



Developing access and benefit-sharing regimes

Plant genetic resources for food and agriculture

Policy brief

Introduction

The Ad hoc Open-ended Working Group on Access and Benefit-sharing has a mandate to elaborate and negotiate an international regime on access and benefit-sharing within the framework of the Convention on Biodiversity (CBD)¹. However it is an open question whether that regime should be a comprehensive 'across the board' attempt to deal with all genetic resources for all uses, or whether it should be tailored to particular categories of genetic resources for particular uses.

The case of plant genetic resources for food and agriculture (PGRFA) highlights the importance of building an access and benefit-sharing regime on an appreciation of the historical development and use of a particular category of genetic resources. PGRFA are distinct from many other types of genetic resources because they have been spread so widely around the globe over thousands of years, and countries are so interdependent upon them for food security and inputs into research and development. The multilateral system for access and benefit-sharing concerning PGRFA created by the International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty) reflects the world community's recognition of these facts about PGRFA.

The Treaty, which came into force in June 2004, is in harmony with the CBD. A list of 35 crops and crop complexes and 29 forage species is included in the Treaty's multilateral system for access and benefit-sharing. This list could eventually be expanded through the consensus of parties to the Treaty. Meanwhile, for non-listed crops and forages countries may consider it in their self-interest to preserve flexibility by providing access and benefit-sharing on terms similar to those in the Treaty, through existing crop and genetic resources networks, on subregional, regional or global bases.

The provisions of the CBD regarding access and benefit-sharing are broad and leave considerable flexibility for implementation. When moving from those broad principles to more specific modes of implementation—e.g. the multilateral system for access and benefit-sharing established by the

Treaty and the international regime currently being considered by the Ad hoc Open-ended Working Group on Access and Benefit-sharing—it is important to define the most appropriate scope and uses of the materials covered by the regime.

Facts and principles underlying the design of the multilateral system for access and benefit-sharing for PGRFA

A combination of factors distinguishes PGRFA from other categories of genetic resources. Human intervention has been key to the creation and maintenance of today's crops; in its absence, those crops would disappear. PGRFA are widely spread around the world and countries are interdependent upon them for their food security. In this section, we focus primarily on the issue of interdependence.

The interdependence of countries on PGRFA is reflected both at the level of international exchanges of plant genetic materials in support of research, breeding and production, and at the level of individual cultivars, which incorporate PGRFA from numerous countries and regions.

Interdependence at the national level

Most crops were domesticated over millennia in areas that are now developing countries. Over the course of hundreds, in some cases thousands, of years they have been transferred around the world, primarily through deliberate human intervention. Wheat was introduced to the Americas from Europe over 500 years ago, while rice was introduced from Asia over 200 years ago.² Finger millet was domesticated in Africa possibly as early as 6000 years ago and was introduced into South Asia as early as 4000 years ago.³ Maize was introduced to Europe on Columbus' return from America and was soon taken to Africa, where it has been managed and further developed by farmers for more than 500 years. Barley was one of the first domesticated crops in the history of agriculture. Over 2000 years ago it was introduced into Ethiopia, which has since become an important secondary centre of diversity.

As a consequence of the movement of PGRFA, the overwhelming majority of countries in the world today are dependent (in terms of percentage of total

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calories consumed within the country) upon main food crops that originated from outside their borders, and in many cases from outside their subregions and continents.⁴ The median level of minimum dependence for food energy supplies on non-indigenous major crops in Sub-Saharan Africa is 73%,⁵ while that of European countries ranges from 54 to 99%, South American countries from 81 to 95% and the Indian Ocean countries from 85 to 100%.⁶

Most of the diversity of the most popular crops—i.e. those that contribute most to overall human caloric consumption around the globe—has been collected and is stored in ex situ collections,⁷ further contributing to the interdependence of countries on PGRFA. There are over 6 million crop accessions held worldwide in approximately 1400 genebanks, located on every continent. Today, researchers are much more likely to acquire samples of a crop accession from a national or international ex situ collection in a genebank (that may or may not be located in a country which is the primary, secondary or even tertiary centre of diversity for the crop)⁸ than to organize there collection of the same materials in those centers of diversity. This will often be the case even for researchers who are themselves located within a centre of diversity of the crop they are studying; they rely upon sources of germplasm located outside that centre of diversity.⁹ Genebank accessions are cheaper to obtain and often are accompanied by characterization and other important information.

Despite the early history of domestication of crops, it is important to note that in more recent times the flow of germplasm, as facilitated by international and some national genebanks,¹⁰ is mostly between developing countries. A study of approximately 1 million samples distributed from ex situ collections of the Future Harvest Centres of the CGIAR from 1973 to 2001 revealed that 73% of the samples originally collected from developing countries were distributed to developing countries. Transfer to developed countries of materials that were obtained from developing countries constituted only 16% of the total. Flows from developed to developing countries accounted for some 8%. Only 3% of the transfers carried out by the Future Harvest Centres were from

developed countries back to developed countries. Through such transfers, countries are able to enjoy a multiplier effect, gaining access to a much wider range of diverse materials than exists within their own borders, and because of this virtually all countries are net recipients of plant genetic resources. For example, 88% of the unique accessions of seven crops accessed by Uganda and Kenya over the last 20 years were originally collected in other countries and continents.¹¹ Maximizing the multiplier effect was one of the original intentions of creating the International Network for the Genetic Evaluation of Rice (INGER). Between 1975 and 2004 over 23 000 unique entries were contributed to the network from all regions of the world, and each region has benefited by being able to evaluate between 2 and 20 times as many varieties as it contributed.

Interdependence at the level of individual cultivars

The historic wide-spread flow and use of plant genetic resources for food and agriculture is evident in the ancestry of individual crop varieties. For example, the VEERY wheat variety, which was widely released in the 1980s and is still used in breeding programmes around the world, was developed through 3170 crosses involving 51 parents from 26 different countries. A study of pedigrees of 1709 rice varieties released in 15 countries revealed that only 145 varieties (8.5%) were developed entirely from own-country parents, grandparents and other ancestors.¹² Thirteen of the 15 countries studied were more than 80% dependant on foreign progenitors for their rice breeding programmes. The two exceptions were India, with 39% of own-country progenitors, and the USA, with 67%. Subsequent analysis of progenitors of 4549 improved rice varieties released in 98 countries revealed that on average 63% of the genetic composition of each variety was of foreign origin. On average, each variety was a mixture of germplasm of seven landraces from four or five countries. Over 93% of the parents were foreign to the 30 countries most reliant on 'outside' parents; interestingly all of them were from developing countries.¹³

These examples highlight the extreme difficulty, and in some cases impossibility, of retroactively calculating the incremental

contribution of each of the ancestors to the development of the improved varieties, advanced lines and landraces that exist today. In some cases, where the pedigrees are known—which is rare with anything but materials improved through institutional breeding programmes that kept records—it might be possible to make a rough quantitative estimate by dividing the value expressed in monetary terms by the number of parents in the pedigree, along standard Mendelian principles. However, this approach is blind to the actual qualitative contributions of each parent, i.e. whether they actually contributed valuable traits to their progeny. This is very different from the situation of wild endemic plant species, which have evolved without human intervention and have no history of existence in other countries that may have contributed to their distinct properties.

As a result of this interdependence countries increasingly need to look for PGRFA outside their own borders or even outside their own regions when faced with new diseases or other environmental challenges. A recent example has been the Taro Leaf Blight, which threatened to wipe out the taro crop of Samoa in the last few years, a crop that was essential to its food security. Samoa had to look to other countries, both within the Pacific Region and outside, in order to find new taro stock that was resistant to the disease. Other countries in the region will be forced to broaden the genetic base of their taro crops if they are to avoid similar crises.

Crop research increasingly depends upon the coordinated efforts of several institutions in different countries around the world; access of researchers to a wide range of genetic resources related to the crop; and frequent transfers of materials between the participating organizations. Requiring unique, transfer-by-transfer negotiations for access to the required materials would (and does) substantially boost the time and costs of such research. Take the example of IRRI's rice collection, which in 2001 included over 80 000 accessions from 111 countries. In the absence of a multilateral system for access and benefit-sharing, a country would have to negotiate a minimum of 110 contractual agreements to get access to that same

diversity. For all countries represented in the collections to get access to all of the material would require a minimum of 12 210 agreements.¹⁴

The International Treaty on Plant Genetic Resources for Food and Agriculture

The design of the multilateral regime for access and benefit-sharing created by the Treaty reflects an appreciation of:

- the interdependence of all countries on PGRFA,
- the importance to food security of maintaining their continued exchange,
- the difficulties of identifying countries of origin for crops that have been widely exchanged and that may have developed their distinctive properties in any number of different areas,
- the need to avoid high transaction costs in ongoing (and desirable future) patterns of relatively low-cost, high-volume exchanges in support of agricultural research and conservation, and
- the importance of sharing the benefits associated with the use of PGRFA.

Parties to the Treaty agree to provide facilitated access to the crops and forages listed in the Treaty's Annex 1 when they are in the public domain and under the management and control of Contracting Parties, for the purposes of research, breeding and training for food and agriculture. Access shall be free or at a minimal cost. The Treaty specifies 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".

Benefit-sharing under the multilateral system is structured on a multilateral basis. To this end, the facilitated access to the PGRFA in the multilateral system is probably the largest single benefit. Other forms of benefit-sharing under the multilateral system include exchange of information, access to and transfer of technology, capacity building and sharing of monetary benefits derived from commercialization. Recipients of PGRFA from the multilateral system who commercialize products that incorporate

that material will pay a share of the benefits arising from the commercialization of that product into a financial mechanism set up by the Governing Body of the Treaty. The payment is mandatory where restrictions are placed on the availability of the product to others for further research and breeding. Where no such restrictions are imposed, the payment is voluntary. Funds from the financial mechanism will be used, for example, to support conservation and crop improvement, especially in developing countries and countries with economies in transition. It is by this means that monetary benefits will be shared with farmers.

The multilateral system includes Annex 1 materials held in the ex situ collections of the Future Harvest Centres. The Treaty further states that Centres' non-Annex 1 materials will be made available under substantially the same conditions.

The terms and conditions will be standard for all material transferred under the multilateral system and will not be subject to any bilateral negotiation. This will reduce transaction costs and allow easier access.

Table 1. Summary of international flows of rice ancestors in selected countries*

Country	Total landrace progenitors in all released varieties	Own landraces	Borrowed landraces
Bangladesh	233	4	229
Brazil	460	80	380
Burma	442	31	411
China	888	157	731
India	3917	1559	2358
Indonesia	463	43	420
Nepal	142	2	140
Nigeria	195	15	180
Pakistan	195	0	195
Philippines	518	34	484
Sri Lanka	386	64	322
Taiwan	20	3	17
Thailand	154	27	127
United States	325	219	106
Vietnam	517	20	497

* Fowler, C. and Hodgkin, T. 2004. Plant Genetic Resources for Food and Agriculture: Assessing global availability. Annual Review of Environmental Resources 29: 10.1–10.37, based on a table originally included in Gollin, D. 1998. Valuing farmers' rights. In Agricultural Values of Plant Genetic Resources (Evenson, R.E. Gollin, D. and Santaniello, V. eds.). CAB International, Wallingford, UK.

Conclusions

The need to allow the growth of multilateral access and benefit-sharing regimes

While the multilateral system for access and benefit-sharing created by the Treaty is limited in scope to the materials listed in Annex 1, the Treaty in general covers all PGRFA. It is important to allow room for the Contracting Parties to the Treaty to consider widening the scope of the multilateral system within the overall scope of the Treaty—a possibility that is explicitly mentioned within the Treaty itself. Meanwhile, regarding non-Annex 1 materials, genetic resources and crop networks will probably want to continue their efforts to promote multilateral forms of access and benefit-sharing as appropriate case by case.¹⁵

The design of any international regime dealing with access and benefit-sharing for genetic resources should reflect the nature of those genetic resources and the uses to which they are to be put. Global interdependence on PGRFA and their importance to food security are facts which the international community took into consideration when developing the legally binding multilateral system for access and benefit-sharing within the framework of the Treaty, in harmony with the CBD. Discussions concerning additional international regimes for access and benefit-sharing within the framework of the CBD will need to take into account the Treaty's multilateral system, as well as the possibilities that it will expand to cover other crops and forages and that subregional networks (and their constituent national governments) might establish systems for access and benefit-sharing concerning non-Annex 1 crops that are particularly important for the regions concerned.

Endnotes

- 1 This mandate was set out in Decision VII/19 D of the 7th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP7), November 2004.
- 2 Gollin, D. 1998. Valuing Farmers' Rights. In *Agricultural Values of Plant Genetic Resources* (Evenson, R.E, Gollin, D. and Santaniello, V., eds.). CAB International, Wallingford, UK.
- 3 Harlan, J. 1992. *Crops and Man* (2nd ed.). American Society of Agronomy, Madison, Wisconsin, USA.
- 4 Palacios, X.F. n.d. Contribution to the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources. Background Study Paper No. 7, Rev. 1. Commission on Genetic Resources for Food and Agriculture, FAO, Rome, Italy.
- 5 Fowler, C., Smale, M. and Gaiji, S. 2001. Unequal Exchange? Recent Transfers of Agricultural Resources and Their Implications for Developing Countries. *Development Policy Review* 19(2):181–204
- 6 Palacios, X.F., supra note 4.
- 7 FAO. 1998. *The State of the World's Plant Genetic Resources for Food and Agriculture*. FAO, Rome, Italy; Fowler, C. and Hodgkin, T. 2004. *Plant Genetic Resources for Food and Agriculture: Assessing global availability*. *Annual Review of Environmental Resources* 29:10.1–10.37.
- 8 For example, researchers on ground-nut might well approach the ICRISAT genebank located in India for landraces of ground-nut that were originally collected in Africa. In this context, it is interesting to note that ICRISAT obtained from non-Kenyan and non-Ugandan sources 67% of the accessions it holds that were originally collected in Uganda and Kenya.
- 9 East Africa, for example, is the centre of origin for the pigeon-pea. Nevertheless a recent analysis of germplasm flows in and out of Kenya and Uganda through the CGIAR showed that 85% of the pigeon-pea distributed from ICRISAT to Kenya and Uganda came from other countries: 40% from other countries in sub-Saharan Africa and 45% from the rest of the world. (Source: Halewood, M., Gaiji, S. and Upadhyaya, H. 2004. *Germplasm flows in and out of Kenya and Uganda through the CGIAR: a case study of patterns of exchange and use to consider in developing national policies*. Discussion draft, IPGRI, Rome, Italy.)
- 10 See Fowler and Hodgkin, supra note 7. The authors summarize data on distributions from the USA (16 300/year); The Netherlands (2500/year); the Nordic Gene Bank (1550/year); Brazil (2200/year) and Canada (1500/year).
- 11 Halewood, M., Gaiji, S. and Upadhyaya, H. 2004. *Germplasm flows in and out of Kenya and Uganda through the CGIAR: a case study of patterns of exchange and use to consider in developing national policies*. Discussion draft, IPGRI, Rome, Italy.
- 12 Evenson, R.E. and Gollin, D. 1997. Genetic resources, international organizations, and improvement in rice varieties. *Economic Development and Cultural Change* 45:471–500.
- 13 IRRI data, January 2005.
- 14 Raymond, R. and Fowler, C. 2001. Sharing the non-monetary benefits of agricultural biodiversity. *Issues in Genetic Resources* No. 5. IPGRI, Rome, Italy.
- 15 PGRFA of some crops important for sustainable agriculture and food security, such as soya bean, ground-nut, many fruits and vegetables and tropical forages, are not included in Annex 1 of the Treaty. Other crops, such as African leafy vegetables, that are not globally widespread are also potentially important from the point of view of their contribution to the nutritional well-being of many people in developing regions of the world. The decision on whether the multilateral system should eventually be expanded to cover such PGRFA would be taken by consensus by the Contracting Parties to the Treaty themselves.

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