5 Technical issues

Pitambar Shrestha, Bhuwon Sthapit and Ronnie Vernooy

The recent popularity of community seed banks raises the question of whether they are able to address the technical issues inherent in their operations, considering the specific local contexts in which they are located. Community seed banks that are set up without a proper understanding of the complexities of seed management may have a short lifespan. In this chapter, we discuss the minimum set of technical criteria and the issues that must be addressed by those who wish to operate community seed banks. To some degree, the technical issues depend on the type of seed bank (see Chapter 3 for our classification framework), but many are relevant to all seed banks. Technical issues emerge throughout the cycle of seed management, from the early stage of selecting which crop species and varieties to keep (and that selection may change over time) to the documentation of the collection and its use. A number of guides offer useful knowledge and practices (e.g. Fanton and Fanton, 1993; Saad and Rao, 2001; Fanton et al., 2003; Seeds of Diversity, 2014), but we have found that few seed banks are aware of or make good use of these resources.

The basic requirements for seed management are: the seed should be physically and genetically pure; it should be free from diseases and pests; it should germinate and establish quickly; and it should be accompanied by useful information and knowledge. The case studies in this book describe a wide variety of ways in which community seed banks deal with technical issues. The technology used ranges from simple to complex. Some rely on local knowledge and expertise, while others involve expertise from outside the community (e.g. agronomists, plant breeders, gene bank managers, organizational experts). Costs vary considerably, and planning ranges from ad hoc to detailed. All together, the cases clearly indicate that technical issues remain a major challenge and that capacity development and stronger technical support could make these operations more robust, both in the short and long term.

Choosing crop species and varieties

The selection of crop species for conservation and management by a community seed bank is usually a matter of discussion among the farmers in charge, in a number of cases informed by interaction with outsiders, such as nongovernmental organizations (NGOs) or government research or extension staff. Most of the community seed banks in the case studies have focussed on local varieties of crop species that are of global significance and local importance and of which there is mainly traditional seed available locally (e.g. Bangladesh, India and Nepal). Some specialize in a few crops native to the area, such as maize and beans in Guatemala; maize, beans, squash and chili in Mexico and southwestern United States; potatoes in Bolivia; and sorghum, pearl millet and cowpeas in Zimbabwe. In other words, community seed banks tend to choose crop species that are locally important.

Some community seed banks have given priority to reviving traditional crops associated with local culture. For example, buckwheat in Bhutan used to be the staple crop, but because of government intervention, its diverse varieties were completely replaced by potato in the late 1970s (Chapter 10). Another example is the recovery of 'lost' crop varieties in Ethiopia, where, after repeated severe droughts and the complete failure of improved varieties of wheat, local wheat varieties that were still maintained by the national gene bank were restored to use (Chapter 37; Development Fund, 2011). In recent years, community seed banks have also given priority to the identification, multiplication and distribution of varieties that are tolerant to local stresses, such as heat, drought and flooding, and that are better adapted to poor soil conditions (for example, Chapters 9, 21, 27, 29 and 31). Community seed banks in Mexico have been rescuing wild species of maize and beans – other important crops.

An important factor related to choosing crop species and varieties is whether a community seed bank should limit its work to local varieties or include improved varieties. One can easily argue for or against these options, but what matters most is whether communities have made an informed decision. The community seed banks in Bangladesh (Chapter 9), Mexico (Chapter 23) and the United States (Chapter 31) have focussed primarily on conservation and promotion of local varieties, based on a situational analysis in which diversity loss is central. But a number of successful community seed banks also deal with both local and improved varieties, e.g. Costa Rica (Chapter 16), Nepal (Chapter 34), Trinidad (Chapter 29) and Zimbabwe (Chapter 38). The idea behind dealing with both local and improved varieties is to provide access to diverse seeds that farmers need at their doorsteps, at a reasonable cost and on time, as well as to generate some revenues to support conservation of local varieties and institutional sustainability through the sale of improved varieties. The broadening of functions thus leads to the broadening of the base of crops or varieties, which has direct consequences for all other technical issues.

Collecting seeds and planting material

The number of local varieties collected and conserved in each community seed bank varies, depending on many factors: the number of crop species grown locally and their availability; human and technical capacity, resources and strategies chosen to identify and collect in the community and surrounding areas; the level of awareness of the value of local genetic resources and their role in conservation; the energy to promote community seed banking efforts; and the nature of the enabling environment.

Several tools are at hand to help decide about selection. Participatory four-cell analysis facilitated by Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and Bioversity International in Nepal helps communities understand on-farm diversity and whether varieties are localized or widespread, common, endangered, rare or lost. Organizers in Nepal held a diversity fair (Adhikari et al., 2012) to help locate rare materials and complete an inventory of available seeds and associated information in a community biodiversity register (Subedi et al., 2012) before establishing a community seed bank. On the one hand, this type of activity helps create awareness among a large number of people about the value of biodiversity and, on the other hand, helps identify custodians of rare, unique and valuable genetic resources. Thus, a broad resource base is created for collecting seeds and planting materials for a community seed bank. Other community seed banks form a committee of two or three members to locate interesting materials and areas of diversity and collect seeds on behalf of the seed bank. Community seed bank members usually also collect seeds via social networks of neighbours, friends, relatives and extension agents.

A critical factor to be considered while collecting seeds is how samples are taken and how to select disease-free material. No field guide is available to help with this process, but the best techniques include sampling from different parts of a field (not just one corner), collecting from a number of plants or panicles and avoiding those next to the road. Attention should also be paid to choosing disease-free plants, panicles or fruit. This should be done in the field to the extent possible, although material can be examined later.

The case studies reviewed seldom describe the scientifically based management practices of community seed banks, including information management, internal quarantine (to safeguard against seed-borne disease) and monitoring of seed germination, viability and vigour.

Documenting, sharing and communicating information

Community seed banks are not only repositories of large numbers of seeds and planting materials, but also places where traditional knowledge and associated information about local varieties can be found. This type of knowledge is usually documented with support from external agencies using a standard form. In general, such documentation includes the local name of the genetic resource, its specific use and value, current status, general characteristics, method of cultivation, related agro-ecology, the extent and distribution of its cultivation, its capacity to tolerate biotic and abiotic stresses in the field, perceived nutritional value and cultural and religious uses (if any).

To a large extent, such documentation depends on the practices and guidance provided by the facilitating organization. For example, in Nepal, community biodiversity registers and passport data have been maintained as basic documents since the establishment of the community seed banks. This information is further used for planning conservation and development activities that are part of a 'community biodiversity management plan'.

To promote ex-situ and in-situ linkages, LI-BIRD has adopted the standard format of passport data for the national gene bank so that transfer of information is error free (Chapter 34). Similarly, passport data, morphological characteristics and seed stock records are kept in Mexico (Chapter 23). The Spanish seed network has been recovering traditional and farmers' knowledge about local varieties and management practices by interviewing farmers (Chapter 36). The point is that every community seed bank should have, in some form, a sound mechanism for documenting basic data, associated information and farmers' knowledge, including farmers' descriptors related to the genetic resources they are conserving and promoting. Not all seed banks reviewed in this book have followed this good practice, however.

Sharing information and experiences among members, non-members and other stakeholders is another important role of community seed banks. Each community seed bank has its own way of doing things, using a variety of processes. In several of the case studies, banks make use of seed fairs and biodiversity fairs: for example, Costa Rica (Chapter 16), Mexico (Chapter 23), Nicaragua (Chapter 26) and Zimbabwe (Chapter 38). Such fairs provide an open and dynamic forum for farmers to learn and share knowledge and experiences. Seed fairs are also a simple way to assess the status of local crop diversity and monitor and collect rare and threatened genetic resources or collect information from custodians to plan future collection. They also allow farmers to convey the value of genetic resources through dancing, singing, poetry and other cultural activities.

In Nepal, some community seed banks organize seasonal participatory seed exchange programmes to share seed and associated knowledge (Shrestha et al., 2013). Community seed banks in Mexico organize seed fairs at local, state and national levels each year. The Mexican network of community seed banks envisions creating an electronic communication network as part of the national conservation strategy (Chapter 42). Field days, demonstrations, sharing at church events, community meetings, training events and community social reunions are some of the other tools used in several cases. Web-based information sharing and use of social media are also becoming common these days, mostly in developed countries, e.g. the Toronto case study (Chapter 14).

Storing seeds: structures and methods

To keep seeds clean, healthy and viable, proper storage equipment and methods are critical. The case studies offer a wide variety of seed-storage structures, depending on the goal, objectives and core values of the facilitating organizations as well as the availability of resources. Some are temporary while others are permanent. Many donor-funded initiatives have invested in large-scale infrastructure that the community may not be able to handle, rather than building the social capital needed to sustain the facilities. Support for physical capital only *after* social and human capital have been built tends to result in an organization that is more self-sustaining. Some seed banks use mostly local materials, while others use 'imported' materials. Some are simple and small; others have multiple rooms or a second floor. Except in a few cases, however, most community seed banks do not have a mechanism for controlling temperature and humidity, which is key to maintaining genetic material over a long period.

Depending on the crop species, community seed banks usually follow traditional methods for storing seeds and planting material, not only to make management simple, but also because farmers are well acquainted with the traditional system and, thus, there are fewer chances of making mistakes in construction. They use mud, bamboo, straw, dried bottle gourds, etc. to make structures and equipment. They use the sun to dry seeds and cool them before storage in mud-sealed containers. In Bangladesh, the community seed bank consists of a storage area and a meeting room constructed using locally available materials; seeds are stored in traditional containers, such as earthen pots (Chapter 9). In most cases, community seed banks consist of just one room for everything, but some (in Zimbabwe and Nepal, for example) have separate rooms for local germplasm and bulk seed storage as well as office and meeting space.

To keep stored seeds healthy and viable, community seed banks are gradually replacing traditional storage structures with modern equipment, such as airtight, transparent plastic or glass jars, metal bins and even SuperGrain bags (multilayer plastic bags that provide a gas and moisture barrier). These practices are becoming common in China, Guatemala, Mexico and Nepal. In Nepal, zeolites (aluminosilicate-based absorbents) have been introduced to control moisture levels. In the exceptional case of Native Seeds/SEARCH in the United States, seed banks have sophisticated storage facilities, such as cold rooms and freezers for short-term storage of their core collections.

Regenerating seeds: bulk seed production and quality assurance

In general, community seed banks hold a large number of local crop species and varieties and few commercial varieties. For the commercial varieties, it is easy to determine the amount to be produced each year based on demand at the local and regional levels. Community seed banks that collaborate with seed companies are producing and selling tonnes of seeds (e.g. in Zimbabwe and Costa Rica). To be able to produce large quantities of seeds, community seed banks require land, water, human resources, transport facilities and large processing and storage facilities. Moving to commercial seed production in such volumes could easily affect the conservation of local crop diversity and change the direction of the seed bank. This is something we have seen in the field, but it is not readily acknowledged by those operating seed banks.

Almost all community seed banks regenerate the seeds they conserve annually, although that practice is not universal. Some seed banks also produce and market local varieties of seed on a large scale. The area to be planted and the quantity of seed to be produced each year largely depend on local demand, but also on the ability and availability of resources within the seed banks. There are no technical guidelines available yet to provide a basis for determining the area needed to produce specific quantities of seed for each variety. The case studies show few commonalities.

In Nepal, the Bara seed bank, located in the central terai area, transplants more than 80 rice landraces in plots of $9m^2$ that each produce about 5kg of seed, on average, every year. The small scale allows farmers to keep management costs low and operations under control. This practice also has great advantages in terms of evolutionary selection based on climate variation.

To ensure good-quality seed (free from disease, insects, weeds and inert materials and isolated from other varieties), community seed banks employ various measures. Some establish a small technical committee for this purpose (e.g. Bangladesh, Costa Rica and Uganda), while, in other cases, the bank's executive committee is responsible for seed quality in the field and in storage (e.g. Nepal). In Nepal, a local person is hired by the community to be in charge of materials and quality assurance in the seed bank. In Bangladesh, community seed banks supported by UBINIG have a Specialized Women's Seed Network responsible for day-to-day management and the annual regeneration of seeds.

On-farm characterization and assessment

Around the world, community seed banks are conserving and promoting thousands of globally significant crop genetic resources native to their areas and adapted to local climatic conditions. Many have documented information and traditional knowledge associated with those genetic resources in various forms and claim that they have conserved local varieties with invaluable traits, such as tolerance to drought, flooding, diseases and insects; good eating qualities; market-preferred traits; long fruiting period; religious and cultural importance, etc. Such documentation may provide the basis for further development of valuable traits through breeding and promotional activities.

However, very few community seed banks have characterized their accessions in detail using standard descriptors or published a diversity catalogue. They may need to collaborate closely with research organizations to carry out this type of work. Apart from traditional knowledge, the nutritional and medicinal properties of local varieties conserved in community seed banks are largely lacking.

Knowledge gaps

Among the case studies, some community seed banks are highly competent and functioning well in terms of collection, documentation, regeneration, storage, distribution and marketing of seeds of diverse local and improved varieties. To a large extent, seed banks are able to build the capacity of their members through training and other activities. Training sessions in quality seed selection and production, management, protecting seeds from insects and pests and enhancing conservation of local varieties are commonly held at most of the seed banks we reviewed. The communities tend to understand the value of conservation when farmers are directly involved in participatory plant breeding and develop their own varieties by crossing a local strain with a modern one. In Bara, Nepal, within a span of seven years, the community seed bank was able to develop a new rice variety (Kachorwa 4), begin seed multiplication and sell high-quality seed to other farming communities, thus earning income to support the seed bank and conservation of local varieties (Sthapit, 2013). In the process, the farming community not only realized the importance of maintaining landraces, but also gained knowledge in plant breeding, seed selection and marketing. This further motivated the community to mobilize social capital for collective action on community-based management of local crop diversity.

Monthly meetings are treated as a permanent forum where information is shared and issues are discussed. Exposure visits, within and between countries, are another way to empower farmers and bridge knowledge gaps. In Uganda, farmers are taught the life cycle of the weevil so that they can find ways to prevent the damage it can cause by timely harvesting and proper drying of bean seeds. Similarly, in Mali, the knowledge and skills of community seed bank members are enhanced in a field school, a place where local seeds are multiplied. Likewise, in Bangladesh, UBINIG organizes campaigns, advocacy work and training in the negative effects of conventional agriculture.

However, community seed banks in most of the case study countries have to think about how to bridge knowledge gaps in such areas as applying scientific methods to the collection, storage and regeneration of seeds; documenting information and traditional knowledge; and introducing the latest technologies and innovations into community seed bank management.

References

Adhikari A., Upadhyay, M. P., Joshi, B. K., Rijal, D., Chaudhary, P., Paudel, I., Baral, K., Pageni, P., Subedi, S. and Sthapit, B. (2012) 'Multiple approach to community sensitization,' in B. Sthapit, P. Shrestha and M. Upadhyay (eds) *On-farm Management of Agricultural Biodiversity in Nepal: Good Practices* (revised ed), Local Initiatives for Biodiversity Research and Development, Pokhara, Nepal, pp21–24, www.bioversityinternational.org/uploads/tx_news/On_farm_management_of_agricultural_biodivesity_in_Nepal_Good_Practices_revised_edition_2012_1222_.pdf, accessed 24 July 2014

Development Fund (2011) *Banking for the Future: Savings, Security and Seeds. A Short Study of Community Seed Banks in Bangladesh, Costa Rica, Ethiopia, Honduras, India, Nepal, Thailand, Zambia and Zimbabwe*, The Development Fund, Oslo, Norway

Fanton, M. and Fanton, J. (1993) *The Seed Savers' Handbook*, The Seed Savers' Network, Byron Bay, Australia

Fanton, J., Fanton, M. and Glastonbury, A. (2003) *Local Seed Network Manual*, The Seed Savers' Network, Byron Bay, Australia

Saad, M. S. and Rao, V. R. (eds) (2001) *Establishment and Management of Field Genebank. A Training Manual. IPGRI-APO, Serdang*, International Plant Genetic Resources Institute, Office for Asia, the Pacific and Oceania, Serdang, Malaysia, www.bioversityinternational.org/uploads/tx_news/Establishment_and_management_of_field_genebank_786.pdf, accessed 24 July 2014

Seeds of Diversity (2014) *Micro-seedbanking: A Primer on Setting Up and Running a Community Seed Bank*, Seeds of Diversity, Toronto, Canada, www.seeds.ca/int/doc/docpub.php?k=2f6ffc26420e3ea79473956419b097c700001004, accessed 24 July 2014

Shrestha P., Sthapit, S. and Paudel, I. (2013) 'Participatory seed exchange for enhancing access to seeds of local varieties' [in Nepali], Local Initiatives for Biodiversity, Research and Development, Pokhara, Nepal, www.libird.org/app/publication/view.aspx?record_id=109&origin=results&QS=QS&f1_4417=Pitambar+Shrestha&f1_4501=5&f1_4554=2013&union=AND&top_parent=221, accessed 24 July 2014

Sthapit, B. R. (2013) 'Emerging theory and practice: community seedbanks, seed system resilience and food security,' in P. Shrestha, R. Vernooy and P. Chaudhary (eds) *Community Seedbanks in Nepal: Past, Present, Future. Proceedings of a National Workshop, 14–15 June 2012, Pokhara, Nepal*, Local Initiatives for Biodiversity, Research and Development, Pokhara, Nepal, and Bioversity International, Rome, Italy, pp16–40

Subedi, A., Sthapit, B., Rijal, D., Gauchan, D., Upadhyay, M. P. and Shrestha, P. (2012) 'Community biodiversity register: consolidating community roles in management of agricultural biodiversity,' in B. Sthapit, P. Shrestha and M. Upadhyay (eds) *On-farm Management of Agricultural Biodiversity in Nepal: Good Practices* (revised ed), Local Initiatives for Biodiversity, Research and Development, Pokhara, Nepal, pp37–40, www.bioversityinternational.org/uploads/tx_news/On_farm_management_of_agricultural_biodivesity_in_Nepal_Good_Practices_revised_edition_2012_1222_.pdf, accessed 24 July 2014