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# Overview of crop genetic resources in agrobiodiversity: CBD Operational Objectives, Principles and Best Practices

Jarvis, D.I.* and Ndung'u-Skilton, J.**

* International Plant Genetic Resources Institute, Via dei Tre Denari 472/a, 00057 Macaresse, Rome Italy.

**International Plant Genetic Resources Institute, Office for Sub-Saharan Africa, c/o ICRAF, PO Box 30677, Nairobi, Kenya

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***(NOTE: Throughout the best practices part of the text, in addition, to best practices from the case study and other published materials, We have also frequently noted:*** "see….. for more best practices"***. These are more notes to myself, as most of the information comes from recent workshop proceedings and will need permission of the authors to be used here as they are in the process of publishing and we must thus contact the authors first inclusion here).***

## SECTION I. Introduction

The future food supply of the world depends on the exploitation of genetic diversity for crop improvement (Reid and Miller, 1989; World Conservation Monitoring Centre, 1992; Gollin and Smale, 1999). At the same time, many of the world's farmers depend directly on the harvests of genetic diversity they sow for food, fodder, and other economic, cultural and ecological activities (Brush, 1991; Bellon, 1996; Zimmerer and Douches, 1991; Mellas, 2000; Jarvis, 1999). The use of locally adapted crop varieties may also serve to improve ecosystem health by their reduced needs for pesticides and fertilizers and their effect on improving soil structure (Zhu et al., 2000; Gliessman, 1998; Glass and Thurston 1978; Vandermeer 1995; Pimentel et al., 1997). Moreover, the availability of locally adapted crop varieties to particular microniches may be one of the few resources available to resource-poor farmers to maintain or increase production on his or her field (Jarvis et al., 2000). Crop genetic resources, therefore, is an impure public good, meaning that it has both public (crop genetic diversity and ecosystem health) and private (farmer utility) attributes and the sustainable management of crop genetic resources is an essential component of the sustainable use of natural resources both for production and environmental benefits (Morris ***et al.***, 1998; Smale et al., submitted 2001).

Given this perspective of crop genetic resources, this document provides a review of the cases studies submitted, together with other relevant information. The review presented within the framework of the four Operational Objectives of the CBD Programme of Work on Agricultural Biological Diversity, and with consideration of the 12 Principals of the CBD Ecosystem Approach.

## SECTION II. Initial comments: Is the information accurate + Other information relevant to the case studies that should be included

**Ethiopia, Kenya, South Africa, Zimbabwe**
One important study missing here is the UNDP/GEF ETH/93/G31 supported project on "A Dynamic Farmer-based Approach to the Conservation of Ethiopia's Plant Genetic Resources". In addition, **Ethiopia** has one of the important genebanks in the region now held at the Institute of Biodiversity Conservation and Research (IBCR). This genebank has also been instrumental and returning local germplasm to farming communities. In addition, there is the on-going Community Biodiversity Development and Conservation (CBDC) Programme a net- work of organizations in which a range of activities are undertaken that aim to strengthen farmer community management of agro-biodiversity. This project supports farmer networks in **Ethiopia**, **Kenya**, **Zimbabwe**, and also Burkina Faso and Sierra Leone. Some other initiatives going on in the region is the INIBAP supported project on ***in situ*** conservation of banana and plantains in the great lakes area (Uganda and Tanzania). There are also several crop diversity management projects in Burkina Faso (supported by IPGRI and CBDC) and in Mali (supported by IPGRI and IFAD). **Kenya** also has genebank facilities, which following the Ethiopia example, have held field grow-outs of local varieties for farmers to select and use. Work has also been done in Botswana, Cameroon, **Kenya**, Senegal and **Zimbabwe** on the biodiversity of leafy green vegetables (see Web site: http://www.ipgri.cgiar.org/themes/human/ethnobotany.htm and the publication: The biodiversity of traditional leafy vegetables (Chweya and Eyzaguirre, eds., 1999). Another on-going project in Kenay is the: "Curcurbitaceae: E. African Bottle Gourds and W. African Egusi Melons" (see: http://www.ipgri.cgiar.org/themes/human/gardens.htm). A key player in **Zimbabwe** working in agrobiodiveristy management is the NGO -- Community Technology Development Association (COMMUTEC or CTDT). CTDT has facilitated community based crop genetic resources management in Zimbabwe and Kenya.

**Cuba, Mexico, Brazil,**
In addition to the studies mentioned in **Cuba** is a three year on-going home garden study to understand, if home gardens retain varietal and species diversity that is undergoing genetic erosion in larger agroecosystems, how commercialisation and crop introduction/improvement affect species and varietal diversity in home gardens and what targeted development interventions enhance home garden biodiversity and improve family nutrition and income (for more information on the home garden project active in Cuba, Ghana, Vietnam, Nepal and

Venezuela see: http://www.ipgri.cgiar.org/themes/human/gardens.htm). **Brazil** also is a strong member of the CBDC project on on-farm management of agrobiodiveristy and the coordinating NGO for Latin America for the CBDC is based in Brazil (CET). In **Mexico**, several key initiatives are missing. The National Mexico Project to Evaluate the Native Maize Landraces of Mexico, directed by Dr. Joaquín Ortíz Cereceres of the Colegio de Postgraduados, as part of a nationwide project for the improvement of local maize varieties in Mexico and funded by the Consejo Nacional de Ciencia y Tecnología (CONACYT).The Colegio de Postgraduados (CP) is the largest in the agricultural institution sector, and consequently, since its inception, has been the institutional leader in research and training in Mexican agriculture and the interdisciplinary Instituto de Recursos Genéticos y Productividad (IREGEP) at the CP has extensive experience in carrying out ***ex situ*** conservation. In addition to the IDRC funded project at CIMMYT in Oaxaca, other on-going in situ projects are the McKnight Foundation funded participatory plant breeding and in situ conservation in the Sierra Norte de Puebla and Chalco, the work being carried out by University of Guadalajara, Instituto Manantlan de Ecologia y Conservacion de la Biodiversidad (IMECBIO), the CIMMYT work in the Valley of Cuzalapa and the Sierra de Manantlan Biosphere Reserve, the Mexico Country component of the IPGRI global project, "Strengthening the Scientific Basis of ***In Situ*** Conservation of Agricultural Biodiversity On-Farm" in the Yucatan (see http://kin.cieamer.conacyt.mx/Ecologia/Proyectos/Milpa/Home.html and http://www.ipgri.cgiar.org/themes/in_situ_project/on_farm/onfarmhome.htm. In addition, although the Andean region was not included within this case study, some note should be made here to the large amount of agrobiodiversity management work going on with Andean roots and tubers through CONDESAN (Consortium for the Sustainable Development of the Andean Region) active in Colombia, Bolivia, Peru, Ecuador (http://www.idrc.ca/minga/97-8754_e.html).

***I would also like to comment here on the statement in Section 2.2. of this case study "that most genetic conservation efforts of relevance to agriculture are ex-situ through genebanks" should be followed by a statement that over 50% of maize seeds in Mexico come from local crop cultivars and not through the formal sector, and therefore, abundant genetic resources are being conserved on farm, though not through formal conservation efforts.***

***This brings in the key need throughout all the case studies to examine the contribution of the formal seed sector to agricultural production of small scale farmers. If we examine Morocco, it is less than 13% for cereals, and less than 3% for grain legumes (Mellas, 2000), if we examine sorghum and millet in Burkina Faso, agricultural production is predominantly based on local seeds from the informal seed sector. Thus, my point here in creating guidelines for Biodiversity Action Plans, there is first an urgent need to examine the amount and distribution of existing crop genetic diversity on farm in the case study countries.***

***In addition, in should be noted that crop genetic resources held*** ex situ ***makes them available to breeders and researchers, but genebanks are not equipped to multiply seeds for direct use to users such as farmers.***

***A note also on the kilo por kilo programme, which is a way to reduce genetic diversity. Farmers are asked to give a kilo of their local seeds for improved varieties. One problem is that these improved varieties (such as the case of the Yucatan) are not adapted to the particular environment of the farmers.***

**Russia, CIS Countries**

In this Case study, the discussion focused mostly on the threat of agricultural to on biodiversity and there was little information on on-going agrobiodiveristy work, both ***ex situ*** and ***in situ***. One of the most important national genebanks in the world for crop genetic resources is located in Russia, the Vavilov Center. In addition, the Central Asian Network on Plant Genetic Resources (CAN-PGR) was established in 1996 with the purpose to coordinate activities on plant diversity conservation and use through collaborative research on set regional species priorities, exchange of information and germplasm, and regional training. In addition, a new project has been initiated for ***In Situ***/On Farm Conservation of Agricultural Biodiversity in Central Asia funded by UNEP focused on horticultural crops and their wild relatives in the Republic of Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and the

Republic of Uzbekistan. The Republic of Uzbekistan is also part of another UNEP/GEF PDF B Project - ***In-situ*** Conservation of Crop Wild Relatives Through Enhanced Information Management & Field Application (http://www.ipgri.cgiar.org/themes/in_situ_project/wild_relatives/gef.htm).

**Yunnan (SW China)**
As this is just a single project case study, it is difficult to add in about other projects. It offers several examples of good practices for community participation and management of agrobiodiversity that I have included below in the best practices session. In addition, in Yunnan, there is an on-going ethnobotanical project looking at the genetic diversity of Taro and farmer's management, that might be included as a complementary study (see the web site: http://www.ipgri.cgiar.org/themes/human/ethnobotany.htm, and papers in: Ethnobotany and genetic diversity of Asian taro: focus on China (Zhu, D., Eyzaguirre, P., Zhou, M., Sears, L. and Liu, G, eds., 1999). In addition, on-going in Yunnan is the IPGRI supported "Indigenous Vegetables of Yunnan." The project combines genetic characterization and ethnobotanical field methods with nutritional analysis of important wild vegetables in Southwest China (see again the above WEB site for further information).

In terms of the region, a great deal of work is going on in Nepal in terms of management of agrobiodiveristy. In fact, there agrobiodiversity is now being integrated into the national biodiversity actions plan and there are many projects on-going in agrobiodiversity conservation with a long list of best practices. You may want to commission a study from the Nepal group (see: http://www.narc-nepal.org/ and http://www.panasia.org.sg/nepalnet/libird/ for an update on the different agrobiodiveristy management projects in crop genetic resources in Nepal). In addition, for more information on the other country components and for the global overview with links to other country projects (**Ethiopia**, Burkina Faso, **Vietnam**, Nepal, **Mexico**, Peru, Morroco and Hungary see: http://www.ipgri.cgiar.org/themes/in_situ_project/on_farm/onfarmhome.htm .

**India, Philippines, Vietnam**
In **India**, the **Philippines** and **Vietnam**, one project that finished in 2000 was the IRRI on-farm conservation project that looked at the amount and distribution of rice varieties under farmer management in these Countries. In the Philippines, South East Asian Research Institute for Community Education (SEARICE) is an important actor in the management of crop genetic diversity (searice@philoneline.com.ph). See also: http://www.psdn.org.ph/agenda21/pcsd2.htm for information on Philippine Council for Sustainable development directory of PO-NGO counterparts. Two other active programmes in the region are UPWARD (User's Perspective with Agricultural Research and Development (http://www.eseap.cipotato.org/upward), ANSWER (Asian Network for Sweet potato Genetic Resources (http://www.eseap.cipotato.org/answer), and UBING in Bangladesh, and the Swaminathan Foundation in India (http://www.mssrf.org.sg).

In addition, in **Vietnam**, in addition to the ***ex situ*** conservation activities mentioned in the report, there are many on-going genetic diversity projects

- Community Biodiversity Conservation (CBDC) project in the Mekong Delta funded by SIDA, IDRC, and DGIS -- The **Philippines** is also a part of this project.
- BUCAP Biodiversity, implemented through the MARD Plant Protection Department in Hoa Binh, Bac Kan, Hue, Hanoi, and Quang Nam provinces, funded by NORAD -- also active in the Philippines and other countries in the region.
- ***In situ*** conservation of landraces and their wild relatives in Northern Vietnam. This project is in the PDF-A phase implemented through the Institute of Agricultural Genetics (IAG) funded by UNDP/GEF. IUCN has prepared a compilation of agrobiodiversity projects in Vietnam for this PDF-A grant.
- NIAR Genetic diversity of rice in Vietnam, funded by Japan (JICA)
- IPGRI Strengthening the Scientific Basis of ***In situ*** Conservation of Agricultural Biodiversity, Vietnam country component in seven sites in Vietnam: Sapa, Hue, Cantho, Daklak, Dabac, Nho Quan, and Ning Hung Red River Delta.
- Home garden project in the Northern Highlands, Central Midlands and Southern Lowlands of Vietnam (see description of home garden project Web site under Cuba review above-- for specific information on biodiversity in home gardens in Vietnam see:

"***In situ*** conservation of plant genetic resources in home gardens of southern Vietnam" (Hodel and Gessler, 1999).

- In addition, IDRC is working with Vietnamese policy makers on crop genetic resources issues.

## SECTION III: Other issues (my opinions) for discussion

1) ***Overall, to me the case studies focus too much on problems and constraints and not enough on best practices or examples of solutions. The case studies also do not cover enough on the methodologies being used in the different countries to assess the amount and distribution of existing crop genetic diversity and the processes and people who are maintaining this diversity. This information assessing what is actual within the country is key to national programmes in developing their Action plans. As I feel that much work has been going on in these countries in this regard, the case studies need to go further in depth, bring out this information and other information of on-going work that meets the four objectives of the CBD Programme of Work on Agricultural Biological Diversity. Questions such as, in what area (geographical, ecological, social-economical) of the country does high crop diversity exist? Given a high diversity area, what is the cost to farmers to continue maintaining this diversity at present and in the future, given that change occurs? What in the action plan (a portfolio of options) will help governments to support these farmers who maintain high levels of diversity, including the role of supporting the informal seed system (see below in best practices)? What is the status of ex situ conservation facilities if maintaining diversity on-farm no longer has a competitive advantage to farmers? What is the role of genebanks in providing seeds to direct users (the Ethiopia Case study mentions this under best practices)?***

2) ***Biosafety. -- Tool and knowledge for National Programmes to regulate GMOs***
   ***Recently, I have had many requests from National Programmes for information on setting up rules and regulations for Biosafety, particularly with the push of developed countries to test GMOs in developing countries. I think that this issue needs to be address within the framework of Developing protocols for National Biodiversity Plans and Strategies.***

3) ***Linking Pest and Disease management, and Soil Nutrition/Fertility Management to better adapted crop genetic diversity.***
   ***I believe there is also a need to link the good practices in Pest and Disease and soil nutrition/fertility management to the use of locally adapted crop varieties. Some of the IPM and soil management methodologies and best practices could be enhanced by including the use of locally adapted or resistant crop genotypes or, particularly in the case of pests and diseases a diverse variety of intra-specific crop cultivars. There are very limited examples on where this has been done: Zhu et al., 2000; Sadiki et al., 2000) and a systematic study in this area is needed***

4) ***Linking livestock and crop genetic diversity.***
   ***Likewise, there is a need to systematically look at the enhancement of locally adapted animal productivity through locally adapted fodder, or from the other direction, the management of livestock diversity such that it enhances crop diversity and production. There is also a need to compare best practices in methodologies for (1) assessing the amount and distribution of livestock and crop diversity in situ, (2) understanding the processes used to manage these two groups of diveristy, (3) identifying the people who maintain both significant amounts of livestock and crop diversity, and (4) understanding the reasons why these two kingdoms of diversity continues to be maintained.***

5) ***Considering Foundations in addition to Government and Non-Government Organizations***
   ***I think there is also some scope here to identify the role of Foundations, such as the Swaminathan Foundation in India in supporting the sustainable management of agricultural biodiversity. There are often left off the list when reports are made, but are usually sustainable institutions (more so than NGOs which may be forced to change their focus because they can be donor driven.***

## SECTION IV. Assessment of case studies in regards to the four operational objectives of the CBD Programme of Work on Agricultural Biological Diversity

### *IVa. CBD Operational Objective1: An assessment of status and trends of the world's agricultural biodiversity and of their underlying causes.*

The primary task for those concerned with conservation and with the maintenance of crop diversity is to understand when, where and how this will happen, who will maintain the material and how those maintaining the material can benefit. Thus, it is was found useful to identify the following four areas of investigation to set the scientific agenda needed to support farmers and local communities in crop genetic diversity conservation, management and use on-farm:

- What is the extent and distribution of the genetic diversity maintained by farmers over space and over time?
- What are the processes used to maintain the genetic diversity on-farm?
- Who maintains genetic diversity within farming communities (men, women, young, old, rich, poor, certain ethnic groups)?
- What factors (market, non-market, social, environmental) influence farmer decisions on maintaining traditional varieties?

Obtaining all the answers to these questions involves a substantial series of investigations. Best practices from the Case studies and other relevant information are listed below together with best practices that fall under the Ecosystem Approach Principals 7,8, 9 and 11. Principal 11 ***- Consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices*** spans all the best practices. Due to the multilevel, multi-disciplinary, and multi-institutional aspect of understanding the management of agrobiodiveristy, answering these questions will need to incorporate a participatory approach at all stages of the process, from the first meeting where national partners identify the main objectives and activities, to the specifics of site and plot selection in collaboration with farmers and communities. Participatory methods, such as key informant interviews, focus group discussions, spatial mapping, matrix ranking and transects, can served to incorporate into the project data farmers' knowledge of local social-cultural, economic and agroecological conditions, their crop and seed management practices, and the characteristics and origins of their varieties. Information from participatory research needs to be complemented by household, market and seed system surveys, field trials on-station and on-farm, and genetic diversity measurements in the field and in laboratories.

**See also: "A training Guide to In situ conservation on-farm" -- for a synthesis of best practices from on-going *in situ* conservation on-farm projects worldwide** (http://www.ipgri.cgiar.org/publications/pubfile.asp?ID_PUB=611).

**Best Practices 1**

***1.1 Measuring the amount and distribution of crop genetic diversity maintained in situ by farmers*:** One of the key methodological problems that faces any study of diversity is deciding what type of diversity is going to be measured and analyzed. A key element in understanding the amount and distribution of crop genetic diversity managed by farmers is to understand the relationship between what farmers recognize or name as a variety and the genetic distinctiveness of this unit. This is important because farmers manage units that they recognize, and thus may manage different recognized units differently, affecting the genetic diversity of the crop in different ways over time.

1.1.1 ***Yunnan Case study:*** In the Yunnan case study high species diversity was found in home gardens, however there needs to be some investigation on whether these single plants as a group of home gardens in a village make up a viable population. We can take the case of sponge gourd in Nepal as an example (Pandey et al., 2001). Sponge gourd is an out-crossing plant, however farmers normally only grown only one or two

plants. Thus the "population" of sponge gourd is maintained by geneflow among plants in the village and not by any one individual farmer

1.1.2. ***Ethiopia Flora Project***. The project has developed capacity on plant taxonomy and includes intra-specific crop diversity specimens to help assess the amount and distribution of crop diversity.

***Other similar studies measuring the extend and distribution of crop genetic diversity include: Nepal (Baniya et al., 2001; Bajracharya et al., 2001; Rijal et al., 2001), Morocco (Kerfal, 1999; Sadiki et al., 2000; Birouk et al., 2001; Bouizgaren et al., 2001), Vietnam (Ha, 2001; Hue 2000), Ethiopia (Weldesemayat, 2000; Assmelash, 2000; Shewaye Deribe, 2000), Mexico (Chavez Servia et al., 2000; Latournerie-Moreno L., 2000); Burkina Faso (Sawadogo et al., 2001); Hungary (Mar 2001).***

***1.2 Understanding the processes used to maintain crop diversity.*** The maintenance of diversity in local crop varieties (both variation within varieties and the number of varieties maintained) depends on natural selection and on farmer management or human selection. In order to develop a conservation strategy it is important to understand the ways in which these two interact and their relative importance. A variable production environment such as fields with a range of soil types and drainage characteristics will tend to favor the maintenance of within variety diversity. Farmers may seek variation in some characteristics while trying to eliminate it in others such as maturity time versus flavor. Seed supply systems and the ways in which farmers select, keep and exchange their seeds seem to be very important to the final observed patterns of diversity (Louette et al. 1997).

1.2.1 Ethioipia -- Agrobiodiveristy used as pest management. The use of trap crops to reduce the parastic weeds of the genus ***Striga*** -- Insects are repelled from the main crop and are simultaneously attached to a "discard" or "trap crop" planted around fields.

***see also Peru (Scurrah, M., 2000) for similar case study with nematodes and faba bean***.

1.2.2 ***Madagascar:*** Transplanting seedlings earlier and in small numbers to that more survive; to keep paddies unflooded for much of the growing period and to use compost rather than chemical fertilizer to reduce environmental degredation.

1.2.2 Irrigation systems at high elevation in Nepal that cipher water off the main rivers into small canals so the water has has time to warm before it is used to irrigate local rice varieties. This and the practice of letting seedlings sprout inside before planting allows rice varieties to grow up to 3000 meters in Nepal (Rijal, 2000).

1.2.3 ***IPGRI - Morocco***: Investigations into the seed system has found that only 13 percent of the seeds for durum wheat and 2.5 percent of the seeds for food legumes come from certified seeds bought annually in Morocco, indicating that the majority of seeds used are from local crop diversity or saved from earlier purchases (Mellas, 2000; Nassif, 2000).

***1.3 Identification of who (men, women, old, young, rice, poor, certain ethnic groups) maintains crop diversity.*** Not all the farmers or all the members of a community play the same part in maintaining a diversity of crop varieties. There can be differences in gender, age, income groups, ethnicity.

1.3.1 Cross-site visits for farmers (male and female) in Morocco (Nassif, 2000) and Nepal (Rana 2001) were found to be critical for understanding who is involved in what stage of different decision-making processes, as farmers were able to compare their varieties and management methods with farmers from other regions.

1.3.2 Dissagregation of data collection in Nepal (Subedi 2001), Mexico (Arias et al., 2000; Morales and Vega, 2000), Burkina Faso (Belem, 2000), and Vietnam (Cuong and Hue, 2000), showed that age, gender, economic status, and migration was linked to decision making and mangement of crop genetic resources and the management and use of the land where the crop was grown.

***1.4 Understanding what factors (market and not market) influence farmer decision-making to maintain crop genetic diversity*.**

1.4.1 Yunnan Case study: Varieties are selected according to agronomic traits (sowing time, color); ecological adaptability traits (cold resistant, heat resistant) and quality traits (glutinous/non-glutinous), a diversity of varieties is grown because of the spread of altitude (i.e., temperature at different altitudes), economic situation of households, differences in soil fertility, and distance to the road where new varieties can be easily introduced.

***For similar studies that link varietal choice together with the area grown by a variety for that season to agroecology, market infrastructure, houshold characteristics and economic status, income sources, human resources and labour and land resources -- see Meng, 1997 (Turkey); Aguirre et al., 2000 (Mexico); Luis et al., 2000 (Mexico); Rana et al., 2000 (Nepal); Nassif, 2000 (Morocco).***

***1.5 Assessing the amount of crop genetic diversity available to national programmes held ex situ in genebanks, botanical gardens, and research stations and the availability of this material for use in conservation activities***

1.5.1 ***Brazil case study:*** Brazil has initiated a study (biological characterisation) and catelogue the accessions available in the germplasm banks, and make available the information through informative services

1.5.2 ***Cuba's National Biodiversity Strategy and Action Plan*** promotes the establishment mechanisms to allow validation, use and dissemination of genetic material included in ex-situ collections of plants of economic importance

***1.6 Undertaken at the appropriate spatial and temporal scales (Ecosystem Approach Principal 7)*** Any case study will need to examine different scales in order to determine appropriate spatial and temporal scales for conservation. The different sources and levels of information, include the local cultivar, the crop, the parcel or plot, the household, the village or community, the landscape or region. This will also include the role of seed supply systems which will affect the effective plant population size for conservation. It should be noted that the information collected at the level of the household or farmer's plot may not be the appropriate scale for analysis or for agrobiodiversity conservation.

***1.7 Recognizing the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management set for the long term (Ecosystem Approach Principal 8). Here best practices should include*** investigations on how local crop diversity can continue to provide sustainable production over the long term. Better adapted varieties identified by farmers need to be investigated in terms of sustainable long term management of the agroecosystem

***1.8 Management must recognize that change in inevitable (Ecosystem Approach Principal 9).*** Conserving the systems that promote the continued evolution and adaptation to changing environmental, social, cultural, and economic conditions. The idea is that local crop cultivars are another option that farmers may have access to in order to meet their changing conditions. Best practices should include those that assess

the buffering capacity of the farmer's seed supply and storage system to adapt to changing environmental and economic conditions, and the capacity of the formal and informal sector to support farmers during times when individuals do not have the capacity to cope with random events (drought, hurricanes, abrupt market changes).

1.8.1 ***Cantho Vietnam, CBDC/IPGRI: Tin (1999)*** -- Do to new irrigation in southern Vietnam, local farmers have changed to use local varieties that can mature earlier thus allowing for two seasons now possible with the new irrigation systems.

***See Burkina Faso (Sawadogo, 2000), Morocco (Sadiki et al., 2000) for other best practices.***

***IVb. CBD Operational Objective 2: The identification of management practices, technologies and policies that promote the positive and mitigate the negative impacts of agriculture on biodiversity, and enhance productivity and the capacity to sustain livelihoods.***

***Here are included Ecosystem Approach Principals 3, and 5.***

**Best Practices 2**

***2.1 Ecosystem managers consider the effects of their activities on adjacent and other ecosystems (Ecosystem Approach Principal 3). By using better adapted local crop varieties farmers are able to reduce amounts of pesticides and fertilizer, and in some cases reduce frequency of irrigation, thus reducing the impact on adjacent ecosystems. Another area would be supporting the selection of crop varieties*** that take less time to cook to help reduce the amount of fuelwood needed from adjacent forest areas.

2.1.1 ***Russia Case study***: Anti-erosion system of cultivation which developed into contour-land improvement system of land cultivation.

2.1.2 ***India: Permaculature Practice and Agrobiodiversity Conservation***. Chemical inputs have been eliminated and the use of biodiversity in the fields has increased.

2.1.3 ***India: Innovations in the NBSAP Process and Revival of Indigenous Crops.*** The biodiversity fair described above resulted in an increase in discussions on the increased nutritive values of the foods they consumed, and the quality of fodder available for their cattle.

2.1.4 ***Mexico Shade Coffee plantations***. Traditional coffee systems grown under shade either under trees from natural vegetation or under fruit trees resemble natural ecosystems keeping in relative small areas a great diversity of animals and plants

***see Nepal (Rijal 2000) for other best practices***

***2.2 Conservation of ecosystem structure and functioning, in order to maintain ecosystem services (Ecosystem Approach Principal 5). Identifying farming system practices where the use of local crop diversity improves ecosystem health, reducing the use of pesticides, herbicides and fertilizer with better-adapted genetic resources.***

2.2.1 ***Cuba:*** The promotion of organic or near organic agriculture and the use of non-chemical technologies, and to increase crop diversification to reduce pests and diseases and thus reduce the need for pesticides.

2.2.2 ***India: Integrated Pest Management and Biodiversity Utilization in Cotton***

2.2.3 ***India: Reviving Traditional Crops and Practices in Jardhargaon***. The Beej Bachao Andolan (Save the Seeds Movement) are pursuing the revival of traditional farming

methods, such as ***baranaja***, in which about a dozen crop species grown together yield a variety of produce that fulfil a variety of domestic requirements, while maintaing soil fertility. There is a similar initiative in ***Bangladesh: Nayakrishi Andolon*** (Mazhar, 1996)

2.2.4 ***IPGRI - Morocoo***, durum wheat varieties that do not require fertilizer are preferred by women of some regions for its better taste (Nassif 2000). Resistant varieties to chocolate spot in Morocco (Sadiki et al., 2000)

***IVc. CBD Operational Objective 3: Strengthening the capacity of farmers, their communities, and organisations and other stakeholders, including agro-enterprises to manage agricultural biodiversity and the promotion of increased awareness and responsible action.***

This includes Principal 1 of the Ecosystem Approach: ***The objectives of management of land, water and living resources are a matter of societal choic,*** Principal 4 ***- Recognising potential gains from management (a) reduced market distortions, (b) align incentives, (c) internalise costs and benefits,*** and Principal 10 ***- seek the appropriate balance between and integration of, conservation and use of biological diversity.*** In terms of crop genetic resources, benefits (economic, social, ecological, genetic) of intra-specific crop diversity when maintained on farm can be both a societal (public) good and a private good or benefit to farmers. Thus, the guiding principal is to enhance the use of local crop diversity for local communities, and the ability of local communities to use and make decisions on local crop diversity, to ensure the continued maintenance of diversity. In this regard, and important principal is that time needs to be devoted to building or creating rapport with the farmers in whose fields much of the work is being undertaken, and whose experiences and knowledge provide a central component of the management of crop genetic resources.

**Best practices:**

***3.1. Community sensitisation***

3.1.1 ***Nepal: Roadside Diversity Drama and poetry contests***. These activities serve to raise awareness of conservation issues and the value of genetic diversity for sustainable agricultural at the village level in Nepal (Rijal, 2001)

***see also Vietnam (N.N.De, 2000), Hungary (Mar, 2000)***

***3.2 Improved access to materials by farmers through developing seed networks, diversity fairs***

3.2.1 ***Ethiopia case study. Reintroduction of lost farmers' varieties***. The gene bank in Ethiopia has a programme to return farmers' varieties to areas from where they had disappeared. One example is the reinstitution of farmers' varieties of durum wheat south of Addis Abeba.

3.2.2 ***Ethiopia: Community seed bank***. In Tigray farmers have established a community seed bank that currently holds seeds of a wide range of traditional crops. The seeds are selected by the local farmers based on specific cultural, technological and ecological criteria.

***3.2.3 Ethiopia (UNDP/GEF Project):*** After constructing 12 community genebanks, the project is now working to link these community genebanks to locally used small storage systems in order to strengthen the seed supply system and enhance its viability. This helps to conserve the traditional storage system and helps link it the formal system.

3.2.2 ***India: Permaculature Practice and Agrobiodiversity Conservation***. The establishment of a community gene-fund programme that established seed banks in over 30 villages and revived over 60 crop varieties.

3.2.3 ***India: Innovations in the NBSAP Process and Revival of Indigenous Crops***. A biodiversity felstival was organized in which about 70 Villages participated. Discussions with farmers took place in each village about agrobiodiversity that they planned to conserve, enhance for sustainable use and equitably distribute. This resulted in a BSAP for agrobiodiversity conservation for each village

**3.3.** ***Management is decentralised to the lowest appropriate level (Ecosystem Approach Principal 2)***

***3.3.1 Nepal Information bases for farmer use on the characteristics and value of local varieties*** (Rijal, 2001): In Nepal, the idea of community gene banks did not fit in with the culture of farmers keeping their own seeds. Farmers prefer to keep their own seeds but to know where they might get other seed varieties within the village if needed. Thus, through a local initiative of a local NGO- LiBird, and NARC the government Nepalese Agricultural Research Council, farmers are now monitoring their own biodiversity through registries of local varieties in the community. Farmers keep track of who has which variety and whether the variety is increasing or decreasing in the village.

3.3.2 ***India: Permaculature Practice and Agrobiodiversity Conservation.*** The establishment of the Deccan Development Society-- the women have organized themselves into ***sanghas*** that have initiated collective farming and the gene-fund programme.

3.3.3 ***Brazil: The Alternative Technologies Project***. Farmers are trained on the basics of stratified mass slection and crossing, and provide with information, which enable them to define, on the basis of their own criteria and needs, the best strategy to puruse. Emphasis is given to the importance of maintaining the widest genetic base possible (Cordeiro and de Melho, 1994)

3.3.4 ***Mexico: The Oxaca Project.*** Interested faremrs are trained in the principles of plant breeding so that they are able to preserve and maintain the characteristics they value in the maize populations they plant.

***3.5 Literacy training as a means to empower farmers in the conservation and use of crop genetic resources***

***3.5.1*** Studies in Morocco and Nepal through the In Situ Project have found that farmers are requesting literacy training to better enable their management of crop genetic diversity, to better monitor changes occurring to their crop genetic resources, and to be better able to market and promote crop genetic resources. In light of this, the next phase of the IPGRI in situ project is including literacy training in some of the participating countries where it was requested, particularly ***(Nepal (Rana 2001) and Morocco (Jarvis, personal communication, 2001)***

***3.6 Creating Informal-formal institutional frameworks -- Involve all relevant sectors of society and scientific disciplines (Ecosystem Approach Principal 12)***

3.6.1 ***Yunnan Case Study***: Organization of Crop conservation organizations. The Gaoligongoshan Farmers' Association for Biodiversity Conservation, established in 1995 is the first NGO for environmental protection in China. It opens the channels between government departments and farmers, as well as donor projects and farmers. The Association has begun to identify and organize expert farmers to demonstrate agrobiodiversity In Vietnam, activities are decided collectively by all participating institutes, but management is done by local multi-disciplinary teams in the different regions.

3.6.2 South Africa. The South Africa Government National Landcare programme for South Africa, a community-based programme supported by both the public and private sectors through a series of partnerships.

***3.7 Market development for the maintenance of on-farm diversity, including better processing, marketing and consumer awareness. A key part of this practice is ensuring that after markets are developed for crop diversity, profits are returned to those growing and managing the diversity (in lieu of middlemen). Thus the best practices focused on below are those, where not only markets are developed, but where revenues are returned to the producer.***

3.7.1 ***India: Permaculature Practice and Agrobiodiversity Conservation.*** The establishment of the Deccan Development Society has also established an alternative market that is under their control where they can fix prices that are higher than regular market prices.

***See Nepal (Rijal et al. 2000) for more best practices***

***3.8 Providing information on nutritional qualities of locally adapted varieties that can provide low cost forms of improved nutrition for humans and fodder for livestock***

***3.8.1 India: Innovations in the NBSAP Process and Revival of Indigenous Crops. The biodiversity fair described above resulted in an increase in discussions on the increased nutritive values of the foods they consumed, and the quality of fodder available for their cattle.***

***IVd. CBD Operational Objective 4: The development of national plans or strategies for the conservation and sustainable use of agricultural biodiversity and their mainstreaming and integration in sectoral and cross-sectoral plans and programmes***

In contrast to research and analysis methodologies to understand the amount and distribution, processes and reasons for crop genetic diversity maintenance and use, which have widespread application, actual interventions are found to be site specific. Therefore, a portfolio of options is needed based on a range of possible methods for increasing the benefits to farmers from local crop diversity to formulate national plans, strategies, and agricultural development activities. This includes methods for integrating locally adapted crop varieties and farmer preferences into national and local development and extension projects and understanding of the role of the formal and informal seed system in the maintenance of crop genetic diversity.

**<u>Best practices</u>:**

***4.1. Strenghtening the informal seed supply system.*** Strong seed supply systems enable farmers to maintain a high level of crop genetic diversity over time, despite losses of seed stock, bottlenecks, and other regular or unanticipated losses of crops genetic diversity. Strengthening the informal seed supply system could serve to promote conservation of local varieties and to supply a majority of farmer seed demand.

***4.1.1 Brazil: The Alternative Technologies Project***. In the south and southeast of Brazil, a group of local associations and farmers organizations supported by NGOS. of the Alternative Technologies Project and EMBRAPA are working to safeguard and encourage farmer production of maize seeds, based on the valuation and reintroduction of local varieties instead of commercial hybrids.

4.1.2. Nepal: Presently 50% of the total rice area in Nepal is under local carieties, while 10% or seeds (modern varieties) are supplied by the formal system (Agricultural Input Corporation; Sthapit et al., 1996). This implies that 90% of the seed supply system

both for local and modern varieties is covered through informal mechanisms. Research has gone into identifying who are the suppliers in the informal system so that they can be supported through the public and private sectors (Gaucham 2001)

***4.2 Creating methodologies for integrating locally adapted crop varieties and farmer preferences into national and local development and extension projects. This includes identifying locally adapted varieties suited to particular marginal agricultural environments and mainstreaming them into agricultural development packages, and supporting the use of crop diversity to manage risk and uncertainty to social and environmental change***

4.2.1 ***Zimbabwe: Supportive agricultural extension policies***. In Mudzi and Mutoko, Zimbabwe, local agricultural extension agents now actively encourage farmers to maintain on-farm crop biodiversity and farmers say this has significantly influenced their agricultural biodiversity decisions. District Councils have also decided to include competitions for greatest number of crops and varieties in the local agricultural show (Cromwell and van Oosterhous, 1999).

***4.5.2 Mexico: The Oxaca Project.*** Breeders solicit input and opinions directly from traditional, small-scale farmers about the traits they value in their maize varieties, and how they select for these traits. The breeders focus their breeding programmes to address the needs identified by farmers as well as agronomic characteristics that they themselves value.

***4.3 Curriculum development in the formal sector (primary, secondary, extension workers, university) on the conservation and use of local crop diversity***

4.3.1 ***examples***

***4.4 Public awareness on the importance of diversity maintained by farmers for present and future agricultural development***

***4.4.1 India: Permaculature Practice and Agrobiodiversity Conservation. Several of the women and men farmers were honored for their outstanding work in conserving seeds and demonstrating sustainable productivity.***

4.4.2 ***South Africa***. The South Africa Government National Landcare programme for South Africa has a communication and information strategy geared primarily for farmers and secondarily for the broader land-user communities and young people. The pupose is to promote a better understanding of factors that can lead to unsustainable use of resources in agricultura and of policies and institutions, which can address this.

***See Nepal (Chaudhary et al., 2001) for more best practices***

***4.5 Mainstreaming local crop materials for participatory breeding and selection***

***4.5.1 Brazil The Alternative Technologies Project.*** Recovering of local varieties for seed multiplication, evaluated the recovered varieties through comparative trials and farmer observations.

***See Nepal (Sthapit et. al,1999, 2000); Mexico (Chavez-Servia, 2001); Morocco (Sadiki et al., 2000) for more best practices***

***4.6 National economic and agricultural policy recommendations.***

4.6.1 ***Cuba National Biodiversity Strategy and Action Plan***: Value the diversitifcation in the use of natural resources that generate the development of alternative production.

***4.6.2 India: Innovations in the NBSAP Process and Revival of Indigenous Crops***. "What came up repeatedly was the need for a change in Government policies to give a boost to the marketing value of traditional varieties, by even including them in the Public Distribution System***.***

## SECTION V: Literature cited