2016

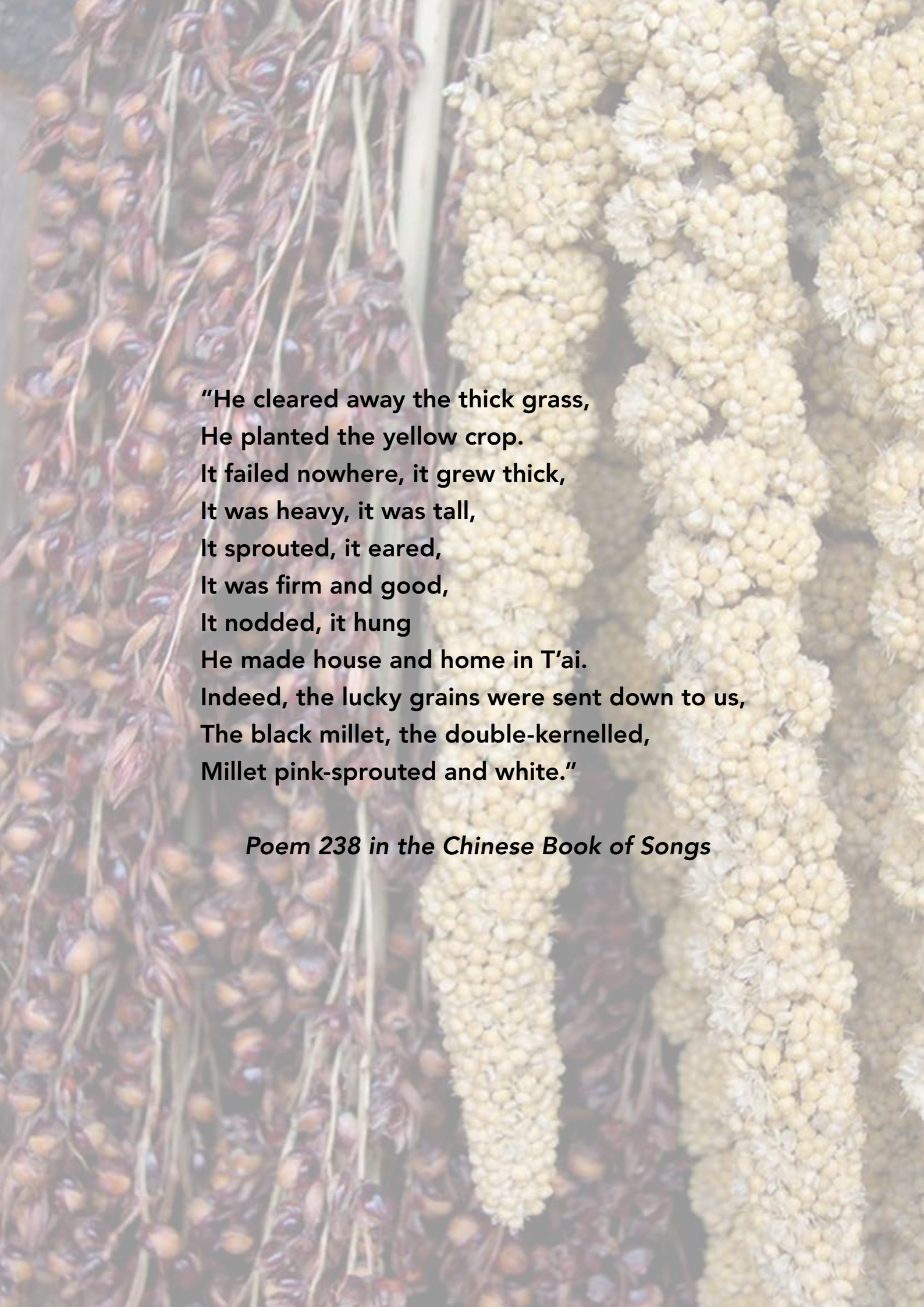
FARMING MATTERS

Formerly known as LEISA Magazine

SPECIAL ISSUE

Access and benefit sharing of genetic resources

Making it work for family farmers



"He cleared away the thick grass,
He planted the yellow crop.
It failed nowhere, it grew thick,
It was heavy, it was tall,
It sprouted, it eared,
It was firm and good,
It nodded, it hung
He made house and home in T'ai.
Indeed, the lucky grains were sent down to us,
The black millet, the double-kernelled,
Millet pink-sprouted and white."

Poem 238 in the Chinese Book of Songs

Foreword

For family farmers, maintaining biodiversity is an essential pillar of their strategies. This is all the more so for farmers who work from an agroecological approach, using the functions of nature to strengthen farming systems. Biodiversity helps to keep farms resilient to climatic and other shocks by improving water retention, increasing crop diversity, improving pollination, ensuring clean water and ensuring healthy soils that absorb carbon. In addition, diversity on farms tends to lead to diverse diets, a prerequisite for food and nutrition security.

Farmers (and especially women) have been the custodians of the world's biodiversity through saving, using, exchanging and selling seed and propagating material. The rights of farmers to do this are a core component of the International Treaty on Plant Genetic Resources (ITPGRFA). The same is true for their right to participate in decision making and in the fair and equitable sharing of benefits arising from the use of plant genetic resources and the need to protect traditional knowledge relevant to these resources. However, the implementation of Farmers' Rights at national levels is not advancing rapidly.

Farmers' Rights are closely linked to access and benefit sharing by(ABS). As we see in this special issue of Farming Matters, there are various examples of 'informal' community seed banks that are more effective, and of successful collaborations between researchers and farmers, some of which have links with the formal system. Countries' ratification of the ITPGRFA and the freshly minted Nagoya Protocol open the door for such new arrangements between farmers, farming communities, NGOs, universities, and public and private sector plant breeding and seed producing organisations. These collaborations can build bridges between the so-called formal and informal sectors building on the strengths, and overcoming the challenges associated with both systems. Hence, this issue further explores the interface between the formal and the informal system and highlights creative access and benefit sharing arrangements that are effective for family farmers.

We hope that the lessons learned in these arrangements a selection of which are presented in this publication, will inspire and help policy actors, scientists and practitioners to develop similarly inspired access and benefit sharing arrangements in the future, and will assist them to 'think-through' options for domestic implementation of the multilateral system of access and benefit sharing and the Nagoya Protocol.

It is no coincidence that women farmers play a central role in biodiversity conservation and in many successful mechanisms for access and benefit sharing. They should have a guiding voice in dialogues on the future of ABS systems, engaging farmers, innovative scientists, policy actors and urban citizens.

We appreciate the opportunity for exchange that this collaboration between our two institutions has provided. Strengthening family farmers as guardians of the world's great agrobiodiversity is a mission we share. We believe this publication provides valuable insights on how to do so.

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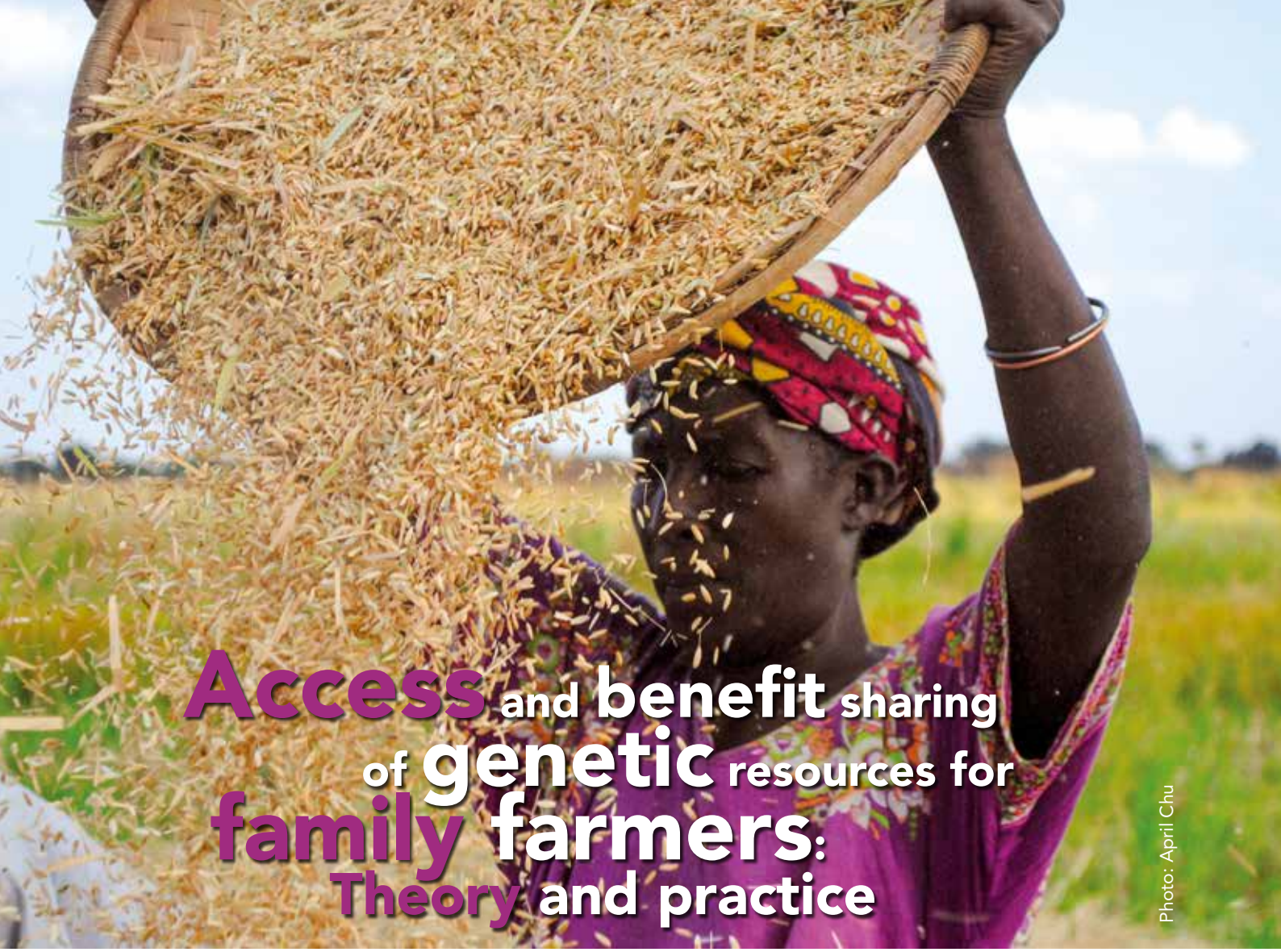

Access and benefit sharing of genetic resources for family farmers: Theory and practice

Photo: April Chu

Only a small number of governments have established meaningful and effective farmer-centred measures for the implementation of access and benefit sharing of genetic resources. One reason is the highly complex nature of the international regulatory system.

This special issue of *Farming Matters magazine* presents practical ways in which access and benefit sharing for family farmers can be enhanced through collaborative efforts based on the rural realities, knowledge and needs of local communities. Key are community seed banks and farmer seed systems. This article presents an overview of both the 'formal' and 'informal' access and benefit sharing systems that are currently being used, and examines the theory and practice of these systems.

Robin Pistorius

The web of biodiversity that the world's food production depends on is comprised of thousands of species of crops with untold genetic variability. Since the emergence of farming systems 12,000 years ago the total sum of the world's plant genetic resources for food and agriculture has vastly expanded. Farmers learned to save the seeds of crops they deemed the easiest to process or store, those that were most likely to survive in harsh growing seasons, or those that simply tasted best. As a result, more than 7,000 species of plants have been cultivated or collected up until the present day.

Many of these crops are important to local communities and family farmers, as a way to achieve food and nutrition security, enhance food sovereignty, preserve biodiversity, maintain cultures and build resilience to climate change and other forms of stress. Seed saving, exchanging, using and selling are a fundamental part of the cultural repertoire of rural communities, especially indigenous peoples. These are customary practices that go beyond national borders. As a result of generations of seed exchanges, peoples and countries have become interdependent as they all rely on genetic resources that have originated elsewhere for food security.[1]

However, genetic resources are disappearing at an alarming rate. Out of a total of 250,000 known plant species, approximately 7000 (as indicated above) have been used for human food since the origin of agriculture. Out of these, just 12 crop and five animal species provide three quarters of the world's food today.[2] Across the world, traditional seed diversity and related knowledge are no longer passed on, as farmers are encouraged or pressured to purchase seed[3].

With the erosion of these resources, farmers and other actors in the food system loose the potential to adapt to new socio-economic and environmental conditions, such as population growth and climate change. Since the emergence of an international plant genetic resources regime[4] in the early 1990s, established in response to these threats, ownership and access to plant species and the genetic potential they have has entered national and international agricultural, trade and environmental agendas. The most significant element of this process has been the debate on the definition and implementation of access and benefit sharing (ABS).

Women play a special role in maintaining genetic diversity. Photo: GREEN Foundation

Harvesting gourd seeds in Guatemala. Photo: Alex Jensen

The formal access and benefit sharing regime

To date, only a relatively small number of national governments have tried to design and enact meaningful and effective measures to implement ABS for genetic resources that are clearly farmer-centred. While ABS implementation faces challenges, many institutions, organisations, indigenous peoples and other actors involved in genetic resources conservation are critical of the development of an overly formal ABS system. As this issue of Farming Matters demonstrates, the current system in place globally is considered to be too theoretical, proposed procedures are too bureaucratic and legalistic, and proposed measures are unsupportive of smallholder farming around the world.

The cases presented here also highlight that there are many practical ways in which access and benefit sharing is designed and implemented through collaborative efforts based on the rural realities, knowledge and needs of local communities and farming families. Community seed banks and other forms of seed exchange are effectively putting access and benefit-sharing into practice in a way that enhances the resilience and autonomy of food producers and their farming systems while preserving biodiversity.

The current ABS regime consists of a number of international agreements, the two most important being the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture. We summarise these agreements below.

The Convention on Biological Diversity (CBD)

Negotiated under the auspices of the United Nations Environment Programme (UNEP), the Convention on Biological Diversity (CBD) entered into force on 29 December 1993. The Convention is legally binding, which means that states who signed it are obliged to implement its provisions. So far, 190 countries and the European Community have become members of the CBD. One of the three objectives of the Convention is the *fair and equitable sharing of the benefits arising from the utilisation of genetic resources*.

Protection of traditional knowledge: theory

Article 15 of the Convention provides a general framework for the implementation of access and benefit sharing arrangements. As states are considered to have sovereign rights over their biological resources, under the CBD they are the designated authority to determine who has access to genetic resources, and how. Access to genetic resources under the CBD must be

based on the two principles. First, *free prior informed consent* which refers to the idea that the country of origin of the genetic resources (or the country that has acquired these resources under the Convention) has to obtain consent from the providing party- which can be an indigenous or local community- to allow third party use of these resources. Second, the terms of such access are to be '*mutually agreed*'.

A supplementary agreement to the CBD, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (2010), provides a legal framework for the effective implementation of benefit sharing. The Protocol was adopted in Japan and has been signed by 92 countries as of 2015. Throughout the Protocol state sovereignty (as in the CBD) overrules the rights of indigenous peoples and small scale farmers.[1] Most notably, the language used in the Protocol creates a double standard between the rights of indigenous and local communities and those of state parties. The Nagoya Protocol Art. 5 requires that States obtain, under certain circumstances, the consent of the concerned communities (including family farmers) to allow another State access to their traditional knowledge, along with an agreement on a mechanism to share the benefits that may come from the use of that knowledge with the respective community. However, this is turning out to be highly problematic in practice.

Protection of traditional knowledge: practice As the CBD throughout reaffirms national state sovereignty over genetic resources, there are serious challenges when it comes to protecting the human rights, cultural rights, and specifically indigenous rights of communities who are the custodians and users of genetic resources. Agriculture and food in particular have characteristics that do not fit into the logic of transactions between state parties. One of the reasons for this discrepancy is that farmers and farming communities have exchanged their crops, and the genes within their crops, since the beginning of agriculture, regardless of states or borders. The CBD leaves no space for these transactions. To date, customary laws can only be recognised under the Protocol when these are 'in accordance with domestic law', which is not the case in many countries. Moreover, free prior and informed consent is not embedded in national law in the majority of countries, and where it is, implementation is often problematic.

This results in a situation where farmer and indigenous communities are not always directly consulted, let alone asked for their consent. It becomes even more complex when the traditional knowledge is already available elsewhere - for instance, in a public database inventory, or through another entity which has already accessed such knowledge. In these circumstances, farmers and indigenous groups can easily be circumvented and outmanoeuvred by governmental parties.

Hence, a lack of power to make use of domestic law, if it is available at all, undermines the rights of indigenous and farming communities to secure benefits from ABS under the CBD. Other than this specific and poorly defined requirement of consent, the CBD and its Nagoya Protocol do not address or even mention Farmers' Rights (see page 10).[5]

The Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

In the context of global interdependence on plant genetic resources for food and agriculture and in reaction to the state sovereignty-based CBD, a global Multilateral

System (MLS) was created in 2001 with the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA, or 'the Treaty') aims to contribute to food security with three specific objectives: the conservation of plant genetic resources; their sustainable use; and the sharing of benefits that are derived from the use of plant genetic resources with the countries where they originated. The Treaty recognises both the necessity of *ex situ* conservation (through seed banks) and *in situ* conservation (through on-farm cultivation of rare and traditional varieties) in order to reverse the loss of crop genetic diversity.

Farmers have exchanged their seeds since the beginning of agriculture, regardless of states or borders

The Treaty establishes a system for access and benefit sharing for 64 plant genetic resources for food and agriculture, listed in 'Annex I' of the ITPGRFA and selected for their relevance for food security. The logic underpinning the MLS is that it enables these resources to be treated as 'pooled goods' without individual owners with whom individual contracts for access and benefit-sharing must be negotiated (as is the case under the CBD). As such, in the MLS benefits resulting from their use do not go back to the provider (one single country) but must be shared with all other states through a multilateral fund. Facilitated access to genetic resources that are included in the MLS is, itself, recognised as a major benefit arising from the use of genetic resources. Other benefits that are to be shared on a 'fair and equitable' basis include the exchange of information, access to and transfer of technology, capacity building and the sharing of monetary and other benefits arising from commercialisation.

The resources in the MLS are available to anyone who wants them under a standard contract, i.e. the Standard Material Transfer Agreement. Monetary benefits from these agreements do not flow from users to providers (as in the CBD) but into a multilateral fund – the Benefit Sharing Fund. This fund is also open to direct contributions from the contracting parties, the private sector, non-governmental organisations and others. However, to date no mandatory payment has been made to the Benefit Sharing Fund (see pages 43-45).

A farmer in Brazil dries his cocoa beans.
Photo: Mauricio Maranhão

As of 2015, 136 countries have acceded the Treaty, which means they have to ensure the conformity of national laws, regulations and procedures with their obligations under the Treaty.

Farmers' Rights The Treaty Article (9.2) on Farmers' Rights recognises the enormous contribution that farmers and their communities have made and continue to make to the conservation and development of plant genetic resources. The Article includes the protection of traditional knowledge, and the right to participate equitably in benefit sharing and in national decision making about plant genetic resources. It gives governments the responsibility for implementing these rights.

Treaty Article 9.2 stipulates that:
"The Contracting Parties agree that the responsibility for realising Farmers' Rights, as they relate to PGRFA, rests with national governments. In accordance with their needs and priorities, each Contracting Party

should, as appropriate, and subject to its national legislation, take measures to protect and promote Farmers' Rights, including:

(a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
(b) the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and
(c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture."

The decision whether or not to embed these Farmers' Rights in national law (in particular trade related aspects of intellectual property rights such as UPOV), however, rests with national governments. This process has proven to be difficult and costly, especially in developing countries where there often is a lack of capacity, expertise, resources and sometimes, political will. Farmer-centred policy measures and legislation exist in a number of countries, such as India and Nepal, as illustrated and discussed in the article on page 50-53, but remain problematic.[6] In addition, patents or breeders' rights may restrict or even prohibit farmers' access.

The 'formal' ABS regime in a deadlock

In summary, progress in the domestic implementation of ABS has been considerably slower than expected, partially due to the difficulties of the complex interface between these two systems: the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture. Combined with the system's bureaucracy and the lack of Farmers' Rights recognition in national law, family farmers have benefited little from the 'formal' system. In addition, agreements on trade related aspects of intellectual property rights also limit the legal space for small farmers and indigenous communities.

At the same time, it should be stressed that access and benefit sharing still is an intrinsic element of the customary community seed saving and exchange initiatives among family farmers and indigenous communities. The following section takes a closer look at these, and the second half of this publication presents three specific case studies.

Access and benefit sharing in community seed banks[7]

Community seed banks store and manage seeds with the aim of providing community members with seeds to use. As such, they are usually part of farmers' informal seed systems, in which the various stages of seed management—selection, conservation, exchange and improvement—take place without involvement of or control by research, development or government agencies. As some presented experiences demonstrate, community seed banks can be an effective way to improve access and benefit sharing of important crop diversity. Community seed banks also function as a mechanism to implement farmers' or indigenous rights, by way of recognition, participation in decision making, benefit sharing and a supportive policy and

The decision whether or not to embed Farmers' Rights in national law rests with governments

seed regulatory framework. This approach is highlighted in a several case studies in this publication (see pages 50-53 and 58-63).

Community seed bank practices and participatory plant breeding activities build on the existing and mostly informal forms of access and benefit sharing while adding new elements. They are sometimes engaged in participatory plant breeding and variety selection, which can strengthen access to and availability of improved seeds and increase diversity. In participatory plant breeding , farmers, researchers, local consumers and other actors join forces in a continuous, highly dynamic and complex process of selection and exchange of seeds, interactions between farmers and seed producers , research institutions and, sometimes, with agricultural and health authorities and government officials (see pages 54-57). Benefits are generated throughout the process of collaboration and are shared dynamically and at all times among the diverse actors (see pages 34-37).

Usually started on a small scale, some of these crop improvement practices have evolved into seed production and the sale of new varieties, such as maize in China (see pages 18-23). Usually, local seed production focuses on the crops and varieties that the commercial seed sector does not offer. This kind of activity can contribute to the financing of operations of community seed banks and thus enhance their viability in the long term.[8] Community seed banks thus serve as key local sources and access points of germplasm, allowing farming communities to exchange seeds in a decentralised manner through social networks and organised events, such as diversity fairs and participatory seed exchanges.

Recognising these benefits, policy makers in several countries have proclaimed that community seed banks should play key roles in crop conservation and improvement including as a way to implement key components of the Treaty. They refer specifically to components such as sustainable use and conservation of genetic resources, the implementation of Farmers' Rights, and adaptation to climate change. Some efforts are underway to concretise this in some countries, such as in Bhutan, Guatemala, India, Nepal and South Africa.

Community seed banks sometimes also serve to open up policy space for national ABS regulation. In Nepal, for example, ten seed banks functioned as the designated local institutions to assess whether to provide Prior Informed Consent to bio-prospectors. This was a way to implement the PIC provisions of the Agrobiodiversity Policy of 2007 and the draft ABS Law of 2003. In the Brazilian state of Paraíba a law was approved to legalise the distribution of seeds produced by community seed banks without the formal certification by specialised agencies normally required (see pages 30-33). In India, researchers are proposing that village-based seed banks become an integral part of the government's national seed policies[9] (see pages 50-53).

In sum, rather than fulfilling international obligations or legal frameworks, community seed bank systems are embedded in traditional and cultural practices in many different specific circumstances. Con-

Sorting potatoes in Cuzco, Peru. Photo: José Solis Mora

Selling different bean varieties at the market. Photo: Jean Claude Rubyogo

cepts of distributive justice, reciprocity and equity are criteria that guide how benefits from the management and use of land and other resources are shared among community members. Fundamentally, these are the principles that make community seed systems effective for family farmers.

This brings into focus questions such as: What are the main success factors and challenges of both formal and informal ABS systems for family farmers? What lessons can be drawn from existing practices? What effective solutions can we develop to make the procedures less bureaucratic and legalistic, while truly enhancing access and benefit sharing for family farmers? Taking experiences from around the world as a starting point, this issue of Farming Matters explores potential answers to these questions.

Notes

1 Koutouki, K. (2011), Nagoya Protocol: Status of Indigenous and Local Communities. Legal Aspects of *Sustainable Natural Resources Legal Working Paper Series.*

2 Bioversity International (2014), *Bioversity International's 10-year strategy 2014–2024.*

3 UN FAO (2010), *State of the world's plant genetic resources for food and agriculture.*

4 'Regime' is commonly understood as a system or method of government (Cambridge Dictionary)

5 Ker, C. Louafi. S., Sanou, M. (2013), Building a Global Information System in Support of the International Treaty on Plant Genetic Resources for Food and Agriculture. In: *Crop Genetic Resources as a Global Commons: Challenges in International Law and Governance.* (Halewood, M., López Noriega, I, Louafi, S. eds). Routledge pp. 283-309.

6 See e.g.: Shrestha, P., Vernooy, R., Chaudhary, P. (eds. 2012), *Community Seed Banks in Nepal: Past, present, future.* Proceedings of a National Workshop, 14-15 June 2012, Pokhara, Nepal.

7 Adapted from: Vernooy, R., Sthapit, B., Galluzzi, G. and Shrestha, P. (2014), The Multiple Functions and Services of Community Seed banks. In: *Resources* 2014:3, pp. 636-656.

8 Vernooy, R. (2003), *Seeds That Give: Participatory Plant Breeding.* International Development Research Centre. Ottawa, Canada.

9 Shrestha, P., Vernooy, R., Chaudhary, P. (eds. 2012), *Community Seed Banks in Nepal: Past, present, future.* Proceedings of a National Workshop, 14-15 June 2012, Pokhara, Nepal.

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Photo: Lindsey Hethcote

Improving access to vegetable seeds for resilient family farms in Costa Rica

A group of coffee farmers in Turrialba, Costa Rica, is successfully exploring diversification options with horticultural food crops. This is being done in collaboration with two vegetable seed banks that allow farmers to use varieties freely under the multilateral system of FAO´s International Treaty on Plant Genetic Resources for Food and Agriculture.

Lindsey Hethcote, Maarten van Zonneveld, William Solano, V. Ernesto Méndez and Nelly Vásquez

Experiments with tomato and sweet pepper varieties were successful and the results show promise for continuing to encourage farmers in gaining access to horticultural crop genetic resources. The resulting diversity could be the basis for diversified farming systems that are more resilient under progressive climate change and in the context of price volatility, while providing nutritious food crops as well. This case study therefore calls for the inclusion of more horticultural crops in the annex 1 list of species covered by the multilateral system (see page 10), such as tomato and sweet pepper.

Why mix coffee production with tomato and sweet pepper?

In Turrialba, Costa Rica, climate change and low coffee prices motivated small scale coffee farmers to spread risk and diversify their farms by integrating new crops. Eight small scale coffee farmers in Turrialba chose to participate in an experiment with tomato and sweet pepper led by the Tropical Agricultural Research and Higher Education Centre (CATIE). These crops were chosen for the experiment for the following reasons:

1. Farmers in this region have expressed strong interest in horticulture crops as alternative cash crops complementary to coffee, as well as for domestic consumption;
2. CATIE's gene bank maintains highly diverse collections of these two crops, which provides the necessary variety for selection of interesting materials, and are openly accessible under the multilateral system (MLS) established by FAO´s International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRA). (see page 15)

The experiment's premise is that diversified farming systems are often ecologically and economically more resilient than those with less components. Diversified systems provide farmers a range of benefits, including stable income and production, as well as diverse food for consumption. This diversity has led to systems becoming more resilient to climate change and price volatility.

However, farmers often do not have access to appropriate seed material to diversify their systems with food and/or cash crops of their interest. In this project we explore how access to diverse genetic material can improve a farmer's ability to effectively diversify their farm in a way that makes it resilient and sustainable.

How did farmers conduct the experiment?

Eight farmers, four organic and four conventional, were invited to participate in the study based on their interest in diversification and willingness to participate. The farmers evaluated three types of tomato and sweet pepper varieties. These included (a) popular commercial varieties, (b) traditional varieties from CATIE's seed bank that were selected according to farmer preferences indicated in initial interviews, and (c) new varieties that were developed by breeders from the World Vegetable Centre (AVRDC) in Taiwan to respond to specific biotic and abiotic conditions in Central America.

Seeds from CATIE's seedbank were ordered using the Standard Material Transfer Agreement (SMTA, see page 10) developed by the International Treaty on Plant Genetic Resources for Food and Agriculture. Seeds of the AVRDC varieties were obtained by CATIE after signing a SMTA to test them in Central America. In addition, the commercially most common tomato and sweet pepper varieties were ordered from a local greenhouse.

After the seedlings were transplanted to each farm, plastic bands were installed as protective roofs above each variety. Conventional and organic seedlings were given to each producer, along with a management guide that was used to ensure that the same management approaches were used at all farms.

Each farm was visited once a week from the time the transplant began in April 2015 until the end of the field experiments in November 2015. During the visits, the following data was recorded: (a) morphological and evaluation data of each variety, (b) site characterisation of each farm, (c) management evaluation of each producer, (d) climate data, (e) yield data, (f) participatory evaluations with the producers, and (g) individual interviews with the producers about their preferences.

Farmers' preferences

Many factors affected the variety preferences of each farmer, including the type of management used on the farm and local market factors as well as local biotic factors. Although many farmers appreciated the commercial varieties because of their pest and disease resistance and their high yields, several CATIE accessions as well as a few AVRDC varieties were ranked either equally or more preferred than the commercial varieties

Most of the producers involved in this project expressed satisfaction with the unfamiliar varieties that were brought to their farms. Rosa Hernández Céspedes, a coffee farmer who has been trying to diversify her 7 hectare farm for the last eight years, is very excited:

> *"These new varieties also give us something new to sell. The local people want new kinds of vegetables, new options, but I never knew where to find the seeds. So I have started saving the seeds from the new varieties and I can now sow my own seedlings and produce these great vegetables again."*

What started out as purely a coffee plantation had already been converted by Rosa into a diverse organic farm that now includes a vegetable greenhouse, a restaurant and tree nursery. Yet, before her involvement in this project Rosa had limited success in diversifying with vegetables:

> *"I always planted the same commercial varieties of vegetables, including commercial varieties of tomato and sweet pepper. But with this project, I have discovered many traditional varieties of great quality, some of which are more resistant to the increase in rain we have had this year. It's great to have all of these new options on the farm."*

For farmers like Rosa who are searching for diverse products with unique characteristics, the traditional CATIE varieties were of most interest. Many of the traditional varieties tested in the study showed characteristics that were appealing to these farmers, such as high resistance to pests and diseases as well as fruit forms that were uncommon, but often preferred. The commercial varieties were often most preferred by producers selling strictly to the conventional market.

What lessons can be drawn from this study? This study shows the importance of facilitating farmers' and breeders´ access to the genetic resources of horticultural crops and the key role that could be played by accessible collections, such as those of CATIE and AVRDC. Tomato and sweet peppers, as well as other important vegetable crops like cucurbits, are not yet part of the list of crops that are covered directly by the multilateral system (see page 10). This means that access to a wide range of varieties for these crops is difficult to obtain for small scale family farmers due to the bureaucracy, cost and intellectual property rights involved.

Access to improved varieties of horticultural crops is difficult to obtain for family farmers due to the bureaucracy, cost and intellectual property rights

Although the resources contained within gene bank collections are important, without proper access to particular information for farmers, breeders and agronomists, the material cannot be used efficiently. In this study for example, morphological data of gene bank accessions were used to select the varieties according to farmer preferences and in the evaluation their on-farm potential under different conditions. It´s important that such morphological characterisation and

One of the conventional farmers participates in the evaluation of fruit production of different tomato varieties.

evaluation data is made accessible by seed banks to enhance its use by different actors.

On the basis of this study, we propose six measures to improve access to plant genetic resources for growers and breeders once the crops are included in the MLS:

1. A clear documentation system with relevant information on agronomic and other commercial properties of the crops covered by the MLS collection is made available in accessible language and media;
2. An online system to directly request seeds and also includes contact data for farmers to call in case of questions;
3. Active assistance to farmers for negotiating a Standard Material Transfer Agreement ;
4. Establishment of straightforward paymentsystems that cover the costs for regeneration of the material by the gene bank, which should remain economically accessible to farmers and breeders;
5. Distribution of hardcopy catalogues that include the most promising materials and contact data to farmers and relevant organisations;
6. Increasing the number of on-farm participatory varietal validation research projects with farmers.

When farmers have better access to the information and seed material that is currently available in seed banks, they can broaden the genetic base of their crops. Our research shows that this is of interest to individual farmers and organisations who seek to diversify their farms to respond to climatic and/or economic shocks, and to strengthen their management of crop varieties by developing participatory evaluation and breeding programmes.

Farmer based experimentation and peer learning

Farmers like Rosa are motivated to seek out new varieties and new markets to enhance their adaptive capacity. However, many producers have lost essential knowledge about ecosystem resilience and the way that diverse, traditional seed systems contribute to this resilience. Therefore, knowledge sharing must also be enhanced in addition to improved access to gene bank material under multilateral seed systems if the material is going to be used effectively.

However, this genetic material cannot simply be brought back to farms by outside intermediaries. Rather, we have seen that knowledge sharing works best when innovative smallholder farmers like Rosa encourage other producers to seek out new material, multiply and breed diverse varieties. Such horizontal learning and farmer based experimentation should be at the centre of knowledge sharing processes, in which other parties (scientists, NGOs) can play a supportive role. This will contribute to the effective use of genetic resources for more resilient and sustainable farming communities.

Documentation of sweet pepper varieties by an organic farmer in his experimental plot in collaboration with the visiting researchers.
Photo: Lindsey Hethcote

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This project was developed by CATIE, Bioversity International and the University of Vermont. It was financially supported by CATIE, Bioversity International, Hivos, CCAFS and the World Vegetable Center (AVRDC). We thank Rosa Hernández Céspedes and all other seven farmers who participated in this project.

Photo: Yiching Song

Access and benefit sharing in participatory plant breeding in Southwest China

This contribution discusses access and benefit sharing within the context of participatory plant breeding. It presents how Chinese farmers and breeders interact in relation to crop improvement and on-farm maintenance of plant genetic resources. Based on more than a decade of action research, a number of institutional changes were accomplished as a result of the interactions between national and provincial breeding institutes, rural development researchers and local maize farmers. Although the respective legislation in China is not yet adequately formulated, access and benefit sharing can still be addressed in contracts and by labelling products of a particular geographic origin.

Yiching Song, Zhang Yanyan, Xin Song and Ronnie Vernooy

At the end of the 1990s, an assessment of the impact on smallholder farming in Southwest China of maize varieties released by the International Maize and Wheat Improvement Centre (CIMMYT) concluded that there had been a systematic separation of the formal seed system and farmers' seed systems. Varieties that were bred and released by scientific institutions were almost never adopted by farmers in the remote mountainous regions of the Southwest due to their poor adaptability to local agroecological conditions.

At the same time, however, the assessment documented for the first time the local diversity of maize landraces that had been conserved in the farming communities studied, with more than 80% of farmers' seed being supplied by their own seed systems. Inspired by this, researchers of the Centre for Chinese Agricultural Policy (CCAP) decided to set up a participatory plant breeding project in order to research the usefulness of local varieties in scientific breeding. Such varieties include farmer improved open pollinated varieties and landraces. The researchers also set out to explore the possibilities for adapting formally released varieties to local conditions.

This project started in 2000 and focused on the province of Guangxi (Southwest China), with the active collaboration of farmers in six villages, maize breeders from the Guangxi Maize Research Institute (GMRI, the provincial public breeding institute) and the Chinese Academy of Agricultural Sciences (CAAS, the national public breeding institute). Funding came from the International Development Research Centre of Canada and the Ford Foundation with facilitation provided by sociologists and policy researchers of CCAP in Beijing.

Key role of farmer-breeders

Breeders of both the provincial and national breeding institutes reported that the genetic base of maize hybrids had become dangerously narrow, which renders crops more vulnerable to pests and diseases, especially in the face of climate change. These breeders were invited to farmers' fields to discover for themselves farmers' skills, knowledge and expertise in managing genetic diversity. Later in the process, farmers brought their varieties to CAAS and GMRI and shared their knowledge and experiences in seed selection. During the exchange visits the 'professional' breeders discovered that the farmers had conserved and improved *Tuxpeño 1* (an open pollinated maize variety released much earlier by CIMMYT). They also learned that one farmer in particular, known as Aunt Pan from Wentan village, had improved a locally important variety of *Tuxpeño 1* that had become widely popular in the surrounding local communities. Due to these interactions, they began to realise that the local landraces that had been conserved on-farm in the Guangxi communities could be a potential source of valuable new breeding material for professional breeders in the country.

The breeders from the national and provincial institutes gradually acknowledged and appreciated that local farmers could become valuable partners in seed development and improvement. As a result, Aunt Pan

Knowledge sharing between farmers and researchers in a participatory plant breeding field trial, Stone Village, Yunnan. Photo: Yiching Song

The harvest dancing team of Mashan Guzhai Village, Guangxi. Photo: Simon Lim

joined the research team to continue improving *Tuxpeño 1*. From 2000 to 2004, the project gradually became a research programme funded in part with Chinese resources, while the research team extended its activities to new communities in Guangxi and to two additional provinces in the Southwest: Yunnan and Guizhou.

These communities were situated in more remote areas. Farmers in these villages reportedly conserved an even larger diversity of landraces. In some of the communities, the research team identified other experienced farmer-breeders, such as in Stone Village in Yunnan. These farmer-breeders are continuing and expanding the crop improvement efforts first started in Guangxi, with women playing a central role. Farmers in the participating villages benefited from the experiments as they got access to improved seeds and were able to exchange these with farmers in surrounding villages, increasing the reach of benefits.

Testing the varieties beyond Guangxi

In 2003, with the support of the participatory plant breeding team, GMRI breeders allowed the first participatory bred variety *Xin Mo 1* (an OPV) into the formal testing procedure for their value for cultivation and use (VCU test). There are two levels of VCU testing in China - one at the national level and one the provincial level. *Xin Mo 1* was entered into the national testing procedure. In the Northern provinces it was entered at provincial level. However, likely due to different agroecological conditions, it did not perform as well as in the original trial villages of Guangxi and hence failed the VCU test.

As a result, the team reflected on the challenges to the registration of their products. They decided that henceforth open pollinated varieties would be released only in the trial villages and their neighbouring communities. The setback motivated the team to add a new research component to the program: a systematic review of national policies and laws impacting crop conservation and improvement with particular interest to finding legal space for variety release at sub-national levels (see the selected books on pages 69-71 for more information).

Another important result of the programme was the release of a hybrid waxy maize variety, *Guinuo 2006*, in 2003. The variety had successfully passed VCU tests in a trial village and was registered through the GMRI. The subsequent commercialisation of *Guinuo 2006* by a GMRI-owned seed company generated significant financial benefits for the professional breeders as it soon became one of the most popular waxy varieties on regional seed markets. Unfortunately, the farmer-breeders did not receive any of these financial benefits.

Farmers' Rights

When *Guinuo 2006* penetrated the commercial market the farmers who had participated in the adaptation testing of *Guinuo 2006* became aware of the costs of purchasing their seed at market price. The team realised that it was unfair that the farmers who had contributed to seed development had to pay for using the seed. In order to help farmers save on the cost of seed and as a way to

redirect benefits to the farmers participating in the participatory breeding project, the team initiated community based seed production of *Guinuo 2006* in a number of trial villages in Guangxi. The seeds were produced and sold by the farmers, who now make some money from their sales and no longer have to buy seeds.

Table 1 gives an overview of the seed production since 2005 in Guzhai village, Guangxi. Production has experienced some ups and downs, but has continued to generate a significant amount of money for the farmer seed producers.

Table 2 gives a summary of the seed production efforts in the last three years in Stone Village, Yunnan, showing a slow but gradual expansion.

A unique benefit sharing agreement

In order to create some legal space for the community based seed production of *Guinuo 2006*, the team facilitated an agreement among GMRI breeders, the GMRI-owned seed company and the seed production villages. This initiative, a first in China and perhaps the world, was generally welcomed and the negotiations resulted in an agreement to share the financial benefits. The GMRI breeding institute and the associated seed company would supply the commercial market while allowing the farmers participating in the project to produce seed for local niche markets, such as the remote areas of Guangxi and nearby Southwest provinces, with the price set by farmers.

This unique agreement was based on the breeders' desire to galvanise the existing mutual trust with farmer-breeders. As one of them explained:

> *"We have collaborated with these farmers for a long time, we trust them as friends, and we would like to grant them small scale seed production in their communities."*

Farmers expressed that they highly appreciated the support given by the professional breeders, which they consider a recognition of farmers' contributions to the development of the new variety.

In 2005, two of the trial villages located in remote mountainous areas were selected for hybrid maize

Table 1: 'Guinuo 2006' Seed production (PPB), Guzhai village, Mashan County, Guangxi

Year	Households #	Acreage In mu	Total Production kg	Sales kg	Price per/Kg in RMB	Total income RMB	
2005-2007							Experimental stage
2008	11	5.5	223.5	205	24	4920	
2009	11	5	127.5	127.5	33.6	4290	
2010	8	6.4	0	0	0	0	Flood
2011	8	3	165.5	150	36	5400	
2012	6	3	153.5	153.5	30	4605	
2013	9	3	250	250	32	8000	
2014	6	4.7	160	160	32	5120	Early maturation & part of the seed was eaten by mice. Farmers lost about 250 kg of seeds.
2015	5	3	210	210	32	6720	

1 mu= 0.1647 acre. 1 USD= 6.55 RMB

Table 2: 'Guinuo 2006' Seed production (PPB) in Stone village, Yunnan

Year	HHs (#)	Acreage (Mu)	Seed Production (kg)			Sale of Hybrid Seeds (Kg, Yuan)		Income
			Hybrid Seeds	Parent lines				
				Male	Female	Quantity	Price/kg	
2013								Experimental stage: no income
2014	1	0.1275	12.6	11.75	2.35		16 (Internal)	Subsidy received: RMB 800
2015	4	1.15	77.2	70.7	10.5		36	Of every sale of 1kg hybrids, RMB 6 goes into the community development fund.

1 mu= 0.1647 acre. 1 USD= 6.55 RMB

seed production. These locations were chosen because the breeders wanted to reduce the chances that the parental lines of the hybrid variety, which remained protected by their plant breeder's rights, would be stolen by rival commercial interests.

This hybrid seed production through participatory plant breeding has been carried out by farmers in two villages in Guangxi since 2005 and has expanded to Stone Village in Yunnan in 2013 through farmer to farmer exchanges facilitated by the project team. The major challenge that farmers face is how to obtain full ownership and legal rights to the variety. Although the farmers who participate in the project and their communities consider that they have collective right to the variety, in China's seed law collective rights are not yet accepted. Another major challenge is the insufficient policy and institutional support for farmers' seed production, distribution and marketing.

Tensions: no formal framework

In order to better understand the emerging tensions between local practices in access and benefit sharing and national regulatory frameworks, an international exchange took place in 2009 of ABS experiences from four countries: China, Jordan, Peru, and Nepal. The meeting comprised a workshop in Beijing and a field visit to trial villages involved in participatory plant breeding in Guangxi.

The relationship between ABS issues and national legislation, crop policy, and stakeholders' interests became a focus of discussion at the workshop. Chinese officials working on ABS legislation from the Ministries of Agriculture and Environmental Protection participated in the discussion. An important discussion point was that according to the current plant variety protection regulation (1997) in China, farmers can in theory be recognised as joint breeders through a contracting arrangement. However, such an agreement is difficult to achieve in practice because the public breeders have a competing stake in plant genetic resources, and farmers' rights can rarely be claimed through the plant variety protection law. Breeders can receive 100 yuan (about 15 USD) for each variety collected for a gene bank, but there is no payment to farmers if seeds are collected from their fields. Also, it should be noted that in China the state ultimately has sovereign rights over all plant genetic resources while property rights have only been vaguely defined. Furthermore, China is not a signatory to ITPGRFA.

To bypass these problems and compensate farmers for their contribution, CAAS breeders suggested refunding the farmers for the costs of maintaining the designated plant genetic resources in their fields to the value of 0.3-0.5% of any profit a commercial seed company may derive from that material. The GMRI breeders endorsed this idea, but when they discussed the proposal within their provincial institute, the institute's commercial branch responsible for seed production and marketing objected because it would not bring commercial benefit to the seed company.

This episode exposed the opinions and interests of each stakeholder and even led to tensions within the GMRI. It was concluded that China lacks a common ABS framework at the national level and that this is creating uncertainty for emerging local practices.

Guinuo 2006 seed. Photo: Yanyan Zhang

ABS contract model from Taiwan

Faced with these challenges, in 2009 CCAP researchers started to negotiate an ABS contract with its stakeholders. CCAP had been inspired by an ABS contract model that was developed in Taiwan. The model requires recognition by name of any farmer who makes a contribution, as well as the creation of an enforceable fair benefit arrangement agreed by all the named parties, before a license for seed release is granted. As such, CCAP researchers recognised that the Taiwanese model law provided an alternative to arrangements based on exclusive rights and compels the balancing of interests among stakeholders in the public sector, commercial sector and farming communities.

Two types of contracts were developed in parallel for two potential purposes (a) to encourage *in situ* conservation (for breeding and agro-biodiversity enhancement), and (b) to fairly share the commercial benefit from market exploitation. The two contract types were signed by three public research institutes (including CCAP), two breeding institutes (GMRI and CAAS),

Women farmers and their participatorily bred maize plants, Masgan Guzhai Village, Guangxi. Photo: Yanyan Zhang

and 12 farming communities in Guangxi in June 2010. In July 2010, the team reported the contract process to the officials of the Ministries of Agriculture (MoA) and Environmental Protection (MoEP) and discussed the feasibility of scaling up the practice at national level. MoEP officials proposed to integrate the team's case experience into the national ABS discussion and supported the idea of setting up a national registration system for plant genetic resources and landraces as the first step required for international recognition of national ABS law.

Slow but steady progress Fifteen years of ongoing and expanding field research in Southwest China combined with strategic policy research at provincial and national levels has resulted in growing recognition and appreciation of the synergies that can be created between the formal and informal seed systems in China. Given the scope and complexity of the institutional landscape in China this has been a remarkable achievement.

In recent years, CCAP, GMRI and CAAS have been joined by other Chinese research institutions to strengthen the efforts that were first started in a few communities in Guangxi. At the same time, lead agricultural policy organisations have become involved and have begun to incorporate the important results of the field research into relevant policies and laws in order to create a more supportive environment for the kind of approach piloted by the participatory plant breeding team. Hopefully, this will allow more farmers to benefit in the forms of recognition of their expertise, improved access to and availability of quality seeds and improved varieties, income generated from seed production and marketing, and the provision of scientific and technical knowhow through collaboration with the formal seed sector.

> Fifteen years of field and policy research has resulted in a growing recognition of the synergies that can be created between the formal and informal seed systems in China

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This article builds on and updates previous publications on the same subject (see Further Reading 69-71). We acknowledge the contributions of a number of colleagues to these publications. We thank Robin Pistorius for his editorial work on this article.

Evolutionary populations: Living gene banks in farmers' fields in Iran

Efforts to rapidly increase on-farm biodiversity are a matter of urgency in an era of climate change. To do so, farmers need better access to the genetic material of research stations and gene banks. Collaboration with scientists who are willing and able to work together with farmers is crucial. The Evolutionary Plant Breeding programme in Iran is one example of how this can be done.

Maryam Rahmanian, Maede Salimi, Khadija Razavi, Reza Haghparast, Salvatore Ceccarelli and Ali Razmkhah

Photo: Maede Salimi

Access to genetic resources and genuine collaboration between farmers and scientists is lacking in most parts of the world. A model in Iran that has given a large number of farmers access to a great amount of biodiversity in a relatively short time is evolutionary plant breeding (EPB). A dynamic and inexpensive strategy, EPB rapidly enhances the adaptation of farmers' crops to climate change. It was developed by the Centre for Sustainable Development (CENESTA) in Iran. It builds on experience with participatory variety selection, in which farmers plant a number of different varieties of the same crop and, after several years of selection, choose a small number of varieties for multiplication and use.

In EPB, farmers begin by planting a large mixture of hundreds or thousands of different varieties, and do not necessarily aim to arrive at the selection of a few varieties. EPB instead relies on mixing as many different types of a particular crop as possible, leaving them to cross freely between each other. Genetically, the seed which is harvested is never exactly the same as the seed which was planted. Several farmers in different regions plant and harvest a small sample of seed (4-5 kg) in the same 250 m^2 plot for successive years. These plant populations then evolve under different types of agronomic management and in the face of specific combinations of stress from diseases, insects, weeds, drought, extreme temperatures and salinity. In this way, the frequency of genotypes that have adapted to local conditions gradually increases.

The idea of EPB is not new, although it wasn't until 2008 that EPB was implemented as a formal project. As early as 1929, methods were developed for generating heterogeneous populations of barley where locally adapted varieties were needed. In 1956, this was labelled as the 'evolutionary plant breeding method'. Yet there was already a strong demand for uniformity in the most important food and feed crops. This was driven by the growing use of chemical inputs, which require uniformity to give a consistent response. In addition, emerging seed companies attempted to protect their breeding programmes and associated products by promoting this uniformity.

Farmers at the centre

Before CENESTA launched participatory breeding projects, all the breeding programmes in Iran had excluded farmers from the most important stages of the breeding process, and farmers often did not adopt the products of these programmes. EPB follows a completely different approach, with farmers at the centre of producing new varieties and applying the principles of natural selection themselves.

In 2008, with support from Dr Salvatore Ceccarelli, CENESTA started with EPB by providing five farmers in provinces of Kermanshah and Semnan with mixtures of 1600 different types of barley that was supplied by the International Centre for Agricultural Research in the Dry Areas (ICARDA). This mixture included a wide range of germplasm: the wild progenitor

EPB rapidly enhances the adaptation of farmers' crops to climate change

Hordeum spontaneum, landraces from several countries, and modern breeding material. Within this 'evolutionary' mixture different plants crossed naturally to produce new types. Each year, the types produced more seed and gradually the population became better adapted to the specific and changing circumstances of farmers.

The success of EPB spread far beyond these first five farmers of the first years. They were so satisfied with the population's performance that they shared their mixtures of barley with other farmers in several provinces, via both CENESTA's PPB programme and also informally with neighbours, friends and relatives. As of early 2016, the seeds cover several hundred hectares and are planted in 19 provinces by about 300 farmers.

EPB is increasingly used in other crops. Based on the success of the barley population, the Dryland Agricultural Research Institute (DARSI) established a similar programme for bread wheat. In 2013, we started to turn our attention towards rice. By combining Iranian landraces currently in use in Iran, with 202 repatriated Iranian landraces provided by the International Rice Research Institute, we created a new mixture to start EPB in rice. Evolutionary populations for a variety of crops are now also grown in several other countries.

Living gene banks

Gene banks perform an important role in the conservation of species, but they 'freeze' not only seeds but also their evolution at the time of collection. Local varieties and wild relatives must also be conserved *in situ*. By combining participation and evolution in breeding programmes, farmers can guide the evolution of their crop mixtures in the most desirable way for them. In the words of Abdol-Reza Biglari, a farmer in Garmsar:

Different varieties of wheat. Photo: Maede Salimi

With EPB, farmers become the owners of their future. Photo: Maede Salimi

"Thirty years ago we used to have many different varieties. Most of the new varieties introduced to us were not suitable for more than one or two years. This shows that we have to return to biodiversity."

The evolutionary populations can be considered as a living gene bank. Farmers (by themselves or in collaboration with scientists) select the most desirable plants and use them in participatory breeding programmes. For farmers who prefer to sow mixtures rather than single varieties, the evolutionary populations serve as a source of genetic resources for creating new mixtures. The importance of having secure access to such a collection of seeds became apparent in Jordan, for instance, where farmers and scientists are turning to evolutionary populations now that the civil war in Syria disrupted their regular source of breeding materials. With EPB, farmers become the owners of their future; with the best varieties evolving in their fields, there is little or no need to buy seeds.

Access to better seeds

Nemat Salemian, a farmer in Anjirak, recalls his first encounter with EPB.

"We received this wheat from another farmer who told us that it's a mixture of hundreds of different varieties and that we should plant it in our worst soil. My father said that in the 80 years that he has been a farmer, he has never seen better plants, despite the very bad soil and the climatic conditions this year."

The EPB mixtures have been shown to produce higher yields and perform better in adverse conditions than their local or improved counterparts. Despite late sowing, in the first year of CENESTA's programme, the evolutionary populations of barley outyielded the local barley and performed almost as well as the improved barley cultivar. In the following year, the evolutionary populations of wheat yielded more than twice as much as the local varieties.

The EPB populations are also more resistant to weeds, diseases and pests. In 2011-2012, a farmer in the district of Garmsar witnessed that his evolutionary population of wheat had higher yields than the local improved variety and the evolutionary population did not need to be treated with pesticides and herbicides. This suggests that evolutionary populations could be very useful in agroecology and organic agriculture and are cheaper to grow.

Farmers have faced some challenges with EPB, but they have also found creative solutions which provide important lessons. For example, very small plots of land may not be enough to grow their own evolutionary population. To resolve this, a community of smallholder farmers can rotate the evolutionary population among them. Another challenge would be severe climatic events in which only a small fraction of the population may survive - leaving too little diversity in the mixture to continue to adapt. In this event it may be necessary to supplement the mixture with new types. Nevertheless, in such circumstances the farmers growing the evolutionary population will still have more chance of harvesting some of their crops, while fields with only one variety may be entirely destroyed.

Unexpected results

After receiving a small amount of seed in the first year of the EPB trials, we expected farmers to continue to sow just enough to allow the population to evolve and to act as a source of locally adapted varieties. One of the most unexpected outcomes of the evolutionary population trials was that some farmers decided to sow all the seed they had harvested, multiplying and cultivating the seed as their main crop.

> *"About 20 farmers have asked me for this seed after they saw it in my field last year,"* farmer Faraj Safari recalls. *"This year I am only going to grow this mixture. I'm going to plant about 40 hectares with this mixture. I can give seed to about 10 or 15 other farmers this year, and more next year."*

Similarly, the cultivation of evolutionary population of barley started in 2010 in the nomadic tribal territory of Bakhtiari and had positive results. In the first year, 55 kg of seed was produced on each hectare, reaching 6 tons per hectare in 2015. Five other tribes in different areas joined in, also using EPB. Among the reasons for the success in Bakhtiari they mentioned the adaptability of the evolutionary populations of barley to drought and the fact that they can feed their livestock highly nutritious EPB barley, which reduces cost for feed, contributes to better animal health, and provides better milk.

The consumer and the market

Many people wonder whether the final product from EPB mixtures is of a high enough quality for use and

By combining participation and evolution in breeding programmes, farmers can guide the evolution of their crop mixtures. Photo: Maede Salimi

Evolutionary populations serve as living gene banks where farmers can source individual varieties.
Photo: Maede Salimi

sale. But there is no need to worry. A protein analysis of the Iranian barley varieties, which are mostly used as an animal feed in Iran, showed that the evolutionary population had more protein in them than the local improved variety. For wheat, farmers and bakers in the provinces of Seman and Kermanshah have made bread from the evolutionary populations and were very pleased with the results. Some are even marketing this bread in local artisanal bakeries. Farmers growing evolutionary populations in France and Italy confirmed that creating mixtures not only brings greater yield stability, but also produces greater aroma and quality when making bread.

Evolutionary plant breeding is reviving a traditional system of access and benefit sharing

In the case of rice, farmers first thought the mixture of rice varieties would not be good for cooking and eating, and as such were afraid they wouldn't be able to sell it. But after harvest, they tested the rice and found that the taste to be excellent. Farmers are currently negotiating agreements with several restaurants who are interested in buying their EPB products.

The suitability of evolutionary populations as a farmer's main crop depends on the use of the crop and the cultural preferences of farmers and consumers. Even when the crop does not lend itself to being consumed as a mixture (which is the case with many vegetable varieties), evolutionary populations can still serve as living gene banks for farmers to source individual varieties. The use of EPB with vegetables is currently underway in Italy with tomato, beans and courgettes.

Access and benefit sharing in evolutionary plant breeding

Iran has no formal ABS policy, but this does not mean that there is no access and benefit sharing. Since the varieties that constituted the first evolutionary populations were taken from ICARDA (barley), DARSI (wheat), and IRRI (rice), there was some sort of access to genetic resources for small scale farmers and local communities. However, in relation to benefit sharing, evolutionary plant breeding does not fit within the official ABS framework.

The main issue is the condition that seeds must be commercialised, and in doing sp needs to be registered and certified. The formal seed release system in Iran requires that new seed varieties pass a series of tests: the value for cultivation and use (VCU) test and the distinctiveness, uniformity and stability (DUS) test. But EPB populations are unlikely to comply with these variety release criteria, which are tailored to the characteristics of modern varieties, since farmer improved varieties cannot show 'clear improvement' under different growing conditions and can hardly meet the DUS criteria. In addition, Iran's seed regulations do not recognise collective intellectual property rights and there is no national ABS regulation.

Yet evolutionary plant breeding is reviving an informal and traditional system of access and benefit sharing. Many EPB farmers share their seeds with other local small scale farmers free of charge, while others sell their seed to other farmers. And CENESTA identifies seed producing farmer cooperatives around the country and works with them to distribute EPB populations in new areas.

Where next? The evolutionary populations of wheat and barley continue to be spread throughout Iran, both through farmer-to-farmer exchanges and through exchanges organised through DARSI, the Department of Agriculture of Fars Province, and CENESTA. Since 2013, there have been annual national workshops on EPB where farmers from several provinces shared their experiences. Regular local, regional and national workshops and field visits continue to be needed to strengthen farmers' knowledge about how to use these populations. The main challenge is to keep up with the fast spread of these seeds, to track the spread and the outcomes, and to support farmers' management practices.

Plant genetic resources for food and agriculture have been developed over millennia to satisfy the most fundamental of human needs. The free flow and exchange of these resources was once governed by individuals and communities. However, this has changed as intellectual property regimes have been applied to agriculture. In international and national law intellectual property laws often overshadow or even extinguish the natural rights of farmers and farming communities to the landraces and varieties they have developed. Commercial plant breeders have benefited from this, as they have been able to develop new seeds, often based on farmers' plant genetic resources, and then protect their investment through commercial patents or plant variety protection laws which prevent farmers from legally exchanging and saving seed for future use.

Therefore, at the same time, we must try to develop awareness of the potential impacts of different seed laws and policies on farmers' rights to save, exchange, develop and sustainably use their seeds.

In workshops, farmers from several provinces share their experiences with evolutionary plant breeding. Photo: Maede Salimi

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This contribution is adapted from an article first published in Farming Matters ('Cultivating diversity', March 2014, www.farmingmatters.org)

Evolutionary Plant Breeding is now also used in rice production. Photo: Maede Salimi

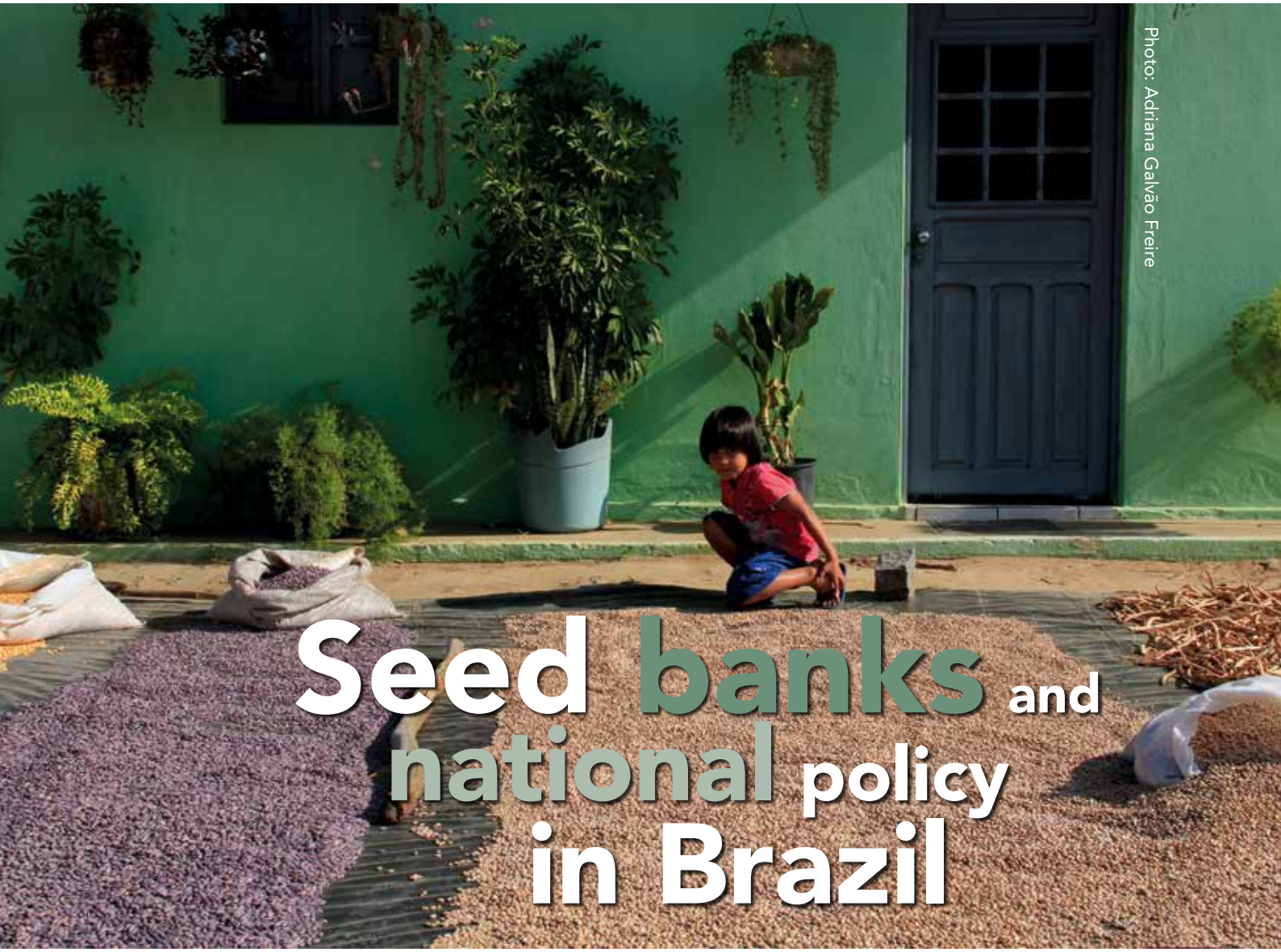

Photo: Adriana Galvão Freire

Seed banks and national policy in Brazil

Increasingly, seeds are the domain of professional breeders, agribusiness and policy makers. They decide what makes for a good variety and they develop legislation that excludes other varieties. Despite this, farmer organisations and social movements in Paraíba, Brazil, have managed to strengthen decentralised farmer-driven seed selection and distribution systems and public seed policies. They may well be opening the way for another seed regime in the country, with its own access and benefit sharing mechanisms.

Paulo Petersen, Gabriel Fernandes, Luciano Silveira and Emanoel Dias

Historically, crops have always adjusted to their natural and cultural environments. The outcome is the rich biocultural heritage that is agrobiodiversity. This process was disrupted when maximising yields became the major guiding principle in crop improvement. According to the dominant view, modern, agro-industrial technologies are needed to create and maintain the necessary environmental conditions for a crop to realise its full genetic potential.

Seed policy

The Brazil federal government and the state of Paraíba launched several programmes in accordance with this agronomic view, promoting varieties that respond well to intensive agrochemical application. Family farmers were encouraged to replace their wide array of local varieties of beans, corn, cassava and peanuts with a few so-called 'improved' varieties. As these new varieties spread, agrobiodiversity declined.

This agricultural approach, or paradigm, was further institutionalised as new regulations defined what a 'seed' is. According to Brazil's seed law, certified varieties can only be commercialised if they are recognised by research institutes and agricultural commissions in the Ministry of Agriculture, which are strongly influenced by the economic interests of seed breeding companies. The country's cultivars law (plant variety protection) sets stability, uniformity and homogeneity requirements on seeds in order to be registered as protected varieties.

There are various problems with this development. Local varieties carry high genetic variability, which is exactly what makes them so resilient to environmental stress. But until 2003 local varieties were not considered to be seeds and were called 'grains' instead. In addition, farmers had to use protected varieties in order to benefit from various support programmes, creating another huge disincentive for the use of indigenous varieties.

This has become an arena of struggle for agroecological farming. Agroecological production favours the use of ecological capital above external inputs, in which locally adapted varieties and agrobiodiversity play a key role. Also, contrary to the State's seed policies, agroecology supports the creation of an increasingly autonomous agriculture, free from the workings of input markets and the agribusinesses that control these markets. The Paraiban Semi-arid Articulation (ASA-PB), a coalition of civil society organisations, has challenged this dichotomy by mobilising farmers and movements around 'seeds of passion': local varieties that, in contrast to most of the seeds distributed by public programmes, are environmentally as well as culturally grounded.

Practices that enhance access

Practices that use and conserve agrobiodiversity in the Brazilian semi-arid region are an important livelihood strategy for family farmers. Although these practices take place everywhere, they were largely invisible, deemed irrelevant by dominant ideological and economic forces. This is why identifying and enhancing the visibility of these practices was a crucial first step.

ASA-PB started this process in 1996. Lead by local farmers' unions and advised by AS-PTA, a participatory appraisal was carried out with farmers to identify local bean varieties in the municipalities of Solânea and Remígio. Through this appraisal, the farmers identified 67 varieties of beans with different characteristics including resistance to droughts and pests, good taste, and acceptance in the market.

They also identified farmer driven mechanisms that enhance access, diversity and seed security. For example, farmers store their seeds and exchange them with other families, allowing for the free circulation of genetic material and of the knowledge associated with each variety in the communities. In another example, local church organisations established seed banks in the drylands of Paraíba in the 1970s proved highly effective in times of drought when crops failed and farmers' own seed stocks were depleted. The bank lends seeds to the farmers which the farmers return, with a small percentage increase, after the harvest. For the organisations that are part of ASA-PB, understanding these practices was the first step towards enhancing the visibility of these mechanisms and scaling them up.

The local seed banks formed an important entry point for a new seed security system based on improved access and availability of diverse and high quality seeds. ASA-PB established the Seeds Network, a knowledge exchange platform around seed practices and agrobiodiversity conservation. This network links 230 seed banks in 61 municipalities, covering 6,500 family farms in Paraíba. During one of the network meetings, Joaquim de Santana, a farmers' union representative coined the term 'seeds of passion'.

> *"Seeds of passion are those that are good, that adapt to our reality,"* he said, *"and people are only passionate about what is significant."*

Changing policy and politics

The Seeds Network formed a space for critical policy analysis and the promotion of alternatives. A drought in 1993 triggered a protest where ASA-PB and other social movements challenged the state's measures that were based on the notion of *'tackling the effects of drought'*. ASA-PB and others instead proposed another slogan: *'living with the semi-arid'*.

As a response, the state government launched a seed banks policy in order to reinforce existing community

Seeds of passion are gaining scientific legitimacy and political recognition. Photo: AS-PTA

seed banks, and donated stocks of seeds as an impetus for communities to construct new seed banks. However, the banks were replenished with conventional rather than local seeds. After the drought of 1998/99, local seed banks were again refilled with conventional seeds, after which protests followed.

ASA-PB persuaded the government of Paraíba to acquire local farmer seeds for the following year. The initiative then stumbled against a legislative barrier: local seeds were not recognised as seeds and therefore could not be distributed officially by the state through the seed bank network. In a creative move, the government bypassed this problem by acquiring the seeds as 'grains', then transferred them to ASA-PB, who then distributed them through their seed bank mediators. In 2002 a law in Paraíba enabled direct transfers.

When local varieties became formally recognised by the national government in 2003, largely as a result of pressure by the National Articulation for Agroecology, the door was opened to more progressive innovations in the government seed programme. One of the strategies of the Lula da Silva government to eliminate hunger was the Food Acquisition Programme. In 2003, as part of this programme, the government and organisations connected to ASA-PB helped farmers to produce and distribute local varieties that were free from transgenic and pesticides contamination. Seeds were directly purchased from, and distributed to, farmers.

This experience confirms that local organisations can and should play a leading role in the maintenance of the rich biocultural heritage embodied in local varieties. The state can play a supportive role in strengthening collective action by redistributing and regulating the diversity of local varieties, something which is for the common good of agriculture.

Engaging with science

Despite the successes achieved by the programme in Paraíba and some other States, most government seed programmes continue to be biased in favour of the conventional paradigm. This is based on the argument that improved seeds have been scientifically proven to work under semi-arid conditions and that initiatives such as those by ASA-PB, while desirable, cannot be scaled up to reach all the farmers who are in need of seeds. This has led ASA-PB to engage in partnership with scientific institutions.

To demonstrate that local use, management and conservation practices are effective and viable, the Seed Network entered into a partnership with Embrapa, the Brazilian government's most influential agricultural research agency. This helped them gain both acceptance in academia and legitimacy among officials involved in seed programmes.

All of the organisations that are part of the Seed Network were involved in the research that followed, which sought to compare the performance of local and conventional varieties. The research team used participatory methods to determine which varieties to compare, which locations to use for testing and how the interactions between farmers and researchers should be structured. Together with farmers, they identified performance parameters. These included grain quality,

Local organisations should play a leading role in maintaining the biocultural heritage embodied in local varieties

plant health, the amount of straw a plant produces, and the effect of intercropping with other crops.

Local varieties outperformed conventional varieties in all regions and in each of the three years that the experiment lasted. Conventional varieties only yielded better in highly fertile soils with plenty of rainfall, which are exceptional conditions for family farmers in semi-arid regions. The varieties that performed best in a certain area usually originate from there. Local varieties were also found to produce more biomass, which is highly valued as animal feed, especially in the erratic climate of the region. Finally, research showed that the seed storage facilities constructed by farmers, often using only local materials and no pesticides, performed well.

Although the research confirmed what farmers already knew, local practices are now scientifically recognised. Moreover, much was learnt, both content-wise and methodologically, from the interaction between farmers and researchers.

The important role the State can play

Recently, under the context of the National Policy for Agroecology and Organic Production, Embrapa has committed to give farmer organisations access to its germplasm collection in order to reintroduce to farming systems varieties that were lost by the push for conventional seeds described above but were conserved in state facilities.

The case of Paraíba illustrates four core functions of community seed banks: conserving genetic resources, enhancing the technical autonomy of family farmers, enhancing access to and availability of diverse local crops, and ensuring seed and food sovereignty. The protests against conventional seeds in '98/'99 and the subsequent governmental action to bypass formal seed laws further confirms that the lack of enabling policy and supportive legal environment is most likely the greatest challenge that most community seed banks face.

But this experience also shows that the state can indeed play an important role in supporting civil society organisations and networks in the construction of seed security systems that allow family farmers in semi-arid regions to build their own food and nutrition strategies and increase their resilience to climatic change. Finally, the case demonstrates the importance of social mobilisation in enhancing the capacity for collective action in rural communities. The struggle fought in Paraíba may well open the way for a different national seed regime with its own access and benefit sharing mechanisms; one that is grounded in the reality of family farmers.

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This contribution is adapted from an article first published in Farming Matters ('Cultivating diversity', March 2014, www.farmingmatters.org)

A farmer drying her seeds. Photo: AS-PTA

Potato breeding in the Netherlands: successful collaboration between farmers and commercial breeders

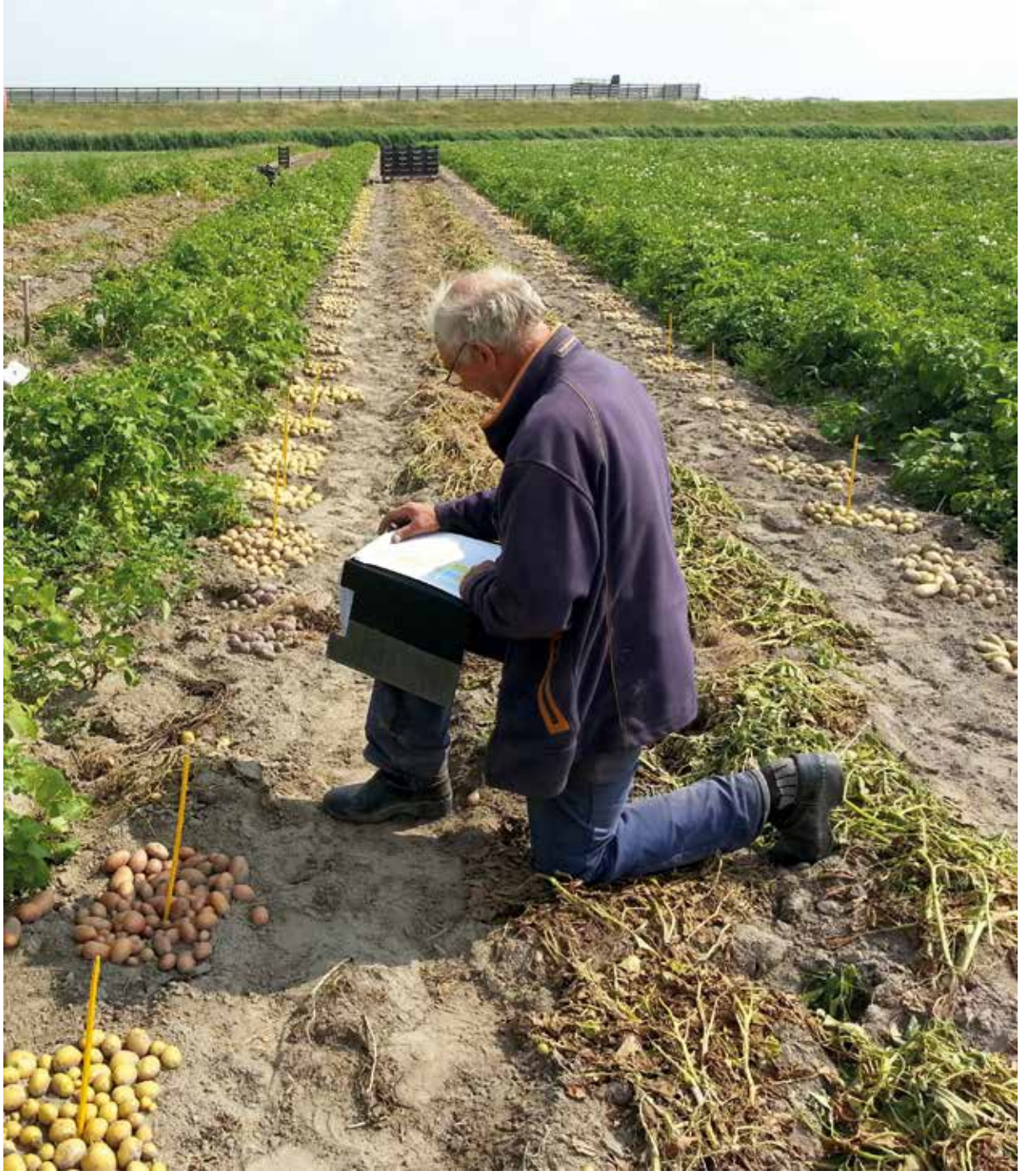
The Dutch potato breeding model, which involves a partnership between farmers and commercial breeding companies in a modern, Western context, is unique. While there are other examples of collaborative relationships between farmers and breeders in Europe, the Dutch potato breeding model stands out in terms of its long track record, the involvement of the private sector, and the institutional integration of the relationship which up to today facilitates access to genetic materials and financial benefit sharing.

Conny Almekinders, Loes Mertens, Jan van Loon and Edith Lammerts van Bueren

Dutch potato breeding model

Participatory Plant Breeding (PPB) is considered to be particularly relevant to smallholder agriculture in developing countries. PPB involves getting farmers to participate in order to overcome shortcomings in the formal plant breeding system. The potato breeding system in the Netherlands has a long standing tradition of farmer participation in breeding and is often referred to as 'the hobby breeder model'. The Dutch potato PPB is unique because of private sector involvement and its situation in a modern Western context. Potato breeding in the Netherlands is rooted in decades of breeding by family farmers in their own fields. When public and private sector breeders became increasingly involved, farmer-breeders continued to contribute significantly to developing this potato breeding system, which supplies a large diversity of crop varieties that are grown in very diverse environmental conditions around the world and for different consumer markets.

Farmers' knowledge and skills are particularly well expressed and vital in breeding in potato which is a very heterogeneous and vegetatively propagated crop. In the Netherlands a new PPB initiative called BioImpuls emerged in 2010, which engages organic potato farmers in a search to develop late blight-resistant varieties for the organic sector. This example supports the argument that farmers' knowledge can substantially contribute to modern and diversified breeding. While Dutch potato breeding is a special case in various re-



Joute Miedema, a Dutch farmer-breeder is selecting in his clones, evaluating the tubers of 4 plants per clone.
Photo: Louis Bolk Instituut

spects, this article indentifies several key attributes which could inform the design of successful PPB programmes in developing countries.

The collaborative potato breeding model in the Netherlands is set in the context of a highly productive agricultural sector. Potatoes are grown by 45% of the Dutch arable farmers and cover more than 150,000 ha of Dutch agricultural land. Forty-six percent of this land is used to grow ware potatoes, 28% starch potatoes and 26% seed potatoes. With an average yield of 46.7 t/ha, Dutch potato yields are among the highest in the world. Approximately 70% of Dutch seed potato production is exported to be grown in diverse environmental conditions around the world and for different consumer markets.

Farmer participation in Dutch potato breeding

The effectiveness of farmer participation in the Dutch potato breeding model in the Netherlands is well illustrated by the share of farmer selected varieties grown there. In 2009, 409 potato varieties were planted for seed potato production. Of these 409 varieties, 293 (almost 75%) have been bred in the Netherlands. Half of those Dutch varieties have been selected by farmer breeders, covering 44% of the total area planted with seed potatoes (Fig. 1). Based on diverse sources of expert information we estimate that 82 farmer-breeders have contributed to this development. Many of the farmer bred varieties have become top varieties. One example is the Spunta variety, which was released in 1967 and

still occupies the largest seed acreage (12%). A more recent example of a successful farmer bred variety is Sylvana, which was released on the market in 2008 and is rapidly gaining market share.

Mutual dependency and benefit

The partnership between the commercial breeding programmes and the farmer-breeders was and still is one of mutual dependency and benefit. For the breeding companies the experienced and eager eye of the farmer-breeders is irreplaceable. Their level of expert knowledge is evidenced by the number of varieties registered in the name of farmer-breeders. Thus, the work of the farmer-breeders provides breeding companies with a high quality and diverse selection capacity at a relatively low cost that involves minimal investment in labour and land (as the farmers work on a no-product/no-pay basis).

Through farmers' participation, the company breeders can handle many more crossings and seedlings without having to evaluate all of the seedlings themselves. This is particularly relevant for potato breeding, which is largely a matter of numbers because of the high level of genetic heterozygosity and the many varied agronomic and quality traits that potatoes can be selected for.

At the same time, most farmer-breeders do not want to get into the more complicated crossing activities and need the company-breeders for access to improved germplasms with novel characteristics and resistances. The introgression of resistance genes from wild species takes 15–20 years of extensive (back) crossing and selection, which can only be conducted by large commercial companies or by publicly funded breeding research programmes. To an extent, even the independent farmer-breeders depend on larger breeding programmes.

The few independent farmer-breeders who still make their own crosses use existing commercial varieties as parental material and source of new genes.

Legal space for farmer-breeders

The use of existing commercial varieties as parental material by those Dutch potato farmer-breeders who make crosses themselves is allowed under the breeder's exemption in the Breeders' Rights Act (this exemption is now under pressure from the proposed TTIP free trade agreement between the EU and the US), which states that breeders cannot market protected varieties from other companies but are free to use each other's varieties for commercial breeding purposes. The Dutch company-breeders and these independent farmer-breeders often know each other from events organised by the companies and the potato breeding associations, and usually describe their relationships as friendly and collegial. Company-breeders even share materials from their programme with some of these independent farmer-breeders. The reasoning is that regardless of whatever success an independent farmer-breeder may have, they will be lagging several years behind the breeders' efforts anyway. This exchange of breeding materials shows how rivalry and collegiality go hand-in-hand in the Dutch potato breeding sector.

The financial/legal model

Initially, the farmer-breeders received public incentive payments, premiums and awards for successful breeding results. These later developed into royalty payments which are now linked to plant breeders' rights. The financial arrangements between the associated farmer-breeders and breeding/trading companies is currently organised on a 'no product/no

Farmer-breeder Joute Miedema explains to a researcher what his selection criteria are.
Photo: Louis Bolk Instituut

pay' basis. A farmer-breeder who receives seedlings from one of the companies usually signs a contract defining the sharing of ownership, the benefits, and the costs of registration if they select a variety that will eventually be registered and marketed. Depending on the way responsibilities are shared, the varieties are registered for breeders' rights in the name of the farmer-breeder and/or the company responsible for trading and maintenance. The sharing of royalties for a marketed variety varies accordingly. Independent farmer-breeders tend to seek a private arrangement for the clone they offer with one of the trading companies. Since their role in the development of the variety is usually larger or even independent of a commercial breeding programme, their share of the royalties can be considerably more than 50%. They can also opt to be the sole owner and license a trading company to propagate and commercialise their variety.

Current developments

Three factors have contributed to the success of this unique collaboration model: the specific historical context of the Dutch agricultural sector in which public institutional support to private sector breeding stimulated the development of collaborative relationships, a high level of farmer-breeder expertise, and potatoes being a genetically diverse and usually vegetatively propagated crop.

The importance of the potato crop for national food security and export earnings stimulated the potato sector to join forces with Dutch research and government institutions. Different forms of collaboration go back to the early 20th century, but the establishment of the Commission to support breeding and Research of new Potato varieties (COA) in 1938 was a landmark event.

The COA played an important role in coordinating and supporting developing potato breeding systems in the Netherlands, trying to engage more farmer-breeders in potato selection work through extensive and free distribution of seeds, seedlings and clonal material, the provision of technical assistance, and incentive and premium payments.

Over the past decades, there has been a decrease in the number of farmer-breeders as the population ages. However, a renewed urgency to overcome the threat of potato late blight has recently swung the pendulum, triggering new and younger farmers, as well as companies, to become engaged in seed potato selection. This urgency was especially felt by Dutch organic farmers after the dramatic potato late blight incident in 2007. Between 2000 and 2007, 20% of the country's organic potato growers stopped producing potatoes because there were no late blight resistant cultivars and no alternative fungicides for late blight are permitted in the Netherlands. Availability of disease free varieties became a key issue.

Jan van Loon, an experienced breeder and co-author of this article, explains in the Bioimpuls farmer breeding course how his field selection is organised. Photo: Louis Bolk Instituut

The future: spearheading development of new varieties

Even if the organic sector may have been previously considered too small to justify the development of specific varieties, the sector has taken the initiative to establish a Dutch PPB model through the public-private funded project BioImpuls. In this long term programme, six commercial companies, two public research institutes and an increasing number of organic farmer-breeders are collaborating to improve the access and availability of organic potatoes and potato seeds.

The purpose of BioImpuls is twofold. First is to develop genitors with new late blight resistance genes from wild relatives, and the second is to support a larger number of organic farmer-breeders in joining the selection programme through offering training courses in selecting potato late blight resistant varieties which have attractive market characteristics such as satisfactory production, good taste, good skin and tuber shape.

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This article is based on Almekinders, C.J.M., L. Mertens, J. P. van Loon and E. T. Lammerts van Bueren (2014). Potato breeding in the Netherlands: a successful participatory model with collaboration between farmers and commercial breeders. Food security Volume 6 (4): 515-524. doi 10.1007/s12571-014-0369-x

Photo: R. Vernooy/Bioversity International

Implementing access and benefit sharing in eight countries

Since 2012, national teams in eight countries in Asia, Africa and Latin America have been identifying options for policy, legal and administrative mechanisms for the implementation of the multilateral system of access and benefit sharing (MLS) for plant genetic resources. This article summarises if and how access and benefit sharing has been strengthened in the eight countries, and to what extent this has benefited family farmers.

Ronnie Vernooy, Michael Halewood, Isabel López-Noriega, Gloria Otieno, Isabel Lapeña, Raymond Vodouhe and Guy Bessette

This Bioversity International-led research effort aims to increase countries' overall participation in the multilateral system for access and benefit sharing, both as providers and recipients of plant genetic resources. Additionally, the research seeks to pursue options for the eight countries to benefit from other aspects of the Treaty, in particular technology transfers.

National research teams in Bhutan, Nepal, Burkina Faso, Côte d'Ivoire, Rwanda, Uganda, Costa Rica and Guatemala consist of the national Treaty focal point, national gene bank staff, and researchers from government and non-governmental organisations. Farmer organisations participated in some of the research activities.

The teams have conducted research on a number of topics relevant to access and benefit sharing: policy actor networks related to the national implementation of the Treaty; germplasm flows and national dependence on 'foreign germplasm,' particularly for climate change adaptation; linkages between the Treaty and the multilateral system (see page 10) and farmers' management of plant genetic diversity through the lens of community seed banks, and technology transfer (as a non-monetary benefit under the Treaty). In the eight countries, the practical implementation process has followed a participatory, multi-stakeholder approach aimed at building a common understanding and broad support for implementation of the Treaty and the multilateral system. Farmer organisations participated in activities such as field research, training workshops, farmer to farmer exchanges, policy dialogues and conferences.

Paving the way for access

In order to prepare countries for regulatory frameworks that could help make access and benefit sharing work in practice, the teams analysed whether there was legal space for the implementation of the MLS and identified options for the revision of the relevant policies, laws, and/or other instruments when there was no legal space. They also developed draft amendments to these instruments that were subsequently introduced into the formal policy making processes of the relevant organisations and political bodies in each country.

As part of this process, they clarified who in the country has authority to consider requests for access to plant genetic resources in the multilateral system (MLS) and what kind of procedures should be used. They identified the plant genetic resources in the country that are 'under the management and control of the contracting party and in the public domain' (as

Smallholder farm in the east of Nepal. Photo: R. Vernooy/Bioversity International

Madan Bhatta, former head of Nepal's national genebank, calls for strong links between the national genebank and community seed banks. Photo: Ronnie Vernooy/Bioversity International

stated in the Treaty), which is a requisite to inform potential users about the germplasm included in the MLS.

This work led to concrete policy changes, such as a revision of the 2003 Biodiversity Act in Bhutan, new access and benefit sharing (draft) laws in Burkina Faso, Costa Rica, Côte d'Ivoire, Guatemala and Rwanda, a revised agrobiodiversity policy and act in Nepal, and new national environment (access to genetic resources and benefit sharing) regulations and a 'temporary procedure' for accessing plant genetic resources for food and agriculture in Uganda. By December 2015, Bhutan, Burkina Faso, Costa Rica, Guatemala, Nepal, Rwanda and Uganda had prepared lists of accessions to be included in the MLS and notifications sent or being prepared to be sent to the Treaty secretary. These achievements pave the way for breeders, farmers and other users to request and obtain germplasm from distant locations for the purposes defined by the Treaty.

Understanding international dependence

In the aforementioned countries we carried out additional studies about the introduction and domestication processes of key food security crops at national level - an often poorly recognised form of access and benefit sharing. This research contributed to an increased awareness of each country's dependency on international germplasm exchanges for their agricultural development and food security. Previously, this fact was perhaps known to a handful of people through advanced studies or work experience, in particular gene bank managers and breeders.

The improved rice variety developed in Nepal, Khumal-4, is a telling example. If this variety had not been developed and promoted using foreign sourced germplasm (the variety IR-28), it may have been more prone to disease and pests, and have lower yields. Thus, family farmers benefit directly from having access to germplasm that has good adaptive capacity. An estimated 70% of rice varieties released in Nepal contain genes from foreign sources, which has been highly beneficial for rice production and food security in the country. Not having access to new germplasm could result in considerable monetary and non-monetary losses for the country. We had very similar findings concerning rice cultivation in Bhutan.

The roles of community seed banks

In order to identify ways to strengthen the utility of the Treaty for family farmers, in particular through providing access to better adapted seeds, we reviewed the functions of community seed banks. A community seed bank is a form of farmer organisation closely aligned with the objectives of the Treaty. They

are mostly informal institutions that are locally governed and managed that have the core function of maintaining seeds for local use. We found that community seed banks perform a broad range of functions including awareness raising and education about the importance of conserving agricultural biodiversity, documentation of traditional knowledge and information, the collection, production, distribution and exchange of seeds, and sharing of knowledge and experience. However, to date community seed banks have not benefitted directly from the Treaty and the multilateral system.

Our inventory found that community seed banks usually have a seed storage facility collectively managed by the farming community. This represents a community level *ex situ* facility, similar to that of a national or international gene bank. In practice, except for a few cases, community seed banks store seeds only for one season and regenerate seeds each year through various mechanisms. For example, the community seed bank in Bara, Nepal, establishes more than 80 local rice varieties in an appropriate area each year to characterise and multiply seeds for the next season. At the same time, they also distribute seeds of each local variety to one or more members on a loan basis, so that the bank has two sources of new seeds each year.

Some community seed banks are continuously working on broader issues such as empowerment of farming communities, promotion of ecological agriculture, participatory plant breeding and grassroots breeding activities, establishing farmers' rights over seeds and development of fair community level benefit sharing mechanisms that may arise from the use of plant genetic resources, for example, through formal collaboration agreements with the national gene bank, such as the collaborations under development in Bhutan, Burkina Faso, Nepal, Rwanda and Uganda.

Community seed banks perform a broad range of functions

In Uganda, the country team decided to explore using the multilateral system to provide new germplasm to one of the community seed banks. The team used climate change scenario analysis and crop suitability modelling applied to beans (a key crop for farmers' livelihoods) to identify bean accessions with good climate adaptation potential from three sources: (i) the national gene banks in Rwanda and Uganda, (ii) communities in both countries and (iii) international gene banks. In 2014, the first phase of participatory field trials with farmers using materials from the national gene banks and locally adapted material was realised. A total of 20

Several popular rice varieties in South Asia have been developed with foreign germplasm. Paro valley of Bhutan. Photo: Tshering Choden

Sorghum varieties in the community seed bank of Tougouri, Burkina Faso. Photo: R. Vernooy/Bioversity International

Farmer seed production is an effective form of technology transfer. Guatemala. Photo: Gea Galluzzi

varieties were evaluated (and ranked) by farmers for climate resilience and other desirable traits. Accessions from international gene banks were obtained in 2015 through the MLS and are now being multiplied for future testing in farmers' fields.

Technology transfer: non-monetary benefit sharing

Country teams conducted studies to analyse technology transfer practices and knowledge needs related to the conservation and sustainable use of plant genetic resources. Technology transfer, as described in the Treaty, is considered to be a major non-monetary benefit to be realised through a variety of forms of international cooperation between and among actors with an interest in plant genetic resources. Experiences have been mixed, some giving satisfactory results, with some ending in failure.

If we look at Guatemala, some of the operations of five technologies generated or transferred by the Institute of Agricultural Science and Technology (ICTA) were successful, others less so. For example, the development and use of the ICTA Ligero bean variety is considered a success due to the collaboration between CIAT, a regional breeding programme (PROFRIJOL), and ICTA. Farmers are using the new bean variety widely, a result achieved through a strong network of national partnerships in which farmer organisations were a key actor. However, the hybrid maize variety ICTA Maya^{QPM} is hardly being used by farmers for a number of reasons, including the high cost of buying seeds year after year, the variety's susceptibility to pest and disease, and a lack of appeal to consumers.

Similarly, in Burkina Faso we found that the key factors constraining technology transfers are lack of financial means, the high cost of technologies, and weak links between farmers' organisations and technology providers. We also found key elements for effective non-monetary benefit sharing of technologies: the capacity of farmers' organisations to reach out to many farmers at the same time, participatory technology needs assessments, development of local fora where stakeholders involved in the concerned technology can meet and discuss needs and interests, and appropriate training and the establishment of demonstration plots around the country.

Prospects

Although significant progress in the eight countries has been made, improving access in particular, national implementation of ABS under the Treaty is still quite weak. This suggests that more support for countries with lacking implementation capacities is necessary in the coming years. In many countries, national policy makers, farmers and other agricultural stakeholders face the challenge of enhancing access and benefit sharing to genetic resources, information and technologies. They must deal with these challenges urgently in the context of the need to adapt to climate changes. The central role of family farmers must remain key in this process.

One of the emerging lessons is that research and capacity building for developing policies, laws and administrative guidelines and their effective implementation are essential for improving access and benefit sharing.

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"The ABS system could be a thousand times simpler"

François Meienberg has worked as Campaign Coordinator for the Berne Declaration since 1999[1], with a focus on access and benefit sharing, intellectual property rights, and agriculture. In this interview Mr Meienberg reflects on the progress of the implementation of the ABS system so far.

Interview by Robin Pistorius

Could access and benefit sharing make farmer seed systems stronger? One focus of the discussion on access is the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA, see also page 10) and its recognition of the right for farmers to save, exchange or sell farm saved seeds. However, if access is prohibited or restricted, for example by patents or breeders' rights, farmers will not be able to develop or adapt the crop varieties that could help their communities survive in changing climate conditions.

Therefore it is mostly *access* that could strengthen farmer seed systems, even if there is no benefit sharing. It is crucial for the seed autonomy of farmers, as well as for national development, that access to seeds is guaranteed and not hindered by regulations or intellectual property issues. This is especially true in relation to climate change, since access to genetic resources is fundamental for the development of resilient varieties.

1 Between 2009 and 2012 Francois Meienberg acted as joint managing director for the Berne Declaration. To learn more, visit www.evb.ch

Drying seed in the Mekong Delta. Photo: CBDC-BUCAP

Could you say more about the challenges related to benefit sharing?

The problem is that the benefit sharing system currently does not work. In the first ten years of the Treaty, no mandatory payment has been made to allow the sharing of benefits to farmers - except for some voluntary contributions from a few governments. But these payments would likely exist without the Treaty, such as those made by development agencies. Recognising this problem, the Governing Body of the Treaty decided to review the multilateral system of access and benefit sharing. The process started in 2014 and will hopefully be finalised in 2017. It is, however, very uncertain if the negotiations will lead to a positive result.

Nevertheless, there are some good examples of how the rather small amounts which have been distributed by the Benefit Sharing Fund so far have been supportive of farmer seed systems.

Examples include participatory plant breeding in Iran, the Potato Park in Peru and farmers' breeding programmes in Southeast Asia. The goal of the ongoing revision is therefore to enhance the mandatory payments by users which, according to the Treaty 'should flow primarily, directly and indirectly, to farmers in all countries, especially in developing countries, and countries with economies in transition, who conserve and sustainably utilise plant genetic resources for food and agriculture'.

What are your concrete proposals to improve the benefit sharing system for family farmers?

If the goal is that benefits should be shared, in the sense that companies that use the genetic resources that have been developed by farmers will give something back to these farmers, then the benefit sharing system under the Treaty could be a thousand times simpler.

Under the current Standard Material Transfer Agreement (SMTA) and Treaty Art. 6.7, companies only share benefits when they commercialise a new variety that incorporates material accessed from the multilateral system and when the new variety derived from material supplied through the multilateral system is not freely accessible by other parties (companies, research centres) for further research and breeding due to intellectual property rights. Besides, even in the (not yet existing) case of a mandatory payment, it will occur only ten years after the initial access. But the accessed genetic resource has to be traced back through the whole breeding process in order to allow for benefit sharing.

The Berne Declaration, together with stakeholders from the Swiss seed sector, proposes that if companies want to have access to genetic resources under the multilateral system, which to a large extent have been developed by farmers, they should contribute a fixed benefit sharing payment on an annual basis. This could be a certain percentage of their annual seed sales, say 0.2%. Payments will be directed to the benefit sharing fund.

This access and payment system would be like a 'library fee', and be much less bureaucratic. There

François Meienberg and Claudio Chiarolla (ENB) at the Third Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture, Tunis (2009). Photo: IISD/ENB

would be no need to trace the genetic contribution of the accessed genetic resources. This proposal could be seen as a further development of the current Art. 6.11 of the SMTA, which asks for payments of 0.5% of the sales of seeds belonging to the same crop as the genetic resource accessed under the MLS. If a party accesses a wheat variety, they will pay 0.5% of the wheat sales based on the resulting variety. Art 6.11 was introduced in the text of the SMTA at the end of negotiations in 2006 by the African delegation. It therefore is commonly referred to as the 'African proposal'. Although users have the option to choose between payment modes either under Art. 6.7 of the SMTA or under Art. 6.11, nobody has chosen 6.11 so far. This shows that it is crucial that a revised benefit sharing system has only one payment modality. As long as there is also an option which allows for access without any obligation for benefit sharing, the option which effectively would implement mandatory payments will not be used.

It should be noted though, that the 'library fee' system does not represent a voluntary payment. Its advantage lies in the fact that it would avoid the task of monitoring the contribution of accessed varieties to the (ultimately) commercial marketing of varieties. It would certainly enhance the mandatory payments to the Benefit Sharing Fund.

How do formal and informal seed systems relate to each other?

The formal and informal seed sectors are interdependent. On the one hand, the Treaty, the Nagoya protocol and the overall ABS regime enable companies to access the pool of genetic resources developed by farmers. This is the biodiversity that is so crucial for further research and breeding. On the other hand, farmers need access to newly developed varieties in order to integrate the varieties into their informal seed systems and adapt them to the local needs and circumstances. This interdependency is often forgotten. We tend to think only about commercial breeders who need access to the gene pool developed by farmers in informal systems, for example, to help them develop varieties adapted to climate change. But there is also a need for farmers to access the formal seed systems on the basis of customary use, often for very similar purposes.

The Nagoya protocol makes an interesting point, stating that "Parties ... shall, as far as possible, not restrict the customary use and exchange of genetic resources and associated traditional knowledge within and amongst indigenous and local communities in accordance with the objectives of the Convention." To me, this proves that the Protocol recognises that farmer seed systems are important to promote biodiversity *and* that the Protocol could be used to support the rights of farmers to freely use, save, exchange and sell seeds.

Exchanging local seeds through a community seed bank. Photo: GREEN Foundation

Is monetary benefit sharing enough?

With regards to Farmers' Rights, it is very important to mention that it is not enough to support farmers engaged in the conservation and sustainable use of genetic resources by the benefit sharing fund for the use of the genetic resources they developed. They especially need the legal space to use and further develop traditional knowledge and genetic resources. This is where the question of national seed laws comes in, which in some countries restrict the commercialisation of farmer seeds, or plant variety protection and patents which in many cases restrict or prohibit the use, exchange or sale of farm saved seed or other propagation material. This could have a negative impact on the further development of traditional knowledge, while at the same time depriving farmers of an essential tool to manage their seeds and ensure food security.

A good example of how plant variety protection should not develop is the 1991 revision of the International Convention for the Protection of New Varieties of Plants (UPOV '91). UPOV does not take into account the interdependence of both the formal and informal systems. While UPOV '91 protects the innovations developed in the formal seed system, at the same time it destroys another innovation and seed system: the farmer seed system. This is why the Berne Declaration opposes its implementation. In summary, we have to look for a kind of system which protects one kind of innovation without destroying the other. Such a system should give access to both systems and allow *all* parties to access each other's results.

Industry benefits but does not pay its dues

Patents are an assault on genetic resources

Patents increasingly undermine the strong legal edifice patiently constructed by UPOV.[1] The Treaty guarantees free access to the main industrial resource of plant breeders - peasants' seeds collected from farms across the world. This article argues that broadening the reach of patents over genetic resources is increasingly replacing benefit sharing, which undermines the multilateral governance of our common heritage. It concludes that the Treaty offers a new legal basis to govern access to plant genetic resources for food and agriculture and to compel industry to pay its dues.

Guy Kastler

Industry appears to have had no difficulty in collecting samples of wild or cultivated plants from all around the world. But to know which plants will provide the secrets of potentially patentable molecules, they also need access to the knowledge of the traditional or indigenous communities that have retained these plants and still to use them. In order access this knowledge, industry has promised first to seek permission before any collection takes place and then to share the profits derived from commercialising useful plant genetic resources with these communities.

Patents instead of benefit sharing States regulated this promise in the 1992 Convention on Biological Diversity (CBD). Through this Convention, countries in the global South gained sovereignty over their biological resources as well as the right to negotiate prior informed consent and the sharing of benefits. As a consequence, states then became the main actor to decide whether or not there would be benefit-sharing with those communities that had conserved these resources and possess the associated knowledge. In order to share benefits, it would be necessary to identify the source of the genetic resources used in final, commercial products.

Examining wheat during a field trip. Photo: Réseau Semences Paysannes

However, as most of the samples taken from the vast reservoir of resources in countries in the global South are no longer identifiable in commercial products, no benefit sharing has taken place. In place of the benefit sharing promised in 1992 but never implemented, there has been acceptance of patents on living organisms. This was imposed in 1995 on almost all members of the World Trade Organisation (WTO), through the agreement on Trade Related aspects of Intellectual Property Rights (TRIPs). Now, 20 years later, benefits are still not being shared, but patents on living organisms have conquered the planet.

The Treaty requires benefit sharing

The Treaty, which came into force in 2004, was designed to ensure that the diversity of the plants that supply, directly or indirectly, all the food in the world, and which has been developed by peasants everywhere, was safely conserved - protecting this 'heritage of mankind' in the public domain. A second goal was that these resources would be used in ways which regenerate their diversity. A third goal was that any commercial benefits derived from the use of the diversity of plants would be shared, especially with the peasant farmers who historically provided the resources and who currently conserve diversity on-farm. In addition to developing a system for formalising international seed exchanges and tracking their use, this landmark Treaty codified what should be considered 'inalienable' farmers' rights.

The modern varieties that are available commercially often come from dozens of different plants, originating from all over the globe, whose genetic resources have been crossed, re-crossed, swapped and exchanged, between researchers, collectors and breeders. According to industry, it is not possible to ensure effective traceability of these multiple transfers and then to trace the attribution of the initial resource in the final product. The bilateral obligation to prior informed consent and benefit sharing for each exchange of seeds is thus not applied in practice. Since under this premise national sovereignty over internationally diverse genetic resources, as enshrined in the CBD cannot be applied, a multilateral system of facilitated access and benefit-sharing (MLS) for some of these resources has been included in the Treaty.

The genetic resources covered by the MLS only apply to the 64 cultivated crop species and 29 forages listed in annex 1 of the Treaty. For the transfer of the genetic material of these crops, the MLS does not require prior informed consent. For other crops, transfers need to be covered by bilateral contracts that include prior consent and benefit sharing.

In return for agreeing with the MLS, industry

Poster for the Week of Peasant Seeds 2015 in France. Design: Réseau Semences Paysannes/ Aline Jayr

Guy Kastler chairs a meeting on Farmers' Rights prior to the 6th session of the Governing Body of the International Seed Treaty. Photo: IISD/ENB

agreed to the establishment of a benefit sharing fund, designed to be funded by royalties generated from the use of seeds provided under the MLS. By agreeing to the Treaty, industry also accepted the recognition of Farmers' Rights to use, exchange and sell their farm saved seeds.

However, the problem is that the enforcement of Farmers' Rights remains the responsibility of States. The majority do not enforce the Treaty, despite signing it, and the Treaty does not contain enforceable measures to require the recognition of Farmers' Rights. In addition, facilitated access to PGRFA under the MLS is only foreseen for research, breeding and training purposes, but not for crop production. The decision whether or not to give farmers access to the PGRFA and seeds which they have given to the MLS, even if by their parents or colleagues, is left to the goodwill of States.

Industry is evading payments

Despite the MLS and Farmers Rights, industry has still not contributed significantly (in proportion to global seed sales) to the Benefit Sharing Fund of the Treaty. Rich countries seem to prefer to give their money to the Global Crop Diversity Trust, which funds their *ex situ* gene banks. Meanwhile, the Treaty has no way to force industry to repay its debt, which should be a condition of access to MLS resources, respecting the commitments made by signing a Standard Material Transfer Agreement (SMTA). As a result, the current way of funding benefit sharing is completely ineffective.

There are options available. Countries can directly tax the profits from the marketing of seeds within their territory. La Via Campesina has proposed that such a tax should be proportional to the quantity of seeds and plants sold, as well as being subject to legal, contractual or technological restrictions limiting their use for research, plant breeding, agricultural production or the production of farmers' seeds.

The International Seed Federation (ISF) does not accept any form of compulsory payments other than those related to the SMTA. Though it is the first to say that even though these are not affordable, the ISF also is well aware that that these obligations are very easily circumvented. ISF also proposes that 'clubs' which organise a private market of license fees should be considered as a form of non-monetary benefit sharing, and that, by using plant variety protection measures, it removes payment obligations to the MLS.[1] Thus, almost no one is forced to pay.

Industry has managed to transform its obligations for benefit sharing into voluntary donations. These donations are directed to financing new collections, pre-breeding and pre-selection programmes, and above all information on plant genetic resources. Pre-breeding enables businesses and research centres to sell pre-selected genetic resources, which can then be developed into multiple varieties with each variety adapted to specific growing conditions. Will the MLS end up as a completely liberalised market for pre-selected plant genetic resources?

Improving information is the stated purpose of the DivSeek programme, which aims to build a digital database to bring together the genetic sequences and phenotypic data of all the resources in the MLS. But this is a dangerous initiative because such a database could facilitate the patenting of native seed characteristics. La Via Campesina has therefore denounced, in strong terms, the involvement of the Treaty in this programme.

The Nagoya Protocol – renewed obligations to pay

Ten years after the Treaty came into force, the CBD secretariat led the creation of the Nagoya Protocol in 2014. The Nagoya Protocol gives each member country the legal possibility to limit access to its national market by only allowing seeds that are accompanied by tangible evidence of compliance with payment obligations of the Benefit Sharing Fund. The Nagoya Protocol defines the binding rules that the contracting parties must apply when exchanging and utilising genetic resources. Any transfer of plant genetic material of a species not included in the Annex 1 of the Treaty, and which is not covered by bilateral contract with prior consent and benefit sharing, is illegal. These include important species such as banana, soy, and tomato.

This is the reason why recently the major seed industry countries (including EU, Canada, Australia) have sought enlargement of the MLS to include all crops under the Annex 1. Countries in the global South, including large economies such as Brazil and India, have refused to negotiate enlargement of the MLS until commitments on benefit sharing relating to existing resources under the Annex 1 and on Farmers' Rights have been realised.

The Treaty has embedded powers

Despite its shortcomings, a number of small scale farmer organisations, including La Via Campesina, have supported the Treaty and are trying to improve it. There are two reasons for this:

- The Treaty is the only international agreement which recognises Farmers' Rights to their seeds. This recognition is an important political lever to strengthen the social struggles for enforcement in each country;
- Providing local peasant varieties of seeds to the MLS can serve as proof of existence of such varieties which can help to fight the biopiracy which could result from plant variety protection or subsequent patenting of an identical or very similar variety.

The Treaty offers a new legal basis to compel industry to repay its dues whenever it sells seeds in a member country. It could also govern access to MLS resources and prohibit the patenting of native traits, limiting their use for selection, research or agricultural production. The Treaty could withdraw from DivSeek, as patents on native traits in plants are not allowed. It could put pressure on FAO to initiate discussions with the World Intellectual Property Organisation to prohibit such patents, in the name of food security. Its members could cite the absence of the agreed review of Article 27.3(b) of TRIPs, which should have been done by 1999, to ban these patents in their own legislation and internationally. They could reject the privatisation of our common heritage through patents, which benefits only a handful of multinationals.

Peasant farmers are calling for state authorities to defend the multilateral public governance of our common heritage. On this depends both food sovereignty and the sovereignty of each country.

Farmer Florent Mercier shows his wheat varieties to visitors. Photo: Réseau Semences Paysannes

Notes

1 From the name of their main sponsor, the Union for the Protection of new Varieties of Plant (UPOV in the French acronym - l'Union pour la Protection des Obtentions Végétales), which brings together countries that have adopted Plant Variety Protection (PVP) as the industrial protection tool for cultivated plant varieties

2 See Inf'OGM, « Les brevets à l'assaut des semences », Guy KASTLER, 2 July 2015

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This contribution is an edited and abridged version of article published in September 2015. InfOGM n°136: 'Les brevets à l'assaut des ressources phytogénétiques' www.infogm.org/spip.php?article5840

Farmers' markets are a great way for people to learn about traditional crops and support local producers. Photos: Emmaüs Lescar Pau

Lessons for access and benefit sharing from community seed banks in India

Photo: GREEN Foundation

The TheruBeedi Seed Bank and Producer Group facilitate informal benefit sharing mechanisms that can be very effective in protecting biodiversity and encouraging farmers to contribute to the genetic pool. The approaches include offering farmers incentives to cultivate traditional or rare varieties, providing assistance in the marketing of their products, and encouraging them to use traditional techniques associated with indigenous crops. The Seed Bank and Producer Group may be considered as a viable alternative to the emerging Indian ABS regime. Importantly, they may be more effective in protecting biodiversity and encouraging farmers to contribute to the genetic pool.

Vanaja Ramprasad and Amelia Clements

The TheruBeedi Community Seed Bank lies off the main road in a village in the hills of the state of Karnataka, India. Its outer walls are adorned with images of women harvesting crops, tending livestock, and collecting seeds. Inside, the brilliant blue walls are lined with tin storage bins and posters explaining organic farming practices in Uttara Kannada, a Karnataka district. Behind a locked door are most of the seed bank's wealth of finger millets and other millets and vegetable seeds, each in a carefully labelled container.

The work being done at TheruBeedi is a collaborative effort between local women farmers and the GREEN Foundation, an organisation that empowers small scale and marginalised farmers. Even though the seed bank is located in a seemingly remote village, its work is strongly connected to and relevant in the

international debate on farmer access to genetic resources. It responds to the facts that across the globe, plant and animal species face extinction and endangerment, longstanding ecosystems have become unstable, and traditional knowledge is fast disappearing.

The TheruBeedi Seed Bank

The TheruBeedi Seed Bank facilitates farmer access to genetic resources and shares the benefits that result from their use amongst community members. Local women and the GREEN Foundation collect, store, and cultivate the seeds of traditional crop varieties in order to safeguard regional biodiversity.

The genetic resources at TheruBeedi are part of a larger network of seven seed banks started by the GREEN Foundation in villages throughout Kanakapurataluk in the Ramanagara district. The efforts to store traditional and regional specific seed varieties are motivated by the principle that farmers, as stewards and developers of the world's crop genetic resources, are entitled to access the benefits that arise out of the use of those genetic resources.

Fox tail millet is a key crop at the Therubeedi Seed Bank. Photo: GREEN Foundation

Although the TheruBeedi Seed Bank was established more than a decade ago, it has been within the last two years that the current team of ten local women farmers was appointed to oversee operations. They make up the TheruBeedi producer group and are responsible for managing the seed bank's collection of seeds, cultivating certain varieties of rare and traditional crops, encouraging local farmers to produce seeds for buybacks, collecting and processing new seeds, and packaging seeds for sale.

GREEN Foundation project managers assist the producer group with marketing and distributing these seeds in surrounding villages. The proceeds from these seed sales provide economic benefits to the women who facilitate widespread community access to the genetic resources at the TheruBeedi Seed Bank.

The seed bank only collects seeds that have been cultivated using organic practices. This model emphasises *in situ* conservation in addition to *ex situ* seed storage, allowing further genetic diversity to develop. Involving local farmers in the seed production process also offers an additional source of income to those who use organic practices, particularly for the women involved in managing the community seed bank.

This initiative is motivated by the belief that the future of food security depends not just on the genetic resources that are stored away in international seed banks, but on the skills and knowledge of the farmers who maintain genetic diversity on a daily basis. The ambition of the TheruBeedi Seed Bank is to expand the number of producer groups and federate them into one company. Currently, there are three other seed banks which are joining hands in procuring seeds and making these available to urban gardeners.

Access and benefit sharing protocols

Recently, national governments have been faced with the challenge of developing standardised protocols for access and benefit sharing (ABS) to determine who has access to genetic resources and under what terms. In these negotiations, much is at stake for family farmers. Faced with wealthy multinational seed corporations, intellectual property right battles, pressures from urban food markets, and the growing trend toward monocroppings sugarcane, maize and tobacco, the crop diversity of many rural farmers has dwindled. These forces are putting traditional farming practices at risk, affecting the supply of food and eroding community cultures, diets and self-determination.

Considering these developments, the TheruBeedi Seed Bank is an example of resistance to rural disempowerment through informal and community based access and benefit sharing mechanisms. At the same time the initiative illuminates the complexities that are inherent in the implementation of national and

Women observing their finger millet plants.
Photo: GREEN Foundation

global benefit sharing regime. Community seed banks provide an opportunity for seed security, which is the basis of food security. In the words of Dr Regessa Fyissa from Ethiopia: *"A community seed bank iis a system in the process of community agriculture. Through this system farmers have played a key role in the creation, maintenance and promotion of crop genetic diversity. With the help of traditional skills, they have been selecting crop varieties to meet their specific needs such as quality, resistance to pests and pathogens, adaptation to soils, water and climates. Under this system local farmers have established their own seed networks to facilitate seed supply to their families and local markets. Community seed banks therefore are one of the major strategies for maintaining genetic diversity in crop/plant species."*

India's Protection of Plant Varieties and Farmers' Rights Act

As of 2014, India is party to the Convention on Biological Diversity, the Nagoya Protocol, and the Plant Treaty, and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). The stakes are particularly high in India, as more than half of the nation's work force is employed in the agriculture sector. There remains an urgent need to integrate and harmonise the various pieces of legislation related to the use of crop genetic diversity and ABS mechanisms. The 2001 Protection of Plant Varieties and Farmers' Rights Act (PPVFR) is a part of the Indian legislation that protects breeders' plant varieties under TRIPS and provides for farmers' rights as outlined in the Plant Treaty.

Under the Article 39 of the PPVFR, farmers are guaranteed the right to save, use, exchange or sell seed as long as it is not a protected variety in a branded package. In addition, farmers who breed or develop new varieties are entitled to the same intellectual property rights as breeders, as long as their varieties meet the criteria for registration. Registration qualifications include variety novelty, distinctiveness, uniformity, and stability (DUS criteria). Some regard India's PPVFR as a model for other countries seeking to reconcile breeders' rights with farmers' rights in their national legislation.

Challenges posed by the new legislation

Unfortunately, the implementation of PPVFR has not yet struck the balance between breeders and farmers. Though most scientists and corporate plant breeders have knowledge of the rights that are afforded to them by the PPVFR, rural farmers are disproportionately unaware of the institutional rules and structures that govern the crop varieties they are allowed to cultivate. The bureaucratic and complex procedure of crop variety registration is simply impractical for farmers who are illiterate, do not have access to the internet, or are without means of travelling to the appropriate government offices. Only a few NGOs are making an effort to facilitate this process. As a consequence, the official benefit sharing regimes are completely inaccessible for a number of farmers.

This is not only a result of the crop variety registration procedures, but also because of the DUS criteria. The variety registration requirements outlined by the PPVFR run counter to the goal of increasing and preserving crop diversity. Even if all rural farmers had the capacity to register their unique varieties, few would meet the criteria of distinctness, uniformity, and stability. Landraces are valued for their ability to adapt to changing environmental conditions and are rarely

Displayed seeds at the TheruBeedi Seed Bank.
Photo: GREEN Foundation

A mix of traditional seeds. Photo: GREEN Foundation

genetically homogenous. In addition to maintaining biodiversity, naturally occurring differences between plants add a measure of livelihood protection should one crop fail. Furthermore, communities that span villages, states, and even countries with similar agro-ecological conditions often develop farmers' varieties collectively.

In these cases, affording intellectual property rights to one farmer over another would misconstrue the process by which the variety in question came to exist. When put into practice, the imposition of a standardised model for variety registration and benefit sharing is detrimental to the continued development of biodiversity.

Frustrating farmers' rights

ABS and intellectual property rights regulation began to frustrate farmers' rights when India passed the 2003 Biological Diversity Act (BDA) in accordance with the objectives of the Convention on Biological Diversity. The BDA established a National Biodiversity Authority to regulate access and use of genetic resources. Also under the BDA, state level Biodiversity Management Committees are responsible for implementing benefit sharing practices. Then, in order to meet the standards of the Nagoya Protocol, the National Biodiversity Authority issued the Guidelines on Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulations in 2014, defining how benefit sharing is to be carried out between interested parties.

In sum, all of the actions that have been taken in the last decade to regulate access to genetic resources and benefit sharing amount to a complex web of legal texts and government bureaucracy impenetrable for most rural farmers and their advocates.

Lessons from TheruBeedi

As part of the movement to preserve genetic resources, the TheruBeedi Seed Bank has benefited rural livelihoods while simultaneously showing other communities that seed is an important component of farming practice and can be produced from their own resources.

What lessons for the future management and development of seed can we draw from this experience? The TheruBeedi Seed Bank and Producer Group show that informal benefit sharing structures present an effective alternative framework to government regulated PPVFR and ABS institutions. A seed bank can be extremely effective in protecting biodiversity and encouraging farmers to contribute to the genetic pool.

The key elements that contributed to its success include offering farmers incentives to cultivate traditional or rare varieties, providing assistance in the marketing of their products, and encouraging them to use the traditional techniques associated with indigenous crops. To make access and benefit sharing relevant to the situation of small farmers and farmer's varieties, it is necessary to ensure community ownership and protect farmer's rights over the genetic diversity within the seed banks. There should also be a way of recognising women's rights to knowledge of plant genetic resources within the new systems that patent, privatise or compensate knowledge and genetic resources.

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Photo: Kaat van Ongeval/ EkoRural

Giving new life to peasant seeds in Ecuador

In the Ecuadorian provinces of Bolivar, Chimborazo, and Cotopaxi, family farmers are building new capacity to conserve and use the biodiversity on their farms. By participating in action research they gain a greater understanding and control of their plant genetic resources. This results in increased resilience to climatic and other shocks and takes them further on the path towards food sovereignty.

Ross Borja and Pedro Oyarzún

Agrobiodiversity enables rural family farmers to cope with the shocks that are inherent in farming, especially weather, market fluctuations, and pests and diseases. For villages in high altitude and risk prone environments, such as the Ecuadorian Highland Andes, this is very important. In the words of farmer Julio Guano from Naubug village in Chimborazo, "*With agrobiodiversity we can produce many different crops. If one does not succeed, others survive, so we don't lose everything and are able to eat in difficult times.*"

Nevertheless, numerous studies in our region provided evidence that on-farm genetic resources have been in sharp decline over the last half-century. Spurred on by these findings, something had to be done.

Farmers as custodians of seeds

Despite owning just 20% of the agricultural resources in Ecuador, smallholder family farms provide more than 70% of the country's staple foods. Farmers have historically conserved the traditional seeds of staple crops as well as the knowledge of how to use them, which together form the basis of the local system of food production. Smallholder family farmers are the largest supplier of seeds for both improved and local varieties, which are the majority of Andean crops. Modern seed varieties have never constituted more

than 1-2% of planting material of Andean crops in Ecuador.

Since the 1960s, agricultural policies that favour monocultures and export led production have neglected smallholder management of genetic resources and weakened the role of the state in improving the knowledge and organisational capacity of small scale farmers. Nonetheless, Ecuador's current farmer seed system continues to be an extraordinary form of social self-organisation. This system encompasses an extensive network of actors, traditions and institutions that has vigorously resisted the influence of external actors and agricultural policies.

Recently, because of concerns regarding the environmental damage created by industrial agriculture and climate change, politicians, technicians, and academics have started acknowledge small scale agriculture as a solution to these problems. This has resulted in the adoption of the Food Sovereignty Law, which promotes agroecological food production and agrobiodiversity conservation, as well as seed banks. Additionally, governmental institutions were created to develop various aspects of the Food Sovereignty Law, including the Pluricultural Commission for Food Sovereignty (COPISA), which consists of civil society organisations, universities, higher education centers, and governmental organisations. Academics, in turn, have included agroecology as a theme in university curricula and have promoted its mainstreaming in scientific fora and debates. As a result of this increased interest, biodiversity is seen as a critical element for maintaining resilient and dynamic agricultural systems and it is now more widely recognised that small scale farmers play a major role in preserving biodiversity.

This is evidenced by various developments. In one example, a recent ministerial decree recognises the potential of the small farming sector to produce and market potato seeds - an important economic sector in the Highlands - through the addition of a new category of 'common seeds circulation' to its certification process. Over 400 organisations from different sectors (such as the Ministry of Agriculture, national and international research centers such as MAGAP and the International Potato Centre, and various NGOs) have joined forces to call for a focus on mixed or 'unconventional'[1] seed systems as an alternative to the formal system. Finally, the Agrobiodiversity and Seeds Bill,[2] though still under discussion, likewise recognises the *campesino* seed and the need to strengthen the informal system with various organisational and institutional initiatives. However, the official policy prioritises the use of certified seeds of bred varieties, and does little to strengthen the farmer seed system.

Traditional potato varieties have high nutritional value. Photo: Kaat van Ongeval/ EkoRural

Researching the roles of biodiversity

For highland villages, which are the greater part of the Andean region of Ecuador, community biodiversity management has evolved as a strategy for on-farm management of genetic resources. Having accompanied this strategy as action researchers, we consider it key to upholding the resilience of productive systems in the face of climate change and recurring market crises.

In order to characterise the state of these communities' on-farm agrobiodiversity and locally run seed systems we conducted approximately 800 surveys in more than 30 communities in the central highland provinces of Bolivar, Chimborazo, and Cotopaxi between 2007-2014. Family farmers responded to questions about genetic resources and the function of these seeds in their lives, as well as knowledge and practices tied to the management, availability, access and control of seeds. In addition, we carried out participatory assessments using a variety of tools for community management of agrobiodiversity, including a method called Participatory Four Cell Analysis: in-depth discussion on the destinations of specific crops, their sale, terms of trade, and family consumption. This analysis is designed to measure the relevance and importance of particular crops.

The main objective of this participatory process was to make visible to the community the roles and functions of their seeds, as well as recognising the individuals with outstanding knowledge and capacity to conserve biodiversity. Throughout this process, we encouraged the farmers to start a dialogue about their genetic resources, as it is often felt by them that only when things are expressed and said, they exist.

The process allowed us to track the specific destinations of products, sales, barters and trades, domestic consumption, etc. We found strong evidence of biodiversity loss in communities. Tubers such as mashua (*Tropaeolum tuberosum*), oca (*Oxalis tuberosa*), jícama (*Pachyrhizus erosus*) and melloco (*Ullucus tuberosus*), had virtually disappeared in local farming systems despite their apparent cultural relevance. This data is

very important when considering strategies for the management of agrobiodiversity, particularly when discerning a new role for these crops on farms and in diets.

> *"Seeing as the plants have protected Mother Earth, we too need to shelter the plants and protect them from harm and illnesses. Agrobiodiversity produces crops so that if one does not succeed, others survive, and we don't lose everything and are able to eat in difficult times."* – Farmer Julio Guamo, Naubug, Chimborazo, 2013

The result of our research (see table) illustrates the systematic loss of community control of biological resources. *Chakras* (plots) are losing their resilience, jeopardising the future of agriculture and livelihoods (Oyarzun *et al.* 2011)[3]. However, the table also shows that the participating communities have identified leaders who are passionate about managing plants and seeds. These individuals are statistical outliers who hold tremendous value for the transmission of knowledge about genetic resources and the enhancement of socio-technical innovations.

Following this analysis, community members visualised their multiple relationships with their biological resources and seeds and their livelihood priorities. We assisted local farmer leaders in conducting experimental learning activities with other farmers, as well as promoting seed circulation, botany, and genetics through field days, study tours and farmer to farmer exchanges. As a result of this combination of research and action, communities are now more aware and better equipped to exercise control over their biological resources.

Strengthening control over genetic resources

In the last five years, communities have started to (re)construct, strengthen and expand their own seed banks, which creates stronger ties within families and communities as they are able to circulate and exchange materials and knowledge. In particular, women have gained greater appreciation within their communities thanks to their knowledge and abilities to conserve and improve varieties and seeds. The idea is to create mechanisms of redistribution to protect the seed varieties in question, as well as to generate products for continued circulation. These mechanisms of redistribution create a multipurpose support fund, as well as forming the basis for equitable dissemination of genetic resources among family farmers.

There are three supporting mechanisms that operate in seed banks that serve to increase capital and equity. First, of each seed that farmers receive from the bank, they return two seeds after their harvest, meaning a gain of 100% for the bank. Second, each new variety or species which comes into the seed bank is then multiplied and then delivered to the community through the mechanism of 'pass the gift'. Finally, we have agreed with seed officials from research organisations that each species or variety donated to a community should be done through the seed bank. Hence, the local seed bank functions as multipurpose support fund since it protects the seed varieties and generates products for continued circulation.

A number of pilot banks successfully operate at present. This success generates curiosity among other neighbouring communities, which are themselves in the process of setting up exchange systems and seed

Table 1. Lost varieties, sources of native seeds, and forms of community-level exchange for five Andean crops. The 'Lost Varieties' column reflects a period of five years.

Crops	How many varieties have disappeared in the past 5 years?	Where do you get your native seeds?	Do you exchange, buy, and sell your seeds? To whom?	Do others recognise you as a seed producer?	Do you recognise other farmers as seed keepers or providers?
Potato (n=50)	90% - 1 75% - 2-4 > 50% - + 3	> 63% - don't have 24% - community	66% - family 12% - others 1% – neighbour	18% yes	30% yes
Maize (n=10)	100% - don't know	80% - don't have 20% - market	40% - nobody 40% - neighbours 20% - family/relatives	20% yes	60% yes
Melloco (n=7)	43% - don't know 56% - 1-3	100% - don't have		14% yes	14% yes
Chocho (n=7)	85% don't know	71% - don't have	57% - nobody 30% - friends	0% yes	30% yes
Quinoa (n=21)	43% - 1 57% - don't know	90% - no	50% - family and relatives 33% don't share	9% yes	9% yes

n = number of farmers

Source: Agricultural surveys in Cotopaxi, Chimborazo, and Bolívar, 2009-2010. Characterization of local seed systems. EkoRural 2010, Quito.

banks. We also identified highly innovative seed guardian families and supported their integration into a support network of likeminded peers. Through contacts with research organisations, they accessed germplasm stored in gene banks, which is especially helpful in recovering lost potato varieties.

Such novel efforts will be at risk without new economic models that recognise the value of local food products. If there is no demand for local food, there will be no use for local seeds. In the last four years we have encouraged a crucial complementary process that connects urban citizens directly with rural producers so that they can access fresh and healthy local food. This stimulates farmers to continue growing a variety of crops using agroecological practices, which in turn reconnects the cultural and political aspects of food. We observe that this is having a very positive impact on health, the environment, and the local economy.

The result has been a slow but steady countermovement against the continued loss of biodiversity in these communities. Several actors, including NGOs, universities, research institutes and local governments have begun to promote the discussion on the value and relevance of conserving and utilising native biodiversity. Urban organisations are actively involved in food sovereignty, agrobiodiversity and seed laws. Their involvement is supported by law: article 8 of the Food Sovereignty Law stipulates that both the state and civil society must promote and protect the use, conservation, and free exchange of native seeds.

ABS in Ecuador As of this writing there exists no legal framework in Ecuador to regulate intellectual property on seed species. As a consequence, any variety can be used freely and without any restriction or obligatory compensation within the country. However, export oriented bioprospecting (particularly by multinational corporations and international agribusiness) is subject to regulations.

EkoRural has been supporting the capacity building of farmers for seed management by strengthening their skills to value local biodiversity, as well as by identifying the knowledge and motivation of community members who show affinity with seed use and conservation. These participatory inventory practices have been strengthened in pre- and post-storage processes, *in-situ* seed selection and discovery of aspects of seed physiology such as vigor or germination capacity. Moreover, we support other forms of peasant organisation. This includes the formation of community seed banks in places where seed varieties are locally threatened, as well as mechanisms for the creation of capital such as trading seeds for other seeds, money, labour or community services. These activities have all been important elements in enhancing access and benefit sharing while promoting the capacities and autonomy of family farmers on their path towards food sovereignty.

A great variety of potatoes in the Andes.
Photo: Kaat van Ongeval/ EkoRural

Both the community members and we researchers feel that this approach needs to be continued and expanded to new crops and territories. The key factor of success in our approach has been to work with, rather than against, local experience, people and knowledge. Everywhere, even under the most difficult conditions of hardship and social marginalisation, there are families that are capable of defending and advancing their own on-farm biodiversity. We find great hope and inspiration in these families. The challenge is in finding ways to strengthen their knowledge and to build links with other likeminded people in order to stand firm against the ongoing threats and mass-marketing of industrial agriculture and industrial foods

Notes

1 Encuentro Regional de Sistemas no convecionales de Semillas. Quito Abril 2012. CIP_ INIAP McKnight Foundation
2 Proyecto de Ley Orgánica de Agrobiodiversidad, Semillas y Fomento Agro-ecológico.
3 Oyarzun, P.J.,Borja, R. M., Sherwood, S. & V. Parra (2013). Making Sense of Agrobiodiversity, Diet, and Intensification of Smallholder Family Farming in the Highland Andes of Ecuador, Ecology of Food and Nutrition, 52:6, 515-541

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The authors wish to thank the participating campesino organisations from the Central Highlands, Steve Sherwood, Keely McCaskie, the McKnight Foundation, the Dutch Embassy in Ecuador, the Tidlund Foundation, the Swift Foundation, and the United Nation's Food and Agriculture Organisation for their contributions.

This contribution is adapted from an article first published in Farming Matters ('Cultivating diversity', March 2014, www.farmingmatters.org)

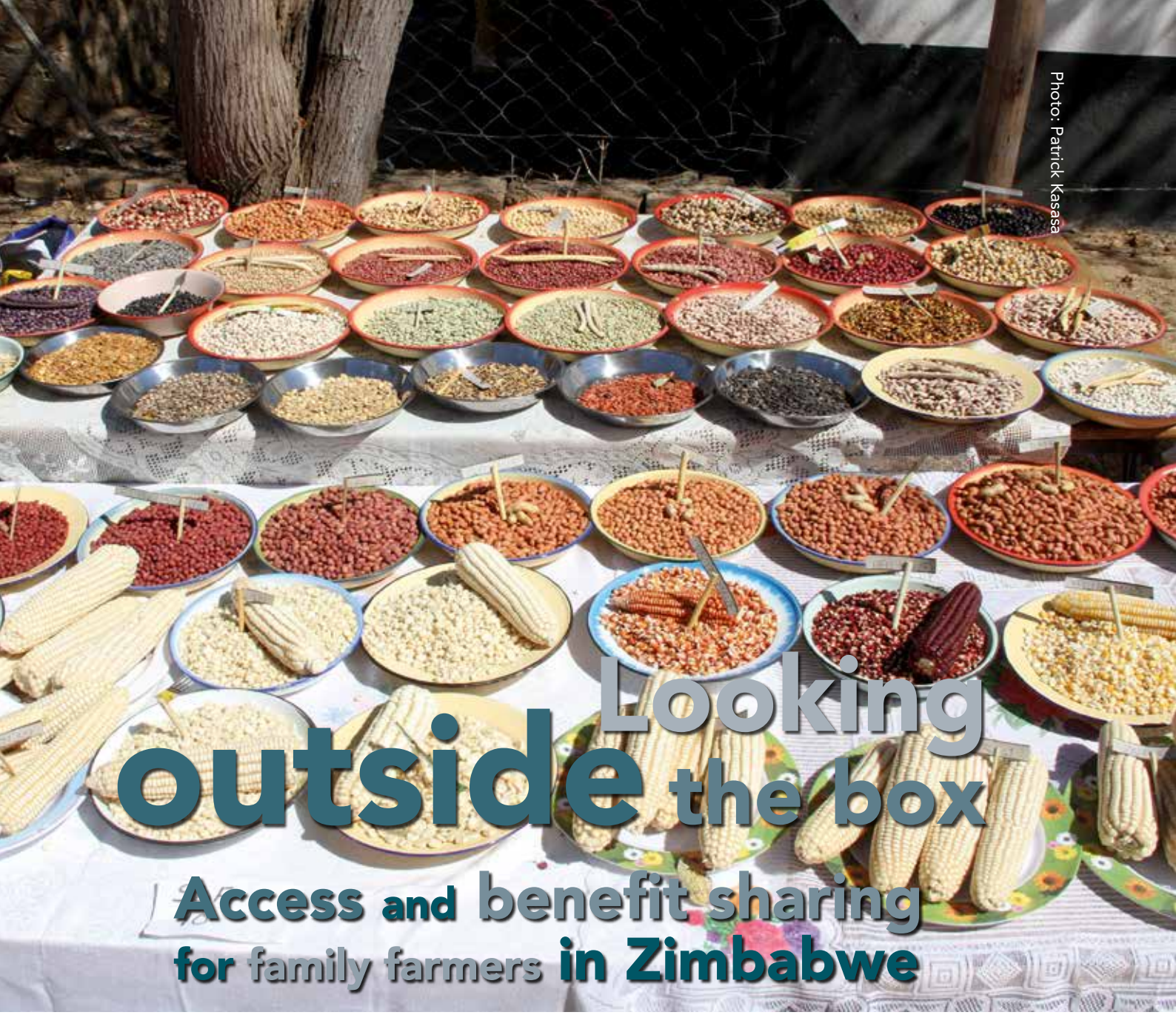

Photo: Patrick Kasasa

Looking outside the box

Access and benefit sharing for family farmers in Zimbabwe

What is successful access and benefit sharing' for smallholder family farmers? This contribution argues it is not about legal contracts or mechanisms that regulate the international transfer of plant genetic resources. It is about farmers' access to seed diversity and the ability to share in the benefits of the continuing cycles of seed conservation and development. The Community Technology Development Trust in Zimbabwe supports mechanisms that, in practice, do result in substantial access to and benefit sharing of local and modern varieties.

Bram de Jonge, Andrew Mushita and Patrick Kasasa

Access to seed diversity and quality seeds of their preferred varieties is absolutely crucial for family farmers

Successful access and benefit sharing (ABS) agreements under the Convention on Biological Diversity (CBD) and the Nagoya Protocol are a rarity and very few funds have flowed into the benefit sharing fund of the Treaty so far. Legal contracts that have been carefully drafted and negotiated by experienced lawyers seem to have become the heart of ABS implementation. In the face of these complex legal and technical challenges, the position and views of smallholder family farmers and indigenous communities can get easily overlooked. This is one of the main obstacles that these stakeholders face in respect to the current ABS systems.

As explained on pages 6-13, under the Nagoya Protocol and the CBD, the rights of (smallholder) farmers and indigenous communities are generally subordinated to those of the state. This is equally true for Farmers' Rights as addressed by the Treaty. For example, while recognising that the right to save, use, exchange and sell farm-saved seed are fundamental to the realisation of Farmers' Rights,[1] the Treaty makes the actual protection of these rights subject to national legislation. As a consequence, they are easily subordinated to the interests and rights of breeders vested in national patent and plant variety protection legislation.[2] It therefore may be useful to approach the issue of ABS the other way around. What could successful ABS imply for smallholder family farmers in, for example, Zimbabwe?

One of the key characteristics of family farmers is their direct involvement in various seed systems. Generally, smallholder farmers grow multiple crops sourced from different providers. For example, a farmer may receive seed as a contract grower for a cash crop such as tobacco, buy maize seed from a local seed trader, barter millet seed with a neighbouring farmer, buy tomato seed directly from a multinational seed company, and use farm saved planting materials for growing cassava. By doing so, family farmers aim to satisfy their various needs, such as income generation, food security, diet and the spreading of risks. Taking the importance of these various seed systems into account, it is clear that access to seed diversity, and more specifically, to quality seeds of their preferred varieties, is absolutely crucial for family farmers. Following this line of reasoning, we can identify alternative ABS mechanisms that are of particular interest to family farmers – i.e. mechanisms that promote the availability and accessibility of quality seeds for both traditional and modern varieties.

Facilitating access to local varieties

Considering family farmers' need to access quality seeds of local and traditional varieties, two initiatives that can function as alternative ABS mechanisms are community seed banks and seed fairs. The Community Technology Development Trust (CTDT) organises over 20 seed fairs which facilitate seed and knowledge exchanges in Zimbabwe every year, as well as supporting three community seed banks which are located in marginal regions of the country.

The community seed banks were established in the early 1990s as a response to droughts that were ravaging the country. They sought to prevent further losses to farmers' plant genetic resources, prevent genetic

Community seed banks can be seen as an institutional platform for making decisions about crop cultivation, seed production and conservation of locally adaptive germplasm. Photo: Patrick Kasasa

When a farmer has multiplied seeds, he or she returns at least 5 kg to the seed bank.
Photo: Patrick Kasasa

erosion, act as a risk aversion measure against the effects of climate change and vulnerability, and conserve local crop varieties on-farm. Over the years, the community seed banks helped farmers to enhance cultivation of local, drought tolerant crops, including sorghum, pearl millet, groundnuts, cowpeas and local vegetables.

Community seed banks can be seen as a collective framework and institutional platform for making decisions about crop cultivation, seed production and conservation of locally adaptive germplasm. As such, they are an effective mechanism to implement farmers' rights as defined by the Treaty.

Women are key actors in seed bank activities and make up at least half of the management committee

Any member of the community can ask for seed from the general collections category for purposes of multiplication. When the farmer has multiplied the seed, he or she returns at least 5 kg to the seed bank. The seed is further distributed to other farmers. Members of a household can freely withdraw from the seed bank small quantities of seed they want at any time. However, drawing seed from the seed bank is usually done at the beginning of the season. Farmers share and exchange seed freely. Members of a farmer field school also use materials from the seed bank in their study plots (demo or diversity plots).

Women, who play a key role in household food security, participate in seed bank activities and make up at least half of the 12-member management committee. Because of socioeconomic and cultural norms and values, women are the main actors within the smallholder agricultural sector in Zimbabwe and, thus, are the main contributors to selecting seeds in the field and after harvest, cleaning and depositing seeds, participating in seed fairs and the general upkeep of the building.

Anyone from outside the community can access materials from the seed bank at a cost. If the person wants seed from the family collections, they are directed to the owner (household) and the two parties then agree on transaction terms. But if the person (farmers, breeders, researchers, visitors, etc.) is interested in material from the general collections category, the seed bank committee negotiates on behalf of the community for payment.

Seed in the general storage room belongs to individual members and are used by them free of charge. This seed acts as a seed reserve in case of drought, flood or any other catastrophe. The seed in the bulk storage room is sold to anyone who wants seed. However, non-members, especially the most vulnerable such as elders and orphans, may also be given seeds on the recommendation of the management committee - a social commitment made by the seed bank.

Technical support is available as well. In Tsholotsho, for example, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) trained CTDT staff and Zimbabwe's agricultural extension service (AGRITEX) officers in crop improvement. The national gene bank also trains the same officers in germplasm collection, recording, processing and storage. AGRITEX is always on the ground working closely with seed bank management committees. CTDT provides technical back stopping to both field officers and the committees. CTDT has also trained all committee members in leadership and seed bank management. Exchange visits (look-and-learn tours) have been organised to allow committee members to share information and ideas, including best practices for plant genetic resource management.

The crucial role of seed fairs Seed fairs are held annually at each community seed bank and biannually at the national level. Initially organised by CTDT in collaboration with the farmers' management committees, these events are now planned by the community seed bank committees. During seed fairs, farmers are encouraged to display their crops,

and prizes are awarded based on the number and range of crops on display, seed quality and presentation. The seed fairs provide a forum for farmers to meet, discuss and exchange seeds, knowledge and their experience with old and new crops and to exchange information about local level seed production. Seed fairs also make it possible to evaluate the level of diversity within the community and assess and monitor genetic erosion. Seeds are also acquired at the fairs to increase seed bank collections.

The seed banks are successful due to the fact that they are community driven and managed, maintain agricultural biodiversity that is adapted to their local ecological environment, and ensure easy access and benefit sharing for smallholder farmers in terms of seeds of choice. The element of ownership and control of smallholder farmer preferred seeds is a key component that provides options, choices and alternatives. Farmers have the opportunity to practice on-farm, pre-harvest seed selection in their cereal crops, the ability to use a complex selection criteria based on use of the crop, and engage in varietal selection and subsequent use of the seed. Other advantages are the timely availability of seed from the community seed bank, storage of strategic seed reserves at community level, the exchange of seed, and local knowledge systems and experience. These complementary components contribute to the community seed security, which is important in ensuring food and nutrition security. Lastly, preservation of biocultural practices associated with the crops is important as well.

Family farmer control is a key component of community seed banks that provides options, choices and alternatives

Nonetheless, there is the need to compliment these efforts with adequate documentation and development of a better, updated database of the germplasms stored in these community seed banks. Capacity building allows farmers to engage in participatory plant breeding and variety selection (PPB/PVS), which improves crops. The other element is on-farm characterisation of farmer varieties and information sharing so

Seed fairs provide a forum for farmers to meet, discuss and exchange seeds, knowledge and experience. Photo: Patrick Kasasa

Farmers' varieties are freely accessible for all whereas modern varieties come with a price plus restrictions on their further use. Photo: Patrick Kasasa

There are a number of lessons that can be drawn from community seed banking practices. These lessons include a better understanding of the local seed systems, opportunities to build on famer seed systems and creating mechanisms to support and strengthen community based seed systems, the ability of farmers to maintain local agricultural biodiversity on-farm, conservation and sustainable use of local agricultural biodiversity, the development of community strategic seed reserves, the maintenance of bio-cultural practices related to local genetic resources, access and benefit sharing to the seed of choice, knowledge sharing, and community seed exchange designed to improve farmer's seed supply systems.

Facilitating access to modern varieties

It is clear that family farmers grow multiple crops that are accessed through various seed systems. These include 'modern' varieties coming from either the public or private breeding sector, as we have seen above. Amongst the perceived benefits of such varieties are higher yields and marketability. Yet it also is clear that smallholders have few resources and cannot afford to buy seed each cropping season. The relatively expensive seed of modern varieties, plus the additional inputs required by these modern varieties, put smallholders at risk since their budgets for farming supplies compete directly with basic needs such as health care and education.[3] For that reason, smallholders try to access modern varieties mainly through the same practices of exchanging and trading farm-saved variety is protected under a plant breeder's right.

Looking at the controversies surrounding ABS this is clearly one of the main problems in the current international legal framework governing seeds and plant genetic material. Farmers' varieties are freely accessible for all without any perceivable benefit sharing mechanism attached, whereas modern varieties come with a price plus restrictions on their further use. This unequal situation is also the source of resistance against the ongoing harmonisation of plant variety protection (PVP) in Africa. Zimbabwe is a member to two regional organisations that are involved in this process: the African Regional Intellectual Property Organisations (ARIPO), which has recently adopted the Arusha Protocol for the Protection of New Varieties of Plants, and the Southern African Development Community (SADC) that is in the process of doing the same. Both organisations aim to implement a plant variety protection system in the region that awards exclusive rights to produce, reproduce or offer for sale a protected variety to the person who bred, or discovered and developed, a new variety eligible for protection.

In their current form, both regional PVP systems strongly curtail the farming practices of family farmers with respect to protected varieties.[5] However, both legal frameworks include the 'private and non-commercial use' exemption. This means that private use of a protected variety for non-commercial purposes is allowed. As a consequence, the use, exchange and local trade of protected varieties amongst smallholders as practiced in community seed banks can be consid-

ered to fall within the scope of this exemption. Such use is essentially for subsistence purposes and hardly, if at all, affects the commercial interests of the breeder.[6] By explicitly confirming this in their implementation regulations, the ARIPO and SADC countries can make their PVP legislation supportive of one important benefit sharing component - the benefits of genetic resource utilization by the formal breeding sector are accessible (i.e., delivered back) to smallholder family farmers.

'Alternative' ABS mechanisms

Other mechanisms that can strongly improve the availability of quality seed for family farmers are seed repatriation from national gene banks and participatory plant breeding. Together with community seeds banks and seed fairs, these types of mechanism that can effectively improve the availability and accessibility of quality seed of the varieties most preferred by farmers. That is what successful ABS implies for smallholder family farmers. It is about accessing and sharing the benefits of seed diversity. This is most crucial for family farmers, which are both the predominant users and providers of seed for most food crops in many parts of the world.

Whereas policymakers and negotiators are mainly discussing ABS mechanisms that regulate the international transfer of genetic resources, we recommend to shift the focus from provider countries and user companies to family farmers. Mechanisms that facilitate the availability and sharing of seed diversity amongst farmers then become the heart of successful ABS implementation. It is these mechanisms - and not legal contracts - that give meaning and purpose to ABS for smallholder family farmers.

Notes

1 ITPGRFA, Preamble.

2 Lawson, Charles. (2015). Implementing farmer's rights : finding meaning and purpose for the international treaty on plant genetic resources for food and agriculture commitments? *European intellectual property review* 37(7), pp. 442-454.

3 Berne Declaration (et al.). (2014). Owning Seed, Accessing Food: A Human Rights Impact Assessment of UPOV 1991 Based on Case Studies in Kenya, Peru and the Philippines. Zurich, Switzerland: Berne Declaration.

4 Louwaars, N.P., & De Boef, W.S. (2012). Integrated seed sector development in Africa: A conceptual framework for creating coherence between practices, programs, and policies. *Journal of Crop Improvement*, 26, pp. 39–59.

5 De Jonge, B. (2014). Plant Variety Protection in Sub-Saharan Africa: Balancing Commercial and Smallholder Farmers' Interests. *Journal of Politics and Law* 7(3), pp. 100-111.

6 De Jonge, B., Munyi, P. (2016). A Differentiated Approach to Plant Variety Protection in Africa. *Journal of World Intellectual Property*.

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Mechanisms that facilitate the sharing of seed diversity amongst farmers must become the heart of successful ABS implementation. Photo: Patrick Kasasa

Learning from farmer-led access and benefit sharing

Conclusions

This special issue of *Farming Matters* magazine has explored the ways in which access and benefit sharing of plant genetic resources can work for family farmers. On one hand it presents cases that demonstrate the limited extent to which family farmers have been able to benefit from the 'formal' ABS process: the rather complex arrangements between international agreements and national authorities, institutions and communities. On the other hand, this publication uncovers some of the effective principles and mechanisms for access and benefit sharing that are part and parcel of farmers' everyday practices, even when formal ABS regulations have not yet been designed or implemented. What can we conclude?

Robin Pistorius, Janneke Bruil and Ronnie Vernooy

Formal access and benefit sharing processes are anchored in what may termed the international 'ABS regime', which consists of the Convention on Biological Diversity (CBD) and its Nagoya Protocol and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Both the CBD and the Treaty recognise the role of indigenous groups and family farmers in the conservation and sustainable use of (agro)biodiversity, and both support ABS arrangements, albeit differently. The contributions in this special issue demonstrate that despite the existence of this ABS regime, indigenous groups and family farmers have so far received very limited material and immaterial support from it, due to political, legal and bureaucratic complexities and hurdles, lack of national implementation capacities, and costly operational procedures. At the same time, much can be learned from traditional and newly emerging forms of farmer-centred principles and practices for access and benefit sharing.

Collaboration The experiences presented here provide valuable insights about what elements of a formal ABS system may work for family farmers. Central to effective ABS arrangements are the practices of collaboration of farmer networks and community seed banks with state actors or professional breeders - in some cases under the CBD and the Nagoya Protocol, and only recently emerging under the Treaty.

A fundamental factor of success is putting farmers at the centre of such collaborations, such as in the case of seed development and improvement seen in China. 'Professional' breeders from the Chinese Academy of Agricultural Sciences (the national public breeding institute) and the Guangxi Maize Research Institute are working with farmers to improve an open pollinated maize variety. Farmers benefit through the recognition of their expertise, improved availability of and access to quality seeds from both institutes, income generated from seed production and marketing, and the provision of scientific and technical knowhow through collaboration with the formal seed sector.

Under certain circumstances, access and benefit sharing mechanisms can also be established through collaborations of private parties and farmers, as the unique participatory plant breeding tradition based on farmer-selected potato varieties in the Netherlands demonstrates. It is important to note however that a major reason for the success of this initiative is the specific historical context of the Dutch agricultural sector. Decades of public investment in breeding has fostered relationships between farmers and public and private sector breeders.

A fundamental factor of success is putting farmers at the centre of ABS collaborations with state actors or professional breeders

Collaborations are also successful when they make collections of genetic resources of key crops accessible to family farmers, especially in cases where farmers have little access to quality seed. The initiative of coffee farmers in Costa Rica demonstrates the positive impact of facilitated access of farmers and breeders to the germplasm of horticultural crops. Access to diverse crops is of strategic importance to farmers as it enhances their resilience to climate change and other shocks. This experience points to the need to include horticultural food crops in the multilateral system of the Treaty.

Pomme grenade seeds in Asia

Local community organisations

This publication furthermore highlights how local community organisations can and must play a leading role in the maintenance of the rich bio-cultural heritage embodied in local varieties. State authorities can support such civil society networks in the construction of seed security systems that allow family farmers to build their own food and nutrition strategies as well as increasing their resilience.

An example comes from Paraíba, Brazil, where the state government launched a seed bank policy in order to reinforce existing community seed banks, and donated stocks of seeds as an incentive for communities to construct new seed banks. When local varieties became formally recognised by the national government in 2003, the door was opened to more progressive innovations in the government seed programme. This could only happen through coordinated efforts of farmer networks, government institutions and scientists.

Maize varieties from Central America

Simplifying the system

Research and capacity building initiatives, such as a Bioversity-led project in eight countries, make an effort to identify ways to strengthen the usefulness of ITPGRFA for farmers. Although significant progress has been made, the project reveals that progress in national implementation of ABS regulation under the Treaty is modest, especially with regards to benefit sharing. In an interview, François Meienberg echoes this observation, noting that under the Treaty's Benefit Sharing Fund to date no mandatory payment has been made that would allow the sharing of benefits with farmers. This can be considered an injustice created by the system.

François Meienberg proposes to simplify the system: corporations that want to access genetic resources under the multilateral system should contribute a fixed benefit sharing payment on an annual basis. Despite the shortcomings, the Treaty remains important as it offers a legal basis to compel industrial agriculture to repay its dues whenever it sells seeds in a member country, as argued by Guy Kastler. The time has come to make concrete proposals to improve implementation of the Treaty.

Self-organised mechanisms

What emerges from the various contributions is that self-organised access and benefit sharing mechanisms can be highly effective for family farmers. Examples are innovative farmer-led seed banking and plant breeding initiatives. They are often based on long standing customary practices and enable family farmers to develop, exchange, sell and use traditional and region specific seed varieties.

In some cases, community seed banks provide an alternative to an ABS regime and may be more effec-

tive in protecting biodiversity and encouraging farmers to contribute to the genepool than the formal system. This is the case in India, where Farmers' Rights are embedded in national law, but implementation poses challenges because of the regulations on trade related aspects of intellectual property rights. In this context of an emerging ABS regime, the TheruBeedi Seed Bank turns out to be very effective in ensuring access and benefit sharing for family farmers. This is also true in Zimbabwe, where smallholder farmers hardly benefit from formal ABS agreements. The Community Technology Development Trust supports alternative mechanisms that have resulted in a substantial increase of farmers' access to seed diversity and their ability to share in the benefits of the continuing cycles of seed conservation.

Similarly, in the Ecuadorian provinces of Bolivar, Chimborazo and Cotopaxi, family farmers are creating new initiatives and capacity to conserve and use the biodiversity on their farmland through agroecological practices. They are gaining greater access to and control over their biological resources while increasing resilience and food sovereignty. Women in particular have gained greater appreciation within their communities due to their abilities to conserve and

Protesting investments in industrial seeds at the Gates Foundation, London. Photo: Patrick Mulvany

Farmers selecting vigorous mother plants, pinpointing them with stakes. Photo: Peter Gildemacher

improve varieties and seeds and maintain an informal culture of free access and sharing of seed through a mechanism referred to as 'pass the gift'. In these initiatives, concepts of distributive justice, reciprocity and equity are some of the guiding principles used by family farmers for access and benefit sharing.

Rooting the system

It turns out that access and benefit sharing is a highly complex matter, especially when it comes to supporting family farmers. We may conclude here that the success of an ABS system not only depends on creating fair and effective institutions and rules, but most of all on learning from and supporting existing (and sometimes longstanding) ABS-mechanisms at a local or regional level. Family farmers can collaborate in their own way, developing their own access and benefit sharing mechanisms. Research and public institutions can play a important role by strengthening them, either through collaborations or through formal policy, which can be beneficial for all parties involved.

In this sense, it is notable that new civil society networks are emerging to ensure access and benefit sharing for family farmers, be it in the form of seed networks, farmer communities, or the agroecology movement. In the light of a trend towards legislation that could severely undermine farmer seed systems, such as is occurring in Africa, these networks at local, national and even global levels hold great promise for ensuring that farmers can continue to be the world's custodians of genetic resources. The 'formal' ABS system could be more effective for family farmers if it becomes firmly rooted in such networks- both longstanding *and* newly emerging community based seed networks.

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Selected books

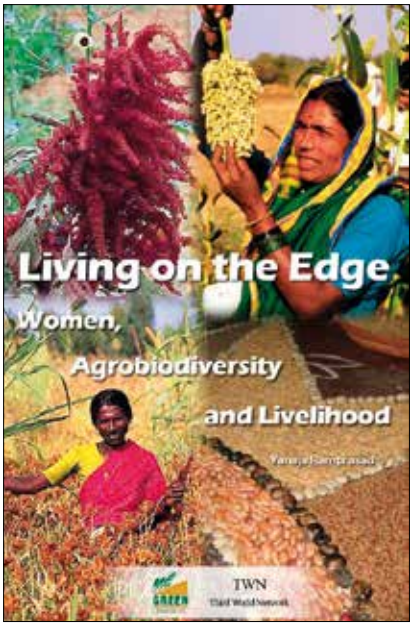
Living on the Edge: Women, Agrobiodiversity and Livelihood

Vanaja Ramprasad, Green Foundation & Third World Network, 2015

It was a fundamental question that drove this author to begin a journey across India in 1974: How could surplus food production and malnutrition co-exist? Her numerous encounters with farmers convinced her that subsistence farmers, and women in particular, had the potential to become custodians of biodiversity, the key to food security. She set up the Green Foundation 25 years ago to work with smallholder farmers and initiated a network of seeds banks to revive and popularise traditional grains (see page xx). Vanaja Ramprasad's monograph gives a bird's-eye view of India's agricultural practices through the ages, compares traditional and technology-intensive corporatised farming, examines the fine print in laws related to plant patenting and farmers' rights, and argues that genetic diversity, not genetic engineering, is the solution to world hunger.

India's staple crops have dwindled to just rice, wheat and maize. Although the Green Revolution was largely responsible for the country losing more than 90 % of its rice diversity, Ramprasad does not decry it outright. She believes that it undoubtedly alleviated hunger at a time when food security was the biggest challenge facing a newly independent India that had been ravaged by successive famines during the British colonial regime. However, she observes, the consequences of popularising just a few high-yielding, water-guzzling hybrids that require large doses of chemical fertilisers and pesticides have been catastrophic.

Green Foundation's mission has been to reintroduce to India's small scale farmers the millets and other traditional grains that adapt well to semi-arid tracts, resist pests and diseases, withstand drought, and require low inputs. But "who will be farming, and on what land?" the author asks succinctly. Ramprasad believes that a disastrous body-blow to the country's food security can be deflected only if its policies address the needs of smallholder farmers, who form a sizeable though neglected chunk of the agriculturist population. Subsistence farmers, who once grew mixed crops on their fields and used hardy local varieties of seeds nourished by organic manure, are burdened by the expensive, high-input agricultural practices that mono-cropping and cash crops demand. Malnourished because they cannot afford to eat what little food they produce, they sell their land and migrate to cities as day wage labourers. Therefore it makes sense to help them retain their holdings and practise sustainable agriculture, because it would not only ensure their survival but also aid national efforts towards providing abundant, safe and healthy food for all.



The Green Foundation has been working against the odds by sourcing and propagating grains that have been 'pushed into internal exile' by monoculture. Ramprasad has reserved a chapter for the 'seed mothers' - exemplary women organic farmers who helped establish the seed banks that the Green Foundation initiated in 1994, where seeds can be stored, borrowed and exchanged.' Ramprasad believes that organic farming should promote an agricultural system that is local, small scale, family-operated, and biologically and culturally diverse, so that organic produce can be accessible to the poor.

Review by C.K. MEENA

Community Seed Banks: Origins, evolution and prospects

R. Vernooy, P. Shrestha, and B. Sthapit, editors, 2015. Routledge, Great Britain. 270 pages. IBSN: 978-0-415-70806-7.

Community seed banks first appeared towards the end of the 1980s, established with the support of international and national non-governmental organisations. This book is the first to provide a global review of their development and includes a wide range of case studies.

Countries that pioneered various types of community seed banks include Bangladesh, Brazil, Ethiopia, India, Nepal, Nicaragua, the Philippines and Zimbabwe. In the North, a particular type of community seed bank emerged known as a seed-savers network. Over time, the number and diversity of seed banks has grown. In Nepal, for example, there are now more than 100 self-described community seed banks whose functions range from pure conservation to commercial seed production. The book reviews their history, evolution, experiences, successes and failures (and reasons why), challenges and prospects. It fills a significant gap in the literature on agricultural biodiversity and conservation, and their contribution to food sovereignty and security.

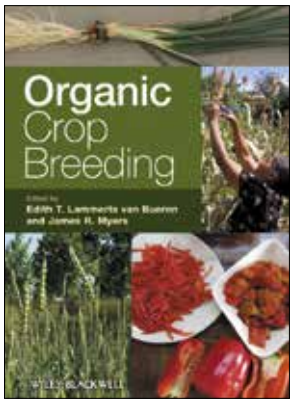
Farmers' rights in practice: Synthesis of the case studies on sustainable use of agrobiodiversity

Fondazione ACRA-CCS, 2013. 65 pages

This publication presents the synthesis of 25 case studies in six European countries with the aim of providing descriptions of the practices carried about by farmers in the interest of sustainable use of plant genetic resources. By providing these particular case studies, the publisher hopes these practices will spread to farmer organisations in Europe and Africa in order to begin to institutionalise effective food sovereignty and dynamic management of cultivated biodiversity. Furthermore, this publication draws links between FAO action plans and the case studies in order to begin to outline new policies and regulations that will promote and support sustainable agrobiodiversity, particularly within the EU. Special attention is paid to European strategy on biodiversity for 2020 and other EU policy norms. The publishers hope to pave the way for policy that "takes into account all facets of the real, instead of reducing reality to a monoculture."

Organic Crop Breeding

E. T. Lammerts van Buren and J. R. Myers, 2012. Wiley-Blackwell, Malaysia. 312 pages. IBSN: 978-0-470-95858-2



Organic Crop Breeding provides readers with a thorough review of the latest efforts by crop breeders and geneticists to develop improved varieties for organic production. The book opens with chapters looking at breeding efforts that focus on specific valuable traits such as quality, pest and disease resistance as well as the impacts improved breeding efforts can have on organic production. The second part of the book is a series of crop specific case studies that look at breeding efforts currently underway from around the world in crops ranging from carrots to corn. *Organic Crop Breeding* includes chapters from leading researchers in the field and is carefully edited by two pioneers in the field. *Organic Crop Breeding* provides valuable insight for crop breeders, geneticist, crop science professionals, researchers, and advanced students in this quickly emerging field.

Further reading

Greiber, T., Peña Moreno, S., Åhren, M., Nieto Carrasco, J., Kamau, E.C., Cabrera Medaglia, J., Oliva, M.J., Perron-Welch, F., in cooperation with Ali, N. and Williams, C. (2012). **An explanatory guide to the Nagoya Protocol on Access and Benefit-sharing**. International Union for Conservation of Nature, Gland, Switzerland. *This comprehensive guide introduces the concepts of access and benefit sharing and the road that led to the Nagoya Protocol and then presents and explains the 36 articles of the Nagoya Protocol in detail. The full text of the Nagoya Protocol is included as an annex.*

Halewood, M., Andrieux, E., Crisson, L., Gapusi, J.R., Mulumba, J.W., Koffi, E.K., Dorji, T.Y., Bhatta, M.R., Balma, D. (2013). **Implementing 'mutually supportive' access and benefit sharing mechanisms under the Plant Treaty, Convention on Biological Diversity, and the Nagoya Protocol**. Law, Environment and Development Journal 9(1): 68. *This article sets out the fundamental issues that must be addressed and the steps that national policymakers must follow when implementing ITPGRFA's multilateral system of access and benefit sharing. It identifies the main points of intersection, at the national level, between the ITPGRFA's multilateral system and laws to implement access and benefit-sharing norms under the CBD. It analyses the hazards that can result from the mismanagement of that interface and offers recommendations for overcoming these hazards to ensure that access and benefit-sharing systems under the ITPGRFA and CBD are mutually supportive.*

Halewood, M. (editor). (2015). **Mutually supportive implementation of the Plant Treaty and the Nagoya Protocol: a primer for National Focal Points and other stakeholders**. Discussion draft. Bioversity International, Rome, Italy. *This report presents the results of a series of activities (survey, workshop, post-workshop analysis) aimed at producing a tool to support implementation of the ITPGRFA and the Nagoya Protocol. It includes a series of scenarios and options for improved coordination in implementation.*

Halewood, M., Andrieux, E., Crisson, L., Gapusi, J.R., Wasswa Mulumba, J., Koffi, E.K., Yangzome Dorji, T., Bhatta, M.R., and Balma, D. (2013) **Implementing mutually supportive access and benefit sharing mechanisms under the Plant Treaty, Convention on Biological Diversity, and Nagoya Protocol**. 9/1 Law, Environment and Development Journal.

Halewood, M. and Vernooy, R. (2014). **Strengthening capacities to implement the multilateral system of access and benefit-sharing: efforts under way and challenges encountered in Bhutan, Burkina Faso, Costa Rica, Cote d'Ivoire, Guatemala, Nepal, Rwanda and Uganda**. In Dasgupta, S. and Roy, I. (eds.) Enhancing understanding and implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture in Asia (GCP/RAS/284/JPN), Report of the First National Focal Point Meeting of the Project, 27-28 May 2013. FAO Regional Office for Asia and the Pacific, pp. 74-79.

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This special issue of Farming Matters magazine is co-published by ILEIA and Bioversity International. It was produced with the support of the project 'Strengthening National Capacities to implement the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)' funded by the Directorate-General for International Cooperation, Ministry of Foreign Affairs, the Netherlands.

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The editors would like to thank the farmers around the world who are the custodians of our biodiversity, all authors of the contributions in this publication, and Patrick Mulvany, Danielle Peterson, Diana Quiroz, Jesse Roberts, Edith van Walsum.

The AgriCultures Network
ILEIA is a member of the AgriCultures Network; six organisations that promote agroecology and family farming worldwide, and that publish: LEISA revista de agroecología (Latin America in Spanish), LEISA India (in English, Hindi, Kannada, Marathi, Oriya, Punjabi, Tamil, Telugu), AGRIDAPE (West Africa, in French), Agriculturas, Experiências em Agroecologia (Brazil, in Portuguese) and Wegel (Ethiopia, in Amharic).

Layout
Yvonne Dijkshoorn – Twin Media bv, Culemborg, the Netherlands

Printing
Koninklijke BDU Grafisch Bedrijf B.V., Barneveld, the Netherlands.

Cover photo
Patrick Kasasa

April 2016
ISSN: 2210-6499

THE FUTURE OF FOOD SECURITY DEPENDS NOT JUST ON INTERNATIONAL SEED BANKS, BUT ALSO ON THE KNOWLEDGE OF THE FARMERS WHO MAINTAIN GENETIC DIVERSITY ON A DAILY BASIS.

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The International Treaty on Plant Genetic Resources for Food and Agriculture does not contain measures to enforce the recognition of Farmers' Rights.

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VARIOUS FORMS OF PEASANT ORGANISATION CAN ENHANCE ACCESS AND BENEFIT SHARING WHILE PROMOTING THE CAPACITY AND AUTONOMY OF FAMILY FARMERS.

Ross Mary Borja and Pedro J. Oyarzún, Page 57

THE ABS SYSTEM COULD BE A THOUSAND TIMES SIMPLER

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Fifteen years of research has resulted in a growing recognition of the synergies that can be created between formal and informal seed systems.

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This issue of Farming Matters is jointly published by Bioversity International and ILEIA, the Centre for learning on sustainable agriculture. April 2016
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