

# ISSD Africa

## Synthesis paper



# Access and benefit-sharing policies for climate-resilient seed systems

## Summary

The international community has negotiated international laws on the conservation and sustainable use of genetic resources, and on access to those genetic resources and the sharing of benefits associated with their use. In theory, these agreements should provide useful policy support for the exchange and use of genetic resources as part of countries' climate change adaptation strategies.

Climate change is increasingly affecting many farmers and rural communities, specifically impacting agricultural productivity and food security. Farmers need to access and manage crop diversity (both between and within crops) with a range of genetically based functional traits as insurance against increasingly unpredictable precipitation, droughts, shifting growing seasons, and prolonged dry spells.

Participatory research with farming communities in Rwanda, Uganda, Zimbabwe and Zambia focused on local climate changes and impacts on local food crops, and identified potentially adapted germplasm that is currently hosted in national and international genebanks. In addition, the four country teams analysed the state of access and benefit-sharing (ABS) policies, and evidence of their influence on germplasm flows and benefit sharing, and made recommendations on ways forward to implement the global ABS agreements so that they can support climate-resilient seed systems.

The study findings report that in light of climate change predictions there will be less and less potentially adapted materials in national genebank collections. In contrast, there is a lot of material in foreign genebanks that is potentially adapted to the changing climatic conditions of the four countries. Farmers identified some potentially useful, adapted varieties being grown by one or a few

farmers locally, but they are not available for wider use. Impediments to their wider use include lack of quality seed (including foundation seed), seed laws that 'criminalize' their sale and/or exchange, and subsidies for alternative materials promoted by companies and national programmes.

There are significant challenges to getting materials from other countries:

- Most countries in sub-Saharan Africa do not have online accession-level documentation that is geo-referenced, making it impossible to search for potentially adapted materials.
- The multilateral system of access and benefit-sharing of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) may not yet have been fully implemented, so the systems may not be in place to provide or benefit from facilitated access.
- The Nagoya Protocol has not yet been implemented, so there is inadequate recognition of the interests of farmers and breeders as potential providers of materials outside the multilateral system, leading to disincentives to share materials.
- National and regional seed laws make it illegal to market farmers' varieties within countries and in other countries in the regions.

It will be necessary to invest in capacity building to take full advantage of potential contributions of the ITPGRFA and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol/CBD) for climate resilience. These agreements are not self-executing. Specific efforts are needed to connect formal sector organizations and farmers, to ensure that they participate in systems for providing and receiving seed and genetic resources.

Considerable effort is also required to integrate formal and 'informal' genetic resources management systems for climate change adaptation.

Future work should focus on the mutually supportive implementation of the ITPGRFA, Nagoya Protocol and national/regional seed laws, in ways that reflect the reality and diversity of different seed systems, with the objective of ensuring that all actors – especially farmers – are able to access and use quality reproductive materials (genetic resources/seed) to adapt to climate changes. A (sub-)regional approach to this effect would make sense given the realities for contiguous climates and agro-ecosystems spanning across international borders, and the likelihood that potentially adapted germplasm will be located across each other's borders. Also, such an approach would hopefully help to build the shared sense of purpose and trust necessary for actors to be willing to share materials and associated benefits as part of climate change adaptation strategies.

## Introduction

Integrated seed sector development (ISSD) acknowledges the coexistence of multiple seed systems in any country, which all play their role in providing farmers with seed. By recognizing that each seed system has its own benefits and limitations, and requires a unique approach towards strengthening it, ISSD aims to foster pluralism and guide

national policymaking in its design to enhance multiple seed systems for providing farmers with quality seed of the varieties they prefer. One of the aims of the ISSD Africa project<sup>1</sup> is to identify opportunities to encourage the adoption and implementation of international agreements in a way that supports a dynamic seed sector, which integrates and takes advantage of multiple seed systems, including the 'informal' or farmer-managed seed system.

Several African countries have made commitments to international agreements and protocols that directly or indirectly affect their agricultural sector, including its key building blocks: seed and germplasm. A key question in this respect is how governments can implement their international commitments in ways that foster a viable and pluralistic seed sector. International commitments in the fields of climate change and access and benefit-sharing are examples of this. The action learning question that this report aims to address is: *How can access and benefit-sharing policies make valuable contributions to seed systems that promote farmers' resilience to climate change?*

The Intergovernmental Panel on Climate Change (IPCC) estimates that the global mean temperature will increase by between 1.4 and 5.8 degrees Celsius (°C) in the period 1990 - 2100, and that precipitation patterns will change considerably across the globe (Niang et al., 2014). Broad-scale modelling studies predict that these changes will have deleterious impacts on the productivity of a number of crops in sub-Saharan Africa (Lobell et al.,

*Participants of capacity building workshop on climate resilient seed systems held in Harare Zimbabwe, May 2015*



Photo: Tinashie Sithole, CTDI Zimbabwe

<sup>1</sup> See, for more information, <http://www.issdseed.org/issd-africa>, accessed 15 February 2017.

2008) One frequently mentioned strategy for adapting to climate changes is that of exploiting genetic sources of resistance to the abiotic and biotic stresses that accompany climate changes (Niang et al., 2014). Both Inter- and intra-crop genetic diversity is useful for climate change adaptation. Farmers may adapt by switching to crops that are more resilient under the current and predicted conditions (e.g. from maize to millet in rain-stressed areas), or by using better adapted varieties of the same crops derived from farmer selection, or through formal sector crop improvement programmes. In all cases, access to quality and diverse seed/reproductive materials is essential for enhancing and improving crop productivity and food security.

As climates migrate across the globe, one country's future climate will be similar to another country's current climate (Jarvis et al., 2015). It is likely therefore that plant populations that have been developed in some parts of the world will possess traits that are adapted to future climatic conditions in other parts of the world. Countries are already extremely interdependent on plant genetic resources for food and agriculture (PGRFA) (Flores-Palacios, 1997; Khoury et al., 2016). It is predicted that climate change will make countries even more interdependent (Fujisaka, Williams and Halewood, 2013), with the concomitant need to access and exchange ever higher numbers of genetic resources across international borders.

In recent years, the international community has negotiated international laws on the conservation and sustainable use of genetic resources, and on access to those genetic resources and the sharing of benefits associated with their use; these include the CBD, the ITPGRFA, and the Nagoya Protocol (to the CBD). In theory, these agreements should provide useful policy support for the exchange and use of genetic resources as part of countries' climate change adaptation strategies.

This study analyses what is actually happening at the national and subnational levels in terms of climate change and its impacts on particular crops; what experiences countries have had to date with regard to accessing, using and sharing benefits derived from genetic resources for climate change adaptation; and what kinds of ABS policy initiatives or reforms could help those countries to make better use of genetic diversity for climate change adaptation in the future. This study is designed to analyse how these different 'threads' come together at national and subnational level in a few countries, at higher levels of granularity than is possible with the global modelling referred to above. This information is critical for identifying potential future interventions at a regional or sub-regional level, and making farmer-managed seed systems more climate resilient.

## Activities undertaken

The research was conducted by four individual country case study teams from Rwanda, Uganda, Zimbabwe and Zambia. The researchers followed a common methodology that was developed in consultation with them. In short, each country team agreed to:

- Identify climate changes in their country, and existing and possible future impacts on cropping systems.
- Review programmes to respond to climate changes (diversification, breeding, etc.).
- Look at past, current and predicted future germplasm flows within, into and out of countries, noting, where possible, if those flows are associated with climate change adaptation strategies.
- Select two communities within each country for in-depth, participatory research and training to identify: local climate changes, impacts on local crops, potentially adapted germplasm (suited to the changing climate) that is currently hosted in the national genebank of the country concerned, and also from collections outside the country, including those hosted by CGIAR centres, the United States Department of Agriculture (USDA) and national genebanks in Europe (for which accession-level information is available in a publicly accessible databank – Genesys<sup>2</sup>). Further details concerning the methodology for these exercises can be found in the country reports.<sup>3</sup>
- Analyse the state of ABS policies and evidence of their influence on germplasm flows and benefit sharing.
- Propose ways forward to implement the global ABS agreements so that they can support climate-resilient seed systems.

Early versions of the four papers were presented and discussed at national and international meetings of interested stakeholders and experts in Addis Ababa in November 2015, South Africa in March 2016, Zambia in April 2016, and Uganda in May 2016, and were subsequently revised. The lead researchers discussed cross-cutting themes, lessons learned and insights gained, and made recommendations based on a comparative analysis of the four country reports.

<sup>2</sup> Available at [www.genesys-pgr.org](http://www.genesys-pgr.org), accessed 15 February 2017.

<sup>3</sup> ISSD country reports are available at <http://www.issdseed.org/thematic-working-group-3-matching-global-commitments-national-realities>.

## Outcomes and lessons learned

### i **Climates are changing, and these changes are negatively effecting key food security crops in Uganda, Rwanda, Zambia and Zimbabwe.**

All of the four countries, and all of the eight case study communities within those four countries, are already experiencing climate changes. Consistent with the global- and regional-level information and forecasts, minimum temperatures in the four countries have been increasing and, most importantly, the seasonal rains that define/characterize cropping seasons are increasingly irregular and unpredictable. The result has been shortened growing seasons, longer periods of drought, harsher rainstorms, and in some areas a reduction from two growing seasons per year to one growing season as the seasonal rains 'merge' the previously distinct growing seasons. When the seasonal rains appear to start normally, farmers plant their crops. However, if the rains suddenly stop within the first few days of planting, most of the germinating seeds will die off, often without recourse to private or public stores of seed to replant if and when the rains become more regular. In other cases, the droughts may hit mid-way into the growing season before any harvesting can be carried out. Both scenarios, with the common denominator of irregular, unpredictable rain, lead to total crop failure and serious consequences for the farmer. In many cases, the farmers will not have recourse to private or public sources of replacement seed if and when the rains become more regular. WorldClim data<sup>4</sup> predicts that temperatures will rise in each of the eight study communities between now and 2050. Overall, annual precipitation will increase in some of the communities, and decrease in others during the same period. More data concerning the climate changes in each of the communities, and the impacts of those changes on food security crops grown by farmers in those communities, are included in Annex 1 below.

### ii **Farmers are embracing (inter- and intra-specific) crop diversification as a means to adapt to climate changes. Crop diversification depends upon accessibility, availability and use of inter- and intra-specific crop genetic diversity from local, national and international sources.**

In each of the countries, national agricultural research organizations, in partnership with international and regional research organizations (and sometimes with community and civil society organizations) are increasingly engaging in research and development projects that involve taking advantage of genetic diversity – between species and within species – to respond to challenges associated with climate change. These include plant breeding programmes and projects that are focused

on searching for genetic sources of resistance to climate change related biotic and abiotic stresses; the introduction of new, different species in areas where previously planted crops are no longer performing well (e.g. moving from maize to millet or sorghum); and the use of mixtures of crops and or varieties that are, cumulatively, more resilient to climate shocks. Most of the projects and programmes rely in part on accessing and using genetic resources/crop varieties that either were not present in local agricultural systems (or in the country as a whole), or were present, but underutilized.

### iii **'Access to genetic resources' and 'access to seed' are overlapping issues, particularly in 'informal' systems of innovation and exchange.**

All four national research teams repeatedly raised issues related to farmers' access to seed and unfair impacts of seed regulations on the ability of farmers to access, exchange and sell seed. In this way, they highlighted the fact that the conceptual distinction between genetic resources and seed as separate objects of regulation – ABS laws for genetic resources, and seed laws for seed – is artificial in some contexts. It works when one conceives of ABS laws regulating uses of genetic resources as upstream inputs into formal sector plant breeding and research, and seed laws regulating access to formal sector produced seed. However, in 'informal' seed systems, where farmers select and replant seed, exposing it to human and environmental selection pressures with each generation, the distinction between seed and genetic resources does not make much sense. Farmers use genetic resources as seed and vice versa. Viewed from the perspective of farmers operating in 'informal' or farmer-managed systems, seed laws (if they restrict what can be registered, exchanged, sold, accessed by farmers) can potentially create bottlenecks limiting farmers' roles in climate-resilient seed systems. Indeed, all four country teams provided examples of how national seed laws were 1) threatening availability (and related exchanges of genetic resources/seed) at the level of local markets, and between farmers; and 2) undermining the full use of genetically diverse materials used and conserved by farmers at broader national scales.

This highlights the importance of looking at the entire length of different seed value chains to see how and where requisite genetic resources/seed can and should be introduced and made available, and where related benefits can be shared. Then, in this broader context, which captures the reality (and diversity) of seed systems, it is useful to analyse the impacts of both ABS and seed regulations (and other potentially relevant policies and regulations) on the use of genetic resources/seed along the various chains.

<sup>4</sup> WorldClim is a set of global climate layers (gridded climate data) with a spatial resolution of about 1 square kilometre (km<sup>2</sup>). The data can be used for mapping and spatial modelling. See [www.worldclim.org](http://www.worldclim.org), accessed 15 February 2017.

**iv In some cases, there are climate adapted, potentially useful materials in farmer-managed seed systems (i.e. farmers' varieties), but there are impediments to their wider-scale exploitation.**

Community participants from each of the eight sites selected a single crop grown in their community on which to focus the purpose of the project's research, based on the criteria of importance to local food security, and perceived vulnerability to ongoing changes in climate. One of the first exercises in each site was to ask farmers to identify materials/varieties of those crops that they use – or are aware of others using – that perform better than other varieties under the current climatic stresses. Some of the varieties that performed well did not represent a mix of the most desirable traits; for example, they performed better than others under drought stress, but they did not taste good. But in some cases, farmers reported that the main bottleneck hampering their use of the materials was the absence of quality seed/planting materials. They also reported that they were encouraged to use other materials introduced by extension agents or companies. The authors of the country papers, and experts that they surveyed, acknowledged that there is inadequate public investment (often, none at all) in enhancing local varieties and multiplying quality seed of those varieties. The four studies also provided examples of other disincentives/bottlenecks in the development of quality seed of locally adapted varieties, including national seed laws that prohibit marketing of farmers' varieties (unless they can satisfy strict registration criteria); lack of recognition of Farmers' Rights to be compensated in some way for the use of their varieties; and lack of engagement of farmers in identifying priorities for agricultural research and development programmes.

**v The proportion of PGRFA in the countries' national genebanks that is potentially adapted to those countries' changing climates is decreasing over time.**

After working with the farmers to identify potentially useful materials from their local agricultural production systems, the national research teams, supported by this project, looked for potentially adapted materials in (first) national genebanks, and (second) genebanks outside the countries concerned. To carry out this research, data concerning past, present and future climates for those eight sites were analysed alongside passport data of collections assembled from within and outside the country, and climate suitability data. Through this method, it was possible to identify materials in those collections that are potentially adapted to a) current climatic conditions, and b) projected future climatic conditions (in 2050), in the community reference sites.

For seven of the eight sites, the number of accessions of the communities' target crops in the respective national genebanks that are potentially adapted to the projected future climatic conditions of the reference sites decreased significantly over time, as those climates changed. Details concerning the numbers of accessions in the national genebanks of the target crops for both current and predicted future (2050) climatic conditions are included in Annex 2 below. While national genebanks are just one of the sources of genetic diversity that countries can and do access (alternative sources are discussed below), these research outcomes are nonetheless significant proxy-indicators concerning the extent to which countries are/will be increasingly reliant on genetic diversity from other countries as a result of changing climates (and even less able to rely on diversity that has evolved and been collected from within their own borders).

**vi There is a wide range of material in foreign genebanks that is potentially adapted to the changing climate conditions of the four countries. Those materials were originally collected from many different countries and continents. The research confirms that countries are becoming increasingly interdependent on genetic resources as a result of climate change.**

For information about potentially adapted materials in PGRFA collections outside the four countries, the research teams relied on Genesys, which is an online, publicly accessible database that includes accession-level information on all of the international PGRFA collections hosted by the CGIAR centres, national public PGRFA collections of European countries, and collections hosted by the USDA. Genesys does not yet include much accession-level information from genebanks in other countries (though it is hoped that eventually more countries will include such information in Genesys in the future).<sup>5</sup>

In all cases, the searches led to the identification of much higher numbers of potentially adapted accessions located (through Genesys) in collections outside the country, than in the national genebank collections. This was the case for both current climatic conditions and those predicted for 2050 in the reference sites. Details regarding the numbers of potentially adapted materials identified through this exercise are included in Annex 2 below.

It is important to underscore that for each crop in each of the eight locations, the potentially adapted materials that were identified in foreign genebanks were originally collected/accessed from several different countries – seven on average.<sup>6</sup> For example, the 537 accessions of finger millet

<sup>5</sup> In most cases, the researchers looked for potentially adapted materials originally collected (or improved) from anywhere in the world, including other continents. In one case, Uganda, the searches were confined to materials that were originally collected or improved in East African countries.

<sup>6</sup> Excluding Uganda, since their search was limited to East Africa only, and is therefore not comparable with the other country searches.



*Participatory evaluation exercises with farmers in Uzumba-Maramba-Pfungwe Zimbabwe, May 2015*

that are potentially adapted for use in Uzumba-Maramba-Pfungwe (UMP) in Zimbabwe, under current climatic conditions, were originally collected from eight different countries. The 331 accessions that are potentially adapted for use under the climatic conditions predicted for 2050 in the same location were originally accessed from seven countries. Annex 2 provides the number of countries from which the potentially adapted materials for all eight sites were originally collected, for both current and projected future climatic conditions.

Since national PGRFA users will have access to less potentially suitable germplasm from their national genebanks for direct use or deployment in crop improvement programmes, they will be increasingly reliant on germplasm obtained from outside their national boundaries for gene-based traits that are adapted to changing climatic conditions. Subject to availability of resources, the national genebanks can also respond to this situation by becoming increasingly involved in identifying and obtaining such germplasm with or on behalf of PGRFA users in the future.

**vii There are significant constraints on ability to access, use and share benefits associated with materials in other countries as a result of the lack of online accession-level documentation (and linked implementation of the ITPGRFA and Nagoya Protocol).**

Ideally, our searches for potentially adapted PGRFA would have included collections held by organizations in neighbouring countries with contiguous agro-ecosystems, and other countries in the world where the same crops are grown and may have evolved useful traits as a result of the interaction of genomic recombination, environmental selection, farmer selection and breeding. However, very

few of these countries publish such information at all, or in a format (or language) that is easy to use from outside the country. The lack of digitalized, published, accession-level information about materials that are potentially available in countries represents a very significant constraint to their identification and use for climate change adaptation. It makes it impossible, when carrying out research such as that supported by this project, to find out if those organizations or countries (or communities) have potentially adapted materials. It also leads to increased reliance on traditional sources of conserved germplasm – the CGIAR, USDA, and some particularly active European genebanks. Exchanges between countries in developing regions are necessarily limited by the lack of published, accession-level information about materials hosted in their countries.

This latter point is closely linked to the state of implementation of the ITPGRFA and the Nagoya Protocol, which will be considered in more detail below. All four countries have ratified both agreements. Ideally, to fully participate in the systems of exchange and benefit sharing that those two agreements support, the countries need to have well documented genetic resources. If information on the materials is lacking, then no one will know the materials are available in the collections and consequently will not try to access them, either under the ITPGRFA's multilateral system of access and benefit-sharing, or via newly negotiated ABS contracts under the framework of the Nagoya Protocol.

**viii International partnerships and programmes are important mechanisms for the exchanges of genetic resources into and out of the four countries for agricultural research and development.**

National agricultural research organizations – and some universities and a few companies – in each of the four countries, are recipients of considerable quantities of improved lines of food security crops from CGIAR plant breeding programmes.

Of the four countries, Zimbabwe has tended to receive the most of such germplasm, and Rwanda has received the least, from the CGIAR centres. Total materials provided to recipients in the four countries from 2007 to 2015 are set out below in Table 1. Further details about the numbers of samples of different crops transferred are available in each of the four country papers. The most likely contributing factor to the relative amounts of germplasm countries received from the CGIAR is the size and capacity of the national agricultural research and breeding organizations. Where countries have sufficient capacity in plant breeding, they are more likely to cross improved materials from the CGIAR with locally adapted materials that have proven, desirable traits. If their breeding capacity is lower, countries will select from among the materials received those lines that perform best under local conditions.

**Table 1. Materials transferred from CGIAR centres to recipients in the four countries using the Standard Material Transfer Agreement (SMTA) under the ITPGRFA, 2007-2015**

Country	Number of samples transferred
Rwanda	5,701 samples
Uganda	9,818 samples
Zambia	11,343 samples
Zimbabwe	33,727 samples

Source of data: ITPGRFA Secretariat (2016)

One example of a CGIAR crop improvement programme, which has developed a range of improved lines that have been transferred to the four countries, is the Drought Tolerant Maize for Africa (DTMA) project. This initiative is a partnership between the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Agricultural Research in the Dry Areas (ICARDA) and various national agricultural research organizations in 13 African countries<sup>7</sup>. DTMA has developed over 200 new varieties and distributed 27,720 samples to recipients in these countries; the countries then select potential lines and develop them further through breeding with local maize breeding programmes, or they select promising lines that they then distribute. Through this project, 14 varieties of drought-tolerant maize have been developed for Zambia, ten for Zimbabwe and six for Uganda. The four country papers provide much more detail about the international projects in which their national agricultural research organizations participate, and through which they receive (and also provide) germplasm and associated knowledge.

The Pan-African Bean Research Alliance (PABRA) is a breeders' network that works in conjunction with the International Center for Tropical Agriculture (CIAT); it has facilitated the exchange of varieties and improved lines of beans between 30 countries in sub-Saharan Africa. Uganda, Rwanda, Zimbabwe and Zambia are also part of this network. Over 550 varieties of beans have been shared through this network between the 30 member countries.

The primary mechanism by which germplasm originally collected from the four countries is made available internationally is through the CGIAR genebanks. Table 2 shows the numbers of accessions of different crops and forages that were originally collected in the four countries that are currently conserved in international collections hosted by the CGIAR centres. Most of those materials were collected in the 1970s and 1980s. The centres make those materials available upon request under the Standard Material Transfer Agreement (SMTA) adopted by the ITPGRFA's Governing Body in 2006, (as they are directed to do by their agreements with the Governing Body that were also finalized in 2006). Organizations within the four countries also occasionally make material available to other countries through crop improvement and genetic resources networks in which they participate.

**ix Stronger linkages between farmers and crop improvement and genetic conservation programmes are needed, including stronger links with intermediaries.**

Direct distributions from international and national genebanks and formal sector crop improvement programmes to farmers operating primarily in 'informal' seed systems are relatively rare. Only approximately 1% of the materials distributed from CGIAR genebanks is distributed directly to farmers (SGRP, 2009). This reflects the fact that partnerships between communities and international and national agricultural research organizations are

**Table 2. Number of accessions of materials conserved and distributed by CGIAR centres that were originally sourced from the four countries**

Country	Number of accessions
Rwanda	1,104
Uganda	6,049
Zambia	6,403
Zimbabwe	9,598

Source of data: Genesys

<sup>7</sup> Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia and Zimbabwe.

themselves relatively rare. And it means that farmers and communities are not being engaged as participants in projects to conserve and improve genetic resources. There are a few examples in the four country studies of organizations stepping into intermediary roles, linking farmers with genebanks and formal sector breeders. One such example concerns the Community Technology Development Trust (CTDT), a non-governmental organization (NGO) that has been coordinating projects to bring together teams of farmers, national researchers and two CGIAR centres – the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and CIMMYT – to access and evaluate on-farm plant genetic resources that have been developed by CGIAR breeders that are likely well adapted to niche conditions in the communities concerned. CTDT also works with farming organizations to identify farmers' varieties that have been 'lost' by the communities, and works to have these varieties restored from national and international collections. In this way, CTDT has helped re-introduce lost varieties of millet and sorghum in Zambia and Zimbabwe.

Another example concerns the direct partnership of the Ugandan National Genebank and the Kiziba community seed bank (CSB) established in 2010 in Kabwohe, western Uganda. The National Genebank has supported the CSB by:

- Restoring 'lost' varieties to communities that used to have them.
- Keeping custody of duplicates of the CSB's collections.
- Providing technical support for the management/conservation of the materials both in the CSB and in situ, and the production of good quality seed.
- Contributing indirectly to the protection of indigenous knowledge and farmers' rights by engaging farmers in the documentation of their traditional practices, and in the management of their varieties in the community seed bank.

In the absence of these kinds of initiatives, farming communities' direct access to and participation in projects in the formal sector on genetic resources conservation, improvement and sustainable use, is limited. Consequently, their direct access to, and use of, genetic resources and information that might otherwise be available to them is also limited. And formal sector institutions are missing out on chances to benefit from farmer-developed populations and knowledge. More pro-active partnership building and further engagement of farming communities is essential to ensure that genetic resources are being used by the people who need them most.

- x **Most international exchanges with formal sector organizations reported in the four country studies were facilitated using the SMTA, which appears to provide a useful basis for exchange, although there is dissatisfaction with the benefit-sharing provisions.**

Most of the exchanges between international organizations and organizations within the four countries were made using the SMTA adopted by the Governing Body of the ITPGRFA. While some of the respondents interviewed expressed concerns that the ITPGRFA system for mandatory financial benefit sharing (through an international benefit-sharing fund – see below for more details) was not working, they also acknowledged that exchanges under the ITPGRFA were in fact becoming streamlined, at least between international and national formal sector organizations. Concerns about unrealized mandatory benefit sharing from commercial users – either because they are choosing not to access materials from the multilateral system or because their uses of those materials are not triggering the benefit-sharing formula – are also acting as disincentives to pro-active national and subnational implementation of the ITPGRFA in a number of countries.

- xi **Very small numbers of exchanges are being made between organizations within the countries, and between countries ... unless international organizations act as intermediaries. Little information is available on 'informal exchanges'.**

In all four countries, the reported numbers of exchanges within the countries between different users, and obtained directly from other countries, appears to be relatively small. This is partly explained by the fact that 'informal exchanges' that took place without the use of material transfer agreements (MTAs), and the SMTA in particular, tend not to be reported. As the ITPGRFA and the Nagoya Protocol have not yet been fully implemented in any of the four countries, the methods for keeping track of what materials are transferred subject to approved access and benefit-sharing rules are still not in place. Furthermore, the authors note that legal uncertainties that arise because the ITPGRFA and the Nagoya Protocol have not yet been implemented nationally can create disincentives for both access seekers and providers from national and subnational organizations. As a result, it is easier to obtain those materials from international organizations that have systems in place to provide materials subject to the ITPGRFA (and because they often have a fairly high diversity of well documented materials, in good health, ready to supply as part of the crop improvement programmes listed above or available upon request). The research teams noted a number of situations where approvals from national organizations for access to materials within and between countries have been subject to long delays, partly as a result of the lack of clear rules for implementation of these agreements.<sup>8</sup>

<sup>8</sup> Nonetheless, some implementation has taken place, with most countries' genebanks having supplied PGRFA on a few occasions under the SMTA in response to requests from international organizations.





Gloria Otieno from Bioversity International evaluating farmers' varieties during a seed fair in Uzumba-Maramba-Pfungwe, Zimbabwe

**xii There is inadequate protection of the interests of farmers as providers of resources and traditional knowledge.**

In all four countries, the authors highlighted the fact that there were inadequate systems in place to promote/protect the rights of farmers as providers of genetic resources and associated information. Collecting missions often take place in contexts where farmers don't know about their country's undertakings and policy commitments concerning access needing to be subject to farmers' prior informed consent (PIC) on mutually agreed terms (MAT). Furthermore, in three of the four countries – Zambia, Zimbabwe and Rwanda – there are still no national laws in place setting out the standards and processes that access-seekers need to follow as part of the national strategy for implementing their policy commitments. (Uganda has a law requiring PIC at the community level.) In all four countries, there is inadequate support for strengthening the capacity of farmers and farmer organizations to be able to exercise PIC-related rights. Several respondents also underscored concerns about the inability of farmers or farmer organizations to monitor uses of materials accessed from farmers to effectively enforce their rights in cases of suspected malfeasance by users. In some cases, farmers have been happy, honoured even, to be asked to provide samples and information about materials they use. In other cases, farmers and community organizations have expressed reluctance.

**xiii The ITPGRFA and Nagoya Protocol are not self-executing agreements. They need to be proactively implemented. And considerable investment in capacity building is necessary for stakeholders – including farmers – to be able to take advantage of them.**

The ITPGRFA and Nagoya Protocol are designed to address some of the issues/challenges flagged above. However, their contributions are not being realized since they are not yet being fully being implemented at national levels.

The ITPGRFA's multilateral system of access and benefit-sharing is meant to provide an even, predictable, safe basis of exchanges of genetic resources between all users at individual, farm, organizational, community, national and international levels. Free facilitated exchange to all the materials – currently 2.3 million accessions – in the multilateral system is meant to be the biggest single benefit associated with the multilateral system. It is also supposed to generate financial benefits (generated by commercial users) to be shared through an international benefit-sharing fund to help developing countries increase their capacity to sustainably use and conserve PGRFA.

However, none of the four countries have put systems in place to fully implement the multilateral system of access and benefit-sharing.<sup>9</sup> In the absence of clear rules about who can provide and request materials, some potential exchanges of materials are not taking place. It is necessary

<sup>9</sup> Uganda appears to have done the most, having recently developed a memorandum of understanding (MoU) between national agencies, clarifying which agency is responsible for implementing the Nagoya Protocol, and which is responsible for implementing the ITPGRFA. This is an important development, given that there is confusion/lack of clarity in many countries about the relative scope of both agreements, and how they should be implemented in mutually supportive ways. Other countries can follow – and some are already following – Uganda in this regard.



*Participatory evaluation exercises with farmers in Chikankata Zambia, August 2015*

for governments to explicitly inform public organizations in the country that they can and should be operating under the ITPGRFA framework, using the SMTA.

It is equally important that national governments send clear signals to all potential users, at all levels, down to farm level, that a) the multilateral system exists; b) it was created for their benefit; and c) they should be taking advantage of it. National governments should be reinforcing that message to providers, so that when they receive requests for access – not only from formal sector organizations, but also from farmers, farmers’ organizations and community organizations, from their own country and from other countries – they feel empowered to respond pro-actively and positively.

It is clear that many potential users will need considerable assistance to be able to take advantage of the multilateral system. This was underscored by this project’s own research and capacity-building activities in the eight communities. It is evidently not enough to inform farmers and community organizations (and many companies) about the existence of the multilateral system, and then expect them to use it. The requisite skills and resources can only be brought together through projects that allow farmers in the communities to work together with experts

in climate science, genebank curation, and plant breeding. National agricultural research organizations, or civil society organizations acting as their agents, need to be empowered to convene such projects and activities, and to provide the necessary support for all stakeholders to be able to use the multilateral system.

Under the Nagoya Protocol, national governments undertake to promote the rights of indigenous peoples and local communities to exercise control over access (by others) to their genetic resources and traditional knowledge. However, the Nagoya Protocol is still relatively new, and most countries – including the four countries in this study – have not yet put policies, laws or administrative systems in place to implement it. Furthermore, as in the case of the ITPGRFA, while putting national and subnational laws and policies in place is a critical first step to implementation, this alone will not be enough for a range of stakeholders in the countries concerned to actually take advantage of the Nagoya Protocol. Considerable additional capacity building and support will be necessary, particularly at the farmer and community level, to raise awareness on rights concerning PIC and MAT, and to support communities in getting organized to collectively exercise those rights.

**xiv Considerable effort will be required to overcome historical division between formal and ‘informal’ seed systems, and to integrate them where useful for climate change adaptation.**

With a few remarkable exceptions, the patterns of germplasm exchange and use, and the partnerships involved in crop variety enhancement and seed multiplication, distribution, and exchange documented in the four papers, generally conformed to the traditionally understood separation/division between formal and ‘informal’ seed systems (Louwaars and de Boef, 2012). The papers also highlighted the inefficiencies and challenges associated with attempting to implement international legal agreements concerning access and benefit-sharing (the ITPGRFA and CBD/Nagoya Protocol), and seed harmonization laws that reflect formal sector innovation models in countries where the ‘informal’ or farmer-managed seed systems are the norm. In many ways, perhaps inadvertently, these international agreements reinforce the distinction between and separation of formal and ‘informal’ seed systems. Our research in the eight communities in the four countries attempted to address this situation, supporting research and development interventions that cut across, and challenged the formal/‘informal’ seed sector and genetic resources/seed divides. It demonstrates the importance of being able to work across these divides in the future, to ensure that all actors in seed systems are able to access and use genetic resources/seed to respond to challenges associated with climate change.

## Next steps

Based on the four country studies and this comparative analysis, the researchers involved in addressing this action learning question recommend the development of pilot programmes and projects to boost the capacity of national and/or African regional organizations to provide technical backup for stakeholders in their countries/region, to:

- Implement the ITPGRFA, Nagoya Protocol and national/regional seed laws in mutually supportive, contiguous ways that reflect the reality and diversity of different seed systems, with the objective of ensuring that all actors involved in formal and 'informal' seed systems – especially farmers – are able to access and use quality reproductive materials (genetic resources/seed) to adapt to climate changes.
- Identify and request materials located locally, nationally, and in collections around the world that are potentially adapted to climate changes in the countries concerned.
- Seek and obtain access to genetic resources/seed under existing laws implementing the ITPGRFA, Nagoya Protocol, and regional seed harmonization agreements, or in the vacuum that may exist if laws are not in place to implement them.

These efforts could be supported or coordinated at sub-regional or regional levels. A regional approach makes sense given the realities of contiguous climates and agro-ecosystems spanning across international borders, and the likelihood that adapted germplasm will be located across borders. Regional-level coordination of such capacity building would also help build the shared sense of purpose and trust necessary for actors to be willing to share materials and associated benefits as part of climate change adaptation strategies. Furthermore, given the scarcity of resources to be able to support 'stand-alone' national programmes, it could be much more effective to coordinate activities at a sub-regional or regional scale.<sup>10</sup> Regional centres of excellence and regional crop evaluation networks have demonstrated how countries can work together sharing germplasm and evaluation data, etc. These include the Sorghum and Millet Improvement Programme (SMIP), DTMA, the Eastern Africa Agricultural Productivity Programme (EAPP), the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), PABRA, and rice and cassava networks.

These initiatives could be built on to regularize systems for regional exchanges. Regional organizations such as the Common Market for Eastern and Southern Africa (COMESA), South African Development Community (SADC), East African Community (EAC), African Union (AU), and African Regional Intellectual Property Organization (ARIPO) could play important convening and supporting roles.



Photo: Gloria Otieno, Bioversity International

*A farmer displaying her seed at a seed fair in Chikankata Zambia, August 2015*

<sup>10</sup> One example of an efficiency that can be achieved at a sub-regional level concerns accessing and using climate and soil data. As stated above, some of the best climate and soil data are privately held, and are costly to get access to. Perhaps a regionally organized programme could negotiate a preferential public-private partnership to get reduced cost or free access to requisite data for the purposes of a regional 'seeds without borders' programme.

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*Farmers harvesting and transporting seed of different varieties of beans tested and evaluated for climate change adaptation in Rubaya Rwanda*

## Annex 1. The climate-related stresses on key crops of each of the sites in Rwanda, Uganda, Zambia and Zimbabwe

Country	Site	Crop	Summary climate challenges (CCs)	Impact of CCs on the specific crop	Temperature (2050s), °C	Precipitation (2050s) mm
Uganda	Hoima	Beans	Shifting growing season, higher temperature, erratic rainfall	Loss of diversity, increased incidences of pests and diseases, low productivity	+1.5	Increase
	Mbarara	Beans	Shifting growing season, shortening of the rainy season, higher precipitation and prolonged dry spells	Increased incidences of pests and diseases and loss of diversity	+1	Increase
Rwanda	Bugesera	Beans	Lower precipitation, higher temperatures and shifting seasons	Loss of diversity, increased incidences of pests and diseases, low yields	+2	Decrease
	Rubaya	Beans	Unpredicted weather patterns, higher temperatures	Increased incidences of diseases and pests, specifically birds. Loss of diversity and lower productivity and food security	+1.5	Increase
Zambia	Rufunsa	Sorghum	Erratic rainfall, shorter growing season, higher temperatures	Lower productivity, increased fungal diseases, loss of diversity	+2	increase
	Chikankata	Maize	Shorter growing season, erratic rainfall and higher temperature	Loss of diversity, low yields and fungal diseases	+2	increase
Zimbabwe	Tsholotsho	Sorghum	Shifting seasons, erratic rainfall, higher temperatures	Increased incidences of pests, i.e aphids, fungal diseases and lower yields	+1.5	increase
	Uzumba-Maramba-Pfungwe (UMP)	Millet	Erratic rainfall, higher temperatures and shifting seasons	Low yields and increased incidences of pests and diseases	+2	increase

## Annex 2. Numbers of accessions in:

- a national genebanks, and
- b genebanks in other countries and international organizations, which are potentially adapted to
  - i) current and ii) predicted future (2050) climatic conditions in reference sites in Rwanda, Uganda, Zambia and Zimbabwe

Reference site, country	Crop	Total accessions of crops in national genebank	Number of potentially adapted accessions from national genebanks for present climatic conditions	Number of potentially adapted accessions from national genebanks for 2050's conditions	Number of accessions of crops in foreign genebanks (included in Genesys)	Number of potentially adapted accessions in foreign genebanks for present climatic conditions	Number of countries from which the materials for present conditions were collected (or were improved)	Number of potentially adapted accessions in foreign genebanks (under Genesys) for 2050's conditions	Number of countries from which the materials for 2050's conditions were collected (or were improved)	Number of local varieties identified by farmers
UMP, Zimbabwe	Finger millet	90	29	6	2279	537	8	331	7	7
Tsholotsho, Zimbabwe	Sorghum	178	11	20	23,941	514	9	242	9	7
Bugesera, Rwanda	Beans	109	21	15	64	10	5	10	3	8
Rubaya, Rwanda	Beans	109	28	16	64	13	5	16	4	11
Chikankata, Zambia	Maize	300	48	11	2800	125	5	87	8	6
Rufunsa, Zambia	Sorghum	176	25	21	23,941	300	8	195	5	-
Hoima, Uganda	Beans	-	-	-	64	9	2	29	6	14
Mbarara, Uganda	Beans	-	-	-	64	11	5	7		23

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### *\*In memoriam*

*We dedicate this report to our co-author Jean Gapusi, who sadly passed away in September 2016. Over the course of his career, Jean took on many roles in the area of agricultural biodiversity, including project officer for the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), senior research fellow at the Tree Seed Centre, curator of the Rwanda National Gene Bank, head of station for the Rwanda Agriculture Board; and researcher at the Institute of Science and Technological Research. He was the Rwanda national focal point for the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and for access and benefit-sharing issues under the Convention on Biological Diversity (CBD). We are greatly indebted to Jean Gapusi for his important work on plant genetic resources management and conservation, and his invaluable contributions to this study. May he rest in peace.*

ISSD Africa is a community of practice that unites African seed experts, seed programmes and associated organizations, and which aims to increase farmers' access to quality seed through the development of a market-oriented, pluralistic and vibrant seed sector in Africa.

The ISSD approach is a farmer-focused and demand-driven seed sector development approach, which caters for the diversity of seed demands. Through this approach interventions are designed that are tailored to specific crops, value

chains and seed systems. It is a seed sector-wide and inclusive approach.

ISSD Africa is coordinated by a consortium of Wageningen Centre of Development Innovation (CDI) of Wageningen University & Research, the Royal Tropical Institute (KIT), the Future Agricultures Consortium and Tegemeo Institute of Agricultural Policy and Development in Nairobi Kenya.

For more information on our ISSD portfolio please visit our website [www.ISSDseed.org](http://www.ISSDseed.org).

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