# Bioversity International's contributions to the implementation of Article 6 of the International Treaty on Plant Genetic Resources for Food and Agriculture

*Isabel López Noriega, Ana Bedmar Villanueva*

*This summary has been prepared as a contribution to the Third Meeting of the Ad Hoc Technical Committee on Sustainable Use of Plant Genetic Resources, Vienna, October 2016*

**In the last 20 years, Bioversity International has coordinated or has been involved in a number of initiatives, projects and activities that contribute to the implementation of Article 6 of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). In this note, we summarize how Bioversity International's work has contributed to each of the measures indicated in Article 6.2 from a) to g) and present examples of projects that are aligned with these measures.**

***Article 6.2 (a) pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources.***

Working with a wide range of partners, Bioversity International researches how policies affect the conservation and management of plant genetic resources. Various projects have identified and proposed public policy options that provide incentives for farmers, natural resource managers, research organizations and food industry to maintain diverse farming systems.

**The Genetic Resources Policy Initiative** (GRPI, 2002-present) investigates and supports model processes for multi-stakeholder, multi-disciplinary and multi-sectoral research and capacity building as inputs into developing national laws affecting the conservation and use of genetic resources for food and agriculture. During its first phase, GRPI was active in Egypt, Nepal, Peru, Uganda, Vietnam, Zambia, as well as East Africa and West and Central Africa regions. In its second phase, GRPI focused on the implementation of the ITPGRFA in Costa Rica, Guatemala, Burkina Faso, Côte d'Ivoire, Uganda, Rwanda, Bhutan and Nepal. Over the years, the Initiative has generated guidelines, methods and tools for national authorities to address policy issues related to the conservation, exchange and use of plant genetic resources for food and agriculture in an informed and participatory manner. GRPI has also contributed to the development and implementation of national legal frameworks that are in line with the Treaty objectives and provisions, particularly in relation to its Multilateral System of Access and Benefit-Sharing, Farmers' Rights and Sustainable Use of Plant Genetic Resources.

*Key publication: Blog of the Genetic Resources Policy Initiative: https://grpi2.wordpress.com/ and www.bioversityinternational.org/research-portfolio/policies-for-plant-diversity-management/*

*Photo: A farmer participating in the 'Improving seed systems for smallholder farmers' food security' project in Uzbekistan. Credit: Bioversity International/I. Lopez Noriega*

Bioversity International, in collaboration with the United Nations University - Institute of Advanced Studies (UNU-IAS) and the Satoyama Initiative have developed a set of **indicators to help assess the resilience of rural landscapes and their communities**. These indicators have been used by different organizations in a number of situations to obtain a clearer understanding of the components of resilience in a distinctive geographical area and to empower local communities with the tools to understand their own resilience, what can erode it, and what can increase it. The indicators are a useful tool to appreciate to what extent existing public policies have a real impact on farming communities' sustainability and resilience.

*Key publication: Bergamini, N.; Dunbar, W.; Eyzaguirre, P.; Ichikawa, K.; Matsumoto, I.; Mijatovic, D.; Morimoto, Y.; Remple, N.; Salvemini, D.; Suzuki, W.; Vernooy, R. 2014. Toolkit for the indicators of resilience in socio-ecological production landscapes and seascapes. UNU-IAS; Bioversity International, Rome (Italy); IGES; UNDP. Available at: http://www.bioversityinternational.org/e-library/publications/detail/toolkit-for-the-indicators-of-resilience-in-socio-ecological-production-landscapes-and-seascapes/*

***6.2 (b) strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests.***

Various Bioversity International's projects aim to generate new knowledge about how the management of inter- and intra-species variation helps farmers deal with biotic and abiotic stresses and at the same time contribute to the sustainability of agricultural systems.

Since 2006, Bioversity International has been working with national partners in China, Ecuador, Morocco and Uganda to see **how planting different varieties of the same crop in mixtures, can reduce pest and disease damage**. Recent findings from trials with the National Agricultural Research Organization in Uganda show that mixing varieties resistant to certain pests and diseases with those that are more susceptible greatly reduces the incidence of that pest or disease. With common bean, we found this to be most effective when at least 50% of a resistant variety is mixed into a plot. For bananas, farmers have reported a 75% reduction in the presence of weevils in their mixtures. It is important to note that many of the resistant varieties we are finding are actually local crop varieties.

*Key publication: Mulumba, J. W., Nankya, R., Adokorach, J., Kiwuka, C., Fadda, C., De Santis, P., & Jarvis, D. I. (2012). A risk-minimizing argument for traditional crop varietal diversity use to reduce pest and disease damage in agricultural ecosystems of Uganda. Agriculture, ecosystems & environment, 157, 70-86. Available at: http://www.sciencedirect.com/science/article/pii/S0167880912000746*

*Common bean varieties, Uganda. Credit: Bioversity International/D.Jarvis*

***6.2 (c) promoting, as appropriate, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas.***

Bioversity International has coordinated a number of initiatives in which scientists and farmers work together to develop and select varieties that are adapted to harsh environmental conditions and that respond to farmers' preferences. New varieties resulting from these joint efforts have been released in various countries and traditional varieties selected by farmers have been multiplied and disseminated through local seed systems.

From 1998 to 2011, Bioversity International, Local Initiatives for Biodiversity Research and Development (LI-BIRD) and the Nepalese Agricultural Research Council led a **participatory crop improvement programme** in high-altitude villages of Nepal and in the lowland area of terai in Nepal. This programme encompassed contractual, consultative, collaborative and collegial modes of participation. Farmers contributed in goal setting, in identifying traits and in providing a testing system that was multi-farmer, multi-locational and allowed the trade-off between many traits. Breeders contributed their more formal scientific knowledge to this process and assisted in the scaling up of products identified from the participatory varietal selection (PVS) and participatory plant breeding (PPB) programmes. Breeding methods were adapted to accommodate the opportunities and constraints of PPB, and used a low-cross-number, high population-size breeding strategy. Within this strategy, modified bulk population breeding was used extensively. The PVS and PPB programmes identified or produced many varieties that farmers prefer.

*Key publication: Joshi, K. D., Sthapit, B., Subedi, M., Witcombe, J. R. 2002. Participatory plant breeding in 10 rice in Nepal. In: Cleveland, D. A., Soleri, D. (eds.) Farmers, scientists and plant breeding: integrating knowledge and practice. pp. 239-269. CABI, Oxfordshire, UK*

Bioversity International's **'Seeds for Needs'** initiative has involved 11 countries, various crops – including rice, beans, sorghum, wheat and barley – and around 25,000 farmers. In Ethiopia 'Seeds for Needs' has been active since 2009 to bring farmers high-quality and diverse seeds that meet their needs. Farmers are directly involved in evaluating and selecting varieties of barley and durum wheat (most of which are traditional landraces conserved in Ethiopia's national genebank), providing valuable feedback on their preferred traits to scientists. Combining scientific data with the experiences and knowledge of farmers is a key element of this initiative. Research found that more than 20% of the traditional Ethiopian durum wheat landraces performed better than commercial varieties bred specifically for drought resistance. From 2010 to 2013 varietal diversity increased by 23% across the initiative's sites and more than half are still sharing these varieties within their seed networks. As a result, the initiative now works with over 1,500 farmers in the country. In 2014 a community seedbank was opened in the Amhara region with the Ethiopian Biodiversity Institute, to provide a reliable source of good-quality seeds to farmers in the area.

*Key publication: Seeds for Needs page on Bioversity International website: http://www.bioversityinternational.org/seeds-for-needs/*

*Farmers partipating in the 'Seeds for Needs' initiative give feedback to researchers about durum wheat varieties, Ethiopia. Credit: Bioversity International/C.Fadda*

### *6.2 (d) broadening the genetic base of crops and increasing the range of genetic diversity available to farmers.*

Bioversity International's extensive work on the phenotypic and molecular characterization of traditional and local varieties has contributed to identify germplasm with promising characteristics for genetic improvement efforts. The introduction of this germplasm in plant breeding (often participatory plant breeding) has led to broadening the genetic base of the cultivars resulting from plant improvement efforts.

Plant breeding and the production of new cultivars is widely regarded as underpinning agriculture and the development of society. Yet, crop failures and risks associated with genetic uniformity on large cultivated areas, yield stagnation, and persistent failures to achieve sustainable are widespread problems. Therefore, the effective utilization of plant genetic resources by enhancing and expanding the genetic base from which future cultivars will be generated becomes essential. Under this context, Bioversity International collaborated from 1995 to 2001 with the United Nations Food and Agricultural Organization, other CGIAR Centres, national agricultural research centres, crops networks and other relevant institutions in the **Base Broadening Initiative**, which sought to identify and evaluate ways in which breeding programmes can make use of greater amount of genetic variation.

*Key publication: Cooper, H. D., Spillane, C. and Hodgkin, T. (eds). 2001. Broadening the genetic base of crop production. CABI, Oxfordshire, UK.*

### *6.2 (e) promoting, as appropriate, the expanded use of local and locally adopted crops, varieties and underutilized crops;*

Bioversity International generates evidences about how traditional crops and varieties contribute or can contribute to respond to food and nutrition security needs, cultural preferences and environmental challenges, including unpredictable climatic changes and pests and diseases. Based on more than a decade of research for development work in various countries, Bioversity has developed methods and tools for the effective management and conservation of local and traditional varieties on farm. A long standing programme on neglected and underutilized species has contributed to first identify promising neglected species and then raise their profile in local and national food systems in Bolivia, Brazil, India, Kenya, Kyrgyzstan, Malawi, Mali, Mozambique, Nepal, Peru, Rwanda, South Africa, Sri Lanka, Tajikistan, Tanzania, Turkey, Uganda and Yemen.

*Labelling stora*

The programme **'Strengthening the scientific basis of *in situ* conservation of agrobiodiversity on farm'** (1997-2002) provided evidence of the overall trends in crop varietal diversity on farm for 27 crop species. Measurements of richness, evenness, and divergence showed that considerable crop genetic diversity continues to be maintained on farm, in the form of traditional crop varieties. It also identified best practices at all governance levels (from household to international) for the effective management of traditional varieties.

*Key publications: Jarvis. D. et al. 2008. A global perspective of the richness and evenness of traditional crop-variety diversity maintained by farming communities. PNAS, 15, 14. Available at: http://www.pnas.org/content/105/14/5326.full; and*

*Jarvis, D., Hodgkin, T., Sthapit, B., Fadda, C. and López Noriega, I. 2011. An Heuristic Framework for Identifying Multiple Ways of Supporting the Conservation and Use of Traditional Crop Varieties within the Agricultural Production System, Critical Reviews in Plant Sciences, 30:1-2, 125-176. Available at: http://www.tandfonline.com/doi/abs/10.1080/07352689.2011.554358*

*age vases in community seedbank with around 400 traditional wheat varieties in Ethiopia. Credit: Bioversity International/C.Fadda*

The project **'Mainstreaming Biodiversity Conservation and Sustainable Use for Improved Nutrition and Well-Being**' is led by Brazil, Kenya, Sri Lanka and Turkey, coordinated by Bioversity International and funded by the Global Environmental Facility. Building on its partner's expertise, the project is addressing growing concerns over the rapid disappearance of agricultural biodiversity, particularly traditional crops and wild species with nutritional potential. Once rich agricultural biodiversity is disappearing due to environmental pressures, unsuitable land management practices and changes in consumer preferences, dietary patterns and lifestyles. Also disappearing is the traditional knowledge associated with the preparation, storage and cultural use of these foods, which, in the past, made up a significant proportion of local diets. The Project hence builds on growing evidence showing that agricultural biodiversity has the potential to fulfil many of the nutritional requirements needed for a healthy and balanced diet and thus can help reverse the alarming trends in under- and over-nutrition afflicting many countries worldwide. The evidence will be used to conserve and promote the use of these species in the four countries by:

- Raising awareness of their importance
- Creating markets and value chains for their use
- Making sure that future policies and strategies that tackle malnutrition include the sustainable use of agricultural biodiversity as a cost-effective solution to rising diet-related nutrition and health conditions – such as nutrient deficiencies and obesity

*Key publication: Project website: http://www.b4fn.org/, and Hunter, D., Özkan, I., Moura de Oliveira Beltrame, D., Samarasinghe, W. L. G., Wasike, V. W., Charrondière, U. R., Borelli, T., Sokolow, J. 2016. Enabled or disabled: Is the environment right for using biodiversity to improve nutrition? Frontiers in Nutrition, 3, 14.*

Nutritious millets were once a strong part of traditional diets in Southern India before agricultural subsidies shifted attention to rice, wheat and maize and they became a 'forgotten food'. Bioversity International has been working for almost 15 years with partners in India, such as the M.S. Swaminathan Foundation and the Indian Council of Agricultural Research to **promote the conservation and use of millets**. Results India's National Food Security Act incorporated millets into the public distribution system in 2013, meaning these nutritious grains are now available to more than 800 million people at a subsidized rate. Improved market links for small-scale producers have seen restaurants adding millet-based dishes to their menus, and new income opportunities for women producing millet-based snacks. In 12 districts in Central and South India, switching from white rice to minor millets in school lunches resulted in increased hemoglobin levels in children – up to 37% higher than the control group – within 3 months.

*Key publications: Bergamini, N., Padulosi, S., Ravi, S.B. and Yenagi, N., 2013. Minor millets in India: a neglected crop goes mainstream. In: Fanzo, J., Hunter, D., Borelli, T., Mattei, F. (eds.) Diversifying food and diets: using agricultural biodiversity to improve nutrition and health pp. 313-325. Routledge: London, UK; Available at: http://www.bioversityinternational.org/uploads/tx_news/Diversifying_food_and_diets_1688_02.pdf*

*and*

*Padulosi, S., Thompson, J., Rudebjer, P. 2013. Fighting poverty, hunger and malnutrition with neglected and underutilized species (NUS): needs, challenges and the way forward. Bioversity International, Rome. Available at: http://www.bioversityinternational.org/uploads/tx_news/Fighting_poverty__hunger_and_malnutrition_with_neglected_and_underutilized_species__NUS__1671_03.pdf*

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

Much of Bioversity International's work in the last 5-10 years has focused on reducing the vulnerability of farming communities, particularly those in marginal areas of developing countries, in front of rapid environmental and socio-economic changes. In this context, Bioversity International has developed and made available tools and methods to help a range of actors integrate crop diversity in their efforts to increase the sustainability and resilience of agricultural systems. With the objective of enhancing smallholder farmers' access to crop and varietal diversity, Bioversity International has supported the establishment of community seedbanks in various countries around the world, and has helped connect them to national genebanks and national systems for the conservation and sustainable use of plant genetic resources.

Based on the experience of various projects, Bioversity International has recently defined a step-wise **method for first identifying and then accessing promising plant genetic resources for climate change adaptation**. This methodology is based on a) developing new or strengthening existing partnerships among a range of stakeholders in each country; b) measuring possible impacts of climate change on target crops; c) identifying promising germplasm with potentially useful traits for climate change adaptation from local, national and international sources; and d) accessing such germplasm in compliance with local, national and international rules on access and benefit-sharing, and other applicable norms.

*Key publications: Resource box for resilient seed systems, available at: www.seedsresourcebox.org/ and www.bioversityinternational.org/e-library/publications/detail/resource-box-for-resilient-seed-systems-handbook/*

Under the framework of various Bioversity International's projects, the functioning of various **community seedbanks** has been analyzed, a number of community seedbanks have been reinforced and new seedbanks have been established. Community seedbanks can enhance the resilience of farmers and communities through securing improved access to and availability of diverse, locally adapted crops and varieties and through enhancing knowledge and skills in plant management including

*Gumbu women inspect first maize seeds for the community seedbank, South Africa. Credit: Bioversity International/R.Vernooy*

*Accessions at the Maharana Pratap Tharu Community Seedbank in Uttar Pradesh, India, that includes varieties of wheat, lentils, oats, peas and millets. Credit: Bioversity International/P. Quekh*

selection, storage, multiplication and dissemination of seeds. Good examples of how community seedbanks can be integrated in national plant genetic resource systems come from Ethiopia, Nepal and Uganda. Here, various community seedbanks work in close collaboration with national agricultural research organizations. Thanks to this collaborative framework, national seedbanks provide long-term conservation services to community seedbanks and obtain new crop germplasm from them; community seedbanks get adapted new germplasm from national genebanks, old local varieties that have been lost, as well as technical advice and training in seedbanking.

*Key publication: Vernooy, R., Shrestha, P., Sthapit, B. eds. (2015) Community Seed Banks: Origins, Evolution and Prospects. Routledge, London, UK. Available at: www.bioversityinternational.org/e-library/publications/detail/community-seed-banks-origins-evolution-and-prospects/*

### *6.2 (g) reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution.*

Working with national agricultural research organizations, non-governmental organizations, farmers' associations and other like-minded international centres and initiatives, Bioversity International analyzes the functioning of seed systems and identifies factors that can affect seed systems' capacity to guarantee the availability and accessibility of crop diversity for farmers in the form of good quality seed and other planting material. In the last decade, Bioversity International has proposed and tested various options at different stages of the seed value chain to diversify crops and varieties that are made available to farmers. Bioversity International's work has paid particular attention to the role of informal, local seed systems in ensuring seed supply, particularly where formal seed systems do not have the capacity to cover all crops that are important for food and nutrition security and to reach farming communities in remote, marginal areas.

The project **'Improving seed systems for smallholders' food security'** involves research organizations, non-governmental institutions and farmers groups in Bolivia, Burkina Faso, Nepal, Uganda, and Uzbekistan. The project aims to diversify both the providers of seed and other planting material, and the crops and varieties made available through formal and informal seed systems. It also seeks to integrate local seed systems in national seed sectors, through the recognition of community-based seed producers and suppliers in national seed policies, and by committing public support to this type of actors. Alternative schemes for the registration of traditional and farmer improved varieties are currently being considered in Bolivia, Nepal and Uzbekistan. More relaxed quality control schemes like the Food and Agriculture Organization of the UN Quality Declared Seed System are being studied by national authorities in Bolivia and Uganda for areas where the presence of formal seed sector is limited and for crops and varieties that are not usually produced by seed enterprises but are still demanded by small farmers. Official recognition of, and technical and financial support to communities and individual farmers which have a good reputation as seed producers and holders of crop diversity are also part of the discussions being held by local, provincial and national governmental bodies in Bolivia, Nepal and Uzbekistan.

*Key publications: López Noriega, I. 2016. Improving seed systems for smallholder farmers' food security. Report of the mid-term workshop of the project. Bioversity International, Rome, Italy. Available at: www.bioversityinternational.org/e-library/publications/detail/improving-seed-systems-for-smallholder-farmers-food-security-report-of-the-mid-term-workshop-of-the-project/; and*

*Otieno, G.; López Noriega, I.; Reynolds, T.W. 2016. Smallholder access to quality and diverse seed in Uganda: Implications for food security. Bioversity International, Rome, Italy. Available at: www.bioversityinternational.org/e-library/publications/detail/smallholder-access-to-quality-and-diverse-seed-in-uganda-implications-for-food-security/*

*Rice terraces containing improved Biramphul-3 variety developed with farmers trhough participatory plant breeding project, Begnas Village, Kaski District, Nepal. Credit: Bioversity International/J.Zucker*

Bioversity International

CGIAR
*Science for a food-secure future*



## Contacts:

**Bioversity International**
Via dei Tre Denari, 472/a
00054 Maccarese (Fiumicino), Italy
Tel. (+39) 06 61181
Fax. (+39) 06 6118402
bioversity@cgiar.org

**www.bioversityinternational.org**