of study by the different research institutions and the lack of coordination and synergy between them. There is a research overlap in relation to the PGRFA under investigation, and it is particularly relevant in the case of Andean roots and tubers research. Likewise, there is a research gap in other areas, such as forage species. These research projects have often been 'scattered,' and this situation has deteriorated as a result of the isolation of various programmes and the lack of coordination between the institutions. Both of these issues make it difficult, at the country level, to achieve more efficiency in the allocation of resources, to develop a more competitive approach to financing among the centres and to be able to maximize the benefits from research.

Thirty national collections make up the INIA's National Plant Genetic Resources Bank, in which 17,147 accessions of 201 plant species are preserved. These accessions include food crops, medicinal and aromatic plants and plants for industrial use. Additionally, there are 16,958 accessions of potatoes, sweet potatoes and other Andean roots and tubers preserved by the International Potato Center in Lima (INIA-SUDIRGEB, 2009, 37).

The National Plant Genetic Resources Bank at the INIA was established in 1986. It is estimated to hold approximately 60.4 percent (10,362) of the total number of accessions collected in Peru. The remaining accessions have a foreign origin. It has not been possible to determine with accuracy the percentage of repatriated material found in the samples collected abroad. There is a record of 45 countries of provenance for the germplasm bank accessions. Bolivia and Colombia would be the main supplier countries followed by Syria, the United States, Ecuador, Spain and Brazil. For 33.2 percent of the plant accessions (or 5,700), passport data are not available, and not even the country of origin is supplied. Most of this data shortage affects the collections of wheat, beans, barley, triticale, oca and kiwicha (Velarde et al., 2007) (see Figure 1).

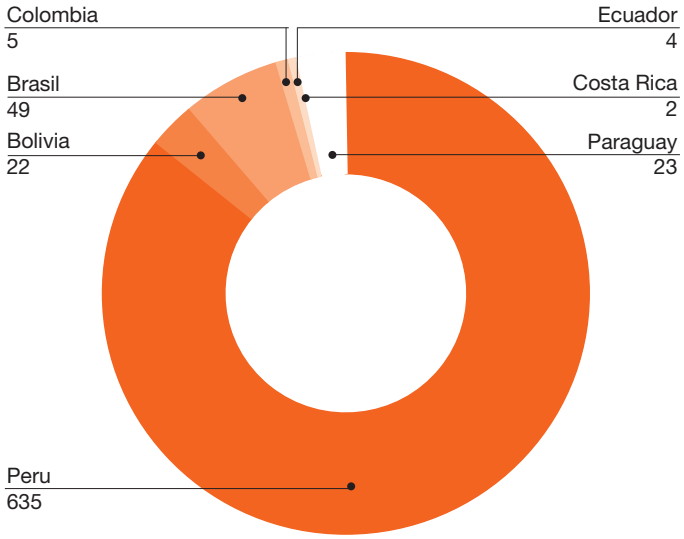
Figure 1
Percentage of accessions according to country of origin



Source: Velarde et al. (2007).

The cassava germplasm collection at the INIA's Subdirección de Recursos Genéticos y Biotecnología is made up of 740 accessions of the species *Manihot esculenta*. The distribution of the collection is extensive, comprising 16 departments of Peru. The passport data have a quality that ranges from good to very good in 85 percent of the accessions, while for 15 percent of them the only information available is from the country where they were collected (see Figure 2).

Figure 2
National collection of *Manihot esculenta* at the INIA (country of origin and number of accessions)



Source: Based on Velarde et al. (2007)

Recently, planned and targeted surveys carried out by the national universities and the INIA's agrarian experimental stations for the collection of rare and endangered species for the purpose of *ex situ* conservation have been limited, mainly due to a lack of economic resources and specialists and the obsolescence of geographical charts (INIA-SUDIRGEB, 2009, 44).

Ex situ collections, particularly those held by the INIA, have played an important role in repopulating rural areas with native crops in those communities that have had to abandon their fields and migrate to urban centres during times of political conflict and terrorism during 1990s and then found that their cultivars had disappeared when they returned. Despite their importance, however, *ex situ* collections in Peru are in a chronic state of vulnerability since the facilities and management for seed production and the conservation facilities for planting materials have been chronically insufficient. The lack of understanding by public authorities, which often ignore the current and potential value of these resources, does not help to improve the situation.

3.2. Research and breeding activities

The INIA, through its various agricultural experimental stations, carries out various research programmes in order to generate technologies that will lead to the integrated management of specific target crops with a market focus and increased production. These so-called national research programs are:

- the National Research Program on Vegetables (garlic, onions, strawberries, artichokes, paprika and asparagus);
- the National Rice Research Program;
- the National Agro-Industrial Crops Research Program (cocoa, coffee, sweet potatoes, sugar cane, cassava and cotton);
- the National Andean Crops Research Program (wheat, barley and quinoa);
- the National Pulse Research Program (beans, broad beans, cowpeas, peas and lentils);
- the National Fruits Research Program, comprising export fruits (avocado, grapes, tangerines and mangoes); domestic market fruits (oranges, papayas, apples, peaches, custard apples, pineapples, granadilla, camu camu, lúcuma and plantains/bananas);
- the National Vegetables Research Program (garlic, onions, strawberries, artichokes, paprika and asparagus);
- the National Corn Research Program and
- the National Potato Research Program.

In regard to breeding programmes, it is common that research centres work with a variety of crops, although there are some relevant programmes at the Universidad Nacional Agraria La Molina (UNALM) and at the INIA, which specialize in corn, rice and potato. The overlap in research is reflected here as well: currently there are nine institutions working on maize breeding, eight on potato breeding, five in quinoa breeding, four in wheat, amaranth and broad beans and three in cotton, barley, rice, beans and peas. Breeding in Peru is shifting towards native crops, since their value has been recognized as well as their future potential in the marketplace and their importance to national food security (Sevilla, 2008a). Such a trend can be recognized in the fact that there are currently 158 research, development and technological innovation projects funded by the Institute for Innovation and Competitiveness for Peruvian Agriculture (INCAGRO, in translation), in which domestic crops such as yacon, tara, quinoa, corn, native potatoes, sacha inchi, pitajaya, camu camu, aguaje and sweet potatoes are being cultivated and researched (Pastor and Sigueñas, 2008, 32).

The issues that currently affect the national agricultural research system are the same ones that are discussed in the *Global Competitiveness Report 2009-2010,* in which Peru ranks 118th (out of 133 countries) in regard to the quality of its scientific research, 84th in innovation capacity, 104th in university collaboration with industry, 90th in relation to private sector investment in research and development and 104th in relation to the government's provision of advanced technology products (World Economic Forum, 2009).

In relation to the agricultural public sector, public investment has been aimed since the 1990s primarily at providing infrastructure, soil conservation and poverty alleviation. During this period, agricultural research has represented marginal figures (around 1.9 percent of the total agricultural investment). Specifically, in 2007, the INIA's budget accounted for 8 percent of the total agricultural sector (approximately US $266,319) to which was added 4 percent of INCAGRO (Ministry of Agriculture, 2007, 39). The scarcity of resources also applies to public universities and has affected long-term research programmes, in particular, the breeding, selection and production of improved seeds programmes.

As a result, the common denominator of all research centres is a major weakness in human and technical resources. The study by R. Sevilla (2008b) indicates that the national capacity in breeding and agricultural biotechnology is currently at a deficit and that this resource and technology shortage is hindering high-quality research work. A matter of concern has to do with the lack of professionals dedicated to basic research in genetic resources, which, according to the author, is due to the lack of prestige and promising scientific career paths.[10]

3.2.1. The provenance of germplasm for research activities

The study conducted by Sevilla (2008b) concludes that farmers' seeds, including wild relatives, are the main source of germplasm for research and breeding activities in Peru. For a total of 148 research and breeding programmes, the main source of genetic resources are farmers (35.1 percent), followed by the CGIAR centres (18.3 percent), local gene banks (11.5 percent), bilateral agreements (9.5 percent), research networks (8.1 percent), national germplasm banks (7.4 percent), public institutions from developed countries (5.4 percent) and private companies (4.7 percent).

As for the crops included in Annex I of the ITPGRFA, the main source of PGRFA are the CGIAR centres (28 percent), followed by farmers (27 percent), the germplasm evaluation networks (10 percent), the national germplasm banks (10 percent) and local germplasm banks (9 percent). The situation changes radically in relation to crops that are not included in Annex I, where farmers (54 percent) and local germplasm banks (15 percent) become more critical. In this case, the CGIAR centres and national germplasm banks have a share of 4 percent respectively. According to the experts, these results need to be revisited, as the percentages of national germplasm banks are illogically low.

Many research programmes (particularly for maize, Andean cereals, Andean potatoes and tubers) are conducted in close collaboration with communities and even with local and regional government agencies that contribute genetic material in exchange for receiving harvested seeds that have been produced by the research programmes. In regard to seed imports for research purposes from 2005 to July 2009, the National Service of Plant Health (SENASA) made a total of around 36 notations. Of these, 44 percent of the imports were made by the private sector, 33 percent were made by the universities, 17 percent by the CIP and 6 percent by the INIA. The seeds that were imported included maize (45 percent), barley (14 percent), wheat (14 percent), potatoes (8 percent), canola (8 percent), triticale (5 percent) and rice (5 percent). The materials were imported from Mexico (31 percent), the United States (14 percent), France (14 percent), Chile (8 percent), Colombia (8 percent), Uruguay (5 percent), Syria (5 percent), Argentina (5 percent), United Kingdom (3 percent), Nigeria (3 percent) and Hungary (3 percent). The benefits derived from germplasm exchange can be appreciated in the results of the work made by the INIA's Santa Ana Agrarian Experimental Station, where germplasm from Argentina and Japan produced two varieties of peas that were released. Also, in recent years, the station has implemented a programme of thornless artichoke production from foreign varieties.

National universities have also established numerous and diverse bilateral or multilateral agreements for germplasm exchange. The most relevant ones include the UNALM's Program of Native Cereals and Grains, which has an agreement for germplasm exchange with the International Atomic Energy Agency, the state universities of Oregon and Nebraska in the United States, the universities of Poland and the Department of Agriculture of the United States. Likewise, the NGO Instituto de Cultivos Tropicales carries out participatory cocoa breeding with the Cocoa Research Center in Brazil and the Agricultural Research Service of the United

States. The limited access to, and use of, the germplasm that is available from a diverse range of international sources can be explained by the complex phytosanitary requirements and the preference for CGIAR materials as they adapt better and have a lower cost for farmers' specific needs.

3.3. Germplasm exchange with the CGIAR centres

According to the second national report on the Status of Plant Genetic Resources for Food and Agriculture, the CGIAR centres provide improved varieties and breeding stock or segregating material for these national institutes (INIA, and universities, basically) (INIA-SUDIRGEB, 2009). Therefore, the CGIAR centres carry out the preliminary germplasm assessment, the selection of parents, the crosses, the generation of segregating populations and the preliminary assessment of lines under controlled conditions. These heterogeneous populations or lines are sent to Peru for evaluation, selection and further development of varieties adapted to the conditions of different Peruvian ecosystems (Sevilla, 2008a, 25). Pre-breeding activities require long-term processes and, in particular, the ability to broaden the genetic base of breeding materials, which are not typically available in the country (INIA-SUDIRGEB, 2009, 45).

Over the past twenty years (1988-2008), the International Centre for Tropical Agriculture (CIAT, in translation) has sent 693 shipments and 1,041 bean samples to Peru as well as 255 shipments and 257 cassava samples.[11] The International Centre for Maize and Wheat Improvement (CIMMYT), in the period 1995-2009, shipped a total of 168 materials to Peru comprising approximately 5,741 corn samples. The principal recipients were the INIA and the Ministry of Agriculture (86 percent), two private companies (8 percent), the CIP (5 percent), and a university (0.8 percent). The countries of origin were Colombia (84.6 percent) and Mexico (15.4 percent).[12] The International Center for Agricultural Research in the Dry Areas (ICARDA), in the period 1997-2009, has made a total of 285 shipments of material to Peru, around 13,094 samples of barley, 1,241 samples of chickpeas, 1,131 samples of durum wheat (*Triticum durum*), 284 samples of broad beans (*Vicia faba L.*); 96 samples of forages; 40 samples of purple vetch (*Lathyrus sativus*), 710 samples of beans, 75 samples of peas, 2,617 samples of spring bread wheat and winter and 475 samples of facultative wheat. The principal beneficiaries were the INIA and the UNALM.[13] In a period of twenty years from 1988 to 2008, the CIP's germplasm bank has provided Peru with 1,644 potato samples (corresponding to 982 accessions) and 385 sweet potato samples (corresponding to 220 accessions). Additionally, 4,701 samples of its potato breeding programme and 1,261 samples of its sweet potato breeding programme were provided. The INIA does not have a potato or sweet potato gene bank, as the national collection is part of the collection under the management of the CIP, but it has developed local collections that have been established in coordination with the CIP.

All of the INIA's national research programmes have matured with the support of various international institutions, mainly from CIMMYT (maize, barley and wheat), the CIAT (cassava, beans and rice), ICARDA (broad beans) and the CIP (potatoes and sweet potatoes). As a result, nearly all of the improved varieties of major species such as rice, corn, potatoes, sweet potatoes, beans and tropical grasses have come from the CGIAR centres. Therefore, the international centres are considered to be a key component of Peru's agricultural innovation system. One of the main recommendations of the study by Sevilla (2008b), in connection to national competence in breeding and biotechnology, concerns the urgent need to strengthen links between the national research centres and the CGIAR centres.

It is important to underline the INIA's collaborative relationship with the CIP in the development of new potato varieties. The INIA is the main institution carrying out work on potato improvement in Peru, but it works closely with the CIP. The CIP generates new populations in its breeding programmes and then develops these lines to produce advanced lines that are transferred to the INIA for the development of new varieties. In addition, the INIA carries out potato breeding work, without the CIP's intervention, in order to develop local varieties for the benefit of the communities.

The native cereals and grains program at the UNALM uses materials coming from CIMMYT and ICARDA (mainly using the species *Triticum aestivum ssp aestivum, T. turgidum ssp durum and Hordeum vulgare*). Two

new varieties of barley (UNALM 94 and UNALM 96) and of wheat (San Lorenzo 72 and Centenary 2006) have been released as a result of the breeding work on such materials. The UNALM's corn program has been developed in conjunction with CIMMYT and uses maize germplasm held in CIMMYT's collection. In the late 1990s, this collaboration resulted in programme-released varieties PM 213 and PM105. Ricardo Palma University, through the BIOGEN genetic resource program has also received materials from the CIP and the Research Institute of Agricultural Technology and Transfer (INTTA) on the north coast has also developed collaborative projects with the CIP and CIMMYT to conduct research on maca and yacon. Finally, in regard to the collaboration between the CGIAR centres and Peruvian NGOs, it is important to highlight the repatriation agreement for native potatoes between the Association Andes and the communities within the Potato Park and the CIP.

The contribution made by the national research centres to the CGIAR centres has been important. In Peru, the CIP has collected 119 species. The CIP's germplasm bank includes 4,167 accessions of potato and 2,341 accessions of sweet potato that originate in Peru. This material was provided primarily by the INIA as well as by the UNALM and the Universities Sierra del Peru. At CIMMYT, the maize collection in Peru was duplicated in the 1970s. In addition, the CIAT's germplasm bank has received 3,666 bean samples and 421 cassava samples collected in Peru before 1988 for germplasm conservation.[14] In the last ten years, CIMMYT and ICARDA have not reported any transfer of material from Peru.

3.4. Peru's dependence on international germplasm

In order to analyze the priorities for developing a national capacity for agrarian research, a questionnaire was sent to 30 research centres by Sevilla (2008b), and the following results were obtained. Only six centres considered developing a capacity for agrarian research to be a high priority, including the need to facilitate germplasm exchange from abroad for research purposes (compared to four in 1980), seven considered it to be a medium priority and four considered it to be a low priority. This focus on capacity building is considered less limiting than other factors such as a lack of funding, a lack of staff, the poor availability of laboratories, lack of access to current literature and a lack of knowledge in molecular biology.

In the same study, out of a total of 17 topics that could be supported by the international community, facilitating germplasm exchange was allotted fifth priority (with 18 votes). A higher priority was given to facilitating the access to new tools in biotechnology (24), training programs to promote biotechnology tools (23), assisting in the preparation of projects to obtain funding (21) and strengthening the capacity of national programmes through investment (19). Facilitating the exchange of germplasm was considered to be more important than awarding scholarships for a Masters degree (15) and promoting training programmes in conventional breeding methods (14). Of the 18 institutions that chose to facilitate the exchange of germplasm as a priority action by the international community with benefits for Peru, six considered it to be a high priority, seven considered it to be a medium priority and five considered it to be a low priority.

3.5. Germplasm flow from Peru to other countries

At present, we can say that there is no systematic record keeping for genetic material transferred abroad except for certificates issued under the INIA's material transfer agreement (MTA) and plant health certificates (SENASA). During the period from 2001 to 2006, the INIA entered into 23 MTAs. The transferred germplasm was predominantly from Andean crops, and most of the recipients were foreign institutions. From a total of 2,476 accessions sent by the INIA, foreign institutions received 94.7 percent (2,345 accessions) and national researchers received 5.3 percent (131 accessions). These figures show not only that the flow of germplasm goes primarily overseas but also that very little of the genetic material conserved in national germplasm banks is used by the national institutions (Pastor and Sigueñas, 2008, 31). In some cases, the germplasm that flows from Peru to foreign countries is attributable to the donations or conservation of duplicate collections abroad. This is the case of the UNALM's duplicate collections of barley and maize held in the National Seed Storage Laboratory of the United States.

3.6. *In situ* conservation

Farmers use and preserve the greatest diversity of PGRFA in Peru. Numerous *in situ* conservation projects have been implemented in the country. In particular, it is worth mentioning the Project on the *In Situ* Conservation of Native Crops and Wild Relatives (2001-5), which involves the INIA and the Peruvian Amazon Research Insitute (IIAP) and four NGOs (the Project on Andean Peasant Technologies, the Coordinadora de Ciencia y Techologia en los Andes, Asociación Arariwa and Centre de Servicios Agropecuarios). This project was geared towards ensuring the *in situ* conservation of native crops and wild relatives in some micro-genetic centres where Andean and Amazonian communities have preserved and protected these crops for centuries. As a result, the project collected and documented information for 11 priority crops and 19 related species such as potatoes, corn, beans, potatoes, quinoa, kañiwa, maca, arracacha, granadilla, cassava and camu camu (Instituto de Investigación de la Amazonía et al., 2002).

The McKnight Project (1995-2005) was a collaborative programme between the CIP, the University of California-Davis, the Universidad San Antonio Abad-Cusco and the McKnight Foundation, with the participation of farmer communities, which was aimed at strengthening research on Andean tubers. The project's objective was to strengthen the *in situ* conservation of Andean tubers and to promote food security in the fragile system of the southern highlands. Over 470 families received the project benefits that refer to the results of participatory research for pest and disease management in Andean tubers.

Different regional governments (from Cusco, Puno, Junín, Iquitos and Huancavelica, among others) are currently promoting the creation of participative and multidisciplinary agro-biodiversity technical groups with the aim of promoting policies that are favourable to the conservation and sustainable use of agro-biodiversity. Regional governments are in support of creating areas for the conservation of agro-biodiversity in their territories and encouraging the objective of conservation *in situ* in their participatory budgeting process.

In Peru, we are witnessing the establishment of community germplasm banks in different Andean areas such as Cusco (in the Potato Park), Ayacucho, Huanuco, Huancavelica and also on the coast in Piura (where farmers have submitted reports on their work to protect maize germplasm) and Lambayeque (coloured fibre cotton). This mechanism has been considered a major tool for achieving security for the farmers' seed system and a way of implementing local farmers' rights as provided in the ITPGRFA (Scurrah, Andersen and Winge, 2009). Finally, a critical issue for the *in situ* conservation of agricultural biodiversity is the loss of conservationist farmers. These farmers are aging, and there is a lack of generational continuity (since so many youth are migrating to the cities, among other reasons). The solution to this problem lies in finding a way to empower conservationist farmers.

3.7. Farmers' access to seed

3.7.1. Technology dissemination

Dismantling the extension mechanisms that once existed throughout the country has resulted in the loss of expertise in the INIA and its delegation. The regional governments are now expected to take over this role, but they have not been given the correlate funding. In general, this dissolution of the public system has taken place, as in many Latin American countries, without a simultaneous promotion of the private sector's technical abilities (Núñez, 2007). Consequently, technology dissemination is being carried out by a range of institutions in isolation and the focus on expertise and specialized knowledge is disappearing (Sevilla, 2008b).

Shifts in the last few decades have resulted in the liberalization of seed policies in the country, particularly with the signature of numerous bilateral trade agreements (particularly with the United States). The amendments to the seed legislation have introduced flexible mechanisms that facilitate the entry of new seeds into the market and have cast serious doubts about the quality of seed to be marketed in the future.[15]

Currently, the INIA's role has been circumscribed to focus on research, technical assistance, the conservation of genetic resources and the production of seeds, seedlings and breeding stock of high genetic value. In addition, the INIA is also responsible for zoning and crop breeding throughout the country.

Most decentralized national universities have developed, as much as possible, seeds and seedlings that are distributed or sold to farmers within their target area. Many of these universities get support from national or international NGOs or through agreements with local and regional governments. The new private universities tend to use a multidisciplinary approach in project implementation in order to link them to investment projects. However, partnerships with producer associations and seed companies are not as common as could be desired. The role of private seed companies is still very limited. There are not enough private actors that can multiply registered seed and sell it in sufficient quantity and quality, on time and at the right price. The low corporate organization of the seed industry is clear, for example, in the case of potatoes, where 25.5 percent of seed producers have a corporate structure and 74.5 percent are individuals. Consequently, the supply of improved breeding material is not enough to meet the field demand. This limitation has prompted some universities to reach agreements with regional governments to establish areas for variety multiplication in partnership with rural communities in order to increase the availability of seed in these regions.[16]

In the absence of public services and private companies in certain areas, the gap has been filled by NGOs and institutions that are supported by international cooperation and that have implemented extension programmes geared towards: identifying the demands of farmers, including participatory mechanisms and the empowerment of farmers. NGOs also play an important role in consultation and policy decision making in the various regions. However, NGOs are gradually changing their agendas for intervention from a productivity approach to a focus on production chains and value added sales and marketing.

Farmers' cooperation with the CIP is rare and not strong. Farmers often get in touch with the CIP only when there is a need for assistance under emergency situations and when the potato harvest and the reserves of seeds have been devastated by pests or climatic conditions. The CIP, however, has taken actions oriented at supporting farmers' communities. These activities include the repatriation of native crops, the regeneration of crops in the field and the participatory breeding of sweet potato and potato varieties that are resistant to late blight. In a ten-year period from 1997 to 2007, the CIP has released 34 new potato varieties in Peru or 70 percent of the total number of potato varieties released in the country. In 2007, a total of 102,131 hectares have been planted with such varieties (Thiele et al., 2008, 13), which would be about 42 percent of the total area cultivated in potatoes in the country. Among the CIP's repatriation programmes to restore native crops in the fields, it is worth highlighting the agreement reached between the CIP and the community association in the Potato Park in 2004, under which about 246 pathogen-free potato accessions were repatriated in this highly diverse area.

A big challenge for all of these initiatives that try to meet farmers' needs for PGRFA is for them to actually communicate with farmers and understand their demands. On the one hand, research institutes and academia frequently fail to address farmers' needs for low-cost solutions that adapt well to the particular conditions of each production area and that are able to upgrade from the traditional technologies. On the other hand, farmers are difficult to engage in these innovative processes, partially because identifying their needs is not always an easy task.[17] Often, interaction with farmers and the dissemination of research activities are monopolized by those communities where research institutions have managed to maintain long-term contact with the farmers (Echenique, 2009, 38).

Farmers' associations play a vital role in the connection between farmers and research institutions. The small number of these associations as well as reliable farmers' representatives is particularly critical in the Sierra region where the lack of social capital is deterrent to many development initiatives. In general, farmers' associations have been barely taken into consideration by state policies. National, regional and local

governments have not adopted any measures that favour the development and maintenance of such associations. The result is that (1) there is no agrarian organization that can channel and defend the legitimate interests of farmers in front of other stakeholders, such as industry and trade and (2) farmers' initiatives to innovate and develop market chains for their products are very limited (Roca, Rojas and Simabuko, 2008, 49). O. Ortiz et al. (2008) carried out an assessment of the role of various stakeholders in the potato innovation process in Peru and concluded that, unlike in other Andean countries where the role of government authorities is strong, in Peru NGOs and private companies have greater involvement in the innovation process. The results also highlight the low participation of producer associations.

Today, the new trends point towards greater communication with farmers, an appreciation of their agronomical knowledge and the empowerment of farmers' communities as a means of solving their problems. This approach seeks to respond more successfully than in the past to the innovation needs of producers, either by adopting technologies validated by these producers or updating their own traditional technology to respond to the market demands (agribusiness and agricultural exports) (Núñez, 2007). In attempting to link the formal and informal systems of agricultural research, participatory breeding programmes as well as farmers' schools have been developed and implemented.[18] In these initiatives, NGOs play a key role in enforcing communication between the formal and informal innovation systems and in making the new knowledge and technologies available to farmers.

3.7.2. Formal and informal seed systems

The law regulating the 'research, production, certification and marketing of quality seeds' is known as the Seed Law, and it was approved by Legislative Decree no. 1080[19] and Supreme Decision 026-2008-AG.[20] This law establishes the minimum standards for a variety to be included in the National Register for Commercial Cultivars, which is required for a variety to be formally marketed. In addition, the National Register of Protected Plant Varieties, which is regulated by Andean Decision no. 345 and Supreme Decree no. 008-96-ITINCI, regulates the granting of intellectual property rights on the variety or cultivar obtained through breeding.[21] This regulation is inspired by the International Convention for the Protection of New Varieties of Plants, which Peru ratified in 2008.[22]

The seed market in Peru accounts for US $30 million, although it is one of the smallest markets in the region compared to other countries (Bolivia accounts for US $40; Chile for US $120, Mexico for US $350 and Argentina for US $950).[23] In October 2009, the number of varieties registered in the National Seed Register for Commercial Cultivars of SENASA was 384, out of which 324 (84 percent) were varieties of crops included in Annex I of the ITPGRFA.[24] Of these varieties, 60 percent were registered by public research institutions, 23 percent by the private sector and 17 percent by public universities. In regard to their composition, 39 percent of the registered varieties were maize, 30 percent were potato, 9 percent were rice, 7.4 were wheat and 5 percent were bean.

In November 2009, 293 certified seed producers and 1,227 certified seed dealers were registered. Rice, potato and maize comprise most of the production of certified seed (41 percent, 24 percent and 18 percent respectively), followed by legumes, wheat, barley and cowpeas. Only one company produces sweet potato seed and another one produces forage seed (alfalfa, ryegrass and clover). Three entities produce the seeds of native crops: capsicum, kiwicha and olluco. On the consumption side, the rate of use of certified seed for cultivation of rice, hard yellow corn, potatoes, cereals and legumes achieved a weighted average of 9.2 percent in the agricultural season from July 2006 to August 2007.[25]

Table 4
Seed Production and Rate of Use of Certified Seed per Crop
(July 2006–August 2007)

Crop	Seed production (metric tonnes)	Rate of use of certified seed (%)
Rice	6,396	22.77
Hard yellow corn	771	10.06
Grains and legumes (beans, Lima beans, broad beans and peas)	75	0.57
Cereals (wheat and barley)	117	0.47
Potato	2,677	0.46

Source: SENASA (2009).

The area planted in modern or improved varieties ranges from 60-95 percent, in which rice, wheat and barley is cultivated in greater quantities and corn and beans are cultivated in lower quantities, with greater genetic variability in the latter (Sevilla, 2008a).

Table 5
Hectares planted with certified seed (2001-2007)

Year	Paddy rice	Potato	Hard yellow corn	Cereals (wheat and barley)	Grain legumes (beans, Lima bean, broad beans and peas)
2001	301,230	248,238	304,578	302,974	231,153
2002	320,210	272,266	278,000	294,153	227,122
2003	315,938	262,912	292,982	290,794	225,361
2004	286,564	261,062	270,502	270,530	216,953
2005	353,056	267,896	286,881	286,976	232,575
2006	346,292	260,196	287,477	295,329	260,415
2007	351,155	292,736	306,460	309,078	264,022

Source: SENASA (2009).

These figures show the limited use of certified seed in Peru and the huge importance of the informal seed production and distribution system in the country. A number of inter-related and complex reasons explain the limited size of the formal seed sector.[26] On the supply side, the limited number of formal seed suppliers, the weak links between industry and national research centres and the lack of information on crops, harvests and farmers render the formal seed market incapable of providing enough quality seed. In addition, the diversity of seed is very limited. Public institutions focus on the production of new varieties, concentrating on a limited number of crops (primarily corn, potato and rice). In addition, most of the approved varieties for marketing are modern cultivars. There is a clear need to expand the number of commercial cultivars of other important crops as well as of traditional varieties for national and global food production. The current schemes for variety registration and seed certification have led to the further marginalization of native crops and varieties that are rich in genetic diversity and crucial for food security, and they have also served to marginalize small seed producers and farmers who cannot afford the costs involved in the registration and certification procedures.

On the demand side, one of the reasons that farmers have a limited access to quality seed is because they are unable to buy quality seeds due to its high cost. Currently, only farmers who own their own lands and who cultivate rice, hard yellow corn, potato and starchy corn can be eligible for a loan from a private institution, which is only one out of ten farmers. Micro-finance systems (supported by NGOs) are proliferating in key rural districts of the country (currently there are 250 branches) as a way of addressing this situation.

Another reason for farmers' limited participation in the formal seed system is a lack of confidence in the seed that is sold as an alternative to the traditional sources. Farmers rely heavily on the information provided by the supplier in terms of variety traits and seed quality. Small farmers are risk averse and rely mainly on their traditional seed supply systems: ancient selection and seed-handling practices; seed exchange in the community and with neighbouring farmers; seed fairs; local markets and 'the route of seed' or seed roads,[27] among others. These mechanisms are linked to relations of trust, interdependence and reciprocity that are part of the cultural heritage and identity of rural communities. According to the studies by M. Hermann et al. (2009), farmers primordially use their own seed storage in 80 percent of the cultivated areas. S. De Haan (2009) also indicates in a study related to the exchange of native potato seeds in the central Andes region that about 40 percent of the interviewed farmers use seed from their own sources.

A study conducted in 2008 on the implementation of farmers' rights in Peru highlights the slow disappearance of traditional exchange systems, the difficulty for farmers to access high quality planting material of traditional varieties and, most importantly, the gradual disappearance of the conservationist farmer (Scurrah, Anderson and Winge, 2009). In order to change this situation, the study presents a series of measures: the establishment of local or community seed banks, the initiation of seed fairs, the development of catalogues documenting traditional local varieties and related knowledge, the development of exchange mechanisms, the identification of high quality seed production farmers, the rehabilitation of old seed sources known for their high quality, the guarantee of the quality of propagation material sources, the training of farmers for breeding efforts and the promotion of participatory breeding.

The INIA has taken some important steps towards the commercialization of quality seed of native crops and varieties. In November 2008, the INIA adopted the necessary measures to register 61 native varieties of potatoes in the National Register of Commercial Cultivars, allowing for the formal commercialization of their seeds by farmers and other seed producers. The INIA's action was a response to several failed attempts to register some native potato varieties by farmers. In order to make the registration of traditional and farmers' varieties affordable, the INIA and SENASA adopted specialized procedures and standards for the official requirement of adaptability and efficiency of the varieties. In addition, the INIA and SENASA agreed that native varieties would be exempted from paying the registration fee. For the same purpose, the Ministry of Agriculture has created a National Register of Peruvian Native Potatoes, which is overseen by the INIA.[28]

4. Peru's participation in international germplasm exchange and conservation initiatives[29]

Since 1993, Peru has participated in two international plant genetic resources networks: the Andean Plant Genetic Resources Network (REDARFIT),[30] a cooperative program for research and technology transfer, and the Amazon Network for Genetic Resources (TROPIGEN),[31] which is primarily aimed at capacity building. Peru's annual contribution to the networks amounts to US $10,000 through the Inter-American Institute for Cooperation on Agriculture's (IICA) cooperative programs for agricultural research and technology transfer.

In general, the importance of these networks is remarkable (and they should be further empowered): skills are being developed, regional initiatives are gaining knowledge, regional projects for germplasm conservation are being developed and proposals to increase added value are incoming. It is especially important for Peru because of its participation in various collaborative projects that include international organizations and counterparts in the Andean countries.

Participation in these networks result in benefits such as the strengthening of germplasm conservation, which has led to the development of new collections and training on issues related to management and conservation of germplasm (Rios, 2009).[32] In addition, participation in these networks has been useful to identify and prioritize regional issues and crops for conservation, which was the case during the development of the Hemispheric Strategy for Conservation of Plant Genetic Resources for Food and Agriculture (Norgen Biotek Corporation et al., 2008). The countries that participated in this strategy undertook an analysis of the status of the *ex situ* collections for major crops in each country (indicating the conservation status of the accessions)

and outlined a strategy for the conservation of PGRFA (collections of interest to developing countries were prioritized and those referring to crops listed in Annex I). Subsequently, the Global Trust invited the individuals responsible for these collections to submit project proposals for regenerating and refreshing these collections. In the case of Peru, collections of maize, cassava and beans were prioritized. Likewise, the broad bean multiplication project was selected as a regional project, and this project was also implemented in Ecuador.

The projects following projects have been developed with the support of the Global Crop Diversity Trust:

- the regeneration of the corn collection (Program for Corn Research and Social Impact by the UNALM);
- the regeneration of the national cassava collection (INIA);
- the regeneration of the national bean collection (INIA) and
- the regeneration of the national broad bean collection (INIA).[33]

These projects seek to help institutions reduce the number of accessions that require regeneration, characterization and duplication. The projects will in turn regenerate a duplicate of the collections for long-term conservation in a germplasm bank that is internationally recognized (the CIP, the CIAT and so on and optionally a deposit in a black box in Svalbard).

Peru has also participated in networks sponsored by the International Fund for Agricultural Development; the Andean Consortium (including Venezuela, Colombia, Ecuador, Bolivia and Peru); the Inventive Systems of World Heritage network (under the Global Environmental Facility and coordinated by the Food and Agriculture Organization (FAO)); the Strengthening of Indigenous Organizations and Support for Knowledge Rescue in High Andean Areas network (under the New Zealand government and the FAO), the Monitoring System for *In Situ* Conservation and the Project of Agro-Biodiversity Conservation in the Farmers Fields networks (the latter based on outputs of the former *in situ* project). Additionally, with the support of other institutions such as Bioversity International, the Regional Fund for Agricultural Technology, the European Community Commission, the Spanish government, the Deutsche Gesellschaft fur Internationale Zusammenarbeit (GTZ) and the IICA, projects were developed for agricultural technology transfer, valuation and sustainable use of PGRFA for both *in situ* and *ex situ* conservation.

In general, although networks promote various collaborative activities, there has been to date no exchange of materials or material transfer agreements being developed in this area. Usually, there are difficulties in germplasm exchange among countries of the Andean region, especially for the development of new crops, as a result of mistrust and fear of competing in the same markets and restrictions associated with national access policies (Ramirez, 2008).

5. Information systems

The agricultural sector in general is lacking a reliable information system that allows better management of access and use of PGRFA. This gap is evident in the case of research centres: the documentation systems are generally inadequate, and there is little coordination at the regional and national levels. In the *ex situ* conservation centres, there is no standardized information system that interested parties can easily access in order to identify duplicated samples, potential gaps in the collections and collaborative conservation strategies. This situation has led to the isolation of researchers and has hindered communication with decision makers and farmers in the country. The result is a poor understanding of the importance of PGRFA conservation for the development of the country (that is, its benefits for nutrition and food security) – in particular, the fragmentation and duplication of various research projects.

Despite this discouraging situation, some efforts have been made to process information on genetic resources and make it available to the public. The Catalogue of the National Collections of the Germplasm Bank, which is published by the INIA's Subdirección de Recursos Genéticos y Biotecnología, includes passport data from 22 of the 30 national collections. The digitalization of the data was done with support from the US Department

of Agriculture, which has allowed it to adopt the Grin system. The National Registers of Native Potato and Native Corn were developed with free access to the Internet.[34] The first register had 28 native potato descriptors and the second had 11 corn descriptors, both were developed with a participatory approach with farmers and the academic community. These registers include an important innovation that allows for the identification of the source of genetic material, such as the name and location of the farmer or the community that provides the genetic material.

It should be noted, however, that the vast amount of information on PGRFA and traditional knowledge as well as on the practices obtained as a result of the Project on the In-situ Conservation of Native Crops and Wild Relatives (2001-5) is still not available although the project was finalized in 2005. The main reasons for this delay include an inability to get the system operational; a lack of prior informed consent by the communities and fears from participating institutions that misappropriation could occur.

In addition to these public information systems, there are other systems that are promoted jointly with civil society aimed at collecting, processing and disseminating the agricultural information that is available in the country (for researchers and producers). Examples include Infoandina and AgroRed Peru.[35] Specifically, AgroRed Peru is a meta-information system that aims to promote, exchange and make effective use of relevant information for the development of agriculture in the country, and it is aimed at researchers, academics, technology transfer agents, agricultural and rural development agents, entrepreneurs and producers.

6. Public awareness about PGRFA

In increasing the public's awareness about he use of PGRFA, communication networks developed from civil society play a very important role. Of particular importance are the massive broadcasting efforts by the Centro Peruano de Estudios Sociales (CEPES) through radio communication networks (Tierra Fecunda) and the publication of mass distribution magazines (*La Revista Agraria*). Also of great importance are the community networks that use radio as a tool for linking small-scale farmers and remote communities with fewer resources. Among the latter, we can mention the network of rural communities of Cusco and Apurimac (with 71 journalists and 210 radio stations and one regional information centre)[36] as well as the initiative of the Pullasunchis Association – radio broadcasting in the Andean schools – which is also in the Cusco region.[37] At the national level, the information networks that use the Internet are important, including Servindi (Intercultural Communication Services, <http://www.servindi.org>) or Internet and radio programs such as Inforegión (<http://www.inforegion.pe>).

Very often, countries that contain a wealth of PGRFA and thus have a major role in the global food and agriculture systems do not have the curriculum and education systems to focus sufficiently on this sector. At the university level, except for the colleges of agriculture, the main academic approach has been from the perspective of restoration and gastronomy by some schools and universities engaged in this specialty in Lima (with a large number of related publications).

Initiatives to increase the public's awareness have been specific and are linked to market development and the booming foodservice industry and are based on building a national identity (Ruiz, 2009).[38] In this way, news in the media about the misappropriation of traditional knowledge and resources have become popular among the public. The issue of biopiracy has been a frequent topic in newspapers with a national distribution (see Table 6).

Table 6
News on Biopiracy in Peru

Peru: Biopiracy: a new form of looting. Ivan Reyna Ramos. *Rumbos al día*, 17 November 2005. **Genetic protection against biopiracy.** *Gestión*, 19 January 2006.
Origin and property of the potato: not Chilean or Peruvian. Manuel Ruíz. *Peru 21*, 24 April 2006.
There are 35 products at risk of biopiracy. *Gestión*. 11 December 2006. **INIA protects genetic resources in Peru against biopiracy: In-situ Conservation project of native crops and their wild relatives.** Bulletin INIA 004-2007-INIA-OII-PW, April 2007.
Sacha inchi protection is requested. *El Comercio*, 20 November 2007. **The potato is Peruvian ... Chile arrives 400 years late with these expectations**. *La República*, 20 May 2008. **Chile registered 60 new potato varieties originating from the island of Chiloe.** *Nacional*, Chile, 26 May 2008. **340 species are registered as bein originated in that country. Peru and Chile in a potato war.** *Ojo*, 27 May 2008. **Now Chile claims ownership over potatoes**. *Expreso*, 27 May 2008. **Patenting of Plants.** Santiago Roca. *Actualidad económica*. *La República*, 14 August 2008.
Statement against Biopiracy. Asociaciones del Cusco, 4 December 2008.
War on biopiracy. *El Peruano*, 15 January 2009. **Government opens the doors to biopiracy: FTA with U.S. will allow companies to patent genes without permission from the State or communities**. *La República*, 26 January 2009.
Statement of the Altiplano Quinoa Production Board against the patenting of quinoa, 3 February 2009, <http://www.biopirateria.org/spa/enlamira_quinoa.php>.
France wants to patent cosmetic use of quinoa. *Peru 21*, 6 February 2009. **Cusco region outlaws biopiracy.** *El Comercio*, 16 February 2009.
Peru: amendment of laws promotes biopiracy. *Zoraida Portillo*, 19 February 2009, <http://www.scidev.net>. **National Commission against Biopiracy prevented foreign companies from patenting indigenous crops**. Press release, Press Office of the National Institute for the Defence of Competition and Intellectual Property, 11 May 2009.
Peru strikes a blow against biopiracy. *Zoraida Portillo*, 16 July 2009, <http://www.scidev.net>. **The Peruvian potential is lost to biopiracy. Sacha inchi, Camu Camu, and Maca products more affected by biopiracy**. 9 November 2009, <http://www.biopirateria.org>. **Protect your resources from biopiracy**. 9 November 2009, <http://www.biopirateria.gob.pe>.

Moreover, initiatives such as the declaration of the National Potato Day and events held to celebrate the International Year of the Potato in 2008 have contributed significantly to a better understanding of the opportunities offered by PGRFA and the strengths and weaknesses in research work.[39] Other aspects of concern refer to the introduction of genetically modified crops into the country and the impact of bilateral treaties on native agriculture.

Likewise, it is also important to underline the growing participation of networks and associations from civil society that are involved in the defence of agro-biodiversity.[40] The result has been the inclusion in the agendas of the media at the national and local levels of the conservation and sustainable use of PGRFA. Several decentralized training workshops have promoted a greater awareness of the importance of agro-biodiversity and related topics such as the use of pesticides or genetically modified organisms.

7. Legal and institutional framework of access and benefit sharing

Peru has developed a collection of regulations on access to genetic resources and traditional knowledge that impact on the flow of PGRFA. Peru is a member of the Andean Community, which is empowered to issue binding legislation for member countries. All Andean countries have ratified the Convention on Biological Diversity (CBD), and this has led the Andean Community to issue Decision 391 on a Common Regime on Access to Genetic Resources in 1996, which requires prior informed consent and mechanisms for access and benefit sharing that apply to all projects having a crop improvement component.[41]

Decision 391 is legally binding for Peru and establishes a bilateral system through access contracts that applies to all genetic resources for *in situ* and *ex situ* conditions and their derivatives.[42] While the implementation of the decision has been very limited in Peru, it has still been necessary to question its compatibility with the ITPGRFA. The Treaty provides for a multilateral system of facilitated access to PGRFA listed in Annex I that 'are under the management and control of the contracting parties and in the public domain' (Article 11.2 of the ITPGRFA) and are intended for food and agriculture production (Ruiz, 2008). In contrast, Decision 391 was designed in the belief that states should have comprehensive control over the flow of genetic resources in order to avoid biopiracy and illicit enrichment, and this notion has resulted in a complex web of contractual relationships.

Table 7
Mechanisms for Access to Genetic Resources and Benefit Sharing included in the ITPGRFA and Decision 391

	ITPGRFA's multilateral system	Decision 391
Instrument	Standard Material Transfer Agreement	Access contract (access to genetic resources) + Accessory contract (access to the biological resource) + Annex (access to traditional knowledge, if applicable)
Process	Standard, adhesion contract (without any possibility of negotiating contractual clauses)	Contract clauses subject to negotiation case by case (there is a reference model to an access contract approved by Resolution 414, 22 July 1996)
Scope	PGRFA in Annex 1 in the public domain and under the control of the parties	All genetic resources from *in situ* and *ex situ* conditions of which member states are countries of origin and their derivatives
Timing	Acceptance and immediate access to resources	Application, review process, negotiation of contracts and authorization
Level of authority	Multilateral system with the FAO acting as the third party beneficiary	Bilateral system subject to national competent access and benefit-sharing authorities and member states
Actors	Applicant, providing institution, third party beneficiary	National competent authority, access applicant, national support institution, indigenous communities (if it be the case)
Ex situ centres	Covered by Standard Material Transfer Agreement	In their condition as receptors of genetic resources: framework access agreement or access contract depending on whether they are defined as research centres or not. In their condition as providers of genetic resources: material transfer agreement

Source: Ruiz (2008).

In relation to the present study, Decision 391 raises concerns by imposing on *ex situ* centres dedicated to research a contractual system of access to genetic resources. In general, the access and benefit-sharing system created by Decision 391 has led to high transaction costs that have had a negative effect on research activities on genetic resources in some of the Andean countries, harming national researchers in particular.[43]

In general, the dynamic nature of materials exchange that was common in the past has been reduced with the entry into force of the CBD – a trend that continued when the regions and countries began to develop access rules. When Decision 391 was approved in the Andean region, there was a reduction in the flow of materials, and this situation still continues at the national level in Peru. In addition, it has been common for the CGIAR centres to work very closely with the national research institutions and this has enabled both of them to have access to the genetic resources that they can access – in the case of Peru the CIP has the authority to collect wild potato germplasm together with the INIA.[44]

From 1996, when Decision 391 was issued, until 2009, when the regulation was adopted, a lack of clarity on the actual functions and responsibilities between the national authorities led to a halt in the granting of access

contracts. The only access contract involving wild species that was granted in this period was to the Korean Institute of Bioscience and Biotechnology to conduct research on traditional medicinal plants in the Amazon. Such a contract required complex institutional arrangements that involved three regulatory agencies and seven institutions in the scientific committee (as opposed to one or two people from the Korean side) (Pastor and Sigueñas, 2008, 23).

In this same period, access to domesticated species and to materials from national gene banks was granted through a MTA with the INIA. This MTA was practically a unilateral declaration in which the user agreed not to claim any form of intellectual property rights over the transferred genetic material and to use it only for research purposes. In the case that the applicant had a commercial purpose, he or she was requested to enter into a proper access and benefit-sharing contract.

During the period 2001-9, the INIA sent out genetic material under 35 MTAs for research purposes only (although in most cases a final commercial objective could easily be foreseen). At this time, the INIA only rejected two applications by a private German company to identify DNA that was responsible for cold tolerance in Andean corn in the early stages of development. In this case, the German company offered training to Peruvian researchers in biotechnology and master's training at German universities. The contract was never carried out because the INIA's capacity to negotiate this kind of contract was not defined in the existing legislation.

In January 2009, Decision 391 finally passed through national regulation, defining its responsibilities and administrative procedures under Ministerial Resolution 087-2008-MINAM, ratified by Supreme Decree 003-2009-MINAM.[45] The regulation attempts to provide clarity and defines the following scenario for the access and use of PGRFA:

- Plant genetic resources included in Annex I of the Treaty: Article 5 (paragraph c) states that these PGRFA are excluded from the scope of this legal framework *'Food and forage species listed in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture of the United Nations Food and Agriculture Organization – FAO'*;
- Plant genetic resources that are not included in Annex I, access can be for two purposes, research and commercial use:

  - For research purposes: Universities and research centres can enter into framework agreements that apply to various projects in which access to, and exchange of plant genetic resources found in in-situ conditions is needed. These centres must be pre-registered with the competent authority. The content of the framework agreement will include, among other aspects, participation of national professionals in the research projects and deposit of a duplicate of the materials (Article 25).

  - For commercial purposes: access authorization shall be requested to the 'Administration and Enforcement Authority.' The INIA is the authority in relation to 'genetic resources, molecules, combination or mixture of natural molecules, including raw extracts and other derivatives contained in domesticated or planted continental crop species. The content can be found in all or part of the sample' and the General Directorate of Forestry and Wildlife of the Ministry of Agriculture in relation to 'genetic resources, molecules, combination or mixture of natural molecules, including raw extracts and other derivatives contained in the continental wild species, such content can be found in all or part of the plant specimen.' Article 15. Access contracts shall include provisions on prior informed consent and mutually agreed terms to ensure access and, when applicable, the agreement on fair and equitable benefit sharing (Article 20). The regulation requires also the signature of ancillary contracts among the applicant and the owner, tenant or manager of the land where the genetic resource is located, including ex-situ conservation centers in possession of the material, the supplier of the intangible component related to genetic resources (people or indigenous community) and the national support institution.

- Plant genetic resources not included in Annex I, which are preserved in CGIAR germplasm banks: the Fifth Temporary Provision (Disposición Transitoria Quinta) states that 'genetic resources originating in Peru who are in *ex situ* centres but are not included in Annex I of FAO ITPGRFA, and which are in germplasm banks under the custody of the centres of the CGIAR are subject to the provisions of this regulation.' This rule was amended at the last moment, because the draft prior to its approval provided that these resources would be subject to the provisions of the Governing Body of the ITPGRFA regarding access regulation. Among the collections that are not included in Annex I of the Treaty and are conserved in CGIAR centres are the collections of maca, arracacha, Andean grains such as quinoa, among others, which were received from universities and independent researchers, but without reference documentation.

According to Article 15.1 of the ITPGRFA and the decision of the Governing Body of the Treaty at its second meeting (Rome, 2007), non Annex I plant genetic resources that are held in the CGIAR centres and that were collected before the Treaty entered into force (before 29 June 2004), would be made available through the Standard Material Transfer Agreement. Non-Annex I material received by the centres after 29 June 2004 would be made available following the conditions established between the CGIAR centres and the originating country of the materials. Therefore, according to the ITPGRFA and the decisions of the Governing Body, the collections of maca, arracacha, yacón and Andean cereals that were received by the CGIAR centres before 29 June 2004 would be subject to an Standard Material Transfer Agreement (SMTA) and not to national access to genetic resources legislation. The contradiction between the Treaty and the Peruvian national regulation may require the regulation to be modified in order to be in accordance with the Governing Body's decisions. This situation of uncertainty has led the CIP to paralyze any shipments of Andean roots and tubers to foreign countries, just until the scope and compatibility of both regimes of access and benefit sharing is cleared.[46]

This is of special relevance, as when the resource would be used with commercial purposes, national regulation on access and benefit sharing would apply and access to the materials would be under an access contract negotiation,[47] and with this aim the interested party would have to present an application before the competent authorities mentioned earlier.

- Plant genetic resources preserved in *ex situ* centres:

  - For research purposes: transfer of materials from *ex situ* centres to national or international researchers will be made under a MTA. The application will include a detailed description of the project, work schedule, budget and professionals involved. The competent authority (INIA) will approve the transfer of materials through a standardized MTA. The MTA will include as mandatory the prohibition to claim for property over 'the genetic material per se' or its derivatives; the obligation of not transferring the material to third parties without competent authority consent and the acknowledgement of the origin of the genetic resource object of the agreement (Article 33).

  - For commercial purposes: access shall be granted through the negotiation of an access agreement and to this end an application shall be submitted to the responsible authorities as was initially mentioned. It is foreseen that an accessory contract will be celebrated between the applicant and the *ex situ* centre that is in possession of the materials (the MTA is considered as an accessory contract to this effect).

When research projects involve associated traditional knowledge the provisions of Law 27811 should be considered.[48] This law, which regulates access to the collective knowledge of indigenous peoples in relation to biological resources, was approved on 24 May 2002. This rule provides for the need for prior informed consent and the execution of license agreements when the use of such knowledge is for commercial purposes. In the case of projects limited to collecting samples or biological specimens of flora or fauna or micro-organisms for the purposes of scientific research, not involving activities at the molecular, genetic or extract research level (except when required for ecological, taxonomic, biogeography, systematic or phylogeny

studies) and activities that take place outside natural protected areas, the rules governing scientific collection standards should apply.[49]

The regional government of Cusco has issued a norm that 'regulates the activities of access to genetic resources and knowledge, ancestral practices and innovations associated with those genetic resources in traditional territories of indigenous and campesino communities in Cusco Region'[50] and grants powers to regional authorities to help communities in developing and monitoring access protocols and obtaining prior informed consent and the development of a register of bioprospecting and research activities in the region.

Finally, Law 28216 established the National Commission against Biopiracy in 2004.[51] Its mission is to identify cases of biopiracy, which are understood to be those cases that involve the unauthorized and uncompensated access and use of biological resources or traditional knowledge of indigenous peoples, in violation of the principles established in the CBD and the existing rules on this issue.[52] In a period of six years, and with great effort by the institutions, six patent applications involving PGRFA of Peruvian origin such as maca, sacha inchi and camu camu were halted.[53] The National Commission against Biopiracy has set priorities for 35 biological resources of Peruvian origin to identify and monitor cases of biopiracy in patent applications or patents granted in major patent offices worldwide. Of these, 15 involve PGRFA (the rest are plants used in medicine, cosmetics or industry).

Table 7
National Commission against Biopiracy:
PGRFA prioritized in the search for cases of biopiracy

Common name	Scientific name
Maca	*Lepidium peruvianum*
Camu camu	*Myrciaria dubia*
Purple Corn	*Zea mays*
Tara	*Caesalpinia tara*
Yacón	*Smallanthus sonchifolius*
Sacha Inchi	*Plukenetia volubilis*
Caigua	*Cyclanthera pedata*
Lucuma	*Pouteria lucuma*
Cherimoya	*Annona cherimola*
Oca	*Oxalis tuberosa*
Olluco	*Ullucus tuberosus*
Mashua	*Tripaeolum tuberosum*
Tarwi	*Lupinus mutabilis*
Cañihua	*Chenopodium pallidicaule*
Soursop	*Annona muricata*

Source: See <http://www.biopirateria.gob.pe>.

A study by S. Pastor (2008), using the search engine of the European Patent Office, reveals that in 2006 a total of 946 patent documents were identified in which biogenetic resources of 91 species of agrobiodiversity native to Peru were used. None of the patents belong to Peru and only 19 cases come from Latin American countries (Brazil and Mexico) that share many of the species. The countries where such patents were registered were Japan (32 percent), United States (19 percent), South Korea (11 percent), China (5 percent) and various European countries (United Kingdom, 4 percent; Romania, 3 percent; France, 2 percent). These patent documents contend that such innovative uses (in the analysis of a random sample of 341 documents) are used for agricultural breeding in 13 percent of cases and for different purposes in 66 percent of cases (parapharmacy (29 percent), industrial (20 percent) and pharmaceutical (17 percent)). Among the species used in inventions registered in patent documents are maize, potatoes, beans and sweet potatoes.

8. Peru and the ITPGRFA: Analysis of the situation and recommendations

This section will analyze Peru's opportunities and obstacles in actively participating in the ITPGRFA and, in particular, its multilateral system of access and benefit sharing in light of all of the information collected during the study and presented earlier.

8.1. Ratification and initial challenges to the implementation of the ITPGRFA

Peru signed the ITPGRFA on 8 October 2002 and ratified it through Supreme Decree on 5 June 2003 (Doc. DS 012-2003-RE), and it entered into force on 29 June 2004. Peru is part of the Governing Body of the Treaty. Potato, maize, cassava, sweet potatoes and beans are among the crops listed in Annex I of the Treaty, for which Peru is a centre of origin and diversification and has several significant collections. The Ministry of Agriculture and, in particular, the INIA was the leading agency in the signature and ratification of the ITPGRFA as its officials were the ones involved in the international negotiation. The INIA promoted the ITPGRFA's ratification on the grounds that the multilateral system was beneficial for Peru as it included the main crops for food and agriculture that are fundamental to the country's agricultural research, export capacity and food security. Permanent and easy access to such resources was considered to be a priority. However, this decision was not subject to discussion or consultation with other related institutions such as universities, farmers' associations or policy experts in relation to access and benefit sharing.

These circumstances have contributed partially to why so many questions have been raised about the compatibility of the ITPGRFA with existing national legislation regarding access to genetic resources and traditional knowledge for research and bioprospecting objectives and the distribution of benefits arising from their use. In particular, it has been questioned whether the ITPGRFA coordinates with Andean Decision 391, which establishes a common regime for the Andean countries in this area.[54] Such uncertainty is why the implementation of the Treaty, despite its entry into force in 2004, has been subject to the approval of a policy and institutional framework that would develop Decision 391 nationwide. Although this decision dates from 1996, it was not until 2009 that its national implementation was defined through Supreme Decree 003-2009-MINAM. Article 2, paragraph c, of this regulation helps to clarify the picture since it expressly excludes from the bilateral access regime the provision of genetic material such as food and forage species listed in Annex I of the Treaty.

8.2. Awareness of the ITPGRFA

To date, a focal point for the Treaty has still not been officially designated. This could be the reason for the lack of knowledge among stakeholders involved in its potential implementation, either as recipients or as beneficiaries (despite the various outreach activities that have been carried out). However, the understanding of users varies. While most farmers are unaware of the ITPGRFA (including medium and large enterprises with greater access to information), research institutes and *ex situ* centres (such as the INIA, universities and the CIP) do have the information. Knowledge is also higher among representatives acquainted with the design of policies regarding access to genetic resources and intellectual property.[55] The official designation of the INIA (in particular, the Sub Directorate of Genetic Resources and Biotechnology) as a focal point will help this institution to promote knowledge enhancement and participate with other stakeholders involved in this issue.

In general, the users that were interviewed assume that the ITPGRFA's operation – both through the multilateral system and its other regimes – has not yet been implemented. Among users with knowledge of the Treaty, there is the common perception of the Treaty as an agreement that involves the transfer of national sovereign rights (which recognizes the countries control over the resources) towards a free exchange aimed at food and agricultural research. In regard to the potential benefits of the Treaty, users emphasize the guarantee of food security. However, they do not have clarity on how it can benefit small farmers; how it can implement farmers' rights; how the distribution of benefits will take place or if a recognition of the origin of materials will be included. There also exists confusion on how the multilateral system will operate in regard to benefit sharing and what its scope will be in relation to PGRFA.

The INIA representatives and related research centres are more acquainted with the implications of the ITPGRFA. However, there is uncertainty about the national collections and whether they meet the requirements of Article 11.2 of the Treaty (that states that all PGRFA listed in Annex I that are under the management and control of the contracting parties and in the public domain should be included in the multilateral system) in order to define their inclusion under the multilateral system.

Finally, in relation to the participation of civil society, there is a shallow understanding of the ITPGRFA and its implications for farmers' associations, especially those that have been involved with the Genetic Resources Policy Initiative Project (GRPI).[56] Civil society organizations and indigenous groups have been more engaged in the CBD process and in national policies in relation to access to genetic resources and traditional knowledge than those that exist under the ITPGRFA. However, it is noteworthy that the Potato Park Association has closely followed the negotiations of the Treaty. Among the 11 projects awarded worldwide by the Treaty's Governing Body at its third session, which was held in Tunis on 1-5 June 2009 under the Benefit Sharing Fund, funding was awarded to the Andes Association and the Potato Park Association in order to strengthen the work of the Colectivo Papa Arariwa to recover, preserve and strengthen traditional practices in order to cope with climate change.[57]

8.3. Incentives and disincentives for Peru to participate in the multilateral system of the ITPGRFA

The multilateral system includes convenient access to a pool of genetic resources, whereby different countries share regulated access to PGRFA from other member states for research, breeding, conservation and training objectives. Material exchange becomes expeditious in real time and at a lower cost. The opportunities offered by this mechanism include two-way communication – countries must agree to share available resources in exchange for the utilization of materials from other member countries. Therefore, the advantages and opportunities are specific to public goods and the interdependence of resources and information. The country contribution to the common pool of resources as well as the possibility to 'appropriate' and benefit from this contribution, will depend not only on the country institutional architecture and policy but also on the capacity of national research and agricultural breeding programmes and the power to disseminate the resulting innovations.

8.3.1. Opportunities and challenges for Peru

In the case of Peru, interesting elements converge and perform as incentives and disincentives to its participation in the multilateral system. These are clearly evident in the situation mentioned by Daniel Debouck (2010) in regard to beans: 'There are two interesting elements in the case of Peru. One, there is little doubt that Peru is the center of origin of two cultivated bean species (*vulgaris* and *lunatus*). However, Peru uses bean genetic resources from other sources. And a very biological explanation for this situation is mentioned: the genes for resistance or breeding often exist in the other centers of origin (and vice versa for Mesoamerica). Also, due to management problems, the largest and best collection of Peruvian material is in Palmira, Colombia. We are trying to correct this situation, but Peru should ensure the availability of adequate skills in this area.'

The demand for PGRFA in Peru relies also on the fact that agricultural production that generates foreign exchange for the country is based on introduced species – the main crops per area harvested are represented by introduced crops such as rice, coffee, barley and wheat. Moreover, food security of the poorest peasants in the highlands relies heavily on the latter two introduced crops. If we look into the future, the need for PGRFA is already clear as a result of the existing narrow genetic base of the agribusiness and the organic market, which has a great export potential; the specific threat of high Andean ecosystems degradation (soil erosion) as well as the presence of new pests and the extreme atmospheric events that are a result of climate change. In the future, this last factor will have a particular impact on the country as we are experiencing an increasing number of climate disasters that will have an effect on the crops listed in Annex I and on highland farmers with scarce resources. In particular, one of the greatest impacts of climate change will be the lack of

available seed for the next planting season, which is one of the biggest challenges for national institutions that support resilient Peruvian farmers.

The multilateral system offers clear advantages in terms of rural development, market opportunity and response to vulnerabilities and environmental risks since it broadens the availability of PGRFA. These variables are decisive for a country with a very small budget in agricultural research as well as with an ongoing need to develop agricultural research and breeding due to the diversity of its ecology regions, climate and the varied geographic latitude that characterize the country. These circumstances force us to cultivate plants that broaden the range of genetic diversity available to farmers. Similarly, Peru's ability to make use of the benefits of the system are very favourable. In Peru, the diverse ecological zones and climate regions converge and allow extensive adaptation of foreign species, especially those listed in Annex I to the ITPGRFA.

Conversely, Peru has great potential to contribute to the multilateral system since it has substantial public collections of germplasm of specific crops in Annex I, such as potatoes, cassava, sweet potatoes, maize and beans. Many of these national collections meet the requirements of Article 11.2 of the ITPGRFA, and they are in the public domain and under the management and control of the parties. Only the INIA's National Bank of Germplasm comprises a total of 5,925 accessions for 20 species listed in Annex I. Furthermore, *in situ* conservation implemented by communities throughout the country demands the recognition of knowledge and traditional practices that allow the country to preserve its rich agro-biodiversity. In this context, national development policies and standards that promote conservation through the recognition of farmers' rights is absolutely relevant in implementing the ITPGRFA in Peru. In the following paragraphs we analyze the key areas where intervention is needed for Peru to fully benefit from its participation in the multilateral system:

Building capacities, improving technologies and enhancing collaboration

In Peru, there is a defined organizational structure with high geographical representation dedicated to research on PGRFA. This is based primarily on public research institutions (the INIA and the IIAP) as well as the country's public universities. The research primarily concerns genetic resources, and there is a weak development in formal crop improvement. Most of the institutions develop morphological characterization – molecular characterization is limited – and there is no systematic agronomic characterization. Most characterization work is performed with descriptors from the International Board of Plant Genetic Resources, which facilitates a global information-sharing approach.

However, a national research system in PGRFA has not been fully developed due to the scarcity of financial resources, technological and human resources and the isolation that is predominant in the work of the various research programmes. There are no minimum resources and technology to conduct research of importance or the necessary coordination between the various institutions of research and breeding. The lack of financial resources has had an effect on the weakness of the *ex situ* collections' conservation. The lack of synergy has resulted in the duplication of collections; an overlap in the plant genetic resources that are under investigation; an overlap in the scope and purpose of the projects; the inefficient allocation of resources; a lack of consolidation in the team work; a weak empowerment of the researchers (especially for basic research on genetic resources); a lack of continuity in the long-term research projects and poor links with private companies, among other factors. The capacity to carry out formal breeding projects can act as a disincentive for institutions to participate actively in a system that has, as its main advantage, the ability to access a wide and diverse gene pool. If there are no technological supports, financial means and human resources available, it is difficult for institutions to be willing to take on new challenges.

The weakness of these research centres is enhanced in the absence of a dynamic and standardized national information and documentation system that enables easy access to information in the collections and provides information to breeders. For this reason, the research centres have appreciated the experience provided by the GRIN program, although further modernization and strengthening is needed. Currently, the information is fragmented and difficult to access. There is no data stored or processed on the germplasm preserved by research centres nationwide that could be of easy access to the third parties.

In this sense, the practical application of the ITPGRFA will depend largely on the enhanced availability and accessibility to information on genetic material. The INIA will have to make an effort as coordinator and focal point in order for this information to be completed easily. If not, the information will be of no use. Therefore, it can be said that the material will only be included under the multilateral system, if it is adequately documented and available to the public. This necessity may promote the development of the National Mechanism of Information Exchange on the Implementation of the Global Action Plan and, consequently, may improve access to nationally available information on the use of PGRFA. Breeders who are currently working in a decentralized manner in the country will benefit considerably.

Thus, participation in the multilateral system can promote consolidation of a National System of Plant Genetic Resources Research that will begin with crops in Annex I and with the potential to include others in the future. Additionally, it can help to rationalize the collection and improve standards of conservation. In addition, such participation may promote the use of common protocols, descriptors and standards among the country's researchers to enable the exchange of information on assessment and characterization developed by the different parties. In this sense, data availability on the characterization of crops in different environments gains special importance as a result of climate change. In turn, this can revitalize the direct exchange of information, the implementation of outreach activities by species or region (seminars, workshops, meetings) and publications on the subject. Accordingly, information generated in the early stages of characterization and evaluation could be used more efficiently. This wider empowerment can promote greater cooperation between the curators of collections and users, with a greater emphasis on breeder's participation to define the priorities of characterization and evaluation of the collections. Finally, it could promote the implementation of national and/or regional networks for collection assessment.

These activities can be included in a strategy for plant genetic resources conservation. Thus, mechanisms can be developed to protect the collections of unique and valuable plant genetic resources in the world, preserved *ex situ*, by facilitating the characterization, regeneration, documentation and exchange of information that is related to them. It can also encourage germplasm duplication to give additional protection to the collections. This opportunity can be linked to initiatives such as those developed within the Conservation Strategy for the Americas. Nationally, this strategy may promote linkages between *ex situ* and *in situ* conservation, which is critical for the conservation of agro-biodiversity and plant genetic resources. It may also involve access to technology for the conservation of PGRFA and might even involve enhanced access to technologies protected by intellectual property rights.

Participation in the multilateral system can help highlight Peru's dependence on foreign crops, despite its condition of being a country rich in agro-biodiversity. This better understanding can help prioritize and determine the need to explore genetic material found in foreign research centres that has a high potential for agribusiness and new national agricultural and export markets. Research institutions may well become not only developers of new inventions but also builders of access bridges to link existing technology with the end users. In this new field of action, the relationships between researchers and companies can become strengthened. Similarly, it could also help to highlight Peru's dependence on material from the CGIAR centres and may provide impetus to further intensify relations with these centres. This recognition is crucial not only for the research centres that are already benefiting but also for universities, both public and private, that are decentralized and whose researchers are isolated.

In this sense, collaboration within the system can contribute to capacity building and technology transfer. There is a great need to promote the training of researchers in master's and Ph.D. programs that will strengthen the country's plant genetic resources and empower this kind of research in national universities. The system can promote scientific cooperation and build partnerships that involve a transfer of knowledge and technology and a better ability to find funding for research. Experience gained in network participation can be of importance to empower national scientists and motivate them in the development of research and the improvement of crops that meet existing domestic and international demands.

Along these lines, the building of skills as a result of this exchange is of vital importance to national agricultural research. The multilateral system can act as a sponsor to open new lines of research such as the behavioural or genetic material response to climate change, which has heretofore been absent in the research agendas of curators or keepers of germplasm collections. It may involve a more efficient allocation of resources for *ex situ* and *in situ* conservation with resource prioritization and the avoidance of duplicating collections.

In Peru, conditions exist for a wider dialogue and better communication between the various stakeholders in PGRFA processes, including a significant number of public institutions engaged in research on PGRFA, with significant geographic coverage; farmers' associations working with Annex I crops; the participation of civil society organizations promoting *in situ* conservation and with links to end users; experience in partnerships with local and regional governments in relation to PGRFA and the creation of consortia with the participation of private companies, universities and policy decision makers and with multi-sectorial and participatory working groups for the drafting of policy and regulatory frameworks for the conservation of PGRFA and agro-biodiversity in the country.

At the government level, synergies should be sought with the Institute for Innovation and Competitiveness for Peruvian Agriculture[58] and the Agriculture and Forestry Biotechnology Centre, which can serve as a link with the private sector and agribusiness and encourage private investment in research. In addition, regional governments have taken on the responsibility of agricultural extension and developing new skills in agriculture. This situation and their best economic capacity give them a strong position to promote with local governments, agricultural research in their territories and spheres of government.

To seize the opportunities that the multilateral system offers, it is necessary to structure this collection of stakeholders, their roles and a short- to medium-term action strategy. A next step could be to set the stage for a network of *ex situ* conservation, involving researchers and breeders nationwide (the INIA is proposing the constitution of a National System for the Conservation of Germplasm). In general, this platform can help to make feasible and available information on plant genetic resources; to encourage the greater coordination and effectiveness of the programmes and to promote long-term research and allow for greater organization of plant genetic resources research.

Moreover, the establishment of a national user platform around the conservation of genetic resources can help to identify partners and join efforts with innovation actors in the private sphere that have the ability of introducing effective changes, including NGOs and farmers' associations as well as the general, social and economic processes that drive innovation to meet their needs. This platform can be used to implement priority plant genetic resources, evaluate relevant materials with farmers, establish better systems for the multiplication and dissemination of varieties and encourage the implementation of farmers' rights in the country.

The INIA has a unique position to act as a pivotal point for the existing players for the implementation of the multilateral system. The INIA is the governing body of the recently created National Agricultural Innovation System.[59] It is made up of several government and civil society institutions[60] and aims to promote the generation, transfer and adaptation of knowledge and technology to farming to boost competitiveness in agriculture. The specific objectives include the promotion of new tools in research processes (biotechnology, nanotechnology and bioinformatics) and of promotion of agricultural producers' access to information related to innovation and technological development of agriculture. In this context, the idea is to set up an agricultural innovation network as a mechanism of direct linkages between the state, private sector and academic institutions responsible for research, training and technological development.[62]

In connection with the extension and dissemination of research, a disincentive to participate actively in the multilateral system is the predominance of an unstructured agricultural extension service that implies the involvement of a wide range of dispersal institutions and that has little social capital to develop technologies. The absence of strong farmers' associations is highlighted (particularly in the Sierra), as these institutions could articulate demand and innovation process development and act as partners with research agencies.

Additionally, it is important to consider that the majority of registered certified seed growers are also seed producers for crops listed in Annex I – thus, the dominance of the informal seed market and the high dependence on imports of seed for planting by the agribusiness and export sector. The traditional farmer does not buy quality seed due to its high cost and lack of confidence in the mechanisms of distribution (high level of tampering). In this regard, the agricultural industry and the farmer's links to research institutions are poor. Another factor is the narrow genetic base for crops that have been certified for marketing. Crops that have been approved for marketing and are the result of breeding processes represent a limited number of species and varieties.

This scenario undermines the possibilities for Peruvian farmers to have quality seed (including crops in Annex I) and indicates a need for a change in the way the national seed system works. The revitalization of supply and demand for quality seed requires the implementation of mechanisms to ensure independence from supervision institutions and a greater control on seed marketing. This change may occur together with the new bilateral trade agreements[62] in which Peru participates and that will demand greater efficiency in public management, as Peru enters new markets where competition is stronger. In this new scenario, the active participation of Peru in the multilateral system is very relevant as the country tries to be more competitive in the domestic agricultural sector.

Establishing a clear regulatory and institutional framework for access to and exchange of germplasm

It is not enough to have genetic material that is viable and available. A country also needs to have a clear and well-defined regulatory and institutional system for access to PGRFA in order to achieve a feasible exchange objective for research and crop improvement. First, the regulatory systems of genetic material exchange have attained great importance in practice. In principle, genetic material exchange is affected foremost by the application of phytosanitary regulations. For genetic material export and import, a plant health certificate is required, and this certificate carries a high cost in time and resources. The second greatest obstacle would be access legislation. Indeed, in recent years, there has been much fear and distrust among institutions in relation to the exchange of genetic material. While there have been dissimilar practices in the academic sector and in some *ex situ* conservation centres in shipments of genetic material abroad, it can be stated in general that the fear of being accused of biopiracy or extracting a country's resources that can be illegally appropriated, as a result of media and social pressure, has encouraged institutions to curb these practices.

Currently, there are clearly defined frameworks on access to genetic resources that originate in Peru in general and to PGRFA in particular. This framework begins with the recent regulation on access to genetic resources in 2009, which identifies the powers and responsibilities of public authorities in the field. Specifically, the regulation on exchange of PGRFA included in Annex I is made using an MTA to be approved by the INIA. This point can be an incentive to build national confidence in the mechanisms of exchange of genetic material and the active participation of Peru in the multilateral system. In this regard, it could be very helpful to hold workshops that allow a deeper understanding of the ITPGRFA, the operation of the SMTA, and the new national access laws.

Raising awareness about PGRFA and the ITPGRFA among decision makers

At high levels of political decision, there is a low level of awareness and relevance granted to the conservation and availability of PGRFA for the development of the country. The benefits that may result from access by national research centres to a wide diversity of genetic materials are not visualized. Hence, budget allocations in these areas suffer the same neglect that has affected private companies. The future focal point for the ITPGRFA's implementation will be the INIA and, in particular, the SUDIRGEB. The main concerns raised in relation to the multilateral system's implementation in the country apply, first, to the provision of the requested material and, second, to the monitoring of its use. In regard to the first point, the most immediate step for the effective implementation of the Treaty is the INIA's designation as the focal point of the ITPGRFA through the relevant rule. Another aspect is the identification of germplasm banks that meet the requirements of Article 11.2 of the Treaty and that are included in crops listed in Annex I.

The INIA's germplasm collection that covers crops listed in Annex I is included within the scope of the multilateral system. However, there is uncertainty in relation to other collections held by public universities and other *ex situ* facilities of the country. The National System for the Conservation of Germplasm can be of great assistance in identifying germplasm banks and collections that are covered within the scope of the multilateral system. It will also help to clarify to what extent the benefits from this exchange of PGRFA can be taken into account. Furthermore, it is understood that there is an excessive focus on *ex situ* conservation that raises questions about the benefits of reaching other types of conservation such as those *in situ*. The dissemination of generated information and pre-breeding material to various communities to develop participatory-breeding processes indicate the way to strengthen *in situ* conservation and contribute to research centres implementation of farmer's rights. In this respect, funding of the Potato Park Project could be a pilot program and contribute to a better understanding.

Peru has important collections of crops listed in Annex I, and in the future it is foreseen that numerous requests will be received for these materials. Therefore, many practical issues may arise including a lack of human resources to process applications and the need for financial resources to provide the requested materials (the need to propagate and multiply materials) as well as the availability of genetic stock and the information about it.[63] The present concern in monitoring the use of resources is the same that has taken place in the past for authorized MTAs. In these cases, if the national authority is suspicious of uses other than those permitted in the MTA, access will be denied as a way of precaution. In view of this situation, it is important to strengthen the INIA's bargaining and legal skills and to strengthen the understanding and implementation of the SMTA at this level.

Finally, the implementation of farmers' rights is considered a priority that serves as an incentive and a challenge to implement the ITPGRFA in Peru. Different institutions require creative solutions from the different levels (legal, policy and scientific) that enable farmers to continue their work in agricultural diversity conservation and to have their efforts acknowledged. Likewise, it is especially important that the implementation benefits of the ITPGRFA reach the end users and have an impact on the livelihoods of small farmers and communities implementing *in situ* conservation.

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[1] Peru has a total area of 128.5 million hectares comprising 12 percent as coastal area, 28 percent as highlands (Sierra) and 60 percent as forest area (Selva)..

[2] Thus, from 8,000 BC, there have been indications of the existence in Peru of crops such as potatoes (Solanum sp.) olluco (Ullucus tuberosus), cassava (Manihot esculenta), sweet potatoes (Ipomoea batatas), jicama (Pachyrrhyzus sp.), Lima beans (Phaseolus lunatus), beans (Phaseolus vulgaris), oca (Oxalis tuberosus) and peppers (Capsicum chinense). Pumpkins (Cucurbita sp.) dates back to 7,000 BC and cotton (Gossipium barbadense) to 4,200 BC. Such crops have witnessed the birth of empires and cultures such as the Wari, Chavin, Tiwanaku and Inca cultures, among others, and represent an ancient cultural heritage. Other crops such as maize (Zea mays), which is of Mesoamerica origin, have a history in Peru from 4,000 BC and at present are adapted to different ecological zones, reaching over 55 races..

[3] International Treaty on Plant Genetic Resources for Food and Agriculture, 29 June 2004, <http://www.planttreaty.org/texts_en.htm> (last accessed 10 May 2011).

[4] Main supplier countries are Argentina, the United States and Chile. See <http://www.minag.gob.pe/download/pdf/especiales/dinamica/VIII_Comercio_Exterior.pdf> (last accessed December 2009).

[5] Total seed imports for asparagus planting during 2005-9 has reached around 18 tonnes (2005: 3.7 tonnes; 2006: 5 tonnes; 2007: 4.8 tonnes; 2008: 2.6 tonnes and 2009: 1.5 tonnes).

[6] Data from the National Statistics and Remote Sensing Office of the National Civil Defense Institute, <http://www.indeci.gob.pe/estadisticas> (last accessed 23 November 2009).

[7] Lima Declaration on Food Security, Climate Change and Bioenergy, issued on the occasion of World Food Day, 30 October 2008, <http://www.minag.gob.pe/download/pdf/especiales/DMA/declaracion.pdf> (last accessed 25 November 2009).

[8] In relation to the impacts on the high Andean zones, see Coordination Unit of the FAO's Emergency and Rehabilitation, Peru, Newsletter no. 1, December 2008..

[9] The importance of the issue for Peru has led to the establishment of the Technical Working Group on Food Security and Climate Change in charge of proposing the sectorial vision of climate change on agricultural production systems in the country through Ministerial Resolution no. 0647-2008-AG.

[10] According to R. Sevilla (2008b), the downward trend in breeding activities is primarily due to: the recent belief that biotechnology will be sufficient for the improvement of plants and animals; the bad reputation of the Green Revolution, which is blamed for the loss of genetic diversity and the need for external inputs that are not available to poor farmers; expectations about the role of the private sector and the centralization of breeding activities in a few companies.

[11] Daniel Debouck, CIAT, personal communication, January 2010.

[12] Luis Narro, CIMMYT, personal communication, December 2009.

[13] Salvatore Ceccarelli, ICARDA, personal communication, January 2010.

[14] Daniel Debouck, CIAT, personal communication, January 2010.

[15] The new regulation allows that both seed production and marketing and seed certification are carried out by the same entities, without needing to show that they have enough technical capacity to provide the certification services. Decree no. 026-2008-AG that approves the regulations of the Seed Law, Law no. 27262 (Article 3a).

[16] For example, the UNALM's Agreement with the Regional Government of Junín, in which the UNALM is committed to provide the seed variety 'Centenario,' required the government to plant one thousand (1,000) hectares for crop year 2008-9 and the regional government to support the UNALM in the call for producers.

[17] In this regard, we must bear in mind the low educational level of the rural population in Peru, where in the year 2007, 22 percent of the rural population of 15 years and older was illiterate in opposition to 10.5 percent at the national level.

[18] In Peru, a participatory six-year (2003-9) breeding program was developed for the central Sierra, in departments affected by extreme poverty and high biodiversity concentration and with high risk of genetic erosion. The resources allocated to breeding processes include the following crops: broad beans, corn and native potatoes. As a result, five varieties of broad beans, six of corn and at least 15 of native potatoes, with traits tailored to the criteria chosen by farmers, are being released in the communities.

[19] Published in the official gazette El Peruano on 28 June 2008.

[20] Published in the official gazette El Peruano on 11 October 2008.

[21] The register is managed by the Institute for Protection of Competition and Intellectual Property.

[22] International Convention for the Protection of New Varieties of Plants, adopted on 2 December 1961, <http://www.upov.int/en/publications/conventions/index.html> (last accessed 15 May 2011).

[23] According to the International Seed Federation, <http://www.worldseed.org> (last accessed December 2009).

[24] Registered seed is the seed of a variety that is entered into the National Register of Commercial Cultivars and on which the competent authority (in relation to seeds) has certified its purity and quality. In some cases, marketed seed is not registered in those crops where no specific regulation has been developed such as the case of quinoa, kiwicha, cañihua, fruit trees, among others.

[25] The prevalence rate refers to the certified seed used in comparison with farmers' seed. Informal seed volumes used are estimates, basically according to the areas intended for planting a particular crop.

[26] According to J. Echenique (2009, 38), the elements limiting technological changes in family farming in Peru are structural and cannot be easily removed with isolated measures. These relate to restricted access to land and water, lack of infrastructure and capital, market defects, poor negotiating skills, high average age of farm owners and low level of formal education.

[27] Seed roads or paths are an important mechanism for acquisition of seed by the Andean farmer. For example, seed routes are identified for corn, beans, cassava, sweet potatoes, granadilla, potatoes and custard apple. The *in situ* project identified 437 seed rutes functioning in ten regions in the project priority areas (INIA-SUDIRGEB, 2007, 49).

[28] The register was created by Ministerial Resolution no. 543-2008-AG.

[29] The information provided under this chapter has been obtained from a study created by M. Ramírez (2008).

[30] The Andean Plant Genetic Resources Network was created in 1992 by Bioversity International and the Cooperative Program of Research and Agricultural Technology Transfer for the Andean Subregion (PROCIANDINO) and it includes Bolivia, Colombia, Ecuador, Venezuela and Peru. Its objectives are to strengthen capacity building in conservation and sustainable use of plant genetic resources. Priority crops include fruits, roots and tubers, native to the Andes (Ramírez, 2008, 87). Currently, PROCIANDINO has prioritized five themes: safety and food security; agro-biotechnology; climate change

[31] The PROCIANDINO created TROPIGEN in 1992 and it includes Bolivia, Brazil, Ecuador, Colombia, Guyana, Suriname and Peru. Its objectives are the conservation and sustainable use of plant genetic resources and capacity building. Priority crops include Bactris, Theobroma, Ananas and Carica (Ramírez, 2008, 87).

[32] Llermé Ríos and Manuel Sigüeñas, INIA, personal communication, September 2009.

[33] This project is framed within REDARFIT. The collection is small.

[34] Acknowledged by Ministerial Resolution no. 0533-2008-AG, 1 July 2008.

[35] See <http://www.infoandina.org>; <http://www.agroredperu.org> (last accessed 11 July 2011). His work was presented at the event held in Lima in October 2009. 'La información en el acceso abierto a la información agrícola y el medio ambiente,' <http://www.aibda.com/ribda/es/node/62 (last accessed January 2010).

[36] See <http://www.comunicadoresrurales.org> (last accessed 15 May 2011).

[37] See 'Seminario Comunicación para el Desarrollo rural,' which was held in Cusco on 15 May 2009, <http://www.cepes.oerg.pe> (last accessed January 2010).

[38] An example is the Comisión Nacional de Productos Bandera, which seeks to promote markets for certain products that are preferred by foreign markets and that highlight the image and identity of Peru such as maca, lucuma, Peruvian cotton, Peruvian camelids, Peruvian cuisine and Chulucanas pottery.

[39] Supreme Decree no. 009-2005-AG, which established 30 May as National Potato Day to highlight the virtues of the tuber and its contribution to food security and Andean cultural diversity.

[40] This is the case of the Action Network for Alternative Agriculture, <http://www.raaa.org.pe>; of the National Association of Ecological Producers of Peru, <http://anpeperu.org/temainteres.php> or the Network of Ecological Agriculture of Peru, <http://www.raeperu.org>.

[41] The Andean Community is currently made up of Ecuador, Bolivia, Colombia and Peru. Of these countries, Ecuador and Peru are parties to the ITPGRFA. Venezuela left the Andean Community in 2006. CBD, supra note 2. Decision 391 on a Common Regimen on Access to Genetic Resources, 2 July 1996, Commission of the Cartagena Agreement of the Andean Community, Comunidad Andina, <http://www.comunidadandina.org/ingles/normativa/d391e.htm> (last accessed 15 May 2011).

[42] Article 1 defines access as 'the collection and use of genetic resources conserved in-situ and ex-situ conditions, its derivatives and, if any, its intangible components, for research, biological prospecting, conservation, industrial application or commercial use, among others.'

[43] These conclusions were reached in the 'Seminario Regional sobre Acceso a los Recursos Fitogenéticos en la Región Andina: el CDB, la Decisión 391, el Tratado Internacional de la FAO y otros Avances Políticos y Normativos,' which was held in 2003 at the International Potato Center and that gathered experts on policies related to access to genetic resources in the Andean Region.

[44] Manuel Sigüeñas, INIA, personal communication, January 2010.

[45] Published in the official gazette El Peruano on 18 January 2009.

[46] According to a document presented at the third meeting of the Governing Body (Tunis, 2009) in relation to CGIAR centres' experiences in the implementation of the Standard Material Transfer Agreement, the CIP would have distributed a total of 143 shipments of non-Annex I materials, of which 134 would have been sent to developing countries; seven to developing countries and two to other CGIAR centres. See Experience of the International Agricultural Research Centers of the CGIAR with the implementation of the agreements of the Governing Body, with particular reference to the use of the standard material transfer agreement for annex I and non-annex I crops, Document no. IT/GB-3/09/Inf. 15 (2009) at 18.

[47] Article 29: 'Genetic Resources shipping from Ex-situ Conservation Centers. Shipping of any genetic resource from ex-situ conservation centers located in the country for research purposes shall be carried out through a Material Transfer Agreement which establishes the obligations and conditions for the use of such material. The agreement shall include conditions for transfer of these materials to third parties, and recognition of its origin.

Shipping of genetic resources from ex-situ conservation centers for commercial purposes is done through an access contract.'

[48] It is worth mentioning in relation to this subject, the recent National Directorial Resolution no. 1986/INC of 23 December 2009, which declared as national cultural heritage the knowledge, traditional uses and technologies associated with the cultivation of corn in the Incas Sacred Valley, Cusco region.

[49] The regulation on the scientific collection for basic research is gathered in the regulation on the Law on Forestry and Wildlife (DS 014-2001-AG). The request to conduct scientific research and collection of biological material must be accompanied by a research plan in the Spanish language that will have the participation of at least a Peruvian researcher or assistant and, if applicable, prior informed consent of communities to participate in the project and the commitment to deliver 50 percent of the material collected by species of flora and/or fauna, holotypes and paratypes, to a nationally recognized scientific institution. The approval is the responsibility of the General Directorate of Forestry and Wildlife of MINAG and concludes with the signature of a letter of agreement in which the researcher agrees to comply with certain obligations, for example, strictly observe that 'rights granted on biological resources do not confer rights on genetic resources contained therein.'

[50] Regional Ordinance no. 048-2008-CR/GRC, Cusco. Official Journal El Peruano on 14 January 2009.

[51] This law is developed through the Regulation no. DS 022-2006-PCM.

[52] As expressed in the website of the National Commission on Biopiracy, <http://www.biopirateria.gob.pe> (last accessed January 2010).

[53] Comisión Nacional contra la Biopiratería impidió que empresas extranjeras patenten cultivos autóctonos,' press release by the INDECOPI, 11 May 2009.

[54] Decision 391 on Common Access Regime to Genetic Resources, 2 July 1996, <http://www.comunidadandina.org/normativa/dec/D391.htm> (last accessed December 2009).

[55] For example,, access regimes and benefit distribution have been the subjects of discussion in the negotiation agenda of free trade agreements in the chapter on intellectual property rights (mainly with the United States and the European Union)..

[56] See Genetic Resources Policy Initiative Project, <http://www.grpi.org> (last accessed January 2010).

[57] See Andes Organization, <http://www.andes.org.pe> and <http://www.bbc.co.uk/mundo/ciencia_tecnologia/2009/11/091126_amazonas_andes_dv.shtml> (last accessed January 2010).

[58] Institute for Innovation and Competitiveness for Peruvian Agriculture is responsible for financing research projects and technological development in agriculture.

[59] This system was established by Legislative Decree no. 1060 published in the official gazette El Peruano on 28 June 2008.

[60] The National Agricultural Innovation System is comprised by the Ministry of Agriculture, the Ministry of Education, the INIA, SENASA, the regional governments and local government agencies dedicated to research, training and technology transfer to farming, public universities and private sector engaged in research and agricultural training, private companies engaged in agricultural activities, agribusiness, seed production, development of animal genetics and biotechnology companies, processing and marketing of inputs and agricultural products, organizations of agricultural producers, individuals with links in research and agricultural training and the National Institute for the Defense of Competition and Industrial Property (Article 2).

[61] Article 5 of Legislative Decree no. 1060.

[62] Peru has signed bilateral trade agreements with the United States, Canada, China, Chile, European Union, Thailand, South Korea and Singapore, among other countries.

[63] In the case of application for cassava samples, for example, material for vegetative propagation (which must be maintained *in vitro*) requires the use of laboratory re-agents and personnel.

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