On-farm management of agricultural biodiversity in Nepal

Good Practices

Bhuwon Sthapit, Pratap Shrestha and Madhusudan Upadhyay, Editors

Revised Edition 2012

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Citation:
Sthapit B.R., P. Shrestha and M.P. Upadhyay (eds) 2006. On-farm Management of Agricultural Biodiversity in Nepal: Good Practices. NARC/LI-BIRD/Bioversity International, Nepal.

On-farm management of agricultural biodiversity in Nepal
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Revised and Redesigned Version

Published by LI-BIRD

First Edition 2006
Revised Edition 2012

Production Team:
Coordination Pitambar Shrestha and Rachana Devkota/LI-BIRD
Language Editing Claire Willey
Type Pratima Rana/LI-BIRD
Design and Layout Mahesh Shrestha/LI-BIRD

UTVIKLINGSFONDET

Financial assistance for this revised edition:
The Development Fund, Norway

ISBN: 978-9937-8145-3-9

Cover Photo: Sijal Sthapit/LI-BIRD

Contents

Strengthening the Scientific Basis of *In-situ* Conservation of Agricultural Biodiversity:

Nepal is one among the selected nine countries, to be involved in the International Plant Genetic Resource Institute (IPGRI)'S Global Project, "Strengthening the scientific Basis of *In-situ* Conservation of Agricultural Biodiversity On-farm". The first phase of the project (September 1997 to December 2001) was funded by the Netherlands Development Agency (NEDA). The project was conducted at three physiographic region of Nepal: Jumla, Kaski and Bara districts.

The project had following three objectives:

- To support the development of a framework of knowledge on farmer's decision making process that influences *in-situ* conservation of agricultural biodiversity.
- To strengthen national institutions for the planning and implementation of conservation programmes for agricultural biodiversity, and
- To broaden the use of agricultural biodiversity and the participation in its conservation by farming communities and other groups.

This project was jointly implemented by Nepal Agricultural Research Council (NARC) and Local Initiatives for Biodiversity, Research and Development (LI-BIRD) in three sites of Nepal and the target crops included were rice, barley, buckwheat, finger millet, sponge gourds, cucumber, taro and pigeon pea.

A supplementary research activities funded by IDRC (August 2002 - Jan 2006) was conducted at two different agro-ecological regions of Nepal viz. Kachorwa in Bara district representing terai flat land with good access and high intervention; and Begnas in Kaski district representing mid-hills with good access and intermediate level of intervention with new target crops like broad leaf mustard, citrus and mango.

The purpose of the project was to strengthen the scientific basis, institutional linkages and policies that can support farmers in conservation and use of crop genetic diversity so that plant genetic resources are sustainable and equitably managed in agroecosystems.

The following are the outputs of this project:

- Output 1: *In-situ* conservation methods and models (examples) within and among different crops in Nepal (Objective 1)
- Output 2: Principles, options and approaches to integrate agrobiodiversity in agricultural development are made available to concerned stakeholders (Objective 2)
- Output 3: To develop indicators for monitoring impact of *in-situ* conservation activities on crop diversity and human livelihoods (Objective 3)

Why Agricultural Biodiversity Matters?

Photo: Mahesh Shrestha/LI-BIRD

How humans use diversity in farming determines our food, our health, and our economic well-being and that in turn determines our political security. Whether they are used in traditional farming systems, conventional or modern breeding, or genetic engineering, the genetic resources of plants and animals are global assets of inestimable value to humankind. As genetic diversity erodes, our capacity to maintain and enhance crop, forest and livestock productivity decreases along with the ability to respond to changing conditions. Genetic resources hold the key to increasing food security and improving human well-being.

Introduction

Agricultural biodiversity in farming systems delivers food and nutrition, fibre, fuel, and services that contribute to people's livelihoods. Apart from health and well-being it also helps to conserve habitats. It is the fruit of thousands of years of observations, selection, exchange and breeding. The value of biodiversity is apparent in agriculture at all levels, both for meeting short-term needs and achieving long-term sustainability. Agricultural biodiversity is measured in terms of ecosystems, species, and genetic diversity.

The importance of agricultural biodiversity is increasingly recognized due in part to many relatively recent international agreements such as the Convention of Biological Diversity (CBD) and the work of the FAO Commission on Genetic Resources for Food and Agriculture that have increasingly highlighted the issues over the last decade. Genetic resources for food and agriculture are the biological basis of world food security and directly or indirectly support the livelihoods of over 2.5 billion people (FAO, 1998). Within the agricultural sciences, a common justification for preserving biodiversity is the need to be prepared for a potential outbreak of disease and pests, and their use as raw materials for breeding improved varieties.

Why is biodiversity important?

Genetic diversity in agriculture enables crops and animals to adapt to different environments and growing conditions. The ability of a particular variety to withstand drought or inundation, grow in poor or rich soil, resist insect pests or diseases, give higher protein yields or produce a better-tasting food are traits passed on naturally by its genes. This genetic material constitutes the raw material that plant and animal breeders and biotechnologists use to produce new varieties and breeds. Without this diversity we would lose the ability to adapt to ever-changing needs and conditions. Sustainable agriculture would not be achieved in many parts of the world with different food production environments.

Diversity among individual plants and animals, species and ecosystems provides the raw material that enables human communities to adapt to change — now and in the future. Deprived of biodiversity, the ability of humankind to meet the challenges resulting, for example, from global warming and ozone depletion would be severely limited. The diversity found within the small number of plant and animal species which form the basis of world agriculture and food production, remains a small but vital part of the earth's biodiversity. Through modern biotechnologies wild diversity can also be incorporated into crops and contribute to world agricultural development.

The genetic diversity contained in traditional farmers' crop varieties and animal breeds are also the raw materials for the production of modern cultivars and commercial breeds-either through animal or plant breeding or through biotechnology. Furthermore, modern biotechnology has increased the value of biodiversity both within crop species and among their wild relatives as genes can now be moved from related or completely unrelated species into new crop varieties. Genetic diversity gives a species or a population the ability to adapt to changing environments. For resource-poor farmers, adaptive animal breeds, crop varieties and cultivars adapted to particular micro-niches, stresses, or uses are the main resources available to maintain or increase production and provide a secure livelihood.

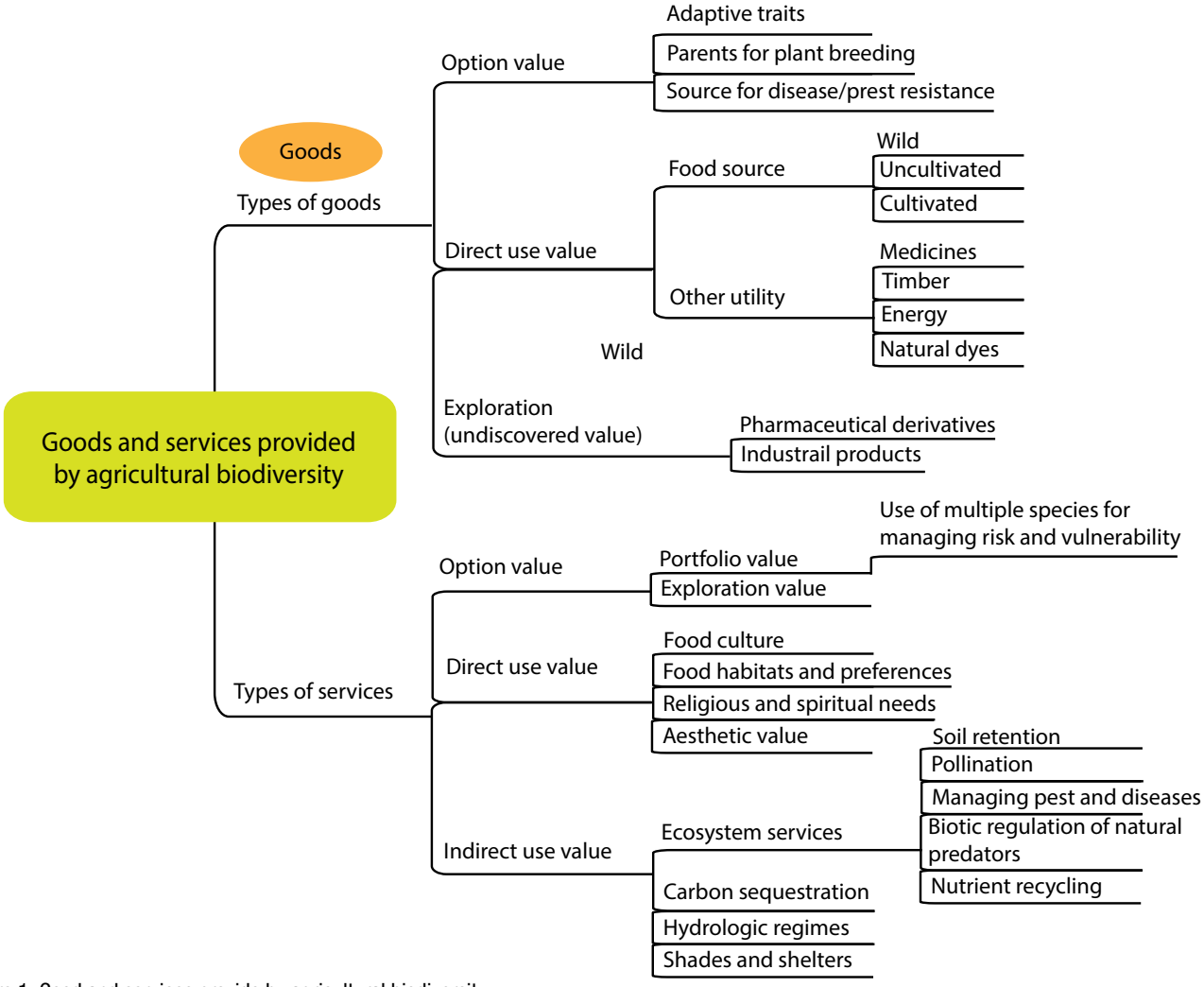


Figure 1. Good and services provide by agricultural biodiversity

Value of crop biodiversity

Farming communities view the landscape as a source of natural resources for their sustainable livelihoods. Such landscapes in areas of high agricultural biodiversity typically include common lands, protected areas, forests, watersheds, larger crop fields, water bodies, home gardens and patches where uncultivated foods are found. In a given ecosystem, biological diversity directly reflects the cultural diversity of the region as it provides both goods and services to the specific culture and people. It is important to understand how communities perceive the value of biodiversity at agro-ecosystem, species and genetic levels and how their interaction affects the livelihoods and quality of people's lives.

The economic value of genetic diversity for productivity and yield traits is often discussed in the literature, however, it is difficult to value many other aspects of agricultural biodiversity as these have both direct and indirect values in terms of qualitative traits as food, nutrition and environmental uses, that include adaptation to low input conditions, co-adaptive complexes, yield stability and the consequent reduction of risk, specific niche adaptation, and in meeting religious and socio-cultural needs. In general terms, as illustrated in Figure 1, agricultural biodiversity provides many goods and services of environmental, economic, social and of cultural importance; these environmental goods and services also contribute to sustainable livelihoods in a number of ways.

In the context of agricultural biodiversity, Brush (2000) distinguished three different types of value of crop varieties: direct, indirect, and option value. Direct or use value is the simplest and most obvious one that refers to harvest and uses of crop varieties. Indirect value refers to environmental services or ecological health to which crop varieties contribute, though farmers may not observe or notice the relationship. Option value refers to the future use of crop varieties. From the farmers' perspective, the latter two values of crop varieties are secondary, whereas for conservationists the option value is of paramount importance. Together, the direct and indirect values of genetic resources for resource-poor farmers are expressed in the range of options in the form of crop varieties and species they use for managing changing environments. The immense genetic diversity of traditional farming systems is the product of human innovation and experimentation-both historic indigenous knowledge and on-going change in biodiversity.

Photo: Pitambar Shrestha/LI-BIRD

Dietary diversity

Home gardens and uncultivated food from wild areas or forests are equally important for households in supplementing family nutrition and meeting other household health and cultural needs.

In many societies uncultivated food, or food collected from the wild, finds its way into people's diets and contributes significantly to the overall food security and micronutrients intake (preventing 'hidden hunger'). In South Asia, uncultivated food items such as leafy greens, fish and tubers-collected from ponds, farmers' fields, roadsides and common lands comprise a large proportion of the daily diet of the rural poor. At least 40 percent of the food consumed by the poor comes from uncultivated sources in Bangladesh. In Nepal, the harvest from forests or the wild is a major source of medicine, food and nutrition for ethnic communities like Chepang, Rai, Sherpa and Gurung. The Rai and Sherpa communities use 47 wild species for household consumption, 38 for fodder, 19 for medicine, 5 for religious and ceremonial purposes, 11 to make household implements, and 11 for trade as raw and processed materials.

The second scenario of home gardens reflects the greater appreciation of the multiple goods and services provided by biodiversity in agricultural ecosystems. In larger ecosystems, multiple farmer concerns (e.g. yield stability, risk, and quality), environmental heterogeneity, and the absence of markets contribute to the persistence or prevalence of landraces. Social, cultural and religious uses are also important value systems for promoting conservation besides economic valuation. Home gardens are typically cultivated with a mixture of annual and perennial plants that can be harvested on a daily or seasonal basis with a wide range of plants. These gardens are microenvironments within larger farming systems containing high levels of species and genetic diversity. A single home garden has ranges of 56-602 species in West Java, Indonesia, 23-54 species in Vietnam, and 123-131 species in Western Nepal. These gardens have not only been important sources of food, fodder, fuel, medicines, spices, construction materials and income but have also been an important means for on-farm management of a wide range of plant genetic resources. Farmers reduce risk by planting different crops as well as planting different varieties to spread harvesting time and rear small livestock around homesteads. Home gardens, with their intensive and multiple uses, provide an insurance against risk and uncertainty for these households. Home gardens are often used to maximize the range of species in order to augment culinary value and food culture of a specific community and ethnicity.

Distribution of crop diversity

We found that there is a common pattern of how farmers value genetic diversity. In Begnas village of Nepal, some subsistence farming HHs grows as many as 22 different kinds of rice varieties. On an average they grow 3-4 local varieties and 1-2 modern cultivars at the HH level. In a community, as many as 69 rice varieties were found. Distribution of crop diversity is a proxy indicator of how farmers valued their crop diversity. Crop or varieties grown for food security or for the market tend to be cultivated in large areas by many households whereas crop or varieties with specific use values to particular families are grown in small areas by few households. Crop or landraces cultivated for socio-cultural (traditions, religious rituals) purposes are grown in small areas by many households whereas crop varieties with specific abiotic co-adaptive traits (such as being adapted to swamp soils, poor soils, drought) are grown in large areas by few households. This common pattern is consistent with economic rationales and there are some variations guided by specific household circumstances as well. The value of diversity for each household is reflected by the proportion of population size of variety allocated from the total cultivated area of the crop.

Photo: Bhuwon Sthapit/Bioversity

Benefits of genetic diversity

Modern agriculture made up of major crops and livestocks depends upon a precariously narrow genetic base. Future food security is threatened by genetic erosion of diversity within and between populations of the same species over time. Genetic diversity within a crop species or animal breed is a crucial asset available to resource-poor farmers for managing vulnerability, uncertainty, shocks, and stresses. Therefore, access to and control over such resources are critical policy issues. Although genetic diversity is needed to provide the raw materials with which farmers and plant breeders produce new varieties for changing contexts, such diversity within animal and plant crops is essential to maximize yields and use options. Breeders tend to rely increasingly on a narrow set of improved varieties or breeds, making them more vulnerable to outbreak of disease and pests (e.g. blight in potatoes or bird-flu in poultry) due to lack of a broad genetic diversity base. For example, Jumli marshi rice is very tolerant to chilling temperatures and adapted to the highest elevation (3000 m asl). The population is very susceptible to leaf and neck blast because of a narrow genetic base as all landraces of Jumla originated from a single origin. In the past, plant breeders were able to depend on farmers to retain sufficient genetic diversity to provide the new genetic materials they need. Constant promotion of homogenous agriculture threatens that source of genetic diversity, and thus threatens both local and global food security. On-farm Project in Nepal improved the quality of the rice variety called *Jetho Budho* landrace by working with farmers to select the six best strains from samples collected by more than 350 households. They outperform local varieties in terms of disease/lodging resistance, aroma, and quality traits and milling recovery. The people who have submitted these six were asked to produce seed to share with other communities and the National Seed Board officially released the improved JB. In the same project, the rice landrace *Mansara*—of poor eating quality but a hardy and reliable performer on marginal lands—was crossed with the modern cultivars best suited to Nepalese farming conditions. Farmers have selected three superior populations from Mansara, which have better cooking quality and productivity under marginal conditions. This was the first PPB case in which a variety specifically adapted by poor farmers has been improved to provide better options. With the improved opportunity to access such genetic resources and knowledge, farmers can improve their ability to meet food, nutrition and livelihood needs by growing an assortment of crop varieties.

Further reading

IPGRI 2004. Why genetic diversity matters. The synthesis of the symposium co-sponsored by the Division of PGR of the Crop Science Society of America. IPGRI, Rome Italy.

Sthapit BR, Rana RB, Eyzaguirre P and Jarvis, D. 2006. The value of plant genetic diversity to resource-poor farmers. Plant Genetic Resources Newsletter (in press)

IDRC. Why diversity matters. Seeds that give participatory Plant Breeding briefs. www.idrc.ca/seeds

(Contributed by Bhuwon Sthapit from the above mentioned articles)

On-farm Conservation of Local Crop Diversity

Photo: Bhuwon Sthapit/Bioversity

Plant genetic resources (PGR) are some of the few biological assets available to resource-poor farmers to improve their livelihood options and to ensure sustainable production. Hence, they can be considered to be the most valued resources. The rapid loss of genetic diversity (genetic erosion), particularly among crop landraces, is a worldwide concern. On-farm (in-situ) conservation of landraces refers to a process whereby plants or their wild relatives are conserved in the very place where they developed their present-day characteristics.

What is *in-situ* conservation?

Genetic resources are conserved through two approaches: *in-situ* (on-farm - in its place of origin) or *ex-situ*, (off-site, outside its place of origin) as in botanical gardens, field genebanks and seed genebanks. On-farm (*in-situ*) conservation of landraces refers to a process whereby plants and their wild relatives are conserved in the very place where they developed their present day characteristics. It includes the conservation of entire agro-ecosystems, including cultivated crops as well as their wild and weedy relatives that may be growing in nearby areas.

On-farm conservation is generally used to describe a management process by which farmers maintain the traditional crop varieties that they develop in their local conditions and continue to manage and improve. Thus, the conservation of specific genotypes is secondary to the continuation of the processes that allow the material to evolve and change over the time.

What factors shape crop genetic diversity?

Environmental, biological, cultural, socio-economic and policy factors influence a farmer's decision to select, replace or maintain a particular crop cultivar at any given time. Additionally, farmers' search for locally adapted crops or cultivars for specific land types and farming systems, selection and maintenance of the seed they like, their preference for specific color, food, taste and type also demands diverse crop varieties. Apart from farmers' decisions, cultural identity such as traditional food culture (tastes and preferences) influences the crops and varieties grown and over time a farmer may alter the genetic structure of a crop population.

Why *in-situ* conservation?

The potential threat of the loss of genetic diversity directly targets to the world's food supply. This had been recognized, leading to the *ex-situ* storage of genetic materials in genebanks. Though this form of conservation remains very useful, especially for immediate use in plant breeding, it has major drawbacks in terms of effectiveness and extensiveness.

On-farm or *in-situ* conservation, on the other hand, contributes to the conservation of diversity at all levels i.e. the ecosystem, the species, and genetic diversity within species. It also empowers the farmers to exercise control over their plant genetic resources as a major biological asset, and to use this to improve their livelihoods. On-farm conservation strategies also promote a broader range of partnerships in conservation efforts involving a diversity of stakeholders to meet desired objectives. It remains a powerful strategy to integrate a farming community into the national PGR system.

It is found that the majority of crop seed is from varieties developed over many generations of selection without direct inputs of formal plant breeding. The seed nurtured by farmers provides opportunities for continuous crop adaptation and selection. Thus, diversity in landraces co-adapted to various biotic and abiotic stresses, is used as the primary breeding material for modern varieties.

Photo: Pitambar Shrestha/LI-BIRD

Who is responsible for *in-situ* conservation?

In-situ conservation has been recognized for the conservation and sustainable use of agricultural biodiversity in several international conventions and agreements, including the CBD, the Global Plan of Action (GPA) of the FAO. Each of these instruments not only recognizes the countries' responsibilities to conserve and use their PGRFA, but recommends the equitable sharing of the benefits derived from the use of resources and technologies. The international community has also recognized the critical role of local institutions of genetic resources, whether they are identified as farmers, indigenous or local communities, as noted in the preamble to the CBD, which has been ratified by 181 countries.

What basic information is needed to understand *in-situ* conservation?

In 1995, IPGRI and its national partners launched a project, 'Strengthening the scientific basis of *in-situ* conservation of agricultural biodiversity on-farm' in nine countries including Nepal and Vietnam to understand four basic questions:

- What is the amount and distribution of the genetic diversity maintained by farmers over space and time?
- What are the processes (consciously or unconsciously) used to maintain genetic diversity on-farm?
- Who maintains genetic diversity within a community and how?
- What factors influence farmers' decisions on maintaining traditional varieties?

Understanding of these questions provides the information needed to manage plant genetic resources on-farm, and also helps to develop economic opportunity. If crop genetic resources are going to be conserved on-farm, it must happen as a spin-off of farmers' production activities directed to his/her livelihood. This means on-farm conservation efforts must be carried out within the framework of farmers' livelihoods and income.

What are the criteria for selecting *in-situ* conservation sites?

A fundamental problem faced by any *in-situ* conservation effort is locating crop populations on which to focus. It is essential to consider some generalized criteria for selection of sites: ecosystems, intra-specific diversity of target species, species adaptation, genetic erosion, diverse use values, and interests of farming community, partners and government agencies and logistics for monitoring. One of the often cited disadvantages of on-farm conservation is the difficulty of accessing the material conserved. This is mainly because the on-farm conservation efforts to date have not been mainstreamed and not linked to national PGR efforts.

How feasible is *in-situ* conservation?

A survey carried out by FAO in recent years illustrated that the role of the *in-situ* approach is increasingly appreciated as complementing *ex-situ* conservation. Hence, it is important to understand how farmers value local crop diversity and how much they are willing to pay for such genetic resources. Agricultural biodiversity provides many products and services of environmental, economic, social and cultural importance. These environmental products and services contribute to sustainable economy in number of ways.

The least cost conservation will occur in sites that are most highly ranked in terms of public benefits and where, because the private benefits farmers obtain from growing genetically diverse varieties is greatest, the public interventions to encourage them to do so are the least. So, the crop genetic resources which have low farmer utility (current private value) and public value will have difficulty finding a place in *in-situ* conservation unless public interventions are made for adding benefits.

How does *in-situ* programme provide benefits to the community?

Benefits achieved can be economic, ecological and socio-cultural, for farmers, communities and society. Mainly two options can be considered in adding benefits; the first through participatory plant breeding, and the second through public awareness, better marketing, and policy incentives. The first option seeks improved quality, disease resistance, high yield, better taste, and other preferred traits through breeding, seed networks and modified farming systems. The second option includes adding value to local crop resources so that the demand for the material or some derived product

may be increased. These diverse options will be possible only if the local capacity of farming communities and institutions are strengthened for making appropriate decisions and these partners also take up the responsibility of monitoring local crop diversity after developmental interventions.

How to implement *in-situ* conservation programme?

It is essential to focus on the scientific understanding of on-farm management of agricultural biodiversity and develop institutional capacity to run internally driven on-farm conservation programme. At the same time, local communities and village-level opinion leaders need to understand how they can use their own local biodiversity and mobilize social and human capital to generate financial resources for developing livelihood options and conservation actions. The following steps are considered essential for community-based biodiversity management (CBM approach) of agricultural biodiversity on-farm (Figure 1).

Photo: Shambhu Basnet/LI-BIRD

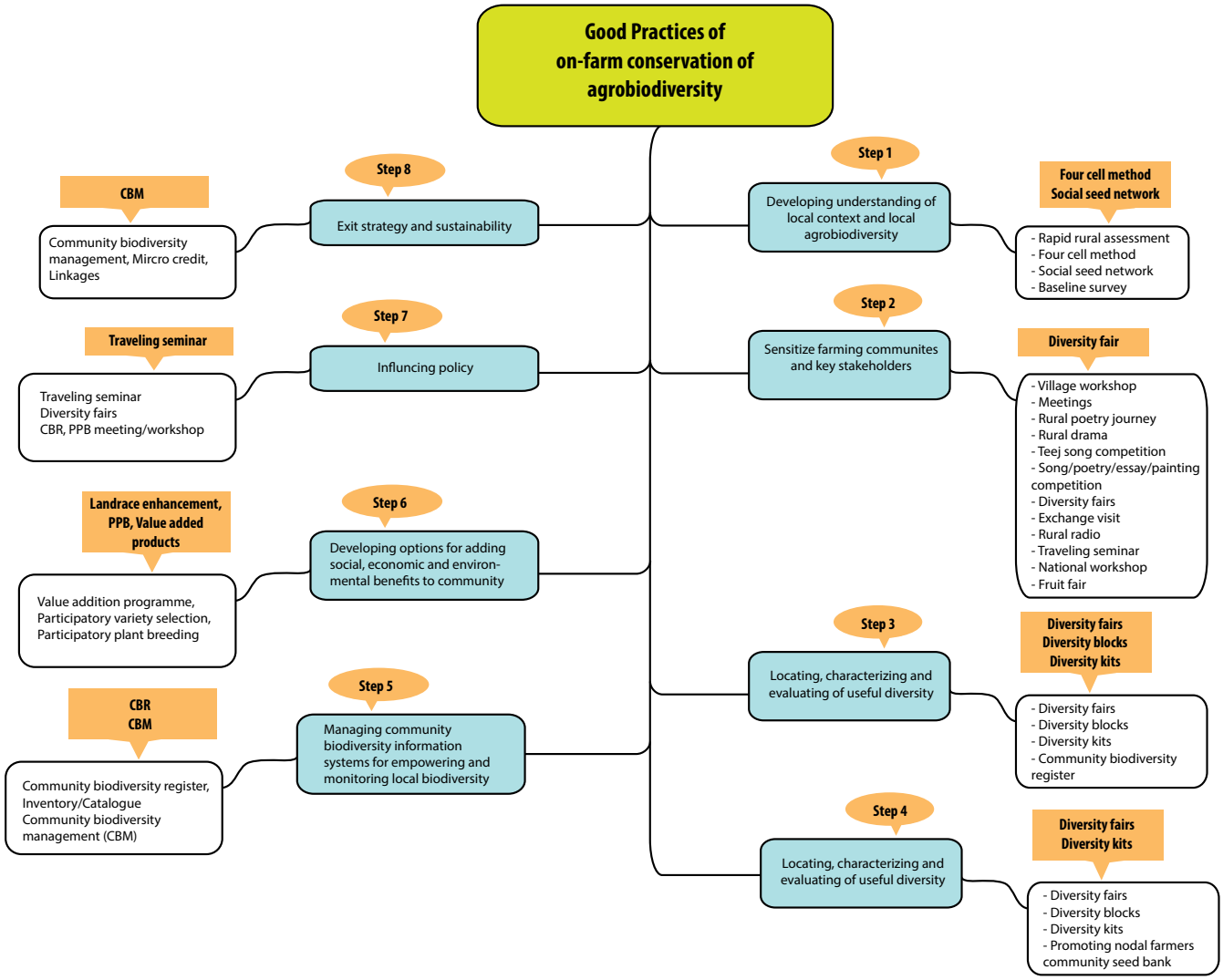


Figure 1. Process and good practices of on-farm conservation of local crop diversity (Sthapit and Jarvis, 2005)

Photo: LI-BIRD Photo Bank/LI-BIRD

Conclusion

Sustainable on-farm and *in-situ* conservation is possible only when farmers, communities, and national institutions perceive benefits in terms of social, economic, and environmental services. Once it is understood that farmer management of local crop diversity is a primary livelihood option for a rural community, then the cost of on-farm conservation becomes much cheaper than *ex-situ* conservation. In the process, farmers not only derive social, economic and environmental benefits from local genetic resources but also enhance the evolutionary potential of such genetic resources. However, it is important to note that on-farm conservation *per se* is not a panacea on its own, it is neither recommended as a universal practice nor is a feasible method in all circumstances; it has a place and time, as on-farm conservation can be transient and subject to change over the time and that provides the major link with *ex-situ* conservation.

Further reading

Jarvis, DI, L. Myer, H. Klemick, L. Guarino, M. Smale, AHD Brown, M. Sadiki, B. Sthapit and T Hodgkin et al., 2000. A training guide for *in-situ* conservation on-farm. Version I. IPGRI, Rome.

Sthapit BR. 2004. *In-situ* conservation of local crop diversity in Asia, the Pacific and Oceania (APO). APO Newsletter 43, IPGRI, Delhi

(Contributed by Bhuwon Sthapit, Madhusudan Prasad Upadhaya and Pratap Kumar Shrestha)

Measuring On-farm Crop Diversity

Photo: LI-BIRD Photo Bank

Diversity can be measured at the levels of ecosystems, species, crops, varieties, agromorphological traits or genetic markers. Variety names are considered as proxy indicators of diversity measurement. The purpose of this flyer is to introduce basic principles and measurements for quantifying diversity, and methods to assess genetic diversity on farm at different levels. It also demonstrates how knowledge about on farm crop genetic diversity can be useful for improving livelihoods and sustainable agriculture.

Why to measure crop genetic diversity on farm?

Ever since humans began farming, farmers throughout the world have continued to maintain and manage substantial crop diversity in agricultural production systems. Traditional crop varieties are vital to this diversity and constitute as a key biological resource, maintained and used by resource poor farmers in difficult production environments. Diverse landraces are under cultivation in traditional farming systems for diversity of use values, indigenous beliefs and rituals and adaptive functions over space and time. Landraces constitute a conspicuous source of variation and provide valuable genes and characteristics for crop improvement. Therefore, basic knowledge of genetic diversity is essential for sustainable conservation and utilization of diversity of crop varieties. Farmers possess an intricate understanding of the crops and crop varieties they grow and they use distinct local names according to characteristics of varieties to identify landraces and manage them in specific ways. The naming of landraces is a preliminary stage which provides a basis for measuring diversity on farm, and diversity in names reflects diversity in utility, agromorphological and adaptive traits of the named landraces. Often variety names also describe how varieties can be distinguished. On measuring the diversity of landraces, physical and social factors of fields and farming communities are also taken into account. During the in situ conservation project, various tools and techniques have been used to measure the extent and level of diversity on farm. The objectives of on farm diversity measurement are:

- To characterize diversity of crop varieties grown on farm
- To examine the genetic variation among named landraces and to be capable of distinguishing landraces from each other
- To measure the extent and distribution of diversity at different physical and social capacities of the farm

Concept and methodology

Diversity can be measured at the levels of ecosystems, species, varieties, agromorphological traits and genetic markers. Three kinds of estimates are used to measure the extent and distribution of diversity:

- Richness-number of types (e.g. crops, varieties, traits, genes)
- Evenness-distribution of the different classes (e.g. % area covered by each variety of a crop in a given village)
- Distinctness- the range of variation found

Two most widely used diversity indices that combine richness and evenness are the Shannon- Weaver (Shannon and Weaver, 1963) and Simpson (Simpson, 1944) indices.

The analysis of diversity is further informed by considering the ways in which it is partitioned:

- Alpha (a) - diversity within a specific population (e.g. Basmati rice), site or context
- Beta (b) -differences between populations (e.g. Basmati population from different districts east to west), sites or production systems
- Gamma (c) -total diversity present in the system as a whole.

Table 1. Various methods available for on farm crop diversity measurement

Methods	Nature of data collection	What it measures?	Commetnts
Rapid biodiversity assessment (PRA)	Number of crops Number of farmer varieties Number of modern varieties	Richness (n, mean)	Good for preliminary diversity assessment Useful for site selection Variation large
Baseline survey	Sample HH number Total no of farmer varieties/HH Total no of modern varieties/HH Total area under a target crop/HH No of farmers growing the target crop/community	Average no of LV + LV Varieties/HH Average area of LV and MV/HH Average area of MV/HH Dominance/evenness (% area covered by each variety) Social, cultural, economic and market forces that influence diversity on farm	Requires specialized skills Time consuming Useful for measuring the distribution of named landraces in a particular location Quantitative assessment of diversity, and establish associated factors influencing diversity at HH and community levels Useful for planning and monitoring impact on genetic diversity
Diversity fairs	Farmer named varieties No of crops/varieties Divergence of population	Richness Distinctness of variation Farmers' indigenous knowledge on landraces	Visual method of assessment; Useful tool to locate genetic materials, identify biodiversity hotspots and custodians across locations
Four cell analysis	No of crops/varieties Name of crops/varieties No and names of varieties into four types: Large area/many HH Large area/few HH Small area/many HH Small area/few HH	Richness-number of varieties Evenness-distribution of the different classes Distinctness- range of variation	Participatory method Needs skill and planning to do Useful as decision-making tool for conservation plans
Diversity block	Name and number of varieties Number of unique traits and descriptors	Shannon Weaver diversity indices of the measured qualitative traits; Means, SD, CV and F-test of quantitative traits	Useful for measuring farmers' consistency in naming and distinguishing farmers' cultivars; agromorphological characterization and grouping of the cultivars Scattered plot distribution
CBR	Total number of crops and varieties at HH and village level Area covered by the diversity	Monitoring dynamic nature of changes in diversity	Useful for locating rare and endangered cultivars; trend analysis establishes pattern on genetic erosion
SSR markers	Total number of alleles Av no of alleles per locus Average no of alleles per polymorphic locus	Shannon Weaver diversity indices of the measured allelic traits Average gene diversity (PIC) Genetic similarity and distances Level of polymorphism at locus and allele determined	Indicative to common and rare alleles among the tested samples Genetic structure of a variety is determined and useful in determining the relationships and tracing the origin and ecological adaptation

Furthermore, diversity changes over time and space, which is often not measured. Both spatial and temporal changes are important in seed systems and they seem to affect both the numbers and identities of crops, varieties and traits. Changes in richness of rice diversity amongst land types are reflected as beta diversity.

Measuring patterns of landrace diversity occurrence

The simplest basis for measuring population genetic structure1 in in situ conservation is the distinct landrace or farmer variety:

1. The number of different unique landraces in a particular sample area or domain or site (varietal richness)
2. The genotype diversity index (diversity within population of a variety; analogous to the Simpson Index or Nei Index of gene diversity)

Furthermore, there are two measures to classify each landrace according to whether or not it is widespread (occurring in more than a few fields) versus localized (restricted to a few fields), and secondly whether it is common (grown in large number of farms) versus rare (grown in small fields) (Figure 1).

Figure 1. Genetic divergence among populations

	Distribution		
Frequency	Localized	Common	Rare
	Widespread		

The Nepalese in situ team devised a participatory method of Four-cell analysis (Figure 2) to understand distribution patterns of farmers' varieties in a given

location.

Figure 2. Fourecell analysis method

Many HH	Large area		Few HH
	Large area Many HH (Common)	Large area Few HH (Threatened)	
	Small area Many HH (Threatened)	Small area Few HH (Rare)	
	Small area		

Box 1. Level of biodiversity

Biological diversity is made up all species of plants and animals their genetic material and the ecosystems of which they are a part
Genetic diversity refers to the variation of genes and genotypes between and within species
Species diversity refers to the variety of species within a given area
Ecosystem diversity refers to interdependent communities of species and their physical environment

Findings

Various methods are available for on farm crop diversity measurement (Table 1). A set of practices for measuring local crop diversity can be employed according to the needs of the study. A diversity fair would be a simple, rapid and reliable method of locating diversity and measuring richness at the community level. A baseline survey would be a relatively expensive method of collecting the statistical data useful for comparative studies. One method cannot replace other completely. Table 2 illustrates some examples of diversity assessment in rice and taro in Nepal (Bajracharya et al., 2003 and Gyawali et al., 2005).

Table 2. Comparative amount and distribution of rice landrace diversity in Nepal

Diversity parameters	Jumla	Kaski	Bara
No of MV	0	5	11
No of LV	21	69	53
% of HH growing landraces	100	64	16
Average no. of variety/HH	1.09	3.61	2.65
Average dominance (Simpson index)	0.05	0.29	0.42
Total area under a crop (e.g. rice) in ha	81	303	618
Total HH/ community (n)	759 (180)	941 (206)	914 (202)
% Polymorphic alleles	5	95.6	94.7
Average gene diversity (PIC)	0.05	0.37	1.40

[1]Measuring morphologic and genetic characteristics of various seed populations of the same variety allows for determining another level of diversity of the variety: for example, between seed populations of the Basmati variety.

Lessons learned

The variety names used by the communities are an essential prerequisite for analyzing the extent and distribution of diversity at the level of the variety. This knowledge is essential for on farm conservation plans. The naming of varieties by farmers is a preliminary stage for measurement of on farm crop diversity. The traditional names given by farmers based on phenotypic traits, adaptation traits, use and quality traits reflect genetic identity in certain circumstances and provide a basic picture of diversity of a crop. Farmers allocate different landraces to different ecosystems and different landraces serve different objectives. These practices will help in the selection and improvement of preferred traits of the diversity that farmers grow and conserve in the field.

Further reading

Bajracharya, J. 2003. Genetic diversity study in landraces of rice Oryza sativa L. by agro-morphological characters and microsatellite DNA markers. A thesis submitted in candidature for the degree of doctor of philosophy, the University of Wales, UK.

Gyawali, S, Joshi, BK, Biswakarma, PR, Brown, AHD, Jarvis, DI and Sthapit BR 2005. The amount and distribution of local crop diversity in three ecophysiographic regions of the in situ conservation project in Nepal. In: BR Sthapit, MP Upadhyay, PK Shrestha and DI Jarvis, eds. On-farm conservation of agricultural biodiversity in Nepal. Vol I: Assessing the amount and distribution of genetic diversity on-farm. NARC, LI-BIRD, IPGRI, Rome.

(Contributed by Jwala Bajracharya, Ram Rana, Bal Krishna Joshi, Abishkar Subedi and Bhuwon Sthapit)

Participatory Four-cell Analysis (FCA) for Understanding Local Crop Diversity

Photo: Pitambar Shrestha/LI-BIRD

Four-cell analysis is a participatory method to identify the most important biological assets that play a role in the livelihoods of local people; to facilitate systematic analysis of farmers logic of extent and distribution of local crop diversity; and to identify common, unique and rare plant genetic resources so that the community and professionals can develop diversified livelihood options and conservation plans.

Rationale

Understanding of amount and distribution of local crop diversity at the community level is basic information required for managing agricultural biodiversity on-farm. Suitable participatory methodologies that help researchers and farmers to understand distribution patterns of local crop diversity and reasons or such distribution are lacking. The FCA method, developed by the *in-situ* project team in Nepal, attempts to determine the risk of genetic diversity loss and the reasons why a species or variety is in the risk zone. Methods to characterize the amount and distribution of crop cultivars were developed based on the average area and the number of households growing each cultivar. Varieties grown by farmers in a given location were categorized into groups of cultivars that occupied large or small areas (based on average area), and those cultivars that were grown by many and few households (based on the number of households). This method has been used in a variety of ways to understand the amount and distribution of local crop diversity at the village or landscape level. Rana *et al.* (2004) used FCA for a) classification of varieties according to population structure, b) identification of common and rare alleles for conservation actions, c) understanding of socioeconomic reasons and use value, and d) a decision-making tool for on-farm conservation actions.

The objectives of the FCA methods are:

- To identify common, unique and rare crop varieties
- To document the reasons why the crops/varieties are found in a dynamic state in the community; and
- To identify the level and type of interventions needed for the conservation of crops/varieties in a given community

Defining concept, terminology and criteria

A matrix is drawn on the ground (or on a large sheet of paper-Figure 1). Participants are asked the following questions:

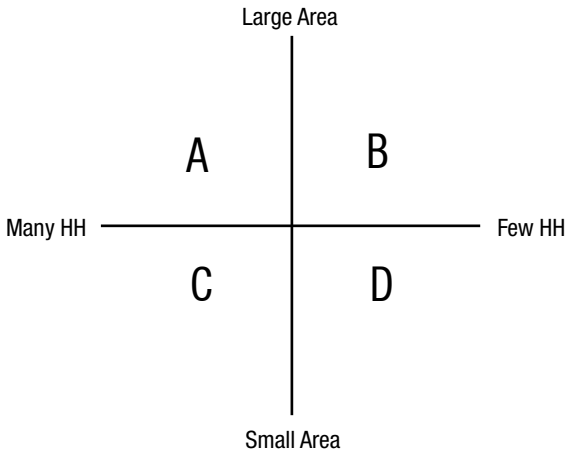


Figure 1: Four-cell analysis of extent and distribution of local crop diversity

Photo: LI-BIRD Photo Bank

- What are the crops that are grown in large area by many households?
- What are the crops that are grown in large area by few households?
- What are the crops that are grown in small area by many households?
- What are the crops that are grown in small area by few households?

Scientific approach

In the case of *in-situ* conservation project in Nepal, one of the ways to classify different varieties found in a given geographic location was to arrange them on the basis of number of HHs growing them and the mean area coverage per HH (0.5 ha)(Figure 1). This method required baseline survey data to decide cut-off points. Numbers of HHs growing a rice variety were classified into two categories: many HHs versus few HHs, with an arbitrary cut-off point of 5 HHs.

Participatory approach

First, villagers define when they regard as a piece of land in the village allocated to a particular crop a "large area" and when it is considered a "small area". They define what people refer to as "grown by many households" and "grown by few households". 'Large' and 'small' are relative measures, depending on the type of crop and production purpose. Experiences have shown that some kind of a definition usually emerges while going through the exercise of allocating the varieties to the four cells.

Procedure

Step 1: Prepare a list of farmers' varieties (local and modern) of a selected crop

- Conduct a brief transect walk through a village for direct observation of key informants (male/female) before the focus group discussion (FGD)
- Collect a list of varieties during a transect walk and review during FGD by asking participants to add up the missing varieties.

Step 2: Conduct participatory FCA analysis of distribution of local crop diversity

- Select 6-12 key informants mixed in gender, age group, well-being and locations for FGD. This is a very important step for ensuring quality analysis and requires good preparation with field based staff or local communities.
- Now we are ready to construct the four cells. First, lay down a large sheet of paper on the ground. Draw two perpendicular axes of area (large to small) and the number of households (many to few) yielding 4 quadrants (see the Figure 1).
- Developing common understanding for the terminology to be used is crucial for the method. The facilitator should encourage discussion with participants so that they come into consensus on terms such as large vs. small area and many vs. few households.
- If there is difficulty defining the area, ask if the variety is grown in a large area or small area of the household. How much is large or small, if necessary, should be determined by questioning the participant about their total cultivable land and the proportion that is occupied by a specific variety.
- Call out the name of variety from the list and let farmers have a discussion about where it should be placed in the quadrants. Similarly, this exercise should be conducted for all varieties listed in the inventory.

Step 3: Explore use values of landraces in each cell

- After completion, farmers are asked why they have placed each specific plant/crop/variety in cell A, B, C or D (Figure 1). The reasons are recorded after a group discussion and consensus is reached in a focus group discussion.
- Now the facilitator should discuss with participants and elicit reasons for placing landraces in a large area or small area. Document the use values of each landrace falling into each category in four cells in order to understand farmers' rationale in greater depth.

Step 4: Participatory analysis of results

- Validate the rationale of managing cultivars at household levels. Varieties which fall into four different cells have one of the following rationales; a) varieties grown for food security or for the market or with multiple use values tend to be cultivated in large areas by many households; b) landraces cultivated for socio-cultural (traditions, religious rituals, food culture) purposes are grown in small areas by many households; c) varieties with specific adaptations traits (such as cultivars adapted to swampy lands, poor soil fertility, drought, shade etc) are grown in large areas by few households and d) varieties with specific uses or limited use value to particular families are grown in small areas by a few households.

- This common pattern is generally found to be consistent with economic rationales and there are some variations guided by specific household circumstances as well. The value of diversity for each household is reflected by the proportion of population size of variety allocated from the total cultivated area of the crop.

Step 5: Use information for diversifying livelihood options and conservation actions by communities

- Helps to identify common and rare types of diversity within the community and facilitate both developmental as well as conservation action plans (Figure 2).
- Helps to discuss the results with the community and ask how they wish to maintain rare varieties. If nobody wants to grow a variety then it should be sent to ex situ conservation (Figure 2).
- Helps to identify cultivars grown by a few households in small areas or in large areas that are vulnerable to genetic erosion and therefore, require a range of interventions.

Impacts

This FCA methodology has become common tool globally and has extensively been used in assessing of the diversity of yams and rice in GEF projects of West African and Asian countries. This FCA methodology has been included in the PGR curriculum of the University of Abomey-Calavi in Benin, West Africa. Scientists from Mozambique, Mali, Sri Lanka, Brazil, Vietnam, Uganda and Malaysia have also been exposed to this method.

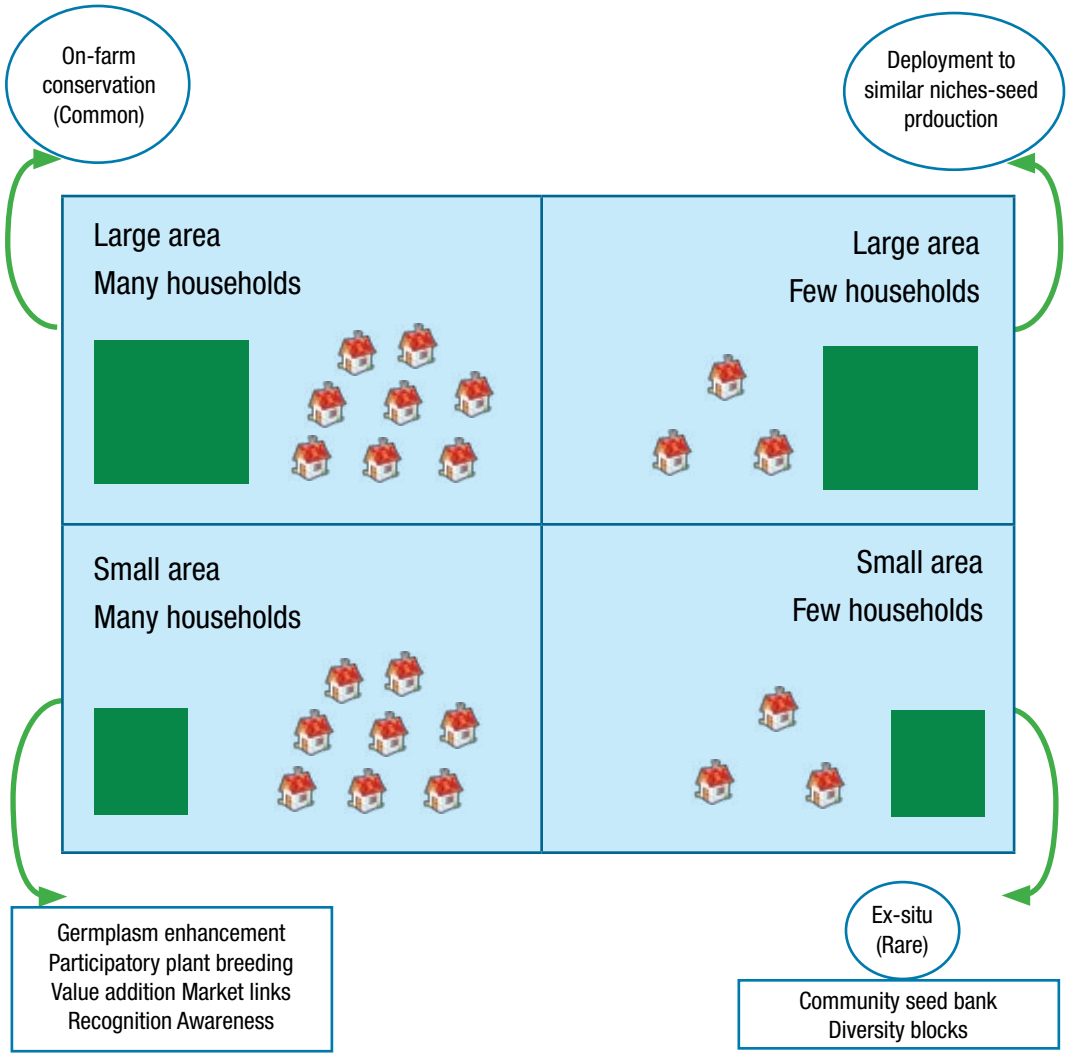


Figure 2: The four-cell analysis for community based on-farm conservation actions

Photo: Pitambar Shrestha/LI-BIRD

Lessons learned and emerging issues

In Uganda, Brazil, Vietnam and Malaysia the methodology required adjustment when it dealt with fruit tree species in home gardens. For perennial species, it was found to be more appropriate to use the number of trees instead of area under the variety. With local adjustments, FCA can be a powerful tool for outsiders for understanding reasons why some farmers do what they do and how best outsiders could help them in diversifying and enhancing livelihood options.

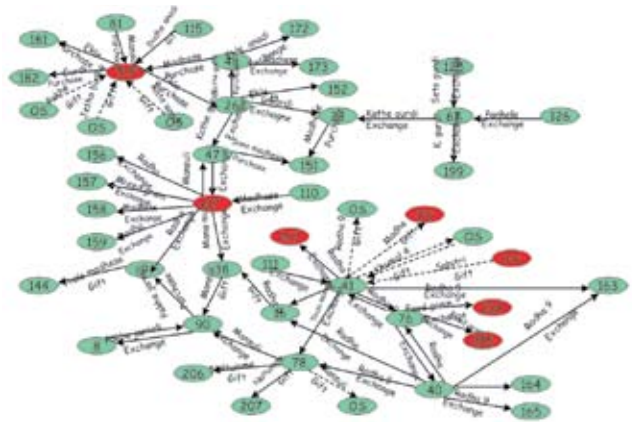
Further Readings

Sthapit, BR, Joshi, K, Gyawali, S., Subedi, A. Shrestha, K. Chaudhary, P, Rana, R, Rijal, D, Upadhyay, M and Jarvis, D.2002. Participatory plant breeding: Setting breeding goals and choosing parents for on-farm conservation. In: Bellon, MR and Reeves, J., eds., Quantitative Analysis of Data from Participatory Methods in Plant Breeding. CIMMYT, Mexico.

Rana R.B, B. Sthapit, C. Garforth, A. Subedi and D. I. Jarvis (2005). Four-cell analysis as a decision-making tool for conservation of agrobiodiversity. on-farm. On-farm conservation of agricultural biodiversity in Nepal. Volume I. Assessing the amount and distribution of genetic diversity on-farm. Proceedings of the Second National Workshop, 25– 27 August 2004, Nagarkot, Nepal. Sthapit, B.R., Upadhyay, M.P., Shrestha, P.K. and Jarvis, D.I. (eds.).

(Contributed by Bhuwon Sthapit, Ram Rana, Abishkar Subedi, Sanjaya Gyawali, Jwala Bajracharya, Pasupati Chaudhary, Bal Krishna Joshi, Sajal Sthapit, Krishna Dev Joshi and Madhusudan Prasad Upadhyay)

Social Seed Network: Good Practice for Ensuring Maintenance of Local Crop Diversity



Most rural farming communities in developing countries continue to use traditional or informal sources of planting materials and seed to meet their seed needs. Either they save their own seed or they obtain seeds from sources such as relatives, neighbours, and local markets independently of the formal certified seed sector. Most community members grow different cultivars, but nodal farmers occupy a relatively more central position in the informal seed network of agricultural biodiversity management. Nodal farmers tend to be diversity minded, maintain rich biodiversity and are willing to share knowledge and genetic materials within or outside their communities. The function of social seed systems is clearly important to the maintenance of crop genetic diversity on-farm. The social seed networks are a practical option for managing vulnerability and uncertainty of rural livelihoods, therefore, access to and control over such genetic resources are a critical policy issue.

Background

Among the developing countries, farming communities maintain a relatively larger number of traditional varieties that contributes a beneficial share to the livelihoods of rural poor farmers. These local varieties possess significant amounts of genetic variation. In these countries informal seed systems play a vital role in the provision of planting materials. For example in Nepal, less than 3% of seed rice was purchased from the formal sector in 1999-2000. Farmers are the managers and also the custodians in maintaining the dynamic processes of crop diversity on-farm. Farmers' seed networks remain as one of the major components through which seed and other genetic materials and knowledge based information are disseminated among farming community members. This social seed system is recognised as a vital process for the maintenance of local crop diversity. Mostly, seed are maintained and saved by individual farmers from season to season. However, there can also be significant amounts of exchange between neighbours and relatives. In Nepal, it was found that 20 – 50% of seeds were exchanged between farmers. Subedi *et al.* (2003) showed that seed exchange processes can be extremely complex, forming reticulate networks of multiple social interactions. It was found that in any network there were some farmers who were involved in more exchanges of seed lots than others and hence suggested that these "nodal" farmers could play a key role in the maintenance of traditional varieties within any community.

Methods

Sociometric survey is the most common source for acquiring network data to obtain relational data among individuals in a social system. Different sampling techniques can be used such as: 1) mapping of community (non-sampling), 2) representative sampling with the community, and 3) snow ball sampling. The most common and widely used is snowball sampling. In this method, information is gathered from focus group discussion (FGD) with male and female farmers.

How to conduct social seed network?

The following step by step process can be used for understanding the social context of a healthy seed system.

Step 1

Primary group formation of starter respondents is needed from where data on sociometric links are collected. Some key questions that need to be asked to understand the flow of genetic materials in a community are:

- From whom do you usually get seed and associated knowledge?

Photo: Pitambar Shrestha/LI-BIRD

- During the growing season, from whom did you obtain variety/seed or planting materials?
- To whom do you usually provide seed and information?
- During the last growing season, whom did you give seeds and information to?
- Who usually comes to you to ask for seed and information?

Step 2

Identification of nodal farmers is done by response of FGD members who are asked to name farmers whom they perceive as most experienced in their community with matters related to seed diversity, seed production, seed selection, production ecology of different cultivars and uses, who are keen on research and diversity minded and are willing to share knowledge and materials with fellow farmers.

Step 3

The sociometrically indicated farmers then become the second-stage respondents. The second-stage respondents are asked the same questions as listed in Step 1. These second stage respondents consequently result to the third-stage respondents and so on. This multi-stage survey helps to determine social links between individuals within and outside the community.

Step 4

Draw network mapping from the relational data from the survey. Draw the relationship lines between HHs/ institutions. Arrows pointing in both directions indicate mutual exchange of materials and knowledge. Maps could be drawn manually or by using NetDraw 1.41 free source software (Borgatti, 2002).

Step5

Identify nodal farmers from the social networks. Nodal farmers are those nodes who provide and receive seed/ knowledge within and outside communities. Nodal farmers are not necessarily leader farmers or village heads but those people of the network, who frequently search, select, maintain, and exchange knowledge and associated genetic materials with other farmers.

Step 6

These nodal farmers can potentially be used to strengthen on-farm conservation, deployment of diversity, strengthening seed supply systems, training fellow farmers and disseminating new information.

Step 7

If the study wishes to understand how farmers maintain local crop diversity *in-situ*, then ask the following questions to the primary, secondary and tertiary respondents:

- When you obtained the seeds, how did you get them (possible answer: purchase, barter, gifts and loan)
- When you gave the seeds, did you sell, barter or gift?

Step 8

Repeat the survey with the same respondents after certain year intervals for at least three times to monitor the stability of a social seed network.

How social seed network works?

Community based seed networks have great potential utility and success in areas with poor technological intervention or with poor access to modern varieties, fertilizers and tools. In these regions farmers are more likely to keep traditional varieties due to lack of resources, as was the case in Jumla valley. Likewise, in marginal economy and disaster prone areas, locally adapted varieties grown by farmers are at a high risk to losses due to stochastic events like bad growing seasons, floods, etc. In these areas, seed grown by neighbouring farmers can provide a viable option for conserving traditional landraces through exchange, gift and purchase of seed or planting materials.

The methods in which farmers produce, select, save and acquire seeds shape the genetic diversity of crop can be considered to be seed systems. About 80-97% of farmers seed of major crops is met through informal seed systems worldwide and this proportion is much higher in the case of locally grown or neglected crops. A farmers' seed system is also considered a healthy system because it has the following important components:

- Germplasm base (diversity, flexibility, selection)
- Seed production and quality (germination, disease problems, quantity)
- Seed availability and distribution (seed sources, networks, markets)
- Knowledge and information (growing methods, utilization, knowledge of new materials)

As a result farmer seed systems or crop diversity is one of the few resources available to resource-poor farmers to ensure sustainable production and livelihoods.

Photo: LI-BIRD Photo Bank

Impact

A baseline survey in Jumla, Kaski and Bara districts revealed that the contribution of landraces for food security is significantly important in Nepal (Rana *et al*., 2000). Dependence on landraces for food security is radically higher in marginal environments (100%) as compared to high production potential systems (17%). Social seed networks were found to be a secure source of locally adapted seed. Since local landraces are one of only few crucial assets available to resource-poor farmers for sustaining their livelihoods and managing vulnerability, access to and control over such resources is a critical policy issue.

The importance of social networks and exchange in variety maintenance in traditional communities, and the fact that most farmers in any year maintain their own seeds and regard seed exchange as a secondary option, raises important questions about the ways in which variety identity is appreciated and maintained. These networks of nodal farmers are considered to be "local institutions" for plant genetic resource management, have been used for "community seed exchange", and can play a significant role in conservation efforts as they manage the majority of genetic resources present at the community level. Although genetic diversity is needed to provide the raw materials with which farmers and plant breeders produce new varieties for changing contexts, such diversity within crops is essential to maximize yields and use options. The result shows that crop breeding programmes becomes more effective by increased use of local resistant materials and new methods to reduce crop vulnerability caused by a policy of crop uniformity.

In many cultural contexts, farmer seed systems are part of the culture and heritage which increases social cohesiveness as it has been managed through individual relationships. Strengthening interventions such as diversity fairs, diversity kits and community seed banks should be given greater priority to seed access for women group members and resource poor farmers who are not able to save or purchase seeds. This has increased the extent of social inclusion and equity as well as provided economic benefits to the community.

Lessons learned and issues

Network and network analysis assume that social seed network stability changes over time. Neither complete stability of nodal farmers exists in a social system nor would it be very useful for conservation. So network data collected over time are necessary to determine the effects of certain interventions and their consequences in a system. Studies revealed that 22-53% of nodal farmers are stable and we are yet to understand the importance of the dynamic state of some nodal farmers for the evolutionary process of creating new genetic diversity in the system. Such a study is even more important to understand the dynamics of the social system in relation to longer-term objectives of how the informal systems that prevail in the farming communities can be better strengthened in the conservation and utilisation of agricultural biodiversity.

On-farm conservation projects tend to focus on persuading farmers to continue planting local varieties. Giving up varieties is seen as dangerous. In this case genetic variation is not static, but is continually being renewed. Social seed network study takes into account the social interaction and supports an increasing trend toward regarding populations of varieties as 'metapopulations' of fields interconnected by varietals exchange. Work focusing on the networks of exchange that make varieties available to farmers suggests that greater attention needs to be given to support the existing local systems of exchange.

Setting up diversity fairs, or establishing community-level seed banks, may be valuable innovations, but they could undermine the existing local systems which link together people who trust one another's judgment and exchange seed along with other forms of goods, aid and information. Priority should be given to understanding how local diversity is sustained, so that modern introductions do not threaten local systems.

Figure 1. Stability of nodal farmers and their networks in three contrasting villages of nepal

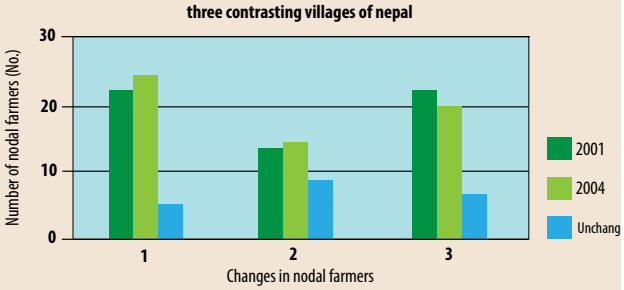


Photo: LI-BIRD Photo Bank/LI-BIRD

Further Reading

Subedi, A., Pasupati Chaudhary, Bimal Baniya, Ram Rana, Radhakrishna Tiwari, Dipak Rijal , Devra Jarvis and Bhuwon Sthapit 2003. Who Maintains Crop Genetic Diversity and How: Implications for On-farm Conservation and Utilization. Culture & Agriculture, 25(2):41-50.

Hodgkin, T., Sajise P., Sthapit, B and Jarvis D. 2005. Maintaining crop diversity on farm: Some aspects of conserving rice diversity in Asia. Paper presented at the Chiangmai University, Thailand.

Paudel D., P. K. hrestha, A. Basnet, P. Shrestha, B. Sthapit and A. SUbedi (2008). Dynamics of farmers' seed networks in rice seed flow systems: Implications for on-farm conservation. Proceeding of National Symposium on "On-farm management of *In-situ* Conservation of Agricultural Biodiversity in Nepal: Lessons Learned," 18-19 July, 2006, Kathmandu, Nepal, B. Sthapit, D. Gauchan, A. SUbedi and D. Jarvis (editors).

(Contributed by Anil Subedi, Bhuwon Sthapit, Ram Rana, Bimal Baniya, Diwakar Paudel, Deepa Singh and Pitambar Shrestha)

Multiple Approach to Community Sensitization

Photo: Pitambar Shrestha/LI-BIRD

Community sensitization is prerequisite for better understanding and devising strategies for biodiversity conservation and its sustainable utilization. It is effective in bringing awareness among farming communities, strengthening CBOs' capacity and changing behaviour towards enhanced conservation and use of local crop diversity. Among the various tools used in community sensitization, a few tools like diversity fair, teej geet (folk song) competition, rural poetry journey and rural roadside journey are people friendly and effective in providing access to information on biodiversity conservation.

Introduction

Most rural farming communities lack access to information regarding agrobiodiversity and its conservation in our country, which is one of barriers in appropriate utilization of the available resources and the benefits of conservation. Wider information dissemination is needed to increase the horizon of conservation of agrobiodiversity, so that the message reaches all levels of stakeholders, including consumers, extension workers, researchers and policy makers. Public awareness regarding agrobiodiversity conservation is essential for effective participation of farming communities in research and development activities. This primarily focuses on educating farmers about the value of local crop diversity, fostering the sense of pride in their cultural heritage of local diversity. The majority of the rural farming communities lack basic access to modern information gazettes (television, radio, and reading materials) due to their economic conditions, which leaves them in ignorance. Considering these existing circumstances, a Nepal *in-situ* project came up with various local methods for community sensitization. These methods are used and can be used in creating awareness among a larger number of people from different stakeholder groups in farming communities. Furthermore, it also helps the rural community to undertake ownership for conservation and utilization of agrobiodiversity.

Understanding participatory tools

Concerned stakeholders can discuss on relevant tools for community sensitization and categorise these according to suitability of stakeholders. This can be shared with the farmers for conceptualising the different methods within the farming community.

Different tools can be used at different times in the same community for creating awareness, as one tool may not be effective for the entire context. There are several participatory tools, which are followed by the *in-situ* project and are listed below:

- **Village workshop** is used to inform local government officials as well as the local community about the purpose of the project, which mutually helps to build a rapport with village leaders during the initial stage. It is also helpful in identifying key contact persons and fosters community participation.

- **Orientation/training** is provided to stakeholders to make them understand the concept of the program. The best way to liberate these local communities from the vicious cycle of poverty is through empowering the control of their own natural resources and access to information and technologies. Continued training and orientation on emerging new issues will increase awareness and intelligence of women farming groups and other farmer organizations and this allows them to influence the research and development agenda.

- **Meeting:** During a meeting the professionals and representatives from different stakeholders sit together and discuss the agenda. Regular short

Photo: Mahesh Shrestha/LI-BIRD

meetings at community level are essential for sharing and learning from the project. Nodal institutions could delegate their networks of farmer groups, clubs or CBO networks for sensitizing the community on topical issues.

- **Field visit** is generally conducted to form a direct interaction of the professionals with farmer or target client groups to discuss and orient them to the field activities. This tool allows direct communication with local communities. According to the situation, traveling seminars, farm walks and combined treks are suggested for field visits to acquire firsthand rapport building with local people.

- **Social and resource mapping** is used for site characterization once the villages are selected for the activity. During participatory rural appraisal, social and resource mapping is a common tool used for mapping out the social structure and resources distribution in a village. This process allows for establishing good communication between rural practitioners and local communities and helps to raise the visibility of the project.

- **Gramin Kabita Yatra (Rural poetry journey):** A series of Gramin Kabita Yatra (rural poetry journeys) was held during 1998 and 1999 in on-farm project sites to sensitize farming communities on conservation issues and to document traditional knowledge about genetic resources using poems and songs. It was a participatory as well as an effective process for reaching the larger mass of farming communities, particularly women farmers. A combined team of both national and local poets and poetesses' traveled together composing poems that highlighted the value of *in-situ* conservation. The impact of the poetic pilgrimages was very encouraging and responsive in creating awareness among a larger mass of the farming communities. The poems recited their odes to biodiversity for community before moving to the next village.

- **Teejgeet Pratiyogita (Teej song competition):** Traditional knowledge on biodiversity is embedded in the folk songs and dances of every ethnic communities of our country. It is often very effective if community sensitization activities are coordinated through culturally accepted means. For instance, Teej is a special festival of Hindu women. During this festival they are free to express their feelings and sorrows in the form of songs and dances. This cultural event has been used to sensitize women farmers' groups regarding the value of agricultural biodiversity and need for conservation. It was conducted amongst women farmers' groups during the festival of Teej to assess and increase their level of awareness about on-farm conservation at the farmers' group level. It is a competition where prizes are awarded to the best group performers with the best songs related on the theme of local diversity conservation.

- **Gramin Sadak Natak (Rural roadside drama):** Local conservationists in the country are using rural roadside dramas to draw attention to the value of native biodiversity. A roadside drama brings together a local group of actors to present a theme-based play, which shows how biodiversity is woven into the lives of the Nepalese people. The shows are shown in a real rural setting, are based on traditional stories or myths about the local crops and are performed by local actors and community groups. It was found that diversity theatre is more attractive to women (70% of people who have seen drama are women and children), who represent the core group of the farming community, and thus enable the communication of important messages to the chief custodians of biodiversity. In order to make such event very effective, an innovative partnership is required with NGOs and local literacy classes and cultural clubs.

- **Traditional food fair:** Biodiversity conservation and cultural diversity are interlinked. Traditional food fair is a powerful public awareness tool for a wide range of people, gender and ethnic groups. It is a fact that no biodiversity can survive without culture and food. It is a marketing concept to add value to local genetic material. It can promote the traditional food culture and menu and can help to link the market with eco-

Photo: Pitambar Shrestha/LI-BIRD

tourism (national and international). Development and promotion of such of local menus may enhance the benefits to local diversity conservation. This kind of food fair could be integrated with eco-tourism and geo-tourism. This type of tourism sustains or enhances the geographical character of a place-its environment, culture, aesthetics, heritage and the well-being of its local residents.

- **Diversity fair** is a unique approach to increase public awareness on the value of traditional knowledge of local crop diversity. The method has been found popular not only in Nepal and Vietnam but also in Africa and Latin America. In this fair, farmers participate to display different plant genetic materials for assessing the status of genetic diversity in the area. The community organized diversity fair exclusively focuses on indigenous landraces and is useful to locate rare diversity and identify custodians of high genetic diversity. This kind of participatory event also helps to enhance social interactions and unifies communities and local organizations.

- **Diversity block** is used to display traditional varieties under farmers' management at public places such as in front of schools, public resting places and near teashops to characterize local landraces under conditions of typical farmer management. It has an additional advantage of raising the public awareness. The block could be used for other purposes as well. Germplasm to be grown in the diversity block may be selected from the materials displayed in diversity fairs or from community members' seed stocks.

- **School competition:** Essay or biodiversity painting competitions are organized amongst the school children on special occasions of biodiversity like World Environment Day, Maghe Sakrati etc. to promote learning from old to young generations. This kind of approach is essential to reach younger groups of future farmers.

Photo: Pitambar Shrestha/LI-BIRD

Photo: Pitambar Shrestha/LI-BIRD

- **Exchange visits** are educational tours for different stakeholders across sites, which can be organized based on their needs. This kind of practice is very useful amongst farming communities as elements of social learning and sharing.

Changing Social Scenario

Communities and their grassroots organizations are involved at all stages of sensitization programming as it helps them to understand what they do, how they do it and why they do it. Among the several tools used for community sensitization, a few tools like diversity fair, *teej geet* competition, rural poetry journey and rural roadside drama are found to be productive and also cost effective in providing access to information on biodiversity conservation. These are a few of the tools which the community can organize on their own. These tools can be merged with the cultural events of the society depending upon the geographic locations e.g. in the hill community *teej* songs while in far western region *deuda* songs that are the best vehicle for this type of information sharing..

In Bara and Kaski eco-sites, the term biodiversity was alien to the farmers and local community before the project's intervention. Various sensitization tools were used by the *in-situ* project team for sensitising the farming community, which helped in creating awareness among them and resulted in the establishment of a community based organisation, Agricultural Development and Conservation Society (ADCS) in the Bara eco-site and strengthened Pratigya Cooperative in the Kaski eco-site. They are actively involved in the management of local genetic resources and income generation activity for their communities. Presently, the CBOs of both eco-sites are involved in documentation of their local plant diversity in a Community Biodiversity Register (CBR). Due to the effort of the project in community sensitization, farmers showed increased levels of confidence, which has resulted in their active participation in various meetings and workshops (local to National). They are able to make significant impacts at these meetings, raising various pertinent issues.

The capacity of local institutions can be enhanced for implementing community based awareness programmes and for which small seed money could be provided to support their conservation actions.

Lessons learned

- Community sensitization results in attitude and behavioral changes at individual and community level and brings change in action.

- Community sensitization is a continuous process, which is crucial from the beginning of the programme until implementation and for sensitization of the community a set of practices is necessary, as one tool cannot sensitise an entire community. Community sensitization should be done on a regular basis, keeping in mind the tradition and culture of the particular area.

- Tools applied for community sensitization increase public awareness to a large extent and help in knowledge transfer to younger generations. Drama and biodiversity fairs are useful to conduct the first year of the project as they attract large groups of people. Appropriate tools should be used showing social and economic benefits to the community. Food and trade fairs are useful in that sense.

- Tools can become more effective with increased participation of rural communities if they are organized during their own cultural events.

Further readings

Chaudhary P, D. K. Rijal, R. B. Rana, D. Gauchan, R. B. Yadav, D. Pandey, S. P. Khatiwada, M. P. Upadhaya, A. Subedi, D. I. Jarvis and B. R. Sthapit. 2003. Enhancing Conservation and Use of Agrobiodiversity On-farm through Public Awareness. Pp 209-214 in On-farm Management of Agricultural Biodiversity in Nepal (B.R. Sthapi, M.P. Upadhaya, B.K. Baniya, A. Subedi and B.K. Joshi, Eds.), Proceeding of a National Workshop, 24-26 April 2001 in Lumle, Nepal. NARC, LI-BIRD and IPGRI.

Rijal D, R. Rana, A. Subedi and B. Sthapit. 2000. Adding Value to Landraces: Community-based Approaches for In Situ Conservation of Plant Genetic Resources in Nepal. Pp 166-172 in Participatory Approaches to the Conservation and Use of Plant Genetic Resources (Esbern Friis-Hansen and Bhuwon Sthapit, Eds.), International Plant Genetic Resources Institute, Rome, Italy.

(Contributed by Anu Adhikari, Madhusudan Prasad Upadhyay, Bal Krishna Joshi, Deepak Rijal, Pashupati Chaudhary, Indra Paudel, Krishna Baral, Prakat Pageni, Shreeram Subedi, Bhuwon Sthapit)

Diversity Fair: Promoting Exchange of Knowledge and Germplasms

Photo: Pitambar Shrestha/LI-BIRD

The diversity fair helps to locate the area of high diversity and most endangered landraces. It also recognises real custodians of rich genetic diversity and traditional knowledge. The diversity fair is considered to be a good practice among diverse actors in a wide range of geographical and institutional settings as it provides a good forum that over time and space maintains, enhances and creates crop genetic diversity and ensures its availability to and from farmers and other actors for improved livelihoods on a sustainable basis. Participation in diversity fairs has become a matter of pride for individual farmers and farming communities as they display their rich crop genetic resources and indigenous knowledge to visitors and fellow farmers. It is one of the best forums to create awareness and interest, amongst diverse stakeholders on the importance and value of local plant genetic resources. Besides which, it creates favourable effects to scientists, researchers, private entrepreneurs, and policy makers.

What is a diversity fair?

Diversity fair[1] is a participatory tool for raising public awareness on the value of conserving local landraces, bringing the farmers from different communities together to exhibit the range of landraces so that traditional systems of seed and knowledge transmission continue to conserve. Traditionally, local seed markets and fairs constituted an important part of the community seed exchange network in the villages of many developing countries. In Nepal, local markets and *haat bazaar* (weekly market) provide an opportunity for the exchange of seeds and knowledge. These local seed markets are also used for maintaining healthy seed system. As a result loss of indigenous knowledge, on-farm management of local genetic resources has started to erode. One of the aims of diversity fairs is to encourage farmers to share information and exchange seeds within the locality, giving them access to a wider choice of varieties and maintaining a higher level of biodiversity. It is often organized as a competitive event so that local communities are encouraged to maintain high crop diversity and bring in rare and unique diversity for display. This is also a good opportunity for researchers and development professionals to identify the custodians and learn more about traditional knowledge.

The objectives of the diversity fair are:

- To create public awareness on the value of local crop diversity
- To locate prime areas of diversity and identify rare and unique species
- To identify key custodians who maintain high genetic diversity and the reasons for conserving them
- To promote exchange of community based seed and knowledge as social learning
- To improve access to rare germplasm
- To document variety names and associated knowledge on uses and other values for community biodiversity register
- To educate young generation and also to influence policy makers on the value of agricultural biodiversity

Methodology

Local institutions (women's groups, Community Based Organisations-CBOs, Indigenous People Organisations-IPOs, farmers group, clubs, schools, etc.) organize diversity fairs with technical facilitation from research and development professionals. First hand information from farmers to understand why farmers grow landraces, when and where they grow landraces, and how they maintain and use them is obtained through participatory rural appraisal (PRA). These participatory methods ensure social learning for conservation and

1 This also refers to Biodiversity fair, seed fair, seed voucher and fairs, seed festivals, agricultural fair, *krishi mela etc.*

Photo: Mahesh Shrestha/LI-BIRD

utilization of agricultural biodiversity. The steps to be followed while organizing a diversity fair are as follows:

Step 1: Participatory planning

In order to sensitize farming communities, development workers and researchers to the purpose of the diversity fair, a series of participatory planning meetings with grassroots institutions should be held, in which the detailed steps and procedures, including the options for the prizes, should be followed. In this phase, interaction with local community members, farmers' groups or CBOs is important to discuss the concept, purpose and financial support for the diversity fair. Identification and agreement with the focal local institution on the organizational modality of the diversity fair should be done. Wider sharing and community level planning of the diversity fair should be visualised. Guiding principles of the diversity fair and criteria for participating community selection should be formulated. Selection of the venue and appropriate date should be finalised in consultation with local institutions. The organizing committee and sub-committees should be formed and roles and responsibilities for each committee should be defined.

Step 2: Preparation for setting norms and procedure for diversity fair

It is essential that norms and procedures should be made transparent due to the competitive nature of the activity. The information should be widely disseminated at different levels. Agro-ecological zones should be defined to determine the participants of diversity fair at the domain level. Different norms should be used in different sites to suit local conditions. Variety names, distinguishing traits and address of custodians, passport information of materials, specific reasons for cultivation and valuable traits should be provided for each sample. Seed or planting materials originating within the group members should be subjected to *in situ* verification, if contested/protested. An oral presentation on the value and importance of local varieties should be presented in front of a panel of judges. It is well advised that the dissemination of all the information to farmers about the date, venue and criteria of diversity fair using various means such as rural FM radio, newspapers, or posters in schools, etc. well before time. The potential competitors should understand the criteria for evaluation in different classes and the overall rules for display or competition. It is important to provide orientation training to participating group members on materials to be displayed, information to be shared, labelling the materials, number, and type of prizes and rules and regulations for the fair. Logistics information and supplies should be distributed to each farmers' committee with roles and responsibilities and practice sessions to fill out information sheets should be organized. Local communities should be encouraged to use local packaging materials so that the fair has an ethnic-cultural flavour. Press should be invited to visit stalls of the fair, along with local dignitaries, policy makers and district administrators, private entrepreneurs, neighbouring farming communities, pupils. An evaluation committee should be formed and should develop the criteria for evaluation.

Step 3: Implementation

Allocate space to each farmers' group along with the materials to decorate their stall. Field registration and registered materials should be verified, and inauguration of the fair should be instigated by the guest of honour. Farmers and invitees should be guided to visit the stalls and facilitate in sharing the information and knowledge associated with the exhibited materials. Local institutions should be encouraged to integrate a light cultural show to attract more participants and share knowledge through songs, poems and dramas.

Step 4: Participatory evaluation

Evaluation of displayed materials by each group needs to be completed before the formal event, if possible a day in advance, and the winners should be notified according to the categories of prizes or award. The prize distribution ceremony should be commenced by the guest of honour. Maintain or update database/inventory of local crop

Photo: Pitambar Shrestha/LI-BIRD

diversity in community biodiversity register (CBR) for future monitoring.

Evaluations of fairs are prepared by experts from outside the community as they are technically sound for improved technologies and new seeds. The compositions of judges should include at least one knowledgeable nodal farmer, PGR specialist, agricultural officer, NGO, merchant, site staff and scientist from the project. The evaluation team should also develop a set of criteria for award assessment. This can vary again according to local expertise and the situation. The major criteria to be considered are:

- Number of local landraces displayed by the group or farmer in the target crops (40%)
- Quality of information (value of PGR) and its authenticity (30%)
- Style of presentation and quality of knowledge (15%)
- Rarity of displayed variety (10%)
- Degree of women participation (5%)

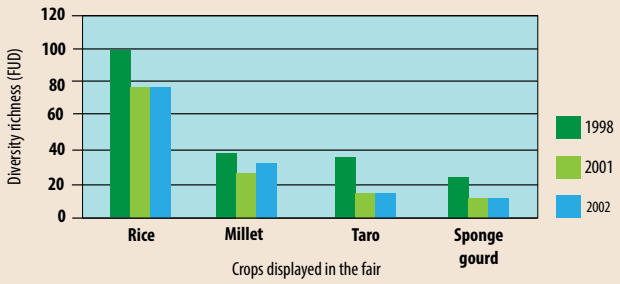
The weight assigned for each criterion can be mutually agreed and the indicators for measurement for each criterion can also be developed by the panel. Prior to the event the information needs be shared with all participating groups at the time of orientation training on the diversity fair.

Impact

During the diversity fair in Begnas the event focused on developing new understanding on the importance of diversity of local plant genetic materials and associated knowledge among the villages, which motivated the local community to develop a community based seed production of unique varieties that allowed them to generate income from their genetic resources. It also inspired local institutions and women's' groups to register inventory in the community biodiversity register and to establish community seed banks for the conservation of local crop diversity.

Photo: Pitambar Shrestha/LI-BIRD

Figure 1. Diversity fair in Begnas, Nepal



The event improved the understanding and increased awareness on the value of biodiversity. It also enhanced recognition and exchange of farmers' knowledge and resources and strengthened the market linkages through collective actions. The diversity fair of Begnas deeply enlightened policy makers when they were exposed to rich biodiversity and its diverse value.

Lessons learned and emerging issues

In general, farmers' naming of varieties is not consistent within and between the villages. So to ensure the authenticity of naming the species or varieties for the display in the diversity fair, field verification through farm visits is necessary during the crop season. CBO members must visit potential households to assess diversity *in-situ*, however, this is only possible if local institution takes the initiative and understands that the main purpose of the diversity fair is to encourage farmers to maintain high and unique diversity.

Rare and unique species or varieties identified and collected during the diversity fair could be useful even for *ex-situ* conservation to prepare an inventory of crop genetic resources as well. Diversity fairs strengthen the healthy seed supply system, identify main sources of informal seed supply within the country to understand reasons for growing diverse genetic resources in terms of economic, cultural, religious, breeding and ecological values. They also promote local community to have control over their genetic resources and develop a sense of ownership using the concept of the community gene bank, linking both informal and formal seed supply systems. Diversity fairs, initially promoted by GOs and NGOs can become financially self-sustaining.

Some of the essential ingredients for successful diversity fairs appear to be:

- Diversity fairs being organized by local institutions creates ownership and develops local capacity to coordinate with various groups and promotes more social interaction and awareness on the importance of biodiversity conservation than a diversity fair managed by the project.

Photo: LI-BIRD Photo Bank/LI-BIRD

- Combining a diversity fair with popular local festivals enhances community participation and effectiveness of the diversity fair. The information available and collected during the fair must be documented and shared at the community level.
- The provision of sharing and marketing genetic materials (seeds, sapling, and other planting materials) during the diversity fairs enhances the flow of genetic materials in the community and fulfils the purpose of the diversity fair. It was found that the diversity fair promotes direct contact with custodians and enhances access to knowledge and materials exchange. Diversity fairs enable community members to access seed of preferred crops and varieties.
- Diversity fairs promote an enabling environment for the young generation to learn from their elders. Organization of the diversity fair should be built on the local activities of schools, clubs, and CBOs for institutional sustainability. In Nepal, all district agricultural offices regularly conduct agricultural fairs with the aim of promoting only modern varieties. With more exposure to diversity fairs, the conventional fair started to display local crop diversity and award the prizes for local innovations.

Further readings

Adhikari A, R. B. Rana, B. R. Sthapit, A. Subedi, P. Shrestha, M. P. Upadhaya, K. P. Baral and S. Gyawali. 2004. Effectiveness of Diversity Fair in Raising Awareness on Agrobiodiversity Management. Paper Presented in National Workshop on Strengthening the Scientific Basis of *In-situ* Conservation of Agricultural Biodiversity. 25-27 August 2004, Kathmandu, Nepal. NARC/LI-BIRD/ IPGRI.

Sthapit, B.R., Rijal D, De NN and D. Jarvis. 2003. A role for diversity fairs: Experiences from Nepal and Vietnam. In: CIP-UPWARDS 2003, eds., Conservation and Sustainable Use of Agricultural Biodiversity: A Source Book Vol II: Strengthening Local Management of Agricultural Biodiversity. International Potato

(Contributed by Anu Adhikari, Ram Rana, Resham Gautam, Abishkar Subedi, Madhusudan Prasad Upadhaya, Pashupati Chaudhary, Deepak Rijal, Bhuwon Sthapit)

Diversity Block: Assessing and Demonstrating Local Diversity

Photo: LI-BIRD Photo Bank

Diversity block is an experimental block of farmers' varieties managed by local institution for research and development purposes. The block is not only used for measuring and analysing agro-morphological characteristics but also used to validate farmers' descriptors by inviting farmers to watch the diversity block in the field and determine whether farmers are consistent in naming and describing varieties. Diversity block also has the additional advantage of raising public awareness. Planting materials can be multiplied for exchange of germplasm, seed production of rare cultivars, ex-situ collection and regeneration for community seed banks.

Background

It is difficult to appreciate the richness of local crop diversity of rare and unique crop varieties present in the community. Despite the prevalence of social seed networks, all farmers do not have the access to information and genetic materials that may enhance the livelihoods of people. Experience suggests that the maintenance of diversity blocks by local institutions such as schools, CBOs or clubs facilitates sensitisation in local communities (young to old generations). Diversity blocks also help to multiply limited rare seed which could be the source of seed for diversity kits, participatory plant breeding, and *ex-situ* collection.

Farmers use names of varieties as a basic unit of diversity for day-to-day on-farm management and often this is consistent at the household and the community levels since they use this information to exchange genetic materials and communicate associated knowledge about the materials. Farmers have a set of agro-morphological descriptors to distinguish the varieties and give specific local names to describe such unique morphology. The consistency index of variety names as a proxy indicator of diversity decreased as the distance from referenced villages increased. In Nepal, diversity of rice is measured by farmers' names and this is often a source of confusion. Landraces such as *gurdi, jhinuwa, madise, basmati* have several names within the group even though they morphologically can be the same or distinct. Often for traditional crops, scientific descriptors are not available and traits used by farmers (can be termed as farmer's descriptors) are often used to distinguish unique diversity. In cases where there is high consistency in variety names, farmer named varieties could be used as a unit for conservation. When the name is not consistent with the unit managed by the farmers, then other parameters need to be added in order to precisely define the unit of conservation. This is a very basic element of on-farm conservation work and therefore, the diversity block is an important practice for understanding the scientific basis of *in-situ* conservation of agricultural biodiversity on-farm.

Purpose

The purposes of the diversity block could be as follows:

- To measure farmers' consistency in naming and distinguishing farmers' varieties
- To validate farmers descriptors by inviting farmers to watch the diversity block in the field
- To assess varietals diversity using agro-morphological characteristics
- To sensitise local community on the value of community managed biodiversity and create ownership of local bio wealth
- To multiply planting materials for research and development purposes
- To repatriate old landraces and foster social exchange of materials and knowledge

Photo: Pitambar Shrestha/LI-BIRD

Methodology

Diversity block is an experimental block of farmers' varieties grown in a non-replicated plot on-farm. This is a practical approach for annual crops to demonstrate varietal richness of the community in a public place. The same concept can be applied in a biodiversity garden, park or golf course for perennial and horticultural crops. Plot sizes are variable depending upon crops, area available and number of farmers' varieties present. This method is specifically designed for annual crops such as rice, finger millet, taro, etc.

How to establish Diversity Block?

Establishment and success of a diversity block is dependent upon the interest and level of awareness of the local community on the importance of agrobiodiversity. However, the following steps and processes can be effective to establish a functional Diversity Block.

Step 1

Collect seed samples (50-200g seed per variety depending upon crop) during a diversity fair along with essential passport data, for example, name of variety, farmers' descriptor, names of farmers, habitat, altitude, name of locality, special use value.

Step 2

Reiterate objectives and potential benefits from the diversity block and discuss in the community to identify interested local institutions to grow and maintain a diversity block at a strategic public place and representative domain.

Step 3

Orient community members for simple field layout, planting and labelling and identify a focal person for management of the block from CBM fund. It is essential to provide conceptual and practical training to ensure proper handling and storage of seeds.

Step 4

Grow available diversity of the crop under the farmers' management system. If the numbers are too high, select seeds of rare, unique and threatened varieties as priority entries for seed multiplication as well as for raising awareness and increasing seed demand. The varieties with inconsistent names can also be included for measuring distinct morphological traits and validating the names.

Step 5

Keep a display board with the purpose of the exercise and name of the individual variety separately.

Step 6

Conduct a farm walk of interested and knowledgeable farmers, researchers and school children in order to:

- promote exchange of knowledge and recognise the variety according to farmer descriptors
- test consistency of farmer-named varieties between communities and villages
- collect demand for seed for future planting (5-10 kegs)
- collect rare and unique seed for *ex-situ* conservation
- regenerate seeds for the community seed banks, identify variety for PPB and plan to promote agro-ecotourism

Step 7

Harvest seed and store seed for the community seed banks. Distribute surplus seed for diversity kits, research, and interested farmers who want to multiply and share seed with at least five neighbours. In addition, maintain a diversity block of each crop as a field gene bank for demonstration and evaluation and to increase seed quantity for the subsequent year. This could be sustainable if the community recognises the value of the exercise and if it is linked with a community seed bank or community based seed production activities.

Step 8

Update the database of the community biodiversity register to encourage participants for on-farm conservation and to support landrace enhancement.

Photo: Pitambar Shrestha/LI-BIRD

How diversity block works?

The diversity block method has been tried initially to test whether farmers are consistent in naming and distinguishing the varieties by names and also farmer's descriptors. One community seed bank initiated at Kachorwa, Bara, ADCS soon realised a need to multiply seed not only for the community seed bank but also for selling seed for market and for sustaining the gene bank. CBOs included the diversity block as part of community pride and demonstrated their resources to fellow farmers and visitors. Hence, the diversity block can be said as a farmer led on-farm seed conservation approach managed by community members. However, initial external support (based on local commitment and contribution) is crucial to establish a diversity block and to link it with other activities such as diversity fairs, diversity kit distribution, community seed bank and community seed production. Diversity blocks have great potential in utility and success in areas with a) high technological intervention, b) poor access to information and germplasm c) and strong community networks. Diversity blocks can provide a constant supply of seeds for these environments, ensuring relatively high production even in a sub-optimal growing environment. It is also helpful to strengthen community networks as it allows social interaction and planning for seed production and marketing.

Impact

Diversity block is a simple method to demonstrate the total amount of local crop diversity at one place and has been a common place for social interaction and knowledge exchange. Women's groups of Majhthar village, Begnas, Nepal used diversity blocks to multiply taro and sponge gourd seed and sell planting materials and seed to other farmers and local institutions. Biodiversity clubs of some schools (e.g. Tarakunj Secondary School) maintain the diversity block of traditional crops and varieties for educational purposes. In Bara, the Agriculture Development and Conservation Society (ADCS) has initiated the diversity block to regenerate seed annually of annual crops and multiply 10-20 kgs for farmers in need. Diversity block has resulted in increased social learning and cohesiveness as it has been managed through community group actions. It also has given greater priority to seed access for women group members and resource poor farmers who are not able to save or purchase seeds. This might increase the extent of social inclusion and equity as well as provide economic benefits to the community; however, no empirical evidence is yet available. Furthermore, the National Rice Research Programme and Horticultural Farm Pokhara have started to maintain diversity blocks of farmers' varieties as field gene banks which was not a common practice before.

Photo: Pitambar Shrestha/LI-BIRD

Photo: LI-BIRD Photo Bank

Diversity blocks have been in practice in Nepal and Vietnam but their sustainability has been questioned. It is important to understand incentives as factors for sustaining such local level initiatives and to develop a strategy to address this. After the success story of Bara, linking diversity blocks with community seed production and community seed banks is in the process of being replicated in Begnas and the Western Terai Landscape Complex (WTLC) project in Nepal.

Lessons learned and issues

The diversity block as a community owned and managed activity with integrated efforts was found to be effective and sustainable. This indigenous knowledge based and low cost approach is managed by local communities. The capacity of local communities needs to be strengthened to address major technical and financial problems. The community has not yet anticipated a potential problem of managing the diversity block in the absence of guidance to diversify and enhance livelihood options using natural, social, human, and financial capitals.

Photo: Chandra Gurung/LI-BIRD

Initial efforts of this community based biodiversity management approach have shown encouraging results in on-farm conservation of agricultural biodiversity. This approach encourages farmers to maintain local diversity by local resources. However, partnership between agriculture development agencies and community seed banks need to be developed for better utilization of local crop landraces conserved at community managed diversity blocks. Further research and development efforts are needed to ensure conservation and utilization of agricultural biodiversity with a simultaneous increase in the income and economic status of the people.

Further Reading

Rijal, DK, Sthapit BR, Bajracharya, JB and Jarvis, DI 2003. Genetic diversity of farmers' varieties of taro in Nepal. In: Sthapit, BR, Madhusudan P Upadhyay, BK Baniya, Anil Subedi, BK Joshi (Eds) 2003. On-farm management of agricultural biodiversity in Nepal, Proceedings of a National workshop, 24-26 April 2001, Lumle, Nepal, IPGRI, LI-BIRD and NARC, Kathmandu, Nepal.

Sthapit, BR, Sajise, P and Jarvis, D. 2000. Strengthening Scientific Basis of In situ conservation On-farm: Learning Experiences from Nepal and Vietnam. In pp. 338-361 Eds. Xu Jianchu 2000. Link between Cultures and Biodiversity: Proceedings of the Cultures and Biodiversity Congress 2000. 20-30 July, 2000, Yunnan, PR China. Yunnan Science and Technology Press.

(Contributed by Radhakrishna Tiwari, Bhuwon Sthapit, Pitambar Shrestha, Krishna Baral, Abishkar Subedi, Jwala Bajracharya and Ram Baran Yadav)

Diversity Kits: Deploying New Diversity to Farmers

Photo: Pitambar Shrestha/LI-BIRD

Most development interventions around seeds and plant genetic resources (PGRs) have a technical focus on production concerns but fail to consider questions on how easy access of the preferred seeds fit into the bigger picture of sustainable livelihoods. The approach of the diversity kit however, facilitates the evolutionary process of on-farm management of agricultural biodiversity and contributes to the livelihoods of the rural farmers

What are Diversity Kits?

The diversity kit is a set of a small quantity of different seeds made available to farmers. It consists of seeds harvested from diversity blocks, research farms or farmers' fields, which are used for assembling a "diversity kit." It is distributed among farmers by community based organisations as a regular annual programme.

Context

Access to seeds and plant genetic resources is vital for food security and sustainable development. Studies show that the inadequate access to genetic resources, seeds and knowledge are major constraints faced by the rural and the poor farmers of Nepal. In Nepal, over 95% of rice seed (the most researched crop) is supplied to farmers through informal systems. It is assumed that seed requirement of most traditional and neglected crops is essentially dependent on informal exchange such as self saved seed, farmer to farmer exchanges and local market purchase, with an almost negligible role of the formal sector. In this scenario, traditional crop varieties and local social seed exchange systems for food security and livelihoods of rural poor become significant and vulnerable. As such policy and development interventions are required. In 1990, an innovative approach to informal research and development (IRD) was initiated at Agricultural Research Centres at Lumle and Pakhribas, to address the problem of inadequate access to germplasm and quality seed (Joshi and Sthapit, 1990). In SDC funded IPGRI/LI-BIRD's home garden project, diverse types of seed/saplings are distributed as diversity kits to improve species diversity. Good practices of such experiences are used to enhance access to locally adapted materials to a wide range of farmers so that they continue to select, maintain, and exchange materials until they find other better alternatives.

Methodology

The practice of making diversity kits available remains an integral part of community biodiversity management (CBM) programme and is linked with diversity fairs, community biodiversity registers, diversity blocks, community seed banks and community based seed production. This practice works well when a set of practices are assembled under a certain enabling environment. Local institutions such as women's groups, clubs, schools and CBOs are encouraged to develop their own diversity kits for the deployment of diversity along with fellow neighbours. Locally available valuable seed and saplings are preferred for this kind of activity as it will generate immediate income for custodians and help other farmers to obtain new materials. The availability of genetic materials, including products of landrace enhancement, pre-breeding and PPB products, is extremely important for the success of CBM.

The general steps of local crop diversity are as follows:

1. Conduct diversity fairs at a regular interval of 2-3 years
2. Identify unique, rare and useful diversity using PRA or four-cell analysis
3. Grow landraces into diversity blocks for characterization and seed multiplication
4. Ensure quality of seed by testing germination, viability and health of freshly harvested seeds

Photo: Pitambar Shrestha/LI-BIRD

5. Store 5-10 kg of seed in community seed banks (optional) and make diversity kits from the rest of the seeds (ranging from 100g to 2 kg depending upon the nature of crops)
6. Distribute diversity kits of rare or unique landraces to the community and take their passport data for future spreads
7. Identify local institutions for distribution and monitoring of spread at the community level according to the CBM work plan

The following steps need to be modified for horticultural/perennial crops and livestock species. The main features of diversity kits are:

- Deployment of easily inaccessible local seed/saplings
- Diverse types of cultivars for providing opportunity for selection
- A system of monitoring for varietal spread

One of the essential steps is to monitor diversity kits, as this allows researchers and development workers to learn the factors affecting farmers' decision in choosing diversity. It is a good practice as the approach of the diversity kit maintains, enhances and creates crop genetic diversity and ensures its availability to and from the farmers and other actors for improved livelihoods on a sustainable basis. In a country like Nepal, where access to information and materials are limited or difficult because of geographical terrain and poor infrastructure, diversity kits are a practical, cost effective, and sustainable approach. Self-driven local institutions such as self-help groups, farmers' organisations, and CBOs can successfully manage this practice. In home garden projects of Nepal, local institutions charged some amount for diversity kits, and the funds collected were saved as a community based conservation fund, where as in Bara site, farmers saved funds by selling local seed and by distributing diversity kits of cereals and vegetable seeds. This approach has potential for scaling up in wider geographical, institutional and socio-cultural contexts because many development and research institutions have a mandate to improve access to locally adapted materials that generate social, economic and environmental benefits.

Impacts

Impacts of such approaches have been demonstrated widely in DFID funded projects of LI-BIRD and FORWARD in Chitwan and 29 other districts of Nepal. Wheat seed networks of CIMMYT in Nepal have also adapted this approach to promote improved varieties. Similarly, a minikits programme (basically with modern varieties along with chemical fertilizers) conducted by the Department of Agriculture in 1980s also showed good results. This approach has been scaled up within the institution of NARC and LI-BIRD and is being adopted by other formal and informal rural development organizations. This approach has become popular and is now extensively followed in Bangladesh by NGO, PROVA and in India by State Universities and Gramin Bikas Trust.

One of the DFID funded projects in Nepal has estimated very significant economic benefits with high net present values (BSP10 m by 2010 for Nepal) and high internal rates of return (83% by 2010). Although such economic impacts have not been documented for diversity kits in three research sites of Nepal, diversity kits have ensured access to rare varieties and illustrated significant environmental benefits as the numbers of households and the area growing rare cultivars have been increased. Such examples have been reported in taro, finger millet, rice, etc. For example, 70 diversity kits of aromatic sponge gourd collected from a diversity fair in 1998 are now maintained in home gardens of 300 households in Begnas village alone. From this simple intervention, a variety that was in the threatened/rare category is now enjoyed as a common variety. This practice has also shown social benefits as access to rare and economically valuable PGR has reached not only the rich and medium economic strata of communities but also many resource-poor farmers.

Photo: Pitambar Shrestha/LI-BIRD

Lessons learned and issues

The method of diversity kits is very similar to the IRD approach. However, diversity kits aim to deploy diverse cultivars and species with the objective of enhancing diversity and reducing vulnerability from pests and diseases. There are no rigid procedures for diversity kits, which makes the approach very user-friendly. Diversity kits will be more successful if the following issues are addressed:

- Identification of genetic resources for food and agriculture that are valued by resource-poor farmers
- Linking diversity kits with community seed production groups, community seed bank and *ex-situ* collections
- Linking diversity kits with farmers' field schools and PPB programmes
- Training to farmers for selection and maintenance/ grassroots breeding

Formal sectors are critical in this approach as they see diversity kits as the source of new pest and diseases in farmers' field. This seems an important concern because just as it can spread crop diversity, it can also spread the diseases. Therefore, capacity building of local institutions in seed health and local quarantine are essential with community seed production groups and community seed banks so that such risks could be minimised. Often distribution of diversity kits is biased towards the richer farmers, however this method, if properly implemented, can be a mode of social inclusion in ensuring access and equity.

Photo: Pitambar Shrestha/LI-BIRD

Photo: Pitambar Shrestha/LI-BIRD

Photo: Sajal Sthapit/LI-BIRD

Photo: Krishna Lamsal/LI-BIRD

Photo: Mahesh Shrestha/LI-BIRD

Further reading

Friis-Hansen, E and Sthapit, BR 2000. Enhancing farmers' access to plant genetic resources maintained *ex-situ*: Overview. In: Friis-Hansen, E and Sthapit, BR editors. 2000. pp 54-55 Participatory approaches to the conservation and use of plant genetic resources. IPGRI, Rome.

Joshi KD and Sthapit BR 1991. Informal Research and Development. Lumle Agriculture Centre, Kaski, Pokhara, Nepal

Witcombe JR, Joshi KD, Gyawali S and Subedi A. 2003. Participatory crop improvement in the low altitude regions of Nepal. Impact assessment Working document Vers 5.1 . CZAS, UK and LI-BIRD

(Contributed by Bhuwon Sthapit, Sanjaya Gyawali, Resham Gautam and Bal Krishna Joshi)

Community Biodiversity Register: Consolidating Community Role in Management of Agricultural Biodiversity

Photo: LI-BIRD Photo Bank

Traditional knowledge and skills of farmers and indigenous people can make a significant contribution to sustainable development. Empowering community and local institutions to document and use information of their traditional knowledge and biodiversity helps to foster bioprospecting and check biopiracy. CBR methods are used by diverse types of institutions for different purposes and, consequently, methodologies for CBR have evolved into different variants. Two distinct types of typology have been emerged: first, inventory of economically valuable biodiversity at the local level and second, strengthening the capacity of local communities to document important genetic resources and traditional knowledge for developing conservation as well as development plans.

What is CBR?

Community Biodiversity Register (CBR) refers toa record kept in a register by community members of the genetic resources in a community, including information on their custodians, passport data, agroecology, cultural and use values It is also defined as an effort by a community to document and conserve both the biodiversity that is used within a given area, and relevant knowledge about it. In recent years, different methods to document the knowledge base of genetic resources held by local communities have been initiated such as Community seed register and Village community register, as well as Peoples' Biodiversity Charter in India. In Nepal, the Community Biodiversity Register (CBR) was initiated by Global On farm Conservation Project in the year 1998 to strengthen in situ conservation of crop diversity on farm. Initially, CBR was piloted in Nepal in three different villages viz. Talium (Jumla), Begnas (Kaski) and Kachowra (Bara) representing high-hill, mid-hill and terai agroecosystems respectively. Due to its multiple uses and the wider implications of CBR methodology, it has been refined and scaled up by different institutions and organizations documenting the wide range of biodiversity and traditional knowledge of different indigenous or ethnic communities in Nepal. However, the present information is the outcome from the lessons learned during the implementation of various CBR work carried out by various institutions and projects. CBR implemented in Nepal has helped farming communities to develop a sense of ownership of their genetic resources.

Conceptual framework

CBR is a participatory method developed by the project team to address a range of objectives, such as protection of traditional knowledge and genetic materials from biopiracy, promoting bioprospecting, monitoring genetic erosion, developing local ownership for development and conservation actions. Basically, through the CBR process, the on farm conservation project aims to empower local communities and institutions to develop better understanding for their own biodiversity assets and their value so that they play an important role in research, development and conservation strategies at the local level. There is a significant difference in the approach of implementing CBR in Nepal. The project aims to strengthen local capacity for conservation through sustainable utilization and this is only possible through public recognition that the community controls information, materials and the decision-making process of access to and benefit sharing of locally endemic genetic resources. The protection against biopiracy from outsiders is only possible if the local communities valued the importance of biodiversity and are willing to

Photo: LI-BIRD Photo Bank

contribute time and resources in the documentation of genetic resources and associated Traditional Knowledge (TK). CBR is needed for three major reasons: documentation from knowledge erosion, biopiracy protection and empowerment for development and conservation actions so that genetic resources for food and agriculture are conserved for global food security.

Methodology

In recent years, CBR has been debated, proposed and set up in a variety of institutional settings, and for a variety of reasons. Two distinct types of typology are emerging: first, listing of economically valuable biodiversity at the community level, assisted by a group of government professionals or university scholars, and second, empowering the local community to document important genetic resources and traditional knowledge. Figure 1 illustrates a common CBR methodology that combines both objectives of CBR and ensures the control of knowledge and information by local community and government.

What are the minimum data required?

Data of CBR can be recorded at the household (HH) as well as community levels. The minimum data requirement also depends upon the purpose of the CBR programme. The database should answer the following key questions:

- What do we have?
- What do we value most?
- Why do we need to conserve these?
- How do we use them?
- Who are the custodians of traditional knowledge and materials?

The CBR should be maintained in vernacular language with the data required to meet the objective of the mission. The size of CBR registers should be short and handy in nature. Therefore, community members can easily carry it from one place to another. The following data have been identified by communities in Kaski and Bara sites:

1. Cultivar/breeds/species/varieties information (Local, scientific and ethnic names)
2. Existence history at a given location (year of introduction, address of locality)
3. Where the variety came from (original place, source of knowledge and materials)
4. Nature of the species (e.g. annual, perennial, ever green, deciduous, herb, shrub, tree, etc.)
5. Mode of reproduction (e.g. means of propagation are described: seed, clones, sapling, stem, leaf)
6. Natural habitats (as defined by farmers)
7. Extent and distribution of genetic diversity ((R) rare, (M) medium, (W) widely grown)
8. Local techniques/traditional knowledge (practices that describe processing of products linked to specific variety and its management)
9. Uses (good and services of cultivar direct use, option and exploration values)
10. Useful parts, stages and times
11. Life cycle
12. Information on custodians (Name, address and digital photo)
13. Photographs/drawings/herbarium specimens (illustrating distinguishing traits and farmers' descriptors)

Monitoring genetic erosion

Information collected at the HH levels is useful to monitor the trends of genetic erosion at the community level with the following indicators:

- Number of variety names at the community level (collect at the time of the diversity fair)
- Changes in the number of variety names and areas of variety at the community level (need time series data at an interval of two to three years from the base year)
- Number of threatened and rare cultivars (measured by four-cell analysis)

Photo: Pitambar Shrestha/LI-BIRD

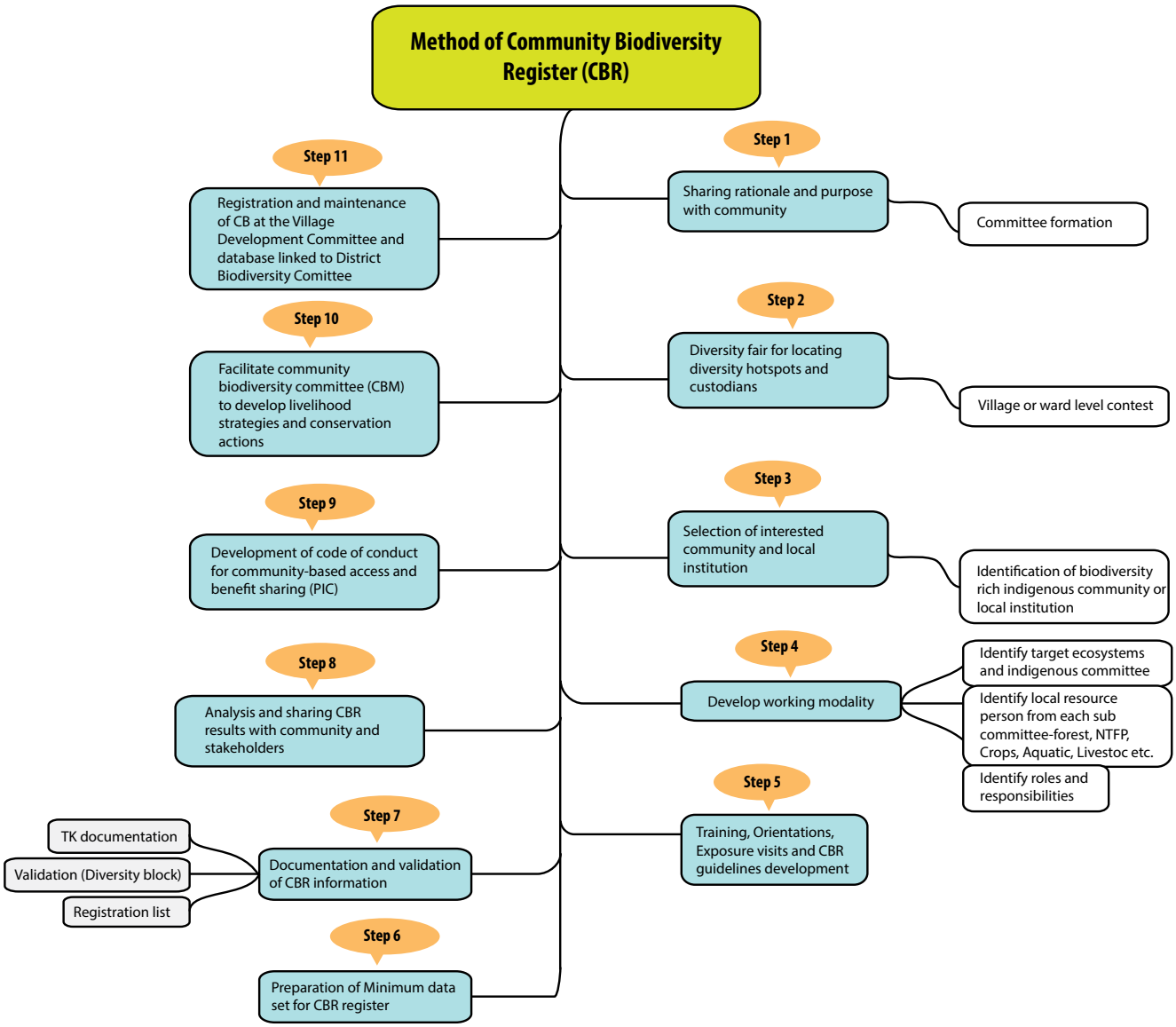


Figure 1. Refined participatory methodology of CBR in Nepal

The monitoring of changes in variety names (richness) and in population size (plot size per variety and number of HHs growing a specific variety in a village or community) of the target crops over time allows community to develop its own conservation plans. This information is not required if the objective of CBR is to check biopiracy.

Use of information for community benefits

The value of CBR will be enhanced if the programme can demonstrate its benefits to the community. It is important to understand why many farmers grow some crops/cultivars in large areas whereas some crops/ cultivars are grown in small areas by many farmers.

The categorization of crop/varietal diversity into a four-cell structure (also see good practice flyer on four-cell analysis) is useful to determine which crops will be necessary to put into on farm conservation and which ones have to be linked immediately to ex situ conservation. In Nepal, based upon knowledge generated for CBR, Community-based organizations (CBOs) have developed income generation programme by promoting high value landrace seed production and marketing (e.g. Jethobudho, Basmati and Anadi rice) as well as conservation actions for rare and threatened local cultivars.

Impact

The Community Biodiversity Register (CBR) method is still evolving and a team is developing this as an empowerment tool to manage biodiversity at community level. However, the impact of the exercise was so great that Ministry of Forest and Soil Conservation (MoFSC), World Conservation Union (IUCN), Ministry of Agriculture and Cooperative (MoAC) and several NGOs invited the project resource persons to train their staff and sought technical inputs during the national biodiversity registration workshop. MoAC) has scaled

Key governance issues	Working modality
What is the unit of CBR documentation?	Village Development Committee (VDC)
Who should have rights to record?	Key stakeholders that have high power, interest (+/□) and legitimacy on specific TK and genetic resources
Who should maintain CBR in a community?	Specialized local institutions (CBOs, IPOs, FGs, UGs) in partnership with its networks and VDC
Who should benefit from the exercise?	Local community and government
Who should fund?	Community biodiversity conservation fund (CBCF) supported by the project and local government (VDC fund)
Where it should be registered?	VDC linked to District Biodiversity Committee
Who should be repositories?	VDC/ward/village
Who should build local capacity?	Specialized NGOs
Who should monitor status of biodiversity?	Local institution
Who should share results and plan for CBM?	Local institutions with GO/NGO support

up the CBR programme in four districts of Nepal with the government's own resources whereas MoFSC has mainstreamed the idea in 25 districts. CBOs like the Agricultural Development and Conservation Society (ADCS) in Bara have linked CBR with the community seed bank and the CBM fund for implementing local level biodiversity activities. This work is highly recognized by national media and policy-makers. Ideas have been further scaled up in Vietnam and other projects in India, Indonesia, Thailand and Malaysia.

Lessons learned and issues

As a result of this project farmers have realized that a large number of local cultivars are conserved by few households and thus are highly vulnerable to genetic erosion and eventual loss. This realization has encouraged 22 farmer groups to form a nodal CBO, namely Agricultural Development and Conservation Society (ADCS) in Bara, one of the in situ sites in the Terai of Nepal. ADCS established a community seed bank with seed money from the local government and the International Plant Genetic Resources Institute (IPGRI, now Bioversity) to store unique landraces of rice, local crops, and vegetables. It is unlikely that biodiversity registration alone by the government or local institutions is a viable and sustainable strategy for TK protection unless the process is internalized for the benefits of local communities.

Further reading

Subedi A, Udas E , Rijal DK, Rana RB, Gyawali S, Tiwari RK, Sthapit BR, Shrestha PK, Upadhyay MP. 2005a. Community Biodiversity Register: Lesson Learnt from Data Analysis of Different Crops at Begnas Village Kaski, Nepal In: Proceeding of Second National Workshop of In situ Conservation of Agrobiodiversity On-farm, 25-27 August 2004, Nagarkot, Nepal, NARC/LI-BIRD and IPGRI.

Sthapit BR and Quek P. 2006. Community biodiversity registers: Overview, concepts and some systematic approaches. Paper presented at the National Workshop of CBR, 27-28 Oct 2005, Khumaltar, NARC, and Nepal.

(Contributed by Abishkar Subedi, Bhuwon Sthapit, Deepak Rijal, Devendra Gauchan, Madhusudhan Prasad Upadhyay and Pratap Kumar Shrestha)

Community Seed Bank: A Reliable and Effective Option for Agricultural Biodiversity Conservation

Photo: Pitambar Shrestha/LI-BIRD

The community seed bank is emerging as reliable option for on-farm conservation of local crop diversity for high technological interventions and high input farming systems with a substantial marginal environment. Farmers are vulnerable to natural disasters such as drought and floods where the speedy erosion of plant genetic resources can be found. In a community seed bank, local crop germplasms are collected along with important information and associated knowledge, stored, regenerated or multiplied as required and distributed to fulfil the seed demands of farmers for their diverse agro-ecology . It is a livelihood strategy and contributes to on-farm management of locally important genetic resources.

Background

Traditional landraces have evolved and adapted to the local farms for many generations. Their loss not only means a loss of biodiversity, but also an abrupt end to evolutionary processes in farming communities. As farmers prefer high yielding modern varieties to maintain food security, there has been significant loss of traditional local landraces. Reasons behind this are lack of quality seeds of local landraces and policy disincentives on landraces. A research study in Kachorwa of Bara district shows that with high technological interventions and easy access to input, farmers are purchasing more high yielding modern variety seeds that are replacing traditional landraces. Such losses of local landraces make the farming community more dependent on outside sources for seeds, reducing their seed security and putting the local seed system in jeopardy.

Community Seed Bank

In spite of various limitations, crop landraces are still being cultivated to meet the seed requirements of variable growing environments and various household needs. However, the growing area and number of landraces is decreasing from large to small and from many households to few. In a community seed bank, local crop germplasms are collected along with important information and associated knowledge, stored, regenerated or multiplied and distributed to fulfil the seed requirements of farmers for their diverse agro-ecology and the promotion off on-farm biodiversity conservation. It is an innovative practice that conserves local landraces and provides continuity to local evolutionary processes along with providing food security to the farming community.

CSB is locally maintained and managed, providing easy access to control over planting materials. Being an *in-situ* conservation practice, local landraces continue to evolve and adapt in their local habitats. CSB addresses all concerns of a healthy seed system. A healthy seed system should have options of diversity, stability, resilience, efficiency and equity.

Methodology

The community seed bank is a community-managed approach that expands local practice from the household to the community. The success of community seed banks rely upon the interest and awareness of the local community on the importance of agricultural biodiversity. However, the following major points can be effective for the establishment of a functional CSB.

Step 1
The community should perceive the alarming rate of landrace erosion and understand the need for conservation. This can be ascertained by referring to the Community Biodiversity Register (CBR).

Step 2
A Community Biodiversity Management (CBM) committee should be formed for cooperating with the

Photo: LI-BIRD Photo Bank

farmers who are motivated for the cause of biodiversity conservation and can invest time in CSB management. The roles of such a committee are to plan and implement village level activities that support sustainable livelihoods and biodiversity conservation actions.

Step 3

Rules and regulations regarding the mechanism for seed collection, regeneration, quality control, access to genetic materials and benefit sharing should be formulated to meet the community interests. Roles and responsibilities of different participants in CBM should also be defined. The decisions should be made with consideration of the local context, customs and values for making it locally sustainable.

Step 4

Locally available materials can be used for the construction of a seed storage structure; the use of local materials and contributions makes the overall management locally sustainable.

Step 5

Collection of local seeds based on information of the CBR, diversity fairs, nodal farmer networks, neighbours, relatives and neighbouring villages. It would be essential to provide a conceptual and practical training to ensure proper handling and storage of seeds.

Step 6

Distribution of the seeds should be based upon the rules and regulations giving special emphasis to the farmers who are not in the position to save or do not have any capacity to purchase seeds. In addition, a diversity block of each crop as a field gene bank should be maintained for demonstration and evaluation and to increase seed quantity for the subsequent year. Provide enough orientation to the seed bank source user during seed distribution and before harvest to maintain quality and assure seed return. Organise seed selection training according to the crop season to encourage participants for on-farm conservation and to support landrace enhancement.

How do community seed banks work?

Community seed banks have great potential utility and success in areas with a) high technological intervention, b) high access to input, c) marginal environments and economies and d) frequent natural disasters like floods and droughts. In areas with high technological intervention or with easy access to input (modern varieties, fertilizers and tools) farmers are more likely to neglect traditional varieties as was the case in Kachorwa. Likewise, in marginal economy and disaster prone areas, landraces are at a high risk to losses due to stochastic events like bad growing season, floods, etc. In these areas, community seed banks can provide a viable option for conserving traditional landraces. Furthermore, local landraces are better adapted to their marginalized environments than modern varieties. Community Seed Banks can provide a constant supply of seeds for these environments, ensuring relatively high production even in sub-optimal growing environments.

The community seed bank initiated at Kachorwa, of Bara district is a leading example of sustainable local seed security, supporting community seed demands, and enhancing farmers' access to quality seeds, thereby promoting conservation of local crop diversity on-farm. After the community seed bank's initiative, the number of rice landraces has been increasing and the seed security system is being enhanced locally. Awareness created by the *in-situ* conservation project encouraged CBR members to establish a community seed bank in a systematic way, for developing storage structure, local seed collection, regeneration, distribution, rules setting and its overall management. However, initial external support (based on local commitment and contribution) is crucial to establish a community seed bank for group organization, seed bank stores and seed storage structures preparation. Being a community-managed approach with direct benefits going to the farmers, the farming community has taken the ownership of this approach making it self-sustaining after its establishment.

Photo: Sajal Sthapit/LI-BIRD

Table 1: Access to rice landraces seed from CSB to different socio-economic categories.

Year	Number of farmers of different socio-economic category				Number of	Seed Qty.
	Rich	Medium	Poor	Total number	Landraces	(Kg)
2003	5 (12%)	19 (48%)	16 (40%)	40	11	86.75
2004	6 (17%)	14 (40%)	15 (43%)	35	13	69.3
2005	17(20%)	37 (42%)	33 (38%)	87	23	197.2

(Source: Seed distribution records from CSB, Kachorwa, Bara)

Impact

CSB has resulted in increased social cohesiveness as it has been managed through community group actions. It also has given greater priority of seed access for women group members and resource poor farmers who are not able to save or purchase seeds (Table 1). This has increased the extent of social inclusion and equity as well as provided economic benefits to the community.

After implementation of CSB the number of landraces and overall diversity has increased and seed has become abundant and accessible. With the increase in biodiversity, the community in Bara internalized the values of biodiversity. CSB has also resulted in a biologically and agriculturally healthy seed system. These changes have increased the stability and resilience of the community agro-ecosystem.

Lessons learned and issues

Community Seed Bank is a community owned and managed activity with integrated efforts like local financial resource mobilization, creation of a conservation fund, income generation and community development activities, which was found to be effective and sustainable. Social, institutional and financial aspects are important elements of sustainability.

This indigenous knowledge based and local community managed low cost approach has not faced major technical and financial difficulties, but still, there is no field guide for implementing community seed banks as the focus has been on long-term preservation in gene banks.

Photo: Sajal Sthapit/LI-BIRD

An initial effort of this approach has shown the encouraging results in on-farm conservation of agricultural biodiversity and hence partnership between plant breeding programs, agriculture development agencies and community seed banks needs to be developed for better utilization of local crop landraces conserved at community seed banks. Further, research and development efforts are needed to ensure conservation and utilization of agricultural biodiversity with simultaneous increases in the income and economic status of the people.

Further Reading

Shrestha P, A Subedi, D Rijal, B Sthapit, D Singh, M Upadhyaya, (2004). Enhancing Local Seed Security and on-farm Conservation through Community Seed Bank in Bara District of Nepal. Proceeding of national workshop on on-farm biodiversity management of agrobiodiversity in Nepal, Nagarkot 2004.

Shrestha P., B. Sthapit, P.K. Shrestha, M, P. Upadhyay and M. Yadav (2008). Community Seed Banks: Experiences from Nepal. In Marja H. Thijssen, Zewdie Bishwa, Abdurhman Beshir and Walter S. de Boef (editors). Farmers, Seeds and Varieties Supporting Informal Seed Supply in Ethiopia, Wageningen International, the Netherlands.

Shrestha P., B. Sthapit, A. Subedi, D. Poudel, P. Shrestha and B.K. Joshi (2007). On-Farm Management of Agricultural Biodiversity through Community Seed Bank in Nepal. Proceeding of National Symposium on "On-farm management of *In-situ* Conservation of Agricultural Biodiversity in Nepal: Lessons Learned," 18-19 July, 2006, Kathmandu, Nepal, B. Sthapit, D. Gauchan, A. SUbedi and D. Jarvis (editors).

(Contributed by Pitambar Shrestha, Abishkar Subedi, Sajal Sthapit, Deepak Rijal, Shalikram Gupta and Bhuwon Sthapit)

Photo: Mahesh Shrestha/LI-BIRD

Community-based Biodiversity Management: Empowering Community to Manage Agricultural Biodiversity

Photo: Pitambar Shrestha/LI-BIRD

Community-based biodiversity management (CBM) is a participatory approach to empower farmers as well as the local institutions for managing biodiversity for social, economic, and environmental benefits to communities as well as to the general public. This approach, developed by the in-situ conservation project, is focused on community level issues, enhancing the capacity of communities to analyzes livelihood assets, problems, and to seek and implement solutions with respect to use and conservation of genetic resources of agricultural biodiversity. It recognizes and supports local institutions and communities as legitimate and crucial actors in the national plant genetic resource system, and its role in the wider context of biodiversity and development. Communities are empowered to exercise their rights and secure access and control over their genetic resources. The approach is community-centered, strengthens local decision making process and emphasizes local governance in the conservation and utilization of community biodiversity resources.

Background

In order to maintain and enhance the value of agricultural biodiversity as a resource for the rural poor and for humanity as a whole, communities and institutions need to be supported, empowered, and assisted in accessing and managing their agricultural biodiversity assets to support their livelihoods. The goal of such a process is to ensure that communities have the capacity to manage the agricultural biodiversity they depend upon and to continue to shape and adapt particular diversity to meet their needs in accordance with changing environments.

Formal research and development programme often fail to involve farmers and/or to strengthen the capacity of local communities for the management of their biodiversity resources. Poor capabilities of farmers and communities to make decisions on issues related to management and conservation of agricultural biodiversity and to implement these decisions are problems that often hinder a farmer's organized efforts in accessing knowledge, information, technology, capital, genetic resources, markets and other sustainable livelihood assets.

Community-based Biodiversity Management is a community-driven participatory approach to strengthen the capacity of farmers and farming communities for managing biodiversity for social, economic and environmental benefits of the household and the community. The approach empowers farmers and communities to organize themselves and develop strategies and plans that support on-farm management of agricultural biodiversity such as healthy seed systems, community seed banks, community biodiversity registers, and reinforces farmers' role as plant breeders. This method results in communities taking more control of their resources with increased ownership for on-farm conservation and sustainable livelihood options with carefully selected and appropriate external inputs and risks. The CBM approach is concerned particularly with facilitating social processes; such as social networks, community institutions, collective action and decision making so as to contribute to conservation and utilization of community biodiversity resources. For example, social seed networks play a key role in determining access to seed and information. The CBM approach is based on the finding that the maintenance of a large diversity of landraces depends on farming practices, customs, traditions and livelihood needs. All of these affect the movement of genes between households, within and between villages, and to larger geographic areas.

Photo: Mahesh Shrestha/LI-BIRD

Methodology

Empowerment of community members and local institution is the fundamental strategy of the CBM approach. It aims to build the capacity of farming or user communities and their institutions in ways that increase their decision making power and secure their access to and control over resources necessary for the sustainable management of community biodiversity resources. The key elements that form the basis of CBM include: (i) knowledge about biodiversity and associated landscapes, (ii) social systems facilitating maintenance and exchange of their genetic resources, (iii) local institutions that support and govern local management and access to biodiversity, (iv) technologies, processes and practices that add value to local genetic resources, (v) local financial resources such as savings and credits to ensure sustainability of continuing good practices, and (vi) necessary linkages to appropriate institutions which will sustain access to livelihood assets. CBM is a process-led approach and builds on the existing capacity of the farming communities. Establishing and promoting the CBM approach to managing community biodiversity resources includes the following steps.

Step1. Enhancing community awareness and education on agricultural biodiversity (building human capital)

Raising public awareness and educating people about the value of agricultural biodiversity conservation is usually the first step in the CBM approach. It plays a crucial role in motivating farming communities in developing and implementing community-based conservation strategies. Individual farmer's actions are largely oriented to addressing livelihood goals and, therefore, though such actions might contribute to conservation, do not ensure conservation *per se*. Awareness and education inspires and binds individuals to show their social responsibility and contribute to the community actions aimed at conservation of agricultural biodiversity resources.

The *in-situ* conservation of agricultural biodiversity project has identified a number of awareness raising methods about the value of and need for implementing conservation strategies. A village workshop is organized as one of the first activities (entry point) to establish a working relationship with the farming communities and initiate interactions to raise awareness about their agricultural biodiversity resources. Then community members plan and implement awareness activities such as biodiversity fairs, food fairs, rural dramas, rural poetry journeys, cultural folk song competitions, rural radio, exchange visits and so on.

Step 2. Understanding the local context (biodiversity, social networks and local institutions)

In the first step, the diversity fair is a good practice to understand the local context and also could be used to locate diversity, custodians and farmers' knowledge base and so on. Then, a participatory assessment of agricultural biodiversity is done using the four-cell analysis method involving community members in the process. The method helps community members and the partner organizations to identify common, unique and rare genetic resources; to understand farmers' rationale determining the extent and distribution of local crop diversity; to identify important biological assets that play vital roles in the livelihoods of local people; and ultimately to enable them to develop diversified livelihood options and conservation strategies.

Social seed network analysis is done to identify nodal farmers who play major roles in the informal flow of genetic materials and associated knowledge within and outside the farming community. Participatory four-cell analysis and other participatory rural appraisal (PRA) methods are also used to understand the community agricultural biodiversity resources and social context governing these resources. During these PRA sessions, community members are facilitated to ask key questions, such as what do we have? What do we value? How do people manage their genetic resources? Why do we need to conserve them? How do we use them? Who maintains diversity and knowledge? What are the key factors that influence farmers' decision making?

Photo: Bhuwon Sthapit/Bioversity

Photo: LI-BIRD Photo Bank

Step 3. Setting up and building capacity of community institutions

The CBM approach to conservation and utilization of agro-biodiversity builds on the capacity of farmers to organize themselves into community institutions. Once community level institution is established, various training and orientation programme on both technical and institutional management aspects are organized to pass the knowledge and skills to assess their own needs, set priorities based upon available resources, prepare and implement CBM work plan. Such programmes have been found to increase work efficiency, self-confidence and social mobilisation capacity of local institutions.

Step 4. Consolidating community roles in planning, and implementation

CBM encourages a bottom-up programme planning process guided by the needs of the community which are assessed locally. The local institution coordinates formulation and prioritization of CBM plans through village workshops and focus group discussions (FGDs) involving community members and local stakeholders in the process. Activities are also organized to strengthen the capacity of community-based institutions to effectively coordinate and implementation of the CBM plans, and mobilize resources and funds from within as well as outside the community. A number of community-based good practices for the conservation and utilization of local genetic resources has evolved from the project and these are increasingly being internalized within the community action plans. These good practices include: biodiversity fair, community biodiversity register, diversity block, diversity kits, community seed bank, and community-based seed production of landraces and local varieties.

Step 5. Establishing a CBM Fund

Implementation of CBM action plans not only requires the collective action of the community members but also the financial resources. Thus, a CBM Fund is included as an integral part of the CBM approach. In the *in-situ* project, such a fund was created by contribution from the project as seed money. This fund is now managed by the local institution and its members receive loan for the conservation-oriented productive.activities The interest generated from such investment helps grow the fund and utilize part of it for its management. This fund could become part of the access and benefit sharing scheme, where a portion of the benefits accruing from the use of community genetic resources can directly go to this fund and later be used for the welfare of the concerned community. The CBM Fund has been found effective in organising community members, developing ownership towards the programme and in motivating them to implement CBM action plans. It is important that the capacity of the CBM Committee is strengthened in managing such a fund. Training on accounting principles and procedures and transparent book keeping is essential.

Step 6. Community M&E System

Developing monitoring and evaluation indicators and agreeing on the procedures for monitoring progress against these indicators with the active participation of farming communities are important components of the CBM approach. The project has facilitated the CBM committee to organize review meetings and traveling seminars, involving community members on a regular basis. Similarly, a CBM activity calendar, prepared in consultation with farming communities, has been found to be an effective tool for planning and monitoring of the CBM activities. Documentation of good practices is also encouraged for scaling up of learning to a wider geographical area and social context.

Step 7. Social learning and scaling up for community collective action

The final step of the CBM approach is scaling up of the good practices of CBM to include a larger number of households and farming communities adopting/adapting such practices. It is useful to organize annual or bi-annual social learning meetings to review the progress, bring out success and failures of interventions and identify new innovations and practices that can be scaled up to other households and communities. The synthesis of social learning and good practices has been effectively used to inform policy makers and influence creation of supportive policy environments.

Impact

Experiences in the *in-situ* project in Nepal show that the CBM approach has been quite effective in empowering farming communities to organize and act collectively to plan and implement programme for the conservation and utilization of community biodiversity resources. In both Begnas and Kachorwa project sites, a number of conservation and utilization practices, such as community biodiversity register, community seed bank, diversity blocks, production and marketing seeds of local crop varieties, value addition through processing

and marketing of local crop products and so on has been fully institutionalized. Landrace enhancement and participatory plant breeding (PPB) have been used in improving competitiveness of locally adapted landraces. The CBM Committees and CBOs have evolved strongly and are effectively coordinating CBM activities. CBM Funds have also been established and are effectively being used for the benefits of the community members. Many socially excluded, poor and marginal women farmers have started to participate and benefit from the CBM programme. Women farmers, who never participated in public meetings or expressed their opinions, have been observed to be active in social activities. These women farmers have gained access to seed and small credits, without having to deposit any collateral, to purchase goats, poultry and agricultural inputs.

Lessons learned and emerging issues

The initial results show that the CBM approach is effective in empowering farming communities to apply a wide range of practices for the conservation and utilization of agricultural biodiversity. The effectiveness of community-based institutions could be further improved by forging effective linkage and partnership with research and development institutions. Technical support to improve quality of seeds in the community seed bank and linking community seed banks with national gene banks are areas that need further attention. Value addition for building incentives for conservation has been recognized as an effective strategy within the CBM approach for the conservation and utilization of local genetic resources. Further validation regarding the success of the value addition approach requires a long-term engagement and commitment. Similarly, capacity building does not happen overnight. It requires continuous engagement and backstopping, especially in financial and human resources management and in seeking funds to sustain and scale up their activities.

Further Reading

Subedi A, Shrestha P, Sthapit B, Rijal D, Rana R, Upadhaya MP and Shrestha PK 2005. Community-based biodiversity management: Lessons learned from the in situ conservation project. On-farm conservation of agricultural biodiversity in Nepal. Vol II. Managing diversity and promoting its benefits (Sthapit et al, 2005 Eds), Proceeding of national workshop on on-farm biodiversity management of agrobiodiversity in Nepal, Nagarkot 2004.

Sthapit B., P.K. Shrestha, A. Subedi, P. Shrestha, M.P. Upadhyay and P. Eyzaguirre (2008). Mobilizing and Empowering Communities in Biodiversity Management. In Marja H. Thijssen, Zewdie Bishwa, Abdurhman Beshir and Walter S. de Boef (editors). Farmers, Seeds and Varieties Supporting Informal Seed Supply in Ethiopia, Wageningen International, the Netherlands.

(Contributed by Abishkar Subedi, Pitambar Shrestha, Pratap Kumar Shrestha, Resham Gautam, Madhusudan Prasad Upadhyay, Ram Rana, Pablo Eyzaguirre and Bhuwon Sthapit)

Participatory Plant Breeding: A Strategy of On-farm Conservation and Improvement of Landraces

Photo: LI-BIRD Photo Bank

Farmers' ability to select, maintain and exchange local crop diversity has been recognized as important human assets for on-farm conservation of agricultural biodiversity. For resource-poor farmers, crop varieties adapted to particular niches, biotic and abiotic stresses, or diverse uses are the main resources available to increase production and provide secure livelihood options. The participatory plant breeding process offers plant breeding concepts and skills to encourage farmers to continue to select varieties and manage local crop populations and seed supply systems through informal and formal seed networks. Hence it can be considered as a strategy for on-farm management of local crop diversity.

What is PPB?

Over the past two decades on-farm conservation and genetic resources management, particularly Participatory Plant Breeding (PPB), has developed from a little known concept to a novel approach, capturing the attention of many people. This concept of PPB has been considered to be a method for on-farm conservation and promote use of local crop diversity. It has been developed to make up for the apparent limitations and shortcomings in the present formal and centralized systems of breeding. PPB attempts to develop crops and varieties that are better adapted to farmers' local environmental conditions and give more attention to the diverse traits that farmers and consumers value in their specific localities. As a default, one of the locally adapted parents is used for hybridization as this allows for retaining some useful alleles in the gene pool.

PPB is a response to various developments in agriculture occurring over the last fifty years, mainly being the following:

- Strong genetic erosion caused by changes in farming systems, land use, and commercialization, which limits farmers options to produce crops and narrows the genetic base needed for rural farming communities to cope with future demands in crop improvement
- Erosion of farmers' knowledge and farmers' culture to deal with new biotic (pest and diseases) and abiotic stresses (draught, cold, heat)
- In general, low adoption rate of formal sector varieties by farmers in specific and difficult areas due to poor emphasis on cultural and other use values

PPB involves a range of different approaches, from formal-led to farmer-led initiatives. The project focuses on development of PPB in a farmer-led environment, where farmers decide on their breeding objectives. The availability of genetic materials, including products of locally adapted landraces and breeding lines, is extremely important for the success of PPB.

PPB aims to conserve local genetic resources that are endangered or are on the verge of extinction from their habitat by adding value to them. The project aims to demonstrate that the value of farmer identified landraces, some of which are threatened for survival, could be increased by a PPB process. PPB offers skill and opportunity to farmers for searching for new diversity, selection and exchange of variable populations that match their local preferences and needs. Under PPB, both the farmer and the breeder take part in selection of segregating populations from the earliest stages.

Methodology

Figure 1 shows two approaches of self-pollinated crop breeding. The steps of plant breeding are common to conventional plant breeding, however, the methodology and approaches for goal setting, choosing parents and

population sizes of early generations and testing and evaluation of segregating materials in farmers' fields are different as given below:

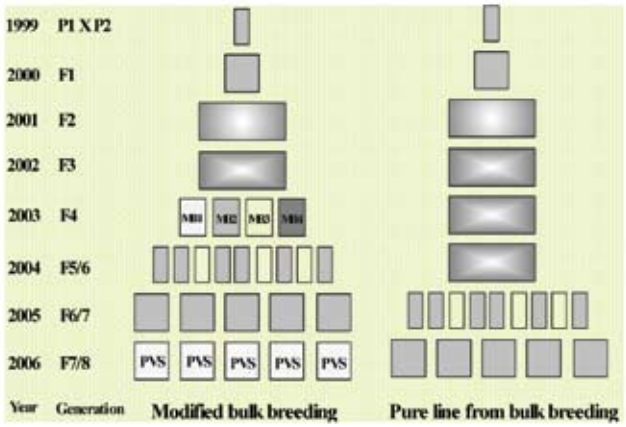


Figure 1. Modified bulk breeding and pure line from bulk breeding adapted to PPB in *in-situ* conservation project in Nepal (Gyawali *et al*., 2005).

Reaching the clients

- Farmers' selection after F5-6 stages are multiplied and tested in many households using mother and baby trials within PPB village. Once the materials are perceived well by the farmers, this is tested further on a wider scale through PVS. The lines selected in PVS are multiplied in parallel through community based seed production programs and linked to agro-vets.
- Experts from the District Agriculture Development Office, seed producer groups, rice millers and merchants are involved during PVS to get their feed back to the selected lines.
- Monitor the farmer to farmer spread of the bulks. The detailed studies of the most superior varieties bred from PPB are done for variety release purpose. Therefore, data right from F6 on ward generations need to be documented properly for variety release purpose.

Steps in PPB program	Objective of each step	Method (how to do?)
1. Goal setting	Setting breeding goal with target farmers	Market analysis: Analysis of use values of local landraces through four cell analysis
2.Generating diversity	Choosing parents	Evaluation of potential parents on performance (adoption studies) such as in diversity blocks, and participatory variety selection (PVS). Analysis of complementarity between parents; use landrace as one of the parents
	Making crosses	Controlled cross pollination between individual plants (self pollinated crops). Crossing among individual plants between selected landrace and complementary parents.
3.Selection in segregating generations	Advancing and selecting in segregating generations.	Generation advance, individual plant selection, selection among and within bulks selection among and within families, stress-screening nurseries in on-farm conditions.
	Community empowerment on selection in segregating materials	Training on the concept of segregation, selection, heritability, and genetics. Organize field visits and facilitate interaction with farmers breeders from other relevant PPB projects, joint selection by breeders and farmers to enhance selection skills
4.Testing varieties	Trials on research station (disease screening and RYT) and farmers' fields (mother and baby trials) simultaneous in PPB.	Evaluation of fixed lines varieties for yield, resistances, and quality in replicated trials milling and organoleptic testing.
5.Seed supply	Seed multiplication Seed supply	Breeder, foundation and certified seed production (formal seed supply). Facilitating informal seed supply (Truthfully labeled and quality declared seed). Marketing and popularization. Information supply.
6.Impact assessment	Impact assessment	Identifying adopters and adopted varieties; collection of feedback through surveys, interviews, group discussions, four cell and molecular analysis.

Photo: LI-BIRD Photo Bank

Changing attitudes of farmers and scientists

Within traditional crop production systems, the direct use value of local crop diversity is well recognized by farmers; however farming communities may often not fully recognize the breeding value of gene and genetic traits inherent in farmers' varieties or landraces. Sthapit et al, (1996) have shown that by utilizing farmers' knowledge, the value of local diversity has been increased by participatory plant breeding. For example, PPB programs using local landraces have enhanced desirable traits such as chilling tolerance, ShBR, blast resistance and adaptive traits and eliminating undesirable grain color and quality. Similarly, through PPB, *Mansara* rice, which is valued for better adapted to poor fields, has been hybridized with locally released quality improved variety viz. *Khumal-4* to improve quality and yield of *Mansara* variety, while still maintaining the traits adapted to the low-input agriculture conditions (Sthapit *et al* 2001). Similarly, the PPB programme in Bara has resulted 5 promising lines (*Kachorwa 4*, *Kachorwa 5*, *Kachorwa 11*, *Kachorwa 124* and Kachorwa 162) which are now increased from 16 households to fields of 35 households. The main reasons for selection were better yield performance under rain fed and drought conditions, resistance to lodging, better taste and grain types similar to the local parent (Shrestha, 2006). A cross of two high quality rice varieties (*Biramphool* and *Himali*) is also doing well in Begnas village.

The involvement of farmers in the breeding process not only adds value to the conservation of local crop diversity but also helps to maintain and enhance farmers' knowledge on the selection and management of local crop populations, and to enhance seed supply systems. Since the PPB group was formed, four broader effects have been noticed: 1) increased quality of farmer participation, 2) increased local capacity, 3) improved work efficiency and 4) increased social learning and feeling of ownership. There were greater realization and respect between farmers and plant breeders that together they can make a difference on crop improvement of their interest.

The involvement of farmers in the breeding process not only adds value to the conservation of local crop diversity but also helps to maintain and enhance farmers' knowledge on the selection and management of local crop populations, and to manage seed supply systems. At the same time diverse farmer preferences, agro-ecological niches and local farming systems help to conserve a reservoir of genetic diversity on-farms. This reservoir can be considered to be valuable pre-breeding germplasm as it adds security to their livelihoods. Since the PPB group was formed within the CBM programme of a local institution (CBO), four broader effects have been noticed: 1) increased quality of farmer participation, 2) increased local capacity, 3) improved worked efficiency and 4) increased social learning and feeling of ownership. There were greater realization and respect between farmers and plant breeders that together they can make a difference on crop improvement of their interest.

Table 2. Spread up of PPB products and its impact on other rice diversity in two on-farm conservation project sites in Nepal, 1998-2005.

Cross	HH #	Variety #	Distribution pattern	Impact on existing diversity at HH level
Kachorwa 4	6	6	2.1% area of total rice area of 6 HHs (2082 m^2)	Kachorwa 4 has replaced both MV viz. China 4 and BG 1442 (Hardinath-1) varieties because of its higher yield and better eating quality
Kachorwa 5	2	4	2.1 % of area of total rice area of 2 HHs (204 m^2)	Kachorwa 5 has replaced China 4 and BG 1442 (Hardinath-1) varieties.
Mansara x Khumal-4	17	19	3.6% of area of total rice area of 17 HHs (2820m^2)	These HHs maintained 17 landrace and 2 modern cultivars. Slowly decreasing the area of landrace *Mansara*
Biramphul x Himali	9	14	2.5% of area of total rice area of 9 HHs (2662 m^2)	These HHs maintained 13 landrace and 1 modern cultivar. Capturing the domain of the *Biramphool* variety and is becoming popular due to its good aroma and yield

Photo: ADCS, Kachorwa, Bara

Learning and emerging issues

Many public-sector plant breeding programme do not use explicit techniques and approaches to orient their programme close to their clients' needs. Four cell analysis devised by the *in-situ* team was found to be rigorous for setting up breeding goals and also identifying the local landraces as one for the parents for PPB. Consultation with target farmers for setting breeding goals is the most important step of PPB, which is often ignored in public sector plant breeding. It is essential to have a large population size during the segregating generations to find the best transgresive segregants. Modified bulk breeding and line breeding from bulk are simple and easily adapted breeding methods to highly client oriented breeding such as PPB.

Selection under target environments is key to the success of PPB in *in-situ* conservation programs. It is important to train the farmers on segregation, selection, heritability, breeding methods and genetics to make farmers realize the importance of diversity in segregating bulks. Farmers' participation in post-harvest and organoleptic quality taste is equally important. The assessment of contribution by local parents (favorable genes) to selected progenies using molecular markers is helpful to assess the output to achieve the *in-situ* conservation objectives. We have found that through PPB, useful genes from local parents could be conserved on-farm and farmers can play an important role in achieving these conservation goals. Issues related to intellectual property rights of PPB products are emerging and need to be discussed at the outset of the programme with the community.

Further reading

Sthapit BR., K.D. Joshi, and J.R. Witcombe. 1996. Farmer participatory cultivar improvement. III. Participatory plant breeding, a case of high altitude rice from Nepal. Experimental Agriculture 32:479–496.

Witcombe JR., Joshi, A. Joshi, K.D. & Sthapit, B.R. 1996. Farmer participatory crop improvement. I. Varietal selection and breeding methods and their impact on biodiversity. Experimental Agriculture 32: 445-460.

Witcombe JR., K.D. Joshi, S. Gyawali, A.M. Musa, C. Johansen, D.S. Virk and B.R. Sthapit. 2005. Participatory plant breeding is better described as highly client oriented plant breeding. I. Four indicators of client orientation in plant breeding. Experimental Agriculture, 41:1-21.

(Contributed by Sanjaya Gyawali, Bhuwon Sthapit, Bal Krishna Joshi, Ashok Mudwari and Jwala Bajracharya)

Participatory Landrace Enhancement: An Economic Incentive to Support On-farm Management of Agrobiodiversity

Photo: Pitambar Shrestha/LI-BIRD

What are the key factors that make some diversity rich farming practices profitable and productive in the market economy? There are meagre examples that demonstrate social, economic and environmental benefits from the use of local crop diversity. The participatory landrace enhancement programme of the Jethobudho (JB) population from Pokhara Valley has demonstrated the value of on farm conservation of traditional varieties. The case study tested the hypothesis that economic incentive is a more low-cost strategy to support on farm conservation than other means of conservation. Preliminary results reveal that there are economic and social benefits from landrace enhancement to farming communities but its ecological cost has to be assessed with livelihood gains over time.

Value of diversity

Landraces, or farmers' traditional cultivars, are important biological resources for ensuring sustainable production and improve livelihood options and are the foundation upon which plant breeding depends for the creation of new varieties. Therefore, they have a critical public value for global food security. In Nepal, there are various local varieties that possess significant amounts of genetic variation. However, they have not yet been fully capitalized on, to demonstrate social and economic benefits of on farm conservation. Not all landraces can be conserved on farm, and not all farmers can conserve them because of the cost involved. Due to the lack of adequate incentives to the farmers for continuing conservation and lack of innovative plant breeding of local crop varieties, landraces are disappearing at an alarming rate. The challenge in many developing countries is to create incentives for maintaining diversity that can benefit the present and future generations of farmers.

Traditional varieties are valued by geneticists and farmers because of diversity (a heterogeneous population), rarity (embodying unique traits) and adaptability (exhibiting wide ecological and socio-cultural adaptation). One way of distinguishing those varieties that provide high public value is to classify them in terms of their immediate and future plant breeding value (Smale *et al.*, 2004). Maintenance of landraces is important to farmers and the country because they serve both private (direct use value) and public (diversity, rarity and adaptability) values. The On-farm Conservation Project in Nepal tested the hypothesis that landrace enhancement of unique landraces is one of the practical strategies for on farm management of agricultural biodiversity *in situ* (Gyawali *et al*, 2004a).

Methodology of landrace enhancement

The project team selected JB landrace population as a test case for landrace enhancement study to demonstrate the value of on farm maintenance of diversity to farmers, researchers and policy makers so that national resources are mobilized for increasing income and livelihood options. The rationales for selecting JB landrace are: 1) heterogeneous population within the valley, embodying unique quality traits, 2) adaptability to local culture and ecology, and 3) potential scope for crop improvement to add value of the landrace.

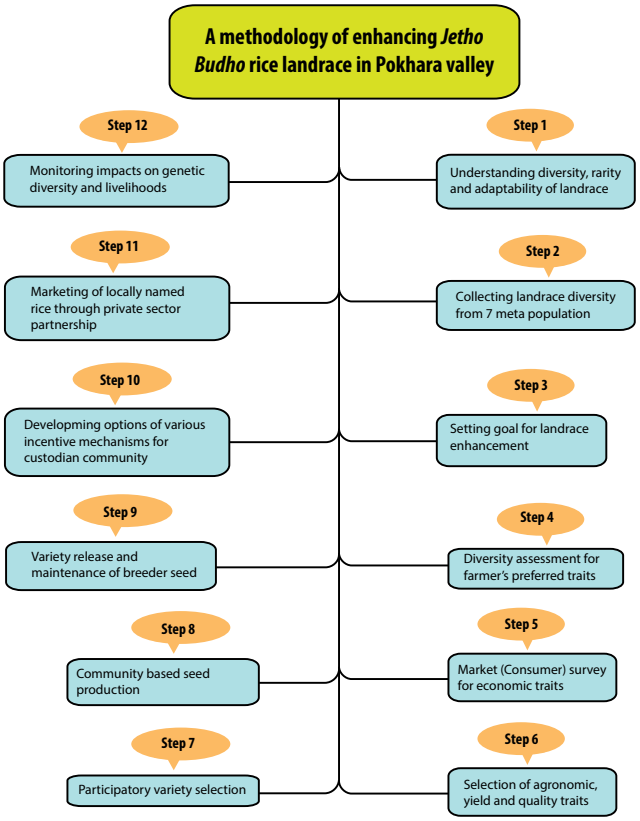


Figure 1. Process of participatory landrace enhancement

Outcomes

Overall performance of Jethobudho (JB)

A total of 260 randomly selected JB growing farmers from Pokhara valley participated in participatory variety evaluation of improved JB with their own local JB during 2003 and 2005. Table 1 shows overall performance of six selected lines. Figure 2 illustrated the comparative performance of the improved JB with local JB in most of the preferred traits.

Gains in quality traits:

JB rice is known for its quality and consumers are willing to pay the premium price (74 % higher price than *Mansuli* rice). A baseline study indicated that 21% of farmers from Begnas village maintained JB for its superior post-harvest qualities, productivity and price stability over other common landraces. Authentic JB rice when cooked has superior softness, flakiness, aroma and better taste, as indicated by a consumer preference ranking survey. Variability in quality is the main concern of consumers and market entrepreneurs for JB rice marketing.

We found the enhanced materials were highly preferred for post harvest quality traits, by the farmers (Figure 3). Selected JB had more than 72% milling recovery with a maximum range of 79%. It was also found that Jethobudho landrace meets international standards and has a potential to be marketed in Arabian markets because of its special quality traits that Arabian consumers prefer.

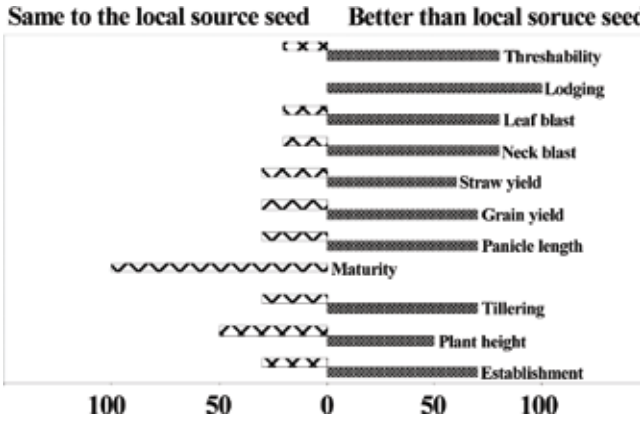


Figure 2. Participatory variety selection resulted in better understanding and farmers acceptance for enhanced materials based on various agronomic characters (Gyawali *et al.,* 2004b).

Table 1. Comparative performance of selected Jethobudho accessions in Kaski

Accessions	Source of materials	Address	Milling recovery %	Plant height (cm)	Grain yield t ha-1	Straw yield t ha-1	Organoleptic weightage
JB-T-010-025/5	Dhan Bdr. Karki	Lekhnath Sisuwa	71.2	178.4	2.95	13.41	427.5
JB-T-023-030/25	Meghnath Subedi	Lekhnath-8, Sisuwa	71.2	171.5	2.96	12.9	465.0
JB-T-103-237/12	Ganga Giri	Kaskikot-7, Pame,	68.8	174.3	3.35	14.0	427.5
JB-T-105-238/5	Man Bdr. Sunar	Kaskikot-6, Pame,	72.9	178.1	3.40	14.6	427.5
JB-T-147-296/6	Kedar Pd. Kafle	Pokhara-17 Biruwa	70.9	177.5	2.83	12.7	420.0
JB-T-168-316/3	Bhim Pd. Baral	Pokhara-7, Maswar	77.2	179.4	2.87	12.7	450.0
Average			72.03				436.25
LSD at 0.05				8.58	0.88	2.46	
CV%				2.7	16.2	10.6	

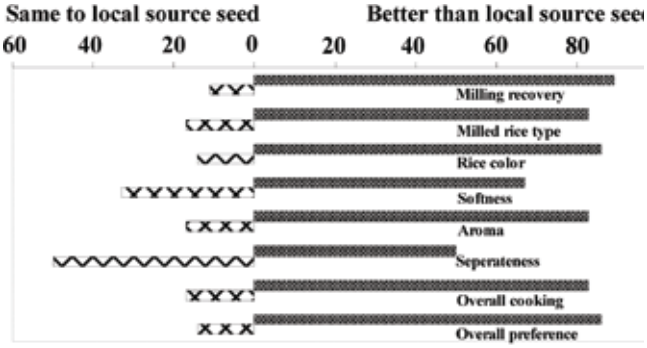


Figure 3. Farmers' perception on post harvest quality traits colleted using HLQ in PVS trials in Pokhara valley in 2003 (Gyawali *et al.*, 2004c).

Community based seed production (CBSP)

In order to share the benefits of JB landrace development with a large number of farmers, community based seed production (CBSP) was initiated with diverse stakeholders for *Jethobudho* landraces. It aims to strengthen healthy seed systems adapted to ensure the sustained supply of seed of enhanced landraces to the farming communities. The project established a link between community seed producers with seed entrepreneurs and a district self reliance seed production programme for social, economic and institutional sustainability. The system has now produced 80 kgs of breeder seed and 1.7 t truthfully labeled seeds for marketing and distribution. The private sector, especially rice millers and merchants, have special interest in enhanced *Jethobudho* for marketing, thereby contributing to conservation through utilization. They are willing to pay NPRs 1500 per *muri* (70 kg husked rice) for enhanced JB compared to local JB (NPRs 1200).

Variety release and recognition of custodians

The National Variety Release and Registration Committee of the National Seed Board visited to assess the performance of *Jethobudho* in farmers' fields in Pokhara valley. The technical committee has invited the plant breeders of the *in situ* project to submit the release proposal as soon as possible.

Learning and emerging issues

Participatory landrace enhancement is a quick method (7 years) for demonstrating value of on-farm conservation to community and policy makers. National partners have initiated germplasm enhancement work in rice landraces (such as *Jhinuwa, Kala Namak, Ganjale Masino* and *Lalka Basmati*) and also fingermillet populations of *Kalo Dalle* and *Samdhi Kodo* in Kaski valley.

Creating market incentives for conservation and exchange of selected populations is a current challenge for the PPB team. The team is developing provision of geographic indication (GI) for landraces such as *Jethobudho,* the native of Kaski valley and incentives ensured through GI should go to the custodian farmers. Policy makers should translate their theoretical support for agricultural biodiversity conservation and commercialization of high value products into practice through policy reforms and legal support.

At the community level, it is essential to link farmers with the market (private sectors), as the quickest way to generate income from their local products. The private sector has initiated interactions with scientists involved in the enhancement process to negotiate for making enhanced *Jethobudho* accessible to large number of farmers in the Kaski valley.

Photo: Chandra Gurung/LI-BIRD

Photo: Purna Paudel/LI-BIRD

Photo: LI-BIRD Photo Bank

Further reading

Gyawali, S., BR Sthapit, B Bhandari, D Gauchan, B K Joshi, I P Poudel, S R Subedi, M P Upadhayay and P K Shrestha 2005a. *Jethobudho* landrace enhancement: I. A participatory method for on-farm management of agrobiodiversity. Proceedings of the 2nd National Workshop on *in-situ* conservation of agrobiodiversity, 25-27 August 2004, Nagarkot, Nepal. NARC, LI-BIRD and IPGRI.

Smale, M., MR Bellon, D Jarvis and B Sthapit, 2004. Economic concepts for designing policies to conserve crop genetic resources on-farms. Genetic Resources and Crop Evolution, 51:121-135.

(Contributed by Sanjaya Gyawali, Bhuwon Sthapit, Bharat Bhandari, Devendra Gauchan, Bal Krishna Joshi, Mahendra Tripathi, Pratap Kumar Shrestha, Krishna Dev Joshi and Ashok Mudwari)

Value Addition of Local Crop Diversity

Photo: Mahesh Shrestha/LI-BIRD

Value addition is a marketing strategy of creating the demand of local crops and varieties in the market by increasing consumers' awareness, better processing, packaging and promoting nutritive and health value of the products. The hypothesis behind this approach is that it will increase demand of the products and thereby the area of depleting crops and varieties will increase and chance of survival will be enhanced. Commercialization tends to bring uniformity and reduce the crop diversity if the product diversification of the crop is ignored. Targeting different categories of consumers and products commercialization of value added products might sustain the maintenance of local biodiversity. Experiences in Nepal have shown that value addition of local plant genetic resources contributes to on farm conservation of these materials by providing economic benefit to local communities as incentive for conservation.

Why value addition?

Genetic diversity of traditional crops is eroding at an alarming pace and it is replaced by the introduced crops and varieties. Farmers are maintaining diversity as a resource to fulfill their diverse production, consumption, economic and socio-cultural needs.

While it is true that, in general, market forces tend to "homogenize" or reduce diversity due to specialization in high-value products and therefore specialization in only those species and varieties that produce these products, there is increasing evidence from current work on under-utilized crops like taro and finger millet that these same market forces can be used to conserve agrobiodiversity. There are not many cases that demonstrate commercialization supports maintenance of local diversity. Therefore, the project interventions need to use multiple strategies to use local crop diversity and knowledge for generating social, economic and environmental benefits to people.

There are two market strategies to enhancing these benefits: 1) ensure competitiveness of local crop diversity as an income-producer, and 2) increase demand (locally, regionally and globally) for the target local and endemic crop diversity. The following general strategy was used to raise the value of local crop diversity:

- Increase value of local crop diversity by increasing access to information and materials (e.g. nutritive value of specific crops or varieties)
- Increase demand of local crop diversity through non-breeding approaches (e.g. value addition of locally processed products or developing new products or better packaging and marketing)

With rapid migration of people from rural to urban areas, consumers are increasingly demanding local crops and their products, which they are accustomed to in the urban market. However, availability of the right product in the right time in the required amount at reasonable price has been a constraint for consumers. On the other hand, producers are not benefitting from local crops and varieties. This may force farmers to abandon the crop/varieties leading, eventually the loss of diversity. Another fact is that there is a very little knowledge among producers and consumers about the nutritional value and the increasingly young generation changing food habits that do not support local food culture. Therefore, there is a need to raise awareness to promote these local and neglected and/or underutilized crops. The non-breeding approach of value addition is particularly for increasing the use value of local and other neglected and underutilized crops that provides incentives for their on farm conservation. Value addition also provides options to generate incomes in rural communities through simple processing and linking with niche markets that support farmers' livelihoods. Thus, value addition improves the use values of local crops for its sustainable utilization that leads to conservation of crop genetic resources on farm.

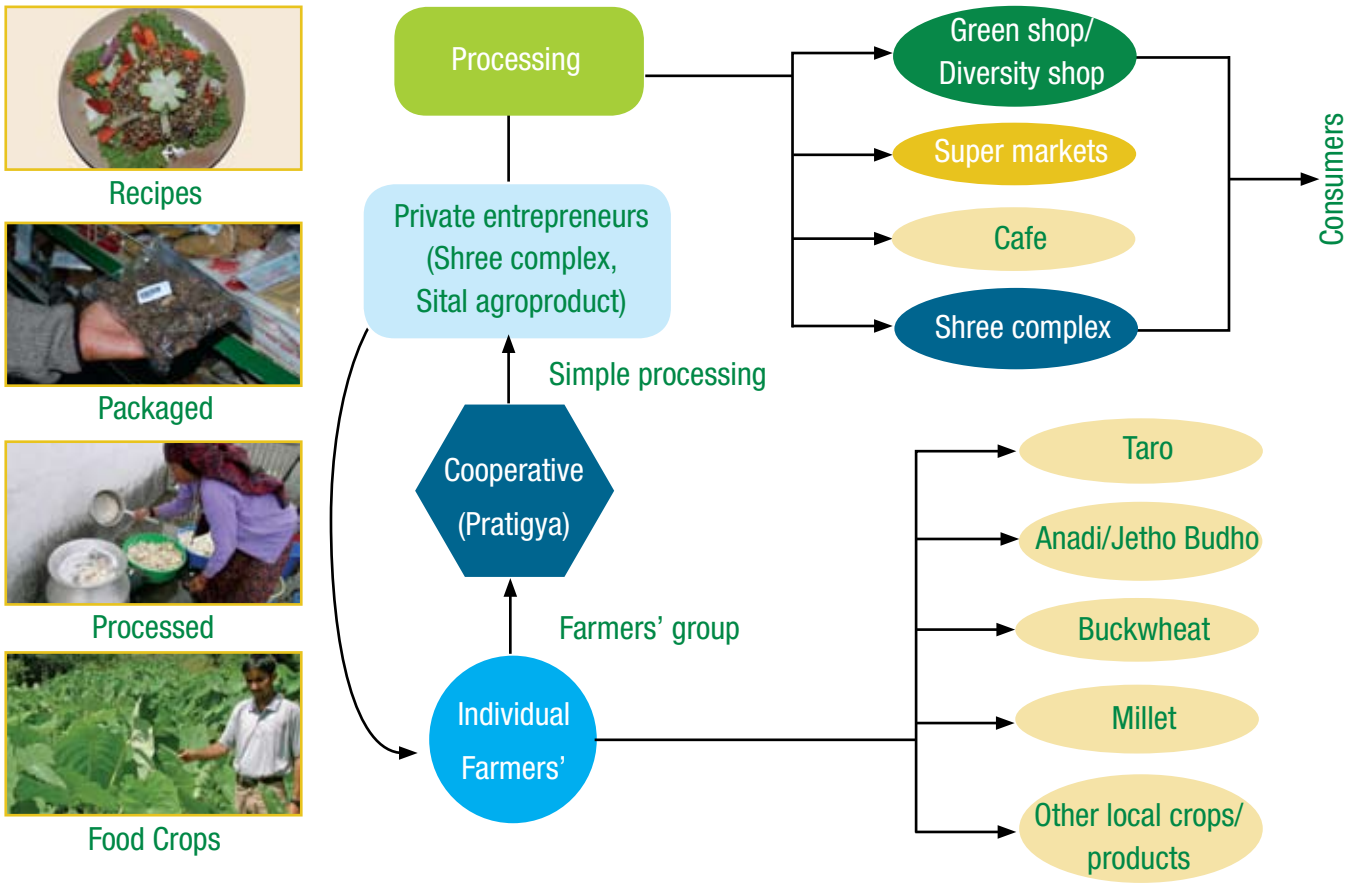


Fig.1 Value addition through market link in peri-urban areas of Pokhara Valley (Subedi A, 2002)

Methodology

The process of value addition requires the joint effort of producers, entrepreneurs, promoters and service providers to promote local crops and crop based products in domestic and international markets.Based on the successful cases of adding values in local crops and varieties in the In situ conservation project in Nepal, the following key steps are suggested as guidelines:

Step 1

Creating awareness about the value of crops/varieties and food culture. A range of public awareness raising tools such as rural radio, diversity fair, and a food fair aiming to promote value of local biodiversity are used.

Step 2

Identification of potential crops, varieties and food recipes for value addition with community participation. Participatory diagnostic four-cell analysis and conventional market analysis of local products are some methods that have been employed.

Step 3

Identification of existing local institutions or facilitation of the process of strengthening farmers' groups/co-operatives on value addition work as their goal of the institution. Community sensitization, and exposure visits and formal/informal meetings are methods used.

Step 4

Explore and identify existing and potential local markets. Methods used for this are market exploration surveys, consultation with promoters and market functionaries.

Step 5

Participatory identification of stakeholders and their technical and resource constraints in production, processing and marketing. A meeting with multi-stakeholders of identified producers, promoters, service providers and other market functionaries is held and institutional analysis is done to identify potential roles and responsibilities in the supply chain of local crop products in the market.

Step 6

Establishment of effective linkages among farmers, farmers' groups/cooperatives and selected market functionaries. Institutional analysis will provide information on different actors that need strategic partnership and alliance through informal or formal agreements and/or negotiations.

Step 7

Capacity building and skill enhancement of selected stakeholders to supply chain management, market trend analysis, and business proposal development for promoting agrobiodiversity through expert meetings, exposure visits, trade fairs and need based training could be used depending upon the capacity of stakeholders.

Step 8
Facilitate the provision of necessary support services (inputs, credit, market information, and lab analysis) to start the business. Through meetings and workshops, opportunities to link public and private sector service providers are essential. Biodiversity/trade fairs are a good forum to bring both parties in on a common agenda.

Step 9
Conduct promotional activities to raise awareness to use local crops and/or crop based products among consumers and obtain feedback. Tools such as FM radio, food fair/festivals, information flyers, website, TV adds, workshops/seminars etc could be used to reach large groups of consumers to increase demand and awareness of conservation of biodiversity.

Step 10
Explore and identify other national and international market outlets to link products. Collaboration and networking with strategic chain for promoting market products.

Effectiveness

In Begnas, Kaski, in situ conservation project revitalized farmers cooperative "Pratigya" and oriented in dealing and promoting local crops and its products. This initiative has increased the demand for Anadi rice and taro and its products (Masaura, Gaya, Tandra) in the market of Pokhara (Fig 1, 2). After successful piloting of the In situ project, this approach has been replicated in other LI-BIRD projects, e.g. linking biodiversity to the market and Community Biodiversity Register (CBR) to add value to neglected local crops in peri-urban area of Pokhara.

Product diversification in neglected crops has promoted their conservation and utilization

LI-BIRD, in collaboration with NARC, initiated adding values through diversifying its products and creating awareness in one of the neglected crops: finger millet. Private entrepreneurs like Sital agro-products and Madhav's café were involved in the process under the facilitation of food experts. They produced different millet products (cookies, bread, rolls, namkin, roasted flour) targeting school children, intellectuals, diabetics, foreigners and particularly the ethnic community (Gurung and Thakali) in Pokhara. The project conducted massive awareness raising activities on the value of millet foods through FM radio, print materials, fairs/festivals, workshops and school programs. This resulted in increased demand of millet products in Pokhara. A case study revealed that such initiatives have increased the demand

Photo: LI-BIRD Photo Bank

for millet grain more than 4 fold in 2004 as compared to base year 2001 in Pokhara (Fig. 3). In addition to millet, The Development Fund supported project facilitated entrepreneurs to produce different buckwheat products like bread, cookies, cakes, noodles. Besides, these food items also contributed to the better health and nutrition of consumers. Farmers were benefited by supplying these crops in the market through their groups and cooperatives.

Some learning from success and failures

It has been observed that, due to added value to the local underutilized crops-based products and improved marketing strategies, area for growing these crops has increased over time and has led to the conservation of the varieties. Public awareness on value of these nutritious crops has created a potential demand in the market. This has generated income for the farming communities which has linked to conservation and sustainable utilization of agrobiodiversity on farm

Sensitization and capacity building among consumers, producers and market functionaries has been found to be important to creating demand of valued local crops. Markets and marketing provide opportunities to rural farmers to earn cash income only in those local crops that have unique values. Awareness on nutrition among consumers and market intermediaries is important to promote local crops in the niche market. Attention should be given not only to the quantity of produce but also to quality of the products. Thus, the capacity of farmers' groups/cooperatives and locally operating small market intermediaries, who deal with local crops, has to be built up through training on better processing and handling. Moreover, producers, promoters and consumers will be more benefited through strong linkages. T Some other issues are listed below:

1. Economic scale of production is needed to enter and sustain in the market.

2. Research based information is prerequisite to promote landrace-based products through value addition.
3. Strong linkages and collaboration are of utmost importance among producers, promoters and entrepreneurs for sustainability in value addition and market promotion.
4. Supportive government policy (i.e. micro credit facility) is vital to promote local crops and their products in the market.
5. Long-term commitment on funding such research and development initiatives.

At the community level, one of the important good practices was to link farmers with the market (private sectors), which was found to be the quickest way to generate income from their local products. The in situ project encouraged local entrepreneurs to purchase produce, add value and market through their market outlets. A meeting with a farmers' cooperative and local entrepreneurs identified a list of local products and the amount required for marketing. However, joy was short-lived as the cooperative could not supply the agreed quantity that has standard quality and variability price offered. Local entrepreneurs were also anxious as they received more complaints from consumers for a variable quality and irregular supply. The project team thus tried to strengthen the capacity of the cooperative to organize a group of women farmers for one commodity and train women groups in quality control and hygiene and agreed to produce the minimum amount to meet the market demand. Local entrepreneurs helped to train farmers who became shareholders of the cooperative. As the business took some momentum, conflicts of interest arose on prices and the cooperative decided to set up their own market outlets by opening a shop (Gaunle Pasal-Rural Shop specialized to sell local products) in Pokhara, Nepal. The project team was ill equipped to help farmers make informed decisions about their eventual fate in the marketplace and within a year farmers realized that marketing of local products is a hard nut to crack without specialized skills, networks, and risk-bearing capacity. It was learned from this failure that farmers were good in producing the agricultural goods and semi-processed materials but it was too risky for them to take up the value addition and marketing work by themselves as the skills and investment required were different.

Although the idea of value addition of local products is very appealing to local communities and policy makers, its successful implementation requires a concerted and integrated long-term professional approach from multi-partners. Marketing local products is a specialized field and therefore needs special attention on skill enhancement of cooperatives, farmers, local entrepreneurs and international companies. The most important lesson derived from this process was that different partners with varied expertise playing different roles in the commodity chain were required to develop a partnership to use comparative advantages of each partner for mutual benefit.

Another important lesson learned from this process is that rural communities that depended on biodiversity also needed to collaborate with other agencies and receive new knowledge and materials from other institutions, stakeholders, and communities involved in agricultural biodiversity management. There is a danger of losing the interest of the community if the value of local biodiversity could not be transformed into economic enterprises. A multi-partners project like this should develop a public good method that brings partnership at the community level so that we can demonstrate social, economic and environmental benefits to our target groups.

Ideas for promoting local foods for good health, food security, culture, business and private sector development are essential. Since our campaign to grow and eat more local food has been gaining wider recognition for health, cultural, economic and other important reasons, the government could spear-head a small pilot project to see if such an idea would in fact work well in other parts of Nepal and Asia.

Further reading

Rijal, DK, Rana, RB, Subedi, A and Sthapit, BR 2000. Adding value to landrace: community-based approaches for in situ conservation of plant genetic resources in Nepal. In Friis-Hansen, E and Sthapit, BR (eds. 2000) pp 166-172 Participatory approaches to the conservation and use of plant genetic resources. IPGRI, Rome.

Sapkota,T. B., B. R. Regmi and R. Gautam 2005. Enhancing Benefits to Marginal Farmers by Linking Biodiverstiy to Markets in Nepal: Proceeding of the stakeholders' workshop, 24th December 2003. Local Initiatives for Biodiversity, Research and Development (LI-BIRD). Pokhara Nepal.

(Contributed by Bharat Bhandari, Ram Rana, Abishkar Subedi, Devendra Gauchan, Deepak Rijal, Pratap Kumar Shrestha, Tek Sapkota, Madhusudan Prasad Upadhyay and Bhuwon Sthapit)

Rural Poetry Journey: An Effective Approach to Sensitize Farming Community

Photo: LI-BIRD Photo Bank

"Many things have vanished"

Many things have vanished from our surroundings
Even the seeds cannot be found, no matter how much we search

Tomorrow it may not remain the same
So, let's save all our crops and landraces
Many things of our village taste better and good
Which the modern hybrids will never possess, no matter how much they try

The above was extracted from one of the selected poem published in the *Sampada* volume I, written by a poet Mr. Prakat Pageni 'Shiva', emphasizing conservation and the significance of local landraces. Such poems written in the context of the value of local landraces and associated knowledge can easily draw the sentiments of farming communities. It is a unique platform where poets and poetesses have been mobilized to document the significance of plant genetic resources in the form of poems and songs. Local poets also get an opportunity to expose their talents and knowledge regarding the biodiversity of their region. It is one of the teaching tools in farmer friendly language, for the farmers, by the farmers and from the farmers.

We all know that Nepal is rich in biodiversity and that there is a strong necessity for ensuring sustained economic growth and food security in the country through utilization of farmers' experiences, agricultural biodiversity and modern technologies. So, it is necessary to raise awareness among the people about the utilization and values of conserving biodiversity. The In situ project has developed a wide range of methods to increase awareness about the significance of biodiversity conservation and its utilization. Considering the geographical make-up and economic condition of the country, the dissemination tool selected has to be cheaper so that it can strike the larger mass.

Every culture has some traditional knowledge which passes from one generation to another through such mediums like folk songs and folk tales. Often, traditional knowledge is embedded in folk songs, poems and folk tales. Such folksongs, tales and poems have reflected social and cultural values in the community since time immemorial. It was observed that the information or message passed on through this medium is easily acknowledged by the people and acts as an effective tool to sensitize the communities. Hence this mode can be considered as the most important and effective medium for communication with the rural population in developing countries as they are the mode of entertainment.

With the vision of sensitizing and raising awareness by educating farmers about the value of crop diversity and restoring the local pride on the existing crop diversity which they have been maintaining till date, the *in situ* conservation project team decided to organise a Rural Poetry Journey in 1999 in association with the local cultural group named *Pokherali Yuva Sanskritic Parishad* at Kholakochheu, Begnas and its surrounding villages.

The major objective of this approach was to sensitize the village community, including farmers and younger generations, on the significance of biodiversity conservation, to document traditional knowledge and to protect and conserve potentially useful and diminishing landraces. Sensitizing the consumers and policy-makers was also equally important as they consume these local products, and it was observed that few landraces were conserved by the farmers as they had high consumption value or high market demand.

Photo: Mahesh Shrestha/LI-BIRD

Methodology

Step 1
A meeting was held between the *in situ* conservation project team and Pokherali Yuva Sanskritic Parishad, a local cultural club, to tell them the objective of the rural poetry journey.

Step 2
The date and time of the Rural Poetry Journey was fixed and the team of 6-10 on farm conservation project members and ten nationally renowned and local farmer poets were informed about the travelling schedule.

Step 3
The objectives, norms, and rationale of the agrobiodiversity program were explained to poets and they were then taken for a field visit to Begnas and the target site villages.

Step 4
The poets were encouraged to interact with the farming communities for two days to know about the local biodiversity of the region, understand the cultural context and the current situation and, most importantly, learn the value of agrobiodiversity.

Step 5
Poets were asked to write poems and songs using the vernacular term about the local landrace or biodiversity which was the theme of their poetry and had to recite it in front of community members every evening when the "*kavi sammelen*" was held before moving to the next village.

Step 6
All the recited poems were documented; they were published in the newspapers. The village poetry reading was audio taped and was planned to be relayed in regional radio- broadcasting.

घिरौंलामा पनि हजूर

घिरौंलामा पनि हजूर हुँदो रैछ वास
विविधता थुप्रै रैछन् खोलाछेउको पास

कतै हेर्‍यो जेठोबूढो कतै रैछन् नाभो
कति मीठा सुन्तला ती ताल पारी उंभो
रूपातालमा खेल्दा रैछन् सुन्दर पानी हांस
विविधता थुप्रै रैछन् खोला छेउको पास

पहेंलेको भात मीठो मनसुलीको उब्जा
सात मुहानेको भुर्लुङ्ग माछा सबै भन्दा उम्दा
इति सुन्दर विविधतालाई नगरौं है नास
विविधता थुप्रै रैछन् खोलाछेउको पास

श्री पुरूष ढकाल

जेठोबुढो धान

दाजुभाई दिदी बैनी एउटा कुरा जान
सबै भन्दा मीठो रैछ जेठोबुढो धान
रोप्दा खेरी अरू धान झैं रोपे हुन्छ यसलाई
पकाउँदा नि अरूलाई झैं छोपे हुन्छ यसलाई
खाँदा भनै मीठो आहा ! बास्ना चल्ने यसको
जोगाई राख फैलाई राख सम्पत्ति हो देशको
साँझ बिहान खाऊ यसलाई या त खाजा छान
सबै भन्दा मीठो रैछ जेठोबुढो धान
स्वादिलो छ आफैं थोरै हाले हुन्छ घिउ
खाने गरे लाभ हुन्छ लाग्छ राम्रो जीउ
जीउ राम्रो भए तिमी देशको काम लाग्छौ
नरोपेर यस्तो धान अन्तै किन माग्छौ ?
दाजु भाइ दिदी बैनी एउटा कुरा मान
खेतबारीमा रोप्ने गर जेठोबुढो धान ।

दिपक समिप

स्कूल - १

खेत
किसानहरूको प्रिय स्कूल हो
उनीहरू जन्मन्छन्
हुर्कन्छन्, मर्छन्
र पुनः जन्मन्छन्
धनहरू भैं ।

खेत
स्कूल हो किसानहरूको
प्रत्येक असारको झमझममा
परिक्षा हुन्छ किसानहरूको
कोही मन परेको ठूलीलाई
अरूले बिहे गर्दा
काटीएको मन भैं
आली तास्छन्
कोही, बिहानीका किरणहरूले
हिमालको अनुहारमा माया रोपे भैं
बीउ रोप्छन्
आफ्नै बैंसको आहलभरि
निर्भय डुबेर
हिलोले अनुहार सजाउंछन्,
परिक्षा सकिएपछि पनि
किसानहरू
बेलाबेलामा खेत धाउंछन्
पानी लाउंछन्
जब मंसिर आउँछ
किसानको परिक्षाफल
बिहानीको घामसंगै झरेर खेतमा
सुन पोतिन्छ विश्वासको
मैले सहकालको स्कूलमा
किसानहरू हांसेको देखेको छु ।

खेत
किसानहरूको प्रिय स्कूल हो
उनीहरू जन्मन्छन्
हुर्कन्छन् मर्छन्
र पुनः जन्मन्छन्
धानहरू भैं
धानहरूका जातहरूमा
किसान बाँधिन्छ भने
किसानका जातहरूमा
धान बाँधिन्छ र ?

रमेश श्रेष्ठ

Photo: LI-BIRD Photo Bank

Step 7
The best poems were selected and published in a collection called *Sampada* in two volumes for wider dissemination.

Step 8
Funds raised from raising such publication went to community biodiversity trust funds, which support local conservation plans.

How it works?

This tool highlighted the importance of genetic diversity and associated knowledge, which reached to a large mass of the population regardless of age, sex, and education level. The rural poetry journey was responded to whole heartedly by the village community and it was found that besides the invited poets, farmers and school students too participated actively, reciting their poems about the landraces and the local biodiversity of that region. The participation of farmers and local people was very encouraging. This response can be utilized as a source to document traditional knowledge and protection from biopiracy.

Impact

With the success of this programme, it is now seen as one of the important and effective tools in sensitization of the community. Learning from the success of this event, local clubs and NGOs have organized similar kinds of programmes alongside culturally significant events like the *Teej geet* competition, where the women's groups are provided biodiversity as the theme of their songs. Various women's groups participated in this competition, coming up with all biodiversity related songs. The best of these was judged as the winner. The panel of judges was formed from the *in situ* project team members. This cultural tool has been broadly used by NGOs for awareness programmes. The same groups used a similar methodology to stage street dramas such

Photo: LI-BIRD Photo Bank

as; "*Gaun ko katha ystai huncha hai*" meaning "Such are the happenings of the village", where the actors staged the play with the story revolving around the theme of agrobiodiversity. This was successful in raising awareness within the community as in the story the community can visualize themselves individually in it. The result has been positive. Learning from the *in situ* project the CBOs too have started organizing folk song competitions within communities. The village communities are now aware about the importance of local landraces and the need to conserve them, whereas before they had seen them vanishing without concern. The publication of the poems and songs in a book also acted as an incentive to these farming communities. This has in a way helped more by educating the villagers about the landraces through traditional knowledge techniques, i.e. folk tales, folk songs etc., hence this book can also act as a mode of traditional knowledge documentation where the poems may have some hidden knowledge conveyed by an older generation. Many local institutions have now used local culture, customs and rituals as an effective medium to sensitize the community on development and social issues.

It was found that a large number of people could be educated through this approach in a short period of time. People easily understand the information disseminated through poems and songs. Community members have already initiated the writing and collection of poems and songs to recite in the formal program within their own gathering. These novel initiations need to be scaled up to include more communities and wider geographical coverage. Poets from the region can re-recite popular poems in other programmes and forums. Reputed poets can also disseminate this information and knowledge in a wider scale. A few of the selected poems can be added in textbooks as compulsory poems to be read by students, while teachers can elaborately explain the importance or the status of landraces.

(Contributed by Smreety Dewan, Radhakrishna Tiwari, Prakat Pageni, Deepak Rijal, Krishna Baral, Pashupati Chaudhary, Ram Rana and Bhuwon Sthapit)

Rural Radio Programme: An Effective Tool for Reaching the Unreachable on Biodiversity Conservation Issues

Photo: LI-BIRD Photo Bank

Radio broadcasting is one of the fastest and most powerful means for providing information and raising awareness of people living in rural and semi-urban areas in Nepal. Rural radio not only disseminates information to stakeholders but also provides a forum for sharing opinions on various issues related to the conservation and management of biodiversity. It is a cost effective and efficient tool impacting a larger audience and has positive implications to the sustainable management of biodiversity and natural resource management in geographically difficult terrain.

Introduction

The in situ project has developed a wide range of methods and tools to increase awareness about the value of biodiversity conservation and its use. Among those, the rural radio programme is successfully tested as one of the means to increase awareness and dissemination of new innovations, technologies, process/methodology, research results, development and policy issues of both public and private concern and attention. It was broadcasted twice a week through Annapurna FM from Pokhara, with coverage of about 16 districts, with financial support from IPGRI. Realizing the significant contribution through initial review of the project, LI-BIRD continued the programme on its own at the later.

Rural radio means the radio broadcast that contains local contents with the active participation of rural people and other stakeholders. The objective of this rural radio programme is to sensitize different stakeholders on the importance and value of biodiversity conservation and use.

Methodology

Step 1
Setting up a multidisciplinary team responsible for launching and guiding the radio programme with clear roles and responsibilities

Step 2
Identification and allocation of appropriate broadcasting time for the radio programme

Step 3
Participatory designing of the day to day programme by a multidisciplinary team of professionals (issue based discussions, interviews, agriculture news and appropriate technologies, problem solving etc.)

Step 4
Establishing a database of contacts, linkages and networks with professionals and experts for problem solving and issue based discussion

Step 5
Periodic review by stakeholders and professionals and revision of the topic of biodiversity

Features of rural radio programme

- Includes local content and involves many stakeholders (participatory)
- Common forum to form public opinion on issues and concerns on agrobiodiversity
- Means to disseminate innovative ideas and information on agrobiodiversity
- Experience sharing and learning forum

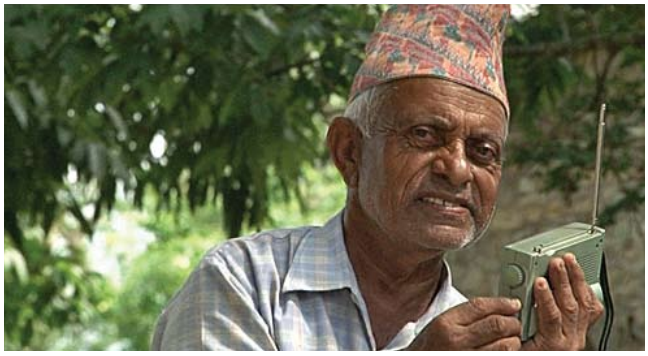


Photo: Mahesh Shrestha/LI-BIRD

LI-BIRDKo Chautari

Radio broadcasting in local language with their own voices has been a powerful and comparatively cheaper medium to reach in huge mass. As one of such initiatives LI-BIRD implemented a rural radio programme 'LI-BIRDko Chautari' from 1st October 2001 with the initial financial support from Bioversity International International the then Plant Genetic Resources Institute (IPGRI) in partnership with Anapurna FM, Pokhara.

Literally, Chautari in Nepali means a resting place under the shade of a tree. Traditionally it is an important place for meeting people, discussing and sharing information. IPGRI provided fund for the programme up to 31st October 2003. The programme was stopped for few years after the termination of IPGRI support. But due to higher demand and growing popularity and impact, LI-BIRD is still continuing the programme through its own resources. The programme was revived on July 2010 with the technical support from Ujyaalo Network of Kathmandu and Radio Taranga of Pokhara.

Now, the programme has revived with new format; Participatory Radio Magazine. Which is covering news, updates, reports and stories on agro-biodiversity, environment, natural resource management and climate change related issues. The programme use to bring into play materials generated by participatory methods of collecting local knowledge and practices generated from local farming communities. Technologies developed by the farming community, as well as the research outputs of university and research stations, are also used. These efforts 2 include sharing the methods and approaches developed in the project activities at local, national and international level. So, the programme format is in Participatory Radio Magazine. Farming communities are encouraged to provide suggestions and feedback. Prizes for the best questions and suggestions and the correct answers given for the month have been introduced to create interest and motivation among listeners. Winners are awarded with gift hamper each month to encourage people to participate in the programme and listen the programme in regular basis.

Every Friday from 7:15 to 7:30 PM 'LI-BIRDko Chautari' (15 Minutes Radio Magazine) is being broadcasted from 14 different radio stations all over the Nepal at the same time (Figure 1). Till now (reporting date is June 2012) 380 episodes have been aired. As a result, there has been increased public awareness of biodiversity issues in more than 40 districts of LI-BIRD's project sites; increased direct sharing of new findings and information with target communities; common forums for panel discussions between the farming community and high level policy makers; the integration of biodiversity education with traditional culture and literature; the bringing together of various stakeholders into common communication links; the documentation of value of local biodiversity; and the provision of feedback to local level conservation and development agencies.

Step 6
Feedback collection through a stakeholders review meeting and letters for refining programme; providing FM radio sets as prizes to listener quiz contests

Step 7
Programme monitoring and evaluation by a multidisciplinary team of professionals (survey, interaction, discussions, etc.)

Effectiveness of rural radio

Rural radio broadcasting has been a powerful and effective tool in creating awareness among farming communities and other stakeholders (Box 1). More than 50 listeners per week are contacting the radio programme, called LI-BIRD KO CHAUTARI, to solve their problems as well as contribute to the radio programme. This has created a forum among stakeholders through increased partnership and collaboration. Seven listeners clubs have been formed to listen to LIBIRD KO CHAUTARI and make it more interactive.

It was found that about 53% of the listeners of the programme were in between the age group of 25-50 years. About 56% listeners of the programme were found to be engaged in farming,

In a listeners' survey, after listening to this program, the majority (36%) of the listeners were found to discuss what they had heard with neighbors followed by discussion with their own family members (32%), farmers group (22%) and development workers (11%). Thus, rural radio programmes increase social cohesiveness among people and non-listener's are also benefiting from the programming.

Further reading

Baral KP, Sapkota TB, Adhikari A, Regmi BR, Aryal K, Shrestha PK, Sthapit BR. 2005. Rural radio programme: good practice for raising awareness on biodiversity conservation. In: Sthapit BR, Upadhyay MP, Shrestha PK and Jarvis DI, edited. On-farm Conservation of agricultural biodiversity in Nepal, volume II. Managing diversity and promoting its benefits. Proceedings of the Second National Workshop 25-27 August 2004 Nagarkot, Nepal. pp. 226-235

(Contributed by Krishna Baral, Tek Sapkota, Bharat Bhandari, Anu Adhikari, Smreety Dewan, Prakat Pageni, Anil Subedi, Madhusudan Prasad Upadhyay and Mahesh Shrestha)

Multi-stakeholder Partnership Approach to On-farm Agrobiodiversity Management

Photo: LI-BIRD Photo Bank

Managing agrobiodiversity on farm is a complex process that requires multi-disciplinary inputs and multi-institution partnerships. The multi-stakeholder partnership approach has been found to be an effective institutional mechanism in promoting the sustainable management of agrobiodiversity on farm. This partnership approach is built on mutual trust and respect for comparative advantages of partner organizations, clearly defined roles and responsibilities, and transparent resource sharing.

Need for multi-stakeholder partnership

Agriculture in Nepal is characterized by farming systems which are quite diversified and complex in terms of enterprise mixes, objectives of the production, and diversity and mobilization of farm resources. Because of this, the diversity of plant and animal genetic resources managed at the farm level is usually very high. Managing such a large diversity of genetic resources, therefore, requires multi-disciplinary, multi-sectoral inputs and multi-institutions participation. With this consideration, the project "Strengthening the scientific basis of *in situ* conservation of agrobiodiversity on farm" has adopted a multi-stakeholder partnership approach involving a number of partners who have a stake and play critical roles in implementing the project and achieving its goals.

The project was designed jointly by the International Plant Genetic Resources Institute (IPGRI), Nepal Agricultural Research Council (NARC) and Local Initiatives for Biodiversity, Research and Development (LI-BIRD), and has been implemented by them in collaboration with farming communities. The Department of Agriculture and relevant divisions of the Ministry of Agriculture and Cooperatives have also been involved in the project. Joint collaboration among these organizations in the implementation of the project activities is referred here as ***Multi-stakeholder Partnership Approach***. The purpose of this approach was to bring in comparative advantages of the relevant organizations and create synergy in achieving the project goals.

Development of multi-stakeholder partnership

The unique partnership between IPGRI (a CGIAR or Consultative Group on International Agriculture Research centre), NARC (a national research organisation) and LI-BIRD (a research and development non-government organization) started on an informal basis in designing the project. IPGRI brought in international expertise, experience and the capacity to lead such project; NARC contributed with its national experience in agricultural research and committed to manage the project; and LI-BIRD enriched the project with its experience and capacity in participatory research and development, and community mobilization.
The partnership further deepened with signing of a tripartite memorandum of understanding. The formal agreement of this kind between CG Centre, Government Organisation (GO) and Non-Government Organisation (NGO) was the first of its kind in Nepal. Policy and development experts from the Ministry of Agriculture and Cooperatives (MoAC) and Department of Agriculture (DoA) also joined the team. The farmers and farming communities of project sites also extended their partnership in hosting and contributing to the implementation of research and development activities.

Turning partnership into effective action was another key feature of this approach. The partnership was

Photo: LI-BIRD Photo Bank

built on clearly defined roles and responsibilities and managed by creating functional management structures and formulating transparent and accountable working modalities (Figure 1). The management structure and working modalities were devised to ensure maximum contribution from each partner involved in the process.

At the core of the management structure was the National Project Management Team (NPMT), headed by the National Project Coordinator (NPC) and comprised of professional experts and thematic leaders of the project activities from NARC, DoA, LI-BIRD and IPGRI. The main role of the NPMT was to facilitate planning, implementation and monitoring of the project activities (see Box 1). It also acted as bridge between project implementation by local project teams and farming communities, and was overseen by the National Project Steering Committee (NPSC). The NPSC, chaired by the executive director of NARC, was the governing body of the project and played an important role in steering,

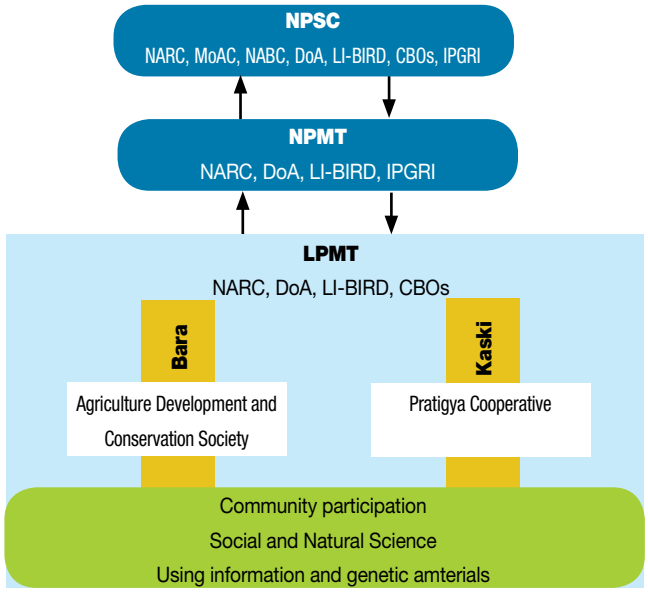


Figure 1. Management structure for multi-stakeholder partnership

overseeing and providing strategic guidance for the implementation of the project activities. It was comprised of representatives of all collaborating partners and provided equal opportunity in the decision-making process (see Box 2).

Box 1: Roles of NPMT

- Identify and prioritize research agenda related to outputs outlined in the LoA and the project document
- Planning, implementation, and monitoring and supervision of project activities
- Coordinate effective implementation of project activities, ensuring participation of all stakeholders involved in the project
- Organize periodic review and help refine the project activities
- Analyse and interpret research data and produce technical reports
- Provide technical backstopping to ensure application of standard research methods
- Establish effective linkage between collaborating partners
- Ensure project activities integrated in the community and national development plans
- Provide forum of participatory and inter-disciplinary process

Box 2: Composition of NPSC

1. Executive Director, NARC - Chairperson
2. Member Secretary, National Planning Commission
3. Director, Crops and Horticulture, NARC
4. Director, Planning & Coordination, NARC
5. Chief, Agri-botany Division, NARC
6. Director Planning, DoA, MoAC
7. Joint Secretary, Environment and Gender Division, MoAC
8. Joint Secretary, Planning and Monitoring, MoAC
9. Executive Director, LI-BIRD (NGO)
10. Representative, IPGRI
11. National Project Coordinator - Member secretary

At the foundation of the whole management structure was the Local Project Management Team (LPMT) comprised of field-based project staff and representative thematic leaders from NARC and LI-BIRD, a representative of District Agricultural Development Office and representatives of farmers' organizations. The main role of the LPMT was to facilitate implementation and provide feedback on the effectiveness of project activities (see Box 3).

Box 3: Roles of LPMT

- Implement research and development activities according to agreed activity protocols
- Establish rapport with local communities and other stakeholders and mobilize them for smooth implementation of project activities
- Engage in monitoring, evaluation and periodic review of project activities
- Manage day-to-day activities and mobilize field staff and other resources at local level
- Collect and process data, and assist in producing technical reports
- Provide link to local communities with relevant district line agencies and NPMT

Working modality

Participatory planning, decision-making through consensus building and implementation of project activities through a multi-disciplinary team, composed of members from partner organisations, were the core of the working modality of the project. Partnership was embedded in all aspects of the project work and transparency in sharing responsibilities and resources was maintained throughout the process.

The project activities were grouped into thematic areas, such as crop biology, social science, participatory plant breeding, gender and community mobilization. Experts from partner organizations were teamed up to utilize their comparative advantage. This created cohesion among professionals of different disciplines as they made efforts to produce the best results in their respective thematic areas. Team building and partnership was further strengthened by transparently defined roles and responsibilities for each member and team. LI-BIRD was given the role of coordinating local level organizations, including farming communities, in the implementation of the project activities as well as leading in the thematic areas of participatory plant breeding, gender and community mobilization. NARC, on the other hand, was given the responsibility to lead the thematic area of crop biology and social science research. With its global experience, IPGRI provided overall technical backstopping. Accomplishing activities and producing good results were linked with sharing of rewards and benefits, for example, opportunities for training and expert visits to other countries, and authorship sharing for contribution to publications. The same was reflected in the performance of the partner organizations.

The coordination of project activities was decentralized at different levels to ensure full participation of the partners. At the project site level, coordination with farming communities and other local stakeholders was done by LI-BIRD through a site-based Field Coordinator with support from other project professional experts. Any management issues and/or conflicts were resolved locally and in the event of continued dispute, such cases were referred to the NPMT. The overall coordination of the project was done by NARC through the NARC-based National Project Coordinator and the NPMT.

The sharing of project funds was also very participatory and transparent between IPGRI, NARC and LI-BIRD – the main implementing organizations. The agreed funds were transferred directly to the respective organizations and each had the freedom to manage the fund according to their own financial rules and regulations. This arrangement avoided conflict over financial incentives and facilitated smooth running of the project activities.

The fruits of multi-stakeholder partnership

This approach of building multi-stakeholder partnership for on farm agrobiodiversity management has now been widely appreciated and frequently referred to, both nationally and internationally, as effective and successful. The approach has been regarded as one of the key factors in achieving the objectives of and producing desired outputs from the project. The following outputs can be directly attributed to the contribution of the multi-stakeholder partnership approach adopted in the project.

Creation of institutional framework for multi-stakeholder partnership between government, non-government and community-based organisations.
The formal agreement signed between LI-BIRD and NARC for joint implementation of the project opened up new avenues for more collaboration involving multi-stakeholders. LI-BIRD and NARC are now partnering in a number of new research projects and jointly harnessing more resources for new research and development initiatives. The joint collaboration between LI-BIRD, NARC and other stakeholders in the Genetic Resource Policy Initiative (GRPI) project, the Western Terai Landscape Complex (WTLC) project, Conservation of Neglected and Underutilised Species (NUS), and Participatory Plant Breeding in rice and maize are some of the examples success of this partnership approach.

Recognition of multi-stakeholder partnership.
The value of multi-stakeholder partnership in agrobiodiversity management programmes is now well recognised both nationally and internationally. The approach has been adopted in a number of new agrobiodiversity related projects such as the GRPI project, WTLCP, Policy issues of neglected and underutilised species and so on. The *in situ* team, comprising NARC, LI-BIRD and IPGRI professionals

is also well recognized and frequently invited to share experiences and provide inputs on agrobiodiversity management at the national and international level.

Joint contribution of the partners to national agrobiodiversity programmes.

The *in situ* team has made significant contributions to including agrobiodiversity in national policies and plans. This includes drafting the National Agro-biodiversity Policy 2005, inclusion of agrobiodiversity in the 10th Five Year Plan, and amendment of Seed Regulation Act 1994 to include national listing of landraces/ local varieties. The team also contributed to a training curriculum on agrobiodiversity management for the Ministry of Agriculture and Cooperatives and provided technical backstopping in the field implementation of the programme.

Lessons and Learning

Though the benefits of multi-stakeholder partnership are well recognized, establishing effective partnership is equally challenging and requires continuous efforts. Partnership is also a process of learning in action. From the last eight years of experience in multi-stakeholder partnership in the *in situ* project, the following lessons and learning have been derived.

- Multi-stakeholder partnership is built on mutual contribution and respect for each others' expertise, experiences and other comparative advantages.
- Multi-stakeholder partnership is smooth when founded on agreed terms and conditions that are continuously respected by all parties.
- Success of multi-stakeholder partnership depends on the quality inputs and commitments of the partners.
- Multi-stakeholder partnership is built on a delicate thread of mutual trust and, therefore, partnership should be dealt with adequate sensitivity.
- Respecting partner organisations' institutional and working environment and accepting flexibility in mobilization of resources are equally critical for a successful partnership.
- Sharing failures and obtaining inspiration from positive/ success cases are also important.
- Team building by complimenting in areas of weaknesses of the partners plays a vital role in strengthening multi-stakeholder partnership.
- Multi-stakeholder partnership produces the best results when it is manageable in size and includes partners who have a strong stake and commitment to the programme.

Further reading

Upadhyay, M.P. and Subedi, A. 1999. Method used to create a framework for implementation and management of in situ conservation on-farm in Nepal. In: Sthapit, B., Upadhyay, M.P. and Subedi, A. (eds.). A scientific basis of *in situ* conservation of agro-biodiversity on-farm: Nepal's contribution to the global project. NARC and LI-BIRD, Nepal and IPGRI, Italy.

(Contributed by Pratap Kumar Shrestha, Madhusudhan Prasad Upadhyay and Bhuwon Sthapit)

Intensive Data Plots for Understanding Farmers' Decisions on Management of Agricultural Biodiversity On-farm

Photo: LI-BIRD Photo Bank

The Intensive Data Plot (IDP) technique is a tool for researchers to understand farmers' behaviour and decision-making on management of agricultural biodiversity on farm. IDP involves detailed monitoring and participatory recording and analysis of on farm activities. Results suggest that some landraces are as competitive as modern varieties in certain ecosystems whereas in others they are the only options available to farmers. Landraces expressed great diversity in production traits and economic returns. Farmers' decision to deploy varieties in the ecosystem is governed by their understanding of the ecosystem characteristics and varietal performance. Farmers' management of varieties in different ecosystems is not driven by profit maximization; rather it is motivated by utility maximization of farmers' given resources.

Intensive Data Plot (IDP)

Environmental, biological, cultural, socio-economic and policy factors influence farmers' decisions to select, replace, or maintain a particular crop cultivar at any given time. In the process of planting, managing and harvesting, farmers make crucial decisions about how many and which varieties of a crop to grow, on what proportion of their land to plant and what management practices to follow. All these 'farmer-managed' factors play an important role in shaping genetic diversity of varieties on farm. The IDP technique helps researchers to monitor 'farmer-managed' factors, i.e. inputs and practices on a specific crop cultivar. The IDP technique involves participatory recording and analysis of on farm activities to provide insight into farmers' behaviour and decision-making processes.

In Nepal, IDP was used in the project 'Strengthening the scientific basis of *in situ* conservation of agricultural biodiversity on farm: Nepal component' to gain a scientific understanding of farmers' management of crop (rice in this case) diversity by intensive monitoring of a plots where a farmer was growing a specific variety. In Begnas ecosite, 90 farmers participated in IDP experiments with four landraces and one modern variety (MV). Detailed data on natural, socio-economic and human-managed factors of the plots and households was collected and linked to the formal 'variety choice' model. The experiments on IDP were carried out to (1) monitor the varietal deployment on specific plots (2) record farmers' management practices on selected varieties, and (3) calculate economics of production for selected landraces and modern varieties (MVs).

Methodological process

The process of IDP can be presented in six sequential steps (Figure 1). The first step in the IDP implementation is the 'data need assessment' that involves a brainstorming session amongst the interdisciplinary team members in the project to agree on the types of data to be collected at the plot level. Once the data need is established, researchers conduct a focus group discussion (FGD) with selected members of the farming community to understand how farmers characterize their ecosystems and on what parameters they base this characterization. Participants in the FGD also deploy varieties to specific ecosystems based on existing realistic experience. Researchers and farmers jointly select a few representative landraces and MVs from each ecosystem for the IDP exercise. Households growing the selected varieties are identified and their consent to participate

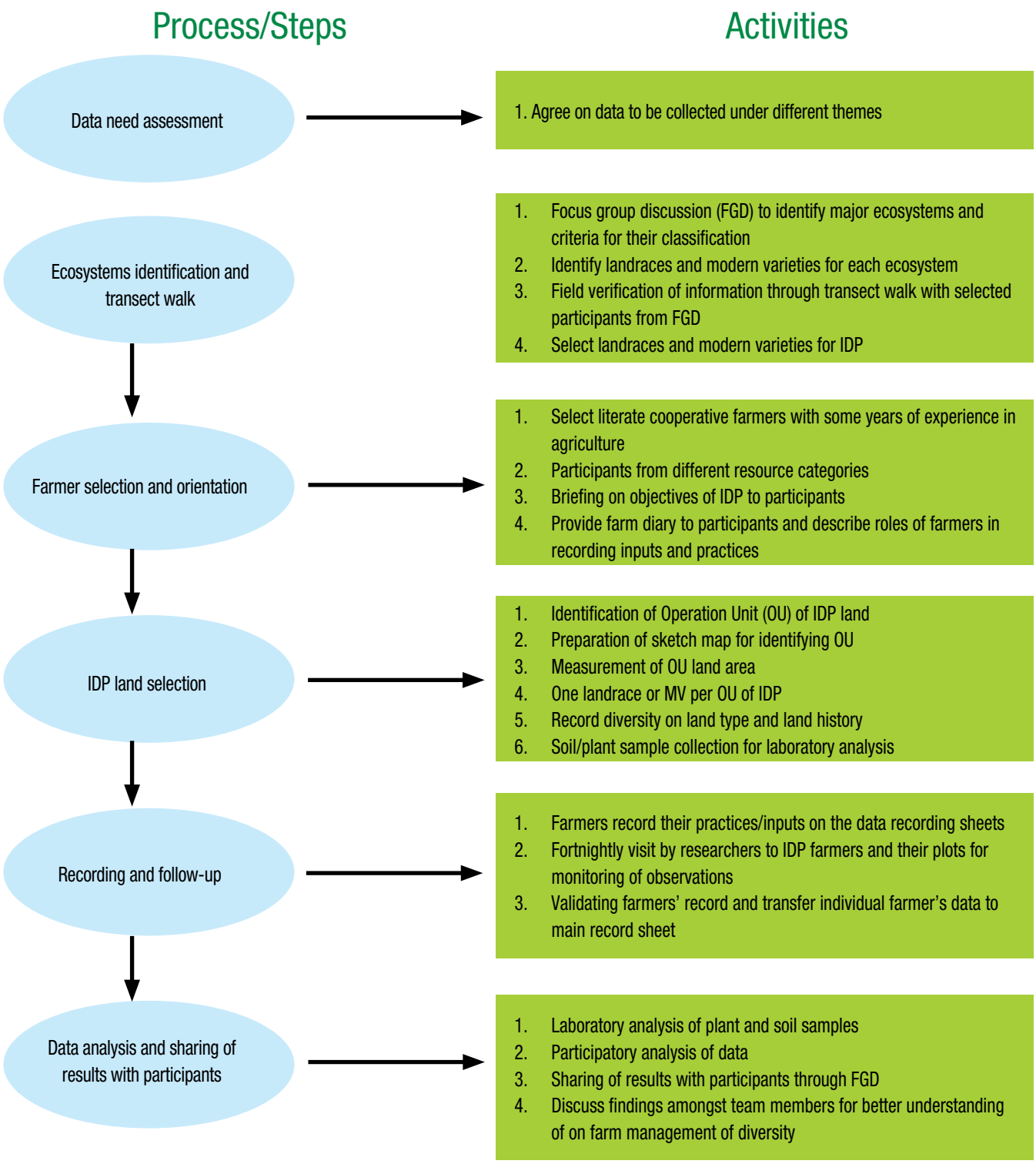


Figure 1. Different steps and activities for Intensive Data Plots

in the experiment is sought. Finally, researchers and farmers jointly make a transect walk of the village to verify the information (ecosystems/varietal deployment) given during the FGD.

The third step in IDP involves the selection of farmers and an orientation to the participants. To capture the variability in socio-economic factors (farm management practices, input levels, credit and market access etc) participating farmers are selected from different resource categories. Since participants do all the recording themselves, literate farmers (someone from the family) need to be selected for this purpose. Participants need to be active in farming with some years of experience because knowledge and information provided by them have to be relevant and reliable. Selected IDP farmers need to be provided with detailed orientation that includes briefing on the objectives of IDP, introduction to the subject matter, and explanation of their roles and responsibilities in the experiment.

Photo: LI-BIRD Photo Bank

The next step in the process includes IDP land selection, conducted jointly by the researcher and participating farmers, followed by necessary measurements of the land area to ascertain input levels and production to be used in a cost-benefits analysis of landraces and MVs. One variety per plot is used in the IDP exercise. Land history of the plots in terms of cropping patterns, fallow periods, compost and chemical fertiliser use, irrigation, etc. is recorded. Soil samples are also collected from the IDPs for nutrient analysis in the laboratory. These factors help explain the performance of any variety in a given plot. The fifth step in the exercise includes the actual recording by participants of all activities and inputs applied on and outputs derived from IDPs. Researchers pay fortnightly visits to participants, verify the recorded data and observe fields and transfer the records from farmers' diaries to the main register. The recording continues throughout the crop season, from seed to seed. Finally, the collected data is analysed by a research team along with inputs from selected participant farmers. Results from the soil/plant analysis are also collated with field observations and records to explain the performance of different varieties across plots and between farms. Effort is made to formally share the findings with the farmers through FGD and to validate the results obtained.

Results from the field

IDP experiments on four landraces and one MV of rice across three rice ecosystems were conducted in Begnas ecosite (600-1200 masl) in year 2002. In total, 90 farmers participated in the IDP experiment that involved detailed recording of production costs: inputs (seed, farm yard manure, chemical fertiliser, pesticide etc) and labour costs. We also measured grain and straw yields from the plots and converted these to monetary values (Table 1). Results suggest that in certain ecosystems (marshy) landraces are as competitive as MVs in economic return, whereas in others (rainfed and irrigated) they are the only option available to farmers. Landraces as a group demonstrated huge variations in agronomic traits, production potential, production costs and the economic return they generate. Therefore, it would be erroneous if they were treated as a homogenous entity having similar features, and rejected *a priori* as inferior material without proper evaluation.

Farmers deploy varieties to specific ecosystems to match the performance of varieties to ecosystem characteristics. In the case of *Mansara*, though the landrace produced lower grain and straw yield, farmers still applied a considerable amount of manure and performed other management practices equal to those applied for other, better yielding varieties. This illustrates that farmers' differential management of varieties is not primarily on the basis of the economic return they generate; rather the decision is based on farmers' intricate understanding of varietal performance and ecosystem characteristics. This finding contrasts significantly with researchers' and developmental workers' perceptions and it would have been difficult to elicit this information any other way.

In a subsistence-oriented farming system, household food security through grain production takes precedence over economic analysis of production while making decisions on variety deployment, area allotment and

Table 1. Input levels, economic return and area coverage for different varieties in Begnas.

Ecosystems	Varieties	Farm yard manure (t/ha)	Labour man days/ha	Economic return (NCRs/ha)	Area covered (ha)
Rainfed	Mansara	8.7±1.1	306	1,376	5.3
Irrigated	Thulo Gurdi	7.7±0.8	285	20,992	4.3
	Ekle	8.5±0.9	267	32,101	14.0
Marshy	Jethobudho	12.6±1.7	239	53,350	3.2
	Mansuli*	12.4±1.4	249	57,504	11.7

* Modern variety

Conversion: 1 US $ = 78 Nepalese rupees

management practices. Hence, farmers' management of varieties falling in different ecosystems is not driven by profit maximization; rather it is motivated by utility maximization of farmers' given resources. Yet, farmers' decisions on area allotment to varieties within an ecosystem was largely explained by economic return that the varieties generate because competition between varieties exists primarily within ecosystems and less so between ecosystems.

Lessons learned

The IDP technique is robust for understanding intra-household dynamics involved in decision-making processes. It is best suited to capture farmers' behaviour by intensive monitoring of different activities at regular intervals. Correct apportioning costs and economic benefits would have been impossible without detailed monitoring at the plot level. However, the IDP technique is rather resource intensive (time and commitment required) for monitoring activities. Hence, the technique is suitable only for research in which detailed farm and plot level data are required to answer research questions.

Further readings

Rana R. B., C. Garforth and B. R. Sthapit (2008). Farmers' management of rice varietal diversity in the mid-hills of Nepal: implications for on-farm conservation and crop improvement. Plant Genetic Resources: Characterization and Utilization, 1 -13.

Rana, R.B., P.K. Shrestha, D.K. Rijal, A. Subedi and B.R. Sthapit. 2000. Understanding Farmers' Knowledge Systems and Decision-making: Participatory Techniques for Rapid Biodiversity Assessment and Intensive Data Plot in Nepal. PP 117-126 in *Participatory Approaches to the Conservation and Use of Plant Genetic Resources* (E. Friis-Hansen and B. Sthapit, Eds.), IPGRI, Rome, Italy.

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ISBN: 978-9937-8145-3-9