



Introduction and overview

Plant genetic resources –
“the part of biodiversity that nurtures people and is nurtured by people.”



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The diversity of Andean potato varieties reflects the varied needs of the farmers who grow them.

Plant genetic resources for food and agriculture (PGRFA) are the biological basis of world food security and, directly or indirectly, support the livelihoods of every person on Earth. PGRFA encompass the diversity of genetic material in both traditional varieties and modern cultivars, as well as crop wild relatives and other wild plant species used as food. These resources serve as the plant breeder’s most important raw material and the farmer’s most essential input. They are also a reservoir of genetic adaptability to buffer against potentially harmful environmental and economic change.

Today, access to food around the world is not secure and 800 million people are undernourished. In the next 30 years, the world’s population is expected to reach 8 500 million. Reliable and sustainable improvements in yield are needed to meet the demands of this population growth. The conservation and sustainable utilization of

plant genetic resources is key to improving agricultural productivity and sustainability, thereby contributing to national development, food security and the relief of poverty.



The Report on the State of the World’s Plant Genetic Resources

FAO’s first Report on the State of the World’s Plant Genetic Resources, prepared in 1996 from more than 150 country reports, identified a number of serious gaps and inefficiencies in the conservation and utilization of these resources. Diversity is being lost in both the fields and forests of rural people and in genebanks, where it should be safe. Linkages between conservation of plant genetic resources and their development and use by plant breeders and farmers are weak. The benefits of one of the world’s most basic and valuable resources are thus not fully realized or shared.



The Global Plan of Action and the Report on the State of the World’s Plant Genetic Resources were prepared through a unique, country-driven process. 158 countries prepared country reports. 143 countries participated in 12 sub-regional and regional preparatory meetings which finalized sub-regional synthesis reports and made recommendations for the Global Plan of Action. The process was guided by the Commission on Genetic Resources for Food and Agriculture and culminated in the International Technical Conference, attended by 150 countries and over 50 non-governmental organisations.



The Global Plan of Action

The Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture is a set of recommendations and activities which grows logically out of the State of the World Report. The FAO International Technical Conference on Plant Genetic Resources held in Leipzig, Germany, formally adopted the Plan on 23 June 1996 and, with it, a Leipzig Declaration that affirmed government-level commitment to implementing the Plan in the context of national efforts to strengthen world food security.

The Global Plan of Action is intended as a framework, guide and catalyst for action at community, national, regional and international levels. It seeks to create an efficient system for the conservation and sustainable use of plant



genetic resources, through better cooperation, coordination and planning and through the strengthening of capacities. It is an essential contribution to successful implementation of the Convention on Biological Diversity.

The Global Plan of Action’s main objectives are to:

- ensure the conservation of plant genetic resources for food and agriculture as the basis of food security
- promote sustainable use of plant genetic resources to foster development and reduce hunger and poverty
- promote the fair and equitable sharing of the benefits arising from the use of plant genetic resources
- assist countries and institutions to identify priorities for action
- strengthen existing programmes and enhance institutional capacity.

In 1983, FAO established an intergovernmental forum: the Commission on Plant Genetic Resources (now the Commission on Genetic Resources for Food and Agriculture). The Commission has since developed a Global System for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, of which the Report on the State of the World’s Plant Genetic Resources and the Global Plan of Action are key elements.

On the following pages we examine some major findings of the Report on the State of the World’s Plant Genetic Resources and 20 related activities of the Global Plan of Action. These are grouped into four sections:

- *In situ* conservation and development
- *Ex situ* conservation
- Use of plant genetic resources
- Institution and capacity building.

What’s next

The implementation of the Global Plan of Action will be guided and monitored by countries through the FAO Commission on Genetic Resources for Food and Agriculture.

Following the Plan’s adoption at the Leipzig Conference, both countries and institutions and organisations concerned with plant genetic resources have begun to use their own resources and existing capacity to implement the Plan. However, the Plan’s full implementation needs a significant increase in current levels of activity. The Leipzig conference reaffirmed that “funds should be made available to finance the implementation of the Global Plan of Action” and stressed the need to enlist the widest possible support for the Plan.



I. *In situ* conservation and development



Chapters 1 and 2

In many parts of the world men and women farmers conserve diversity by maintaining landraces or farmers' varieties. Farmers consciously select plants for various characteristics and save seed for replanting. Over one billion people live in farming families, where responsibility for managing plant genetic resources rests with the family itself. These farmers are concentrated in marginal areas where access to appropriate, scientifically bred, improved varieties is limited. Farming systems are also threatened by natural disasters, civil strife and war. To support and build farmers' ability to manage plant genetic resources, a number of projects have been undertaken. These usually aim to improve farmers' livelihoods as well as contribute to conservation.



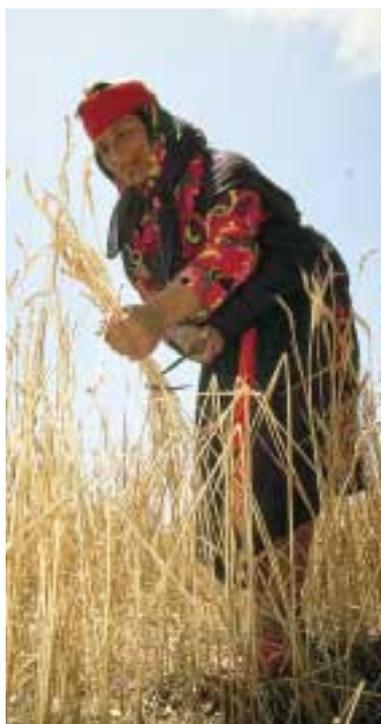
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There are an estimated 100 000 distinct varieties of rice. Java, Indonesia, is one of the centres of origin and diversity of this crop.

Natural ecosystems hold important PGRFA, both the wild relatives of crop plants and wild plants used for food and agriculture. Many are important to local communities' food security but are not managed sustainably. Even many of those located in the world's 8 500 national parks and other protected areas are not safe due to lack of adequate management plans; most countries lack comprehensive inventories of PGRFA.

The Global Plan of Action includes four activity areas to improve the management of plant genetic resources *in situ*:

1. **Surveying and inventorying** plant genetic resources for food and agriculture.
Rational conservation and national policies for the use of plant genetic resources ideally begin with a survey of existing resources to develop inventories. Drawing



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Harvesting wheat in Tunisia. Many of the farmers' local varieties are particularly drought tolerant.

upon local knowledge, methodologies to assess diversity are to be developed and countries' capacity to undertake surveys and inventories is to be increased.

2. Supporting on-farm management and improvement of plant genetic resources for food and agriculture.

Farmer and community activities to manage plant genetic resources will be supported through training, participatory research and a supporting policy environment. New partnerships will be developed between genebanks and plant breeders on the one hand and farmers and their organisations on the other, giving farmers access to a broader range of planting materials including through direct use of landraces conserved in genebanks and through farmer selection.

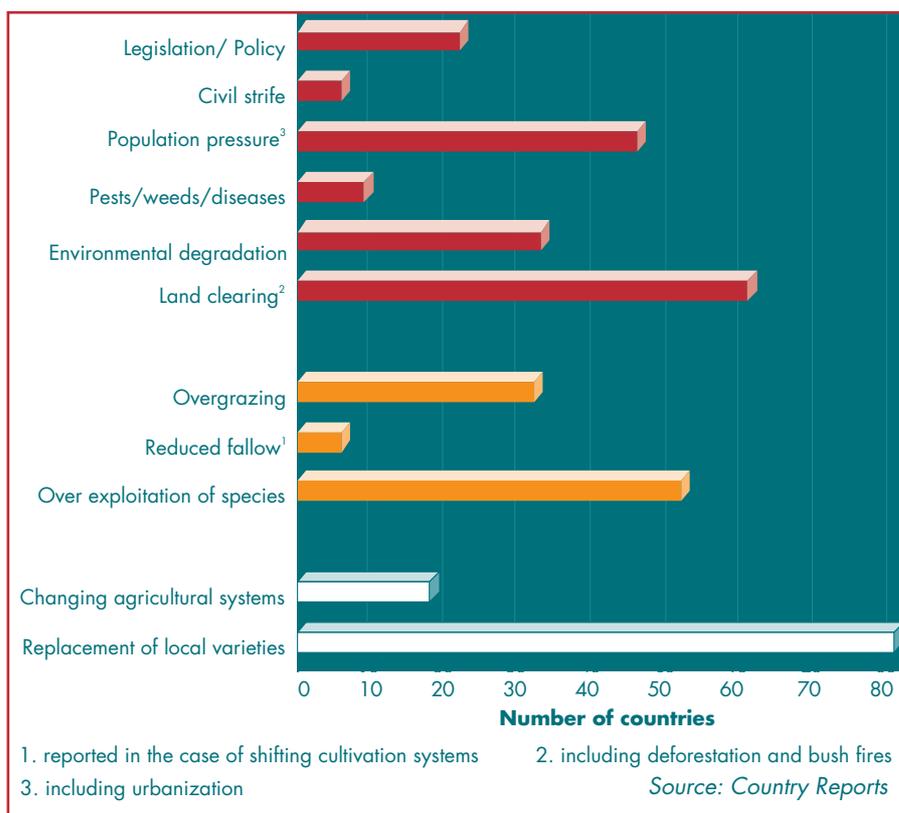
3. Assisting farmers in disaster situations to restore agricultural systems.

Important plant genetic resources that are uniquely adapted to local needs and conditions are often lost as a result of disasters. The Plan calls for a new initiative by the international community to establish capacity to deliver seed of adapted local varieties as needed to help re-establish local agricultural systems in areas affected by war, civil strife and other disasters.

4. Promoting *in situ* conservation of wild crop relatives and wild plants for food production.

This activity area aims to promote the conservation of genetic resources of wild crop relatives and wild plants of importance to food and agriculture through improved management of PGRFA in protected areas and elsewhere. Essential to this is enhanced local participation in *in situ* conservation.

The chief contemporary cause of the loss of genetic diversity has been the spread of modern, commercial agriculture. The largely unintended consequence of the introduction of new varieties of crops has been the replacement – and loss – of traditional, highly variable farmer varieties. This process was the cause of genetic erosion most frequently cited by countries in their Country Reports.





II. *Ex situ* conservation



Chapter 3

In the genebank of the International Potato Centre, Peru, potato germplasm is stored *in vitro* as slow growing cultures.

The main approach to conservation of plant genetic resources has been through the use of *ex situ* genebanks (seed stores kept at low temperature and humidity). A massive collection effort was launched in 1970 in response to genetic erosion and now 6 million accessions are stored in the world's genebanks. Cereals such as wheat, rice and maize are particularly well represented, although some specific gaps remain. Other staple crops, such as cassava and sweet potato, are less well represented. Many tropical crops cannot be stored as seed and instead have to be maintained as living collections in field genebanks or by *in vitro* storage. Crops of local importance are rarely found in genebanks.



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Although over 1000 genebanks exist today, only about 30 countries provide secure long-term storage because there is little provision for the long-term, sustainable management of genebanks once built. The result is that many collections are in poor condition and about one million accessions are in need of regeneration. Safety duplication rates appear low, but precise estimates are not possible due to lack of information and documentation by many genebanks. Besides genebanks, botanic gardens hold many species of value to food and agriculture.

The Global Plan of Action includes four activity areas to improve the *ex situ* conservation of plants and genetic resources.

5. **Sustaining existing *ex situ* collections.**

This programme aims to transform the current poorly coordinated, often inefficient and frequently redundant efforts of *ex situ* conservation into a rational, effective and sustainable system. All countries without their own long-term storage facilities will have the option to store their collections in international or regional genebanks. The sovereign rights of the providing countries to these resources can be guaranteed through appropriate legal agreements.



The fifteen largest national collections hold about one third of the world's plant genetic resources stored *ex situ* ●. A further 12% are held by the International Agricultural Research Centres ●. These include: International Centre for Agricultural Research in Dry Areas (ICARDA), International Centre for Tropical Agriculture (CIAT), International Centre for Maize and Wheat Improvement (CIMMYT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Institute for Tropical Agriculture (IITA), International Rice Research Institute (IRRI)



The Ethiopian genebank holds thousands of samples of traditional varieties including barley, wheat, sorghum and the local crop teff.

6. Regenerating threatened *ex situ* accessions.

The Plan calls for a global strategy and major programme to regenerate up to one million accessions in genebanks worldwide, giving priority to samples in long-term storage and those that are globally unique.

7. Supporting planned and targeted collecting of plant genetic resources for food and agriculture.

Future PGRFA collections will focus on filling gaps in existing collections, collection of certain regional, minor and subsistence crops and collection from particular countries where collection has not taken place or been very limited.

8. Expanding *ex situ* conservation activities.

Greater use of field genebanks and of *in vitro* facilities as well as the development of new technologies is needed to conserve important plant species that cannot be stored as easily as seed. The Plan also proposes that botanic gardens play a greater role in conserving these species, as well as many other plants of local importance for food and agriculture that have been neglected by conventional genebanks.



III. Use of plant genetic resources



Chapter 4

Plant genetic resources for food and agriculture are conserved so that they can be used and the diversification of agriculture depends on their greater use. Better deployment of these resources could also reduce the vulnerability of crops to pests and disease outbreaks, at the same time as reducing dependence on pesticides. But plant genetic resources are currently under-used, which limits the long-term economic and social benefits of society's investment in conservation.

Most countries identify numerous obstacles to making greater use of conserved material, pointing to areas that need improvement. These include lack of information on the value and use of the material and poor communication between genebanks, plant breeders and other users.

A further problem is the lack of incentive for the private sector to become involved in the many activities essential for the effective use of plant genetic resources. This includes programmes of pre-breeding or “genetic enhancement”, which make genetic material more easily used in plant breeding programmes. With weak private sector involvement in developing many crops essential to the food security of millions of poor people, such as cassava, plantains and millets, public support for these activities is vital. However, national capacities in plant breeding and in seed production and distribution vary widely and insufficient capacity in these areas often limits the effective use of plant genetic resources.

The Global Plan of Action includes six activity areas to improve the use of plant genetic resources:

9. Expanding characterization and evaluation and the number of core collections to facilitate use.

Plant genetic resources must be evaluated for their useful characteristics and be well described to be of use to farmers and breeders. The Plan also proposes a strategy to make it easier to locate useful varieties and genes in collections by developing properly identified core sub-sets of larger collections.

10. Increasing genetic enhancement and base-broadening efforts.

Programmes to develop improved crop varieties can take decades. The Plan calls for long-term public financial support for genetic enhancement programmes, starting with the 15 crops of most international and regional importance. The tangible benefit will be to broaden the genetic base of food crops and increase world food security.

11. Promoting sustainable agriculture through diversification of crop production and broader diversity in crops.

The Plan proposes a number of activities to increase the use of genetic diversity in the field and to reduce crop vulnerability. Amongst these are to:

- monitor genetic uniformity and crop vulnerability
- review policies that affect diversity in the field
- increase the use of varietal mixtures



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Sowing seed in Zimbabwe. Saving seed from their own harvests, and farmer to farmer seed exchange provide the main sources of seed for most farmers.



- improve the deployment of genetic diversity as part of strategies for integrated pest management
- promote decentralized and participatory plant breeding strategies.



Pollination of sweet potato. New varieties are produced in CIP's breeding programme.

12. Promoting the development and commercialization of underutilized crops and species.

A large number of crops contribute to household crop security, many of which have potential for wider use and could contribute to food security, agricultural diversification and income generation. This activity aims to:

- identify under-used species
- develop sustainable management practices
- develop post-harvest and marketing methods
- promote policies for the development and use of under-utilized species.

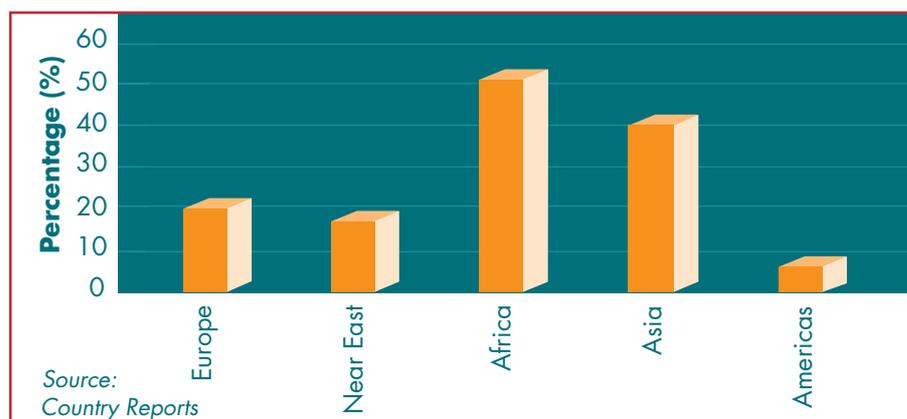
13. Supporting seed production and distribution.

Farmers benefit from access to a choice of good quality planting material. The Plan proposes actions to make available to farmers a wider range of crop varieties by:

- improved complementarity between parastatal, commercial and small-scale enterprises
- expanding viable local level seed production and distribution systems
- making suitable material stored *ex situ* available for multiplication and distribution
- reviewing seed certificate regulations.

14. Developing new markets for local varieties and diversity-rich products.

The Plan aims to stimulate demand for diverse products derived from landraces and farmers' varieties, including through the creation of niche markets, labelling and niche variety registration schemes to permit and promote the production and commercialization of local varieties.



About one in four countries report that the dissemination of improved varieties is constrained by poor seed distribution systems. For Africa the figure is one in two.



IV. Institution and capacity building



Chapters 5 and 6

The successful conservation and sustainable utilization of PGRFA involves action by a wide range of people in every country: policy makers, planners, scientists, germplasm curators, breeders, rural communities and farmers. Strong coordination mechanisms are required at the national level to enable all these players to participate constructively. Yet only a third of countries have national committees or other coordination mechanisms; similarly, few have laws or policies to develop plant genetic resources in line with national needs.

Within regions and sub-regions, countries usually have many crops and much plant genetic diversity in common. This demands sub-regional and regional collaboration, in addition to national efforts to enhance plant genetic resources.



The Global Plan of Action includes six activity areas to strengthen institutions and promote capacity building:

15. **Building strong national programmes.**

The ultimate purpose of PGRFA conservation and use is to contribute to national development and sustainable agriculture. This activity of the Plan focuses squarely on developing and strengthening national programmes. High priority is given to establishing national committees or similar coordinating bodies to ensure the involvement of all stakeholders.



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The Herbarium Samples in the Agricultural Research Institute, Cyprus, are documented with field data.

16. Promoting networks for plant genetic resources for food and agriculture. Regional and sub-regional networks are operational in many parts of the world. The Plan calls for the strengthening of these and the establishment of new networks in:

- the Pacific
- the Caribbean
- Central Asia and the Caucuses
- West and Central Africa
- East Africa
- the Indian Ocean Islands.

A stronger role for crop networks is also envisaged: the Plan calls for increased cooperation between networks and the International Agricultural Research Centres.

17. **Constructing comprehensive information systems** for plant genetic resources for food and agriculture.

The Plan calls for improved access to information on plant genetic resources. High priority is given to constructing broad, user-friendly information systems at national level and to promoting compatibility between countries. Coordination at the global level will be developed in the context of FAO's World Information and Early Warning System on plant genetic resources.



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Training course in collecting practice for *Vigna spp*, Vietnam. Training is identified as a priority need by all countries.

18. Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture.

To identify threats to genetic resources and minimise genetic erosion, the Plan calls for greater efforts to assemble information on threatened resources, building on both local and national levels. FAO's World Information and Early Warning System on plant genetic resources will be reviewed and expanded.

19. Expanding and improving education and training.

The Plan provides for increased training and educational activity, including advanced interdisciplinary work, courses in technical and managerial subjects and special on-site training for rural women, who play an often unrecognised role in developing and maintaining plant genetic resources.

20. Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use.

Public information activities are given high priority, to generate support for plant genetic resources activities at national and international levels. National programmes need appropriate information material in local languages. Schools and educational institutes of all types, including specialized agricultural institutions, need to be encouraged to spread better understanding of the value of plant genetic resources to food security.

National PGRFA Programmes

Purpose

to contribute to national development, food security, sustainable agriculture and the maintenance of biodiversity through the conservation and utilization of PGRFA

Functions

- develop national policies and strategies
- provide basic building blocks for regional and international collaboration
- co-ordinate national activities, involve all stakeholders and promote linkages

Activities

- inventorying, exploration, collecting
- conservation *in situ* & *ex situ*
- characterization and evaluation
- genetic enhancement
- crop improvement
- seed/variety production & distribution
- documentation & dissemination of information
- training & capacity building
- research
- fund raising
- development of legislation
- regulation of access and exchange of genetic resources
- public awareness

Partners

- ministries and government departments
- women's groups (i.e. agriculture, forestry, natural resources, environment, science and technology, planning, research and education)
- universities, research and other educational institutions
- Non-governmental organizations, farmers' organizations, women's groups
- private sector and parastatal companies
- regional and international organizations and networks

Source: Recommendations of Sub-regional Meetings

About 55 countries have formal national programmes. A further 20 countries have coordination mechanisms. The Chart lists the purpose, functions and typical activities of national programmes based on recommendations of the sub-regional meetings, preparatory to the International Technical Conference.