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Local Community Participation in Reversing Trends of Genetic Erosion: The Community Seed Bank Approach from Ethiopia

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1. INTRODUCTION

Farmers depend on genetic diversity for their livelihood and, hence, are the principal mangers of crop genetic resources since the beginning of agriculture. Subsistence households use crop diversity to meet multiple needs i.e consumption, marketing and coping with environmental variations. Diversity offers farmers the choice of planting materials that fit into specific agroecological niches, minimize climatic risks and ensure harvest security. The indigenous seeds traditionally maintained by farmers are repositories of useful traits and serve as raw material for the conventional breeders in variety development.

However, the richness of these resources is declining over time through genetic erosion. The rate of loss is variable for the different crops and parts of the country. Loss of adapted planting materials and diversity in seeds poses serious challenge in terms of raising agricultural production and achieving overall food security. Degradation of the natural resource base (mainly decline in land productivity) also contributes to low production levels.

Though demographic, economic and technological factors influencing biodiversity conservation activities were studied relatively better, institutional factors and property right issues are less addressed. Hence, the paper tries to make a contribution toward such a discussion focussing on the conservation of crop genetic resources and taking the community seed banks as an institution. Hopefully, the workshop discussions may lead to highlight possible options and learn from best practices elsewhere for designing a better future.

This paper highlights the experiences and lessons learnt in terms of mitigating the loss of genetic diversity through the community seed bank approach. The role farmer communities play in the conservation of genetic resources is gaining importance and farmers are central stakeholders in this endeavour. The first section provides background information about the Institute of Biodiversity Conservation and Research (IBCR) and the establishment of Community Seed Banks (CSBs) as part of the on-farm crop conservation strategy. Experiences with seed banks are discussed considering CSBs run by IBCR and the Relief Society of Tigray (REST), an indigenous NGO. Each case is reviewed with respect to access, use and management right. The next section presents the link between property right of land and its impact on crop genetic diversity. Collective action of farmers in plant genetic resources conservation is assessed in relation to cost of conservation, information flow and prospects for enhanced access and use of germplasm. Prospects for CSBs as sustainable local institutions as well as issues of farmers' rights are briefly mentioned preceding the concluding remarks.

2. BACKGROUND

2.1 Ethiopia - a Center of Diversity

Ethiopia is known as a world center of diversity of cultivated plants and has various agroecosystems (Figures 1-3 in appendix). This rich diversity is maintained by more than 80 ethnic and linguistic communities representing great cultural diversity. Over centuries, these communities have developed various forms of resource management systems for utilizing the natural resources. The highly varied agro-ecological and climatic zones enabled the communities to grow and utilize different crop plant species and varieties (Demissie 1999). Different forms of utilization resulting from the diverse cultural backgrounds required sustained cultivation, hence, favoured *de facto* conservation of crop genetic diversity. As a result, Ethiopia hosts a number of food, oil and industrial crops, medicinal plants as well as wild and weedy species.

Agriculture is the mainstay of the national economy being the main foreign exchange earner and source of livelihood for more than 85% of the population (CSA 2002). Typical features of the sector include that production is small scale subsistence-oriented with extremely small land holdings per household (often less than one hectare on the average due to settlement concentration in the highlands), fragmented croplands, low productivity of land, and rainfed agriculture. Reliance solely on rainfall exposes the farmers to risks of climatic vagaries.

As individual farms become small and farmers poorer, they have less capacity to maintain many farmers' varieties[1] (landraces). Fragmentation leads to smaller farm sizes, which in turn limits the choice for farmers to grow a range of crop species. Consequently, farmers are bound to relying on few crop varieties and getting low production. As such, the decline in farm size has increased the rate of genetic erosion.

2.2 Threat of Genetic Erosion

The once rich resources of plant genetic diversity of the country experienced serious genetic erosion over the past decades due to natural and human-induced factors. The rate of erosion varies considering different parts of the country and crop species. Though there are no detailed studies quantifying the loss for each crop, the level of diversity observed currently on farmers' field is generally low.

For instance, durum wheat is the most threatened crop in Eastern Shewa. It was once the only wheat variety grown in the locality until improved bread wheat varieties were introduced to the area. The local durum wheat varieties were completely replaced in Lume locality whereas a few households in Akaki locality maintained only one variety (purple seeded). The main factors that contributed to the loss of diversity in durum wheat varieties in Eastern Shewa include: displacement of indigenous landrace varieties by new,

[1] Farmers' varieties:- refers to local crop varieties developed and maintained by farmers through generations. These are commonly referred to as landraces, but the name farmers' variety is preferred in this paper to give recognition to the dynamic and collective role of farmers.

genetically uniform varieties; displacement due to competition from other crops with higher market value such as teff (Worede et al. 2000), changes in land use and cropping patterns.

2.3 IBCR and its Role in Plant Genetic Resources Conservation

The Institute of Biodiversity Conservation and Research (IBCR) is the national institution responsible for coordinating efforts made to halt back and eventually reverse the rate of genetic erosion by promoting genetic resources conservation activities. It was initially established in 1976 as a Plant Genetic Resources Center of Ethiopia (PGRC/E) and its activities focused on the collection and *ex situ* conservation of crop plants that have high research and economic importance. Priorities were given to crops facing immediate danger of genetic erosion. Series of plant exploration and collection missions were launched to collect and conserve important crop types and their wild relatives. To date, some 61,000 accessions representing 104 plant species were collected and conserved in the gene bank (Kibebew 2001). Other *ex situ* conservation strategies included field gene banks (for plants with recalcitrant seed and root crops) and botanical gardens.

IBCR was restructured in 1999 as an autonomous body and its mandate now covers all forms of biological resources (plants, animals and microbial resources). The general objective of the Institute currently is to undertake conservation and research, and promote the development and sustainable utilization of the country's biological resources giving due emphasis to local and national needs and values. Towards meeting these, the Institute follows *in situ* conservation strategies complementing the *ex situ* conservation activities. The importance of *in situ* conservation strategy was discussed in many literatures (Maxted et al. 1997; Jarvis et al. 1999; Brush 2000). The Community Seed Banks are part of this dynamic on-farm (*in situ*) crop conservation strategy. The aim of this approach is to support conservation of local crop diversity through continued use by local communities, i.e collective action of farmers.

3. THE COMMUNITY SEED BANKS AND COMMUNITY PARTICIPATION AS PART OF THE ON-FARM CONSERVATION STRATEGY

3.1 Conceptual Framework

A strategy followed by IBCR to strengthen local support for *in situ* conservation is through establishment of community seed/gene banks (CSB/CGB) at district level (Worede 1997). The prime goal of the CSBs is to ensure sustainable supply of locally adapted planting materials and fill gaps where the currently available improved or new varieties fail to meet the specific requirements of resource-poor farmers. Basic traits that farmers look for in seeds includes not only grain yield potential but also agromorphological characters, taste, cooking quality, nutritional value, tolerance to stress and yield stability.

The purpose of CSBs is to promote community based seed production, marketing and distribution system at local level. The seed banks operating in a network with the traditional individual seed storage systems at household level, aided by the local markets, offer a promising opportunity to avert the risk of loss of crop diversity (Worede 1997, Feyissa 2001).

The full-fledged community seed/gene bank will be able to supply good quality seed both for conservation and production purpose. Samples of all crops handled by the CSBs will be kept at the central gene bank. Detail operational structure was discussed by Feyissa (1999). Combining secure access to diverse planting materials with improved access to marketing farmers' produce would, therefore, enhance maintenance of crop diversity on farmers' field for the long future. Farmers are expected to have better negotiating power collectively through the Crop Conservators' Associations as an institution.

3.2 How the Community Seed Banks Function

The seed banks are owned and managed by the community. Volunteer farmers are organized into Crop Conservators' Association (CCA). Criteria used to identify CCA members include: experience in conservation of farmer varieties, ability to share experience with other farmers, open-mindedness for new innovations and social acceptance by the village community. The CCAs serve as a link to reach other non-member farmers, local agricultural extension agents and IBCR. More specifically, the CCAs are designed to rebuild the sense of self-reliance of farmers in on-farm conservation activities (*de facto* conservation through continued use). The strategy gives recognition to farmers' role in the conservation of indigenous crop plants and the associated local knowledge as well as in the efforts made to restore genetic diversity through reintroduction, multiplication and enhancement activities.

Among the duties of the CCAs are: identification of threatened farmers' crop varieties, purchase of seed variety that need to be stored, deciding on terms and conditions for seed supply (loan and repayment), and producing internal regulations/bylaws. For instance, the priority crops that the CSBs deal with in Eastern Shewa include durum wheat, chickpea, faba bean, field pea, lentils, fenugreek and grass pea. Durum wheat is the most threatened crop and pulses are rotation crops traditionally associated with durum wheat production.

The Community Seed Banks provide warehouse service for farmers' varieties and provide seeds to members on loan. Farmers willing to borrow farmers' varieties get seed during planting season and pay back in kind after harvest with some 15-25% interest (rate varies with locality). The interest rate is fixed by the General Assembly and is targeted towards serving more number of users the next season and directing the CSBs into a self-sustaining system in the long future. Initial construction cost, basic furniture, material supplies and start-up seed money as a revolving fund (to purchase farmers' varieties identified as threatened and worth conserving) was provided by IBCR. Refresher trainings on the importance of landrace varieties, role of seed banks, farmers' role in seed conservation as well as practical seed bank management strategies were given to members, non-members and management committees as appropriate. Experience sharing

visits were provided for selected CCA members to learn from their fellows in other localities. IBCR continues to provide technical backup service to make the seed banks full-fledged community-based organizations.

4. EXPERIENCES WITH COMMUNITY SEED BANKS

4.1 IBCR and the Community Seed/Gene Banks

IBCR has established 12 Community Seed/Gene Banks across the country. They are located in East Shewa, Northern Shewa, South Wollo, East Tigray, Bale and Keffa Sheka zones (Table 1). The total number of CCA members as of 2002/03 crop year was 3,359 farmers.

Table 1. Distribution of Community Seed Banks and Number of CCA Members and Crop Species Under On-farm Conservation (2002/03)

Zone	District	CCA Members (No.)			No. of Crop Types	Quantity (MT)
		Male	Female	Total		
East Shewa	Lume	800	200	1000	7	3.63
	Ghimbichu	240	60	300	4	3.63
Bale	Agarfa	86	12	96	3	3.17
	Goro	82	19	101	5	1.95
Keffa Sheka	Decha	170	56	226	5	1.30
	Chena	268	29	297	6	1.47
North Shewa	Ankober	70	18	88	2	2.36
	Insarona wayu	60	6	66	5	1.32
South Wollo	Kallu	206	17	223	3	8.67
	Woreilu	311	51	362	8	9.82
East Tigray	Hawzen	270	30	300	11	7.00
	Genta Afeshum	270	30	300	9	2.44
	Total	2831	528	**3359**	22*	13.69

Source: IBCR 2003 (Terminal Report)

Note:- the number of crop species refers to those handled by each seed bank and are not additive as some crops are handled by two or more seed banks. The total is 22 crop species for all seed banks.

Among these, the CSBs in Eastern Shewa are chosen for in-depth study. There are 2 CSBs in Eastern Shewa (Fig 4a and 4b in appendix). They serve 15 Peasant Associations (PAs) and have a total of 1300 members in 2002/03 crop year. Functionality of the CSBs would be discussed from three perspectives: access, use and management right.

4.1.1 Access

All members have access to seeds held by the CSB, i.e farmers' varieties. There were 1,195 farmer households who benefited from the services of the CSB in Eastern Shewa in 2002/03 (Table 2). Traits mentioned by farmers as favouring farmers' variety conservation were: (a) preferred taste, (b) diverse home use, (c) weed tolerance, (d) adaptation to stress conditions (moisture stress, low soil fertility), (e) frost tolerance, (f) resistance/tolerance to pests, (g) low seed requirement per unit area, (h) high tillering potential, (i) quality straw, and (j) harvest security. No single variety is versatile enough to meet all these qualities. Hence, infraspecific diversity of durum wheat is maintained to meet the household's production and marketing objectives.

Many households joined the CCAs because the local seeds are not available in the local market. In the long future, the presence of CSB in a locality offers an indirect access to non-member households as well. It is a common practice to get seeds through informal seed exchange system from neighbours and friends as well as through the local market once a variety is widely grown. Hence, access is ensured not only for CCA members, but also for non-member households. The availability of diverse and locally adapted planting materials has positive contribution to overall food and livelihood security of farm communities.

Table 2. Farmers' Varieties Distributed to Farmers through Community Seed Bank in East Shewa

	1997/98		1998/99		1999/00		2000/01		2001/02		2002/03	
Crop Type	**Qt**	**No**	**Qt**	**No**	**Qt**	**No**	**Qt**	**No**	**Qt**	**No**	**Qt**	**No**
Wheat	16	80	55	226	71	286	177	596	186	572	131	289
Pulses	8	76	22	174	21	156	33	192	153	730	103	389
Total	24	156	77	400	92	442	210	788	399	1302	234	687

Source: IBCR (2003) Terminal Report. Note:- Qt = Quantity in quintals (1Qt=100 Kg).

Note:- Pulses include chickpea, faba bean, grass pea, field pea, fenugreek and lentils.

The reason for decline in quantity of seed distributed in 2002/03 was the dry spell that led to crop failure in the locality. As a result farmers who borrowed seed were not able to repay the loan on time. Hence, available stock for the season was less than what was anticipated.

4.1.2 Use

Availability of good quality and adapted seeds locally promotes wider use of the materials. Given the choice, farmers naturally opt for diversity. The farmers' varieties (FVs) offer a basket of choice for farmers to resort to whenever they desire some specific preferred qualitative traits (or meet specific production objectives). Informal farmer-to-farmer seed exchange systems and local markets also promote wider use of the seed varieties to villages beyond the immediate vicinity of the CSBs. Women farmers are knowledgeable about use of varieties and also make evaluation/selection out in the field.

A survey covering 120 households was carried out in East Shewa taking two localities i.e Lume - having a community seed bank and Akaki not having one. Comparing the two

localities, the number of farmers having FV durum wheat in Lume were twice as much as those in Akaki locality (Table 3). The presence of the CSB has enabled more number of households to access and grow durum wheat farmers' varieties. The respondent households borrowed seed from the seed bank for the following reasons: (i) to increase diversity (get new types of seed they don't have) – 39%, (ii) get good quality seeds – 47%, and (iii) fill gaps in seed shortage – 14%.

Table 3. Number of Farmers having No Farmers' Variety (FV) and having FV of Durum Wheat by Locality and Wealth Group

Wealth Group	AKAKI Locality (has No Seed Bank)		LUME Locality (has Seed Bank)	
	No Farmers' Variety	Growing FV	No Farmers' Variety	Growing FV
Rich	10	8	7	7
Medium	18	5	15	11
Poor	19	0	12	8
Total	47	13	34	26

Source:- Household survey (2002)

The reasons mentioned for not growing farmers' varieties of durum wheat were: (i) new improved wheat varieties perform better (42%), (ii) unavailability of seeds of FVs (37%), (iii) shortage of land to try out the FVs (15%), and (iv) lack of confidence on the performance of FVs due to changes in the growing condition (6%). Presently, farmers grow both improved varieties of bread and durum wheat using chemical fertilizers.

Concerning the source of seed for FVs of durum wheat, some 38% from Akaki locality maintained own seed while 31% got from other farmers through exchange. In Lume, the larger share of FV growers (69%) obtained seed from the community seed bank and market had low contribution (19%) (Table 4). It would be reminded here that FVs of durum wheat were completely lost from Lume locality and were reintroduced by IBCR through its on-farm conservation scheme. Hence, the presence of the *in situ* conservation program (the CSB) has had strong positive impact in restoration of FVs of durum wheats once more in Lume locality.

Table 4. Source of Seed for FV Durum Wheat Growing Households in East Shewa

Source of Seed	Akaki Locality		Lume Locality	
	No.	%	No.	%
Market	4	31	5	19
Own saving	5	38	-	-
Exchange with other farmers	4	31	3	12
Community Seed Bank	-	-	18	69
Total	13	100	26	100

Source:- Household survey (2002)

Another survey conducted in Bale zone also presented the importance of CSBs as sources of durum wheat farmers' varieties. Considering the various sources, CSBs and markets constituted the larger share (60% and 24% respectively) for the 200 respondent households.

Table 5. Sources of Seed for Durum Wheat Landraces in Bale

Seed Source	No. of HHs	% of Total
Own saving	25	12.5
Market	48	24
CSB	120	60
Exchange	7	3.5
Total	200	100

Source: IBCR (2003). HHs = Households

In sorghum growing areas of Southern Wollo, the level of diversity observed on farmers' field (Fig. 5 in appendix) has increased tremendously since the initiation of the on-farm conservation scheme. The improved sorghum varieties largely failed to meet the needs of farmers and, hence, didn't gain popularity. The main reason for non-preference was the short stalk of the new varieties (breeders' aimed to have more grain harvest with dwarf varieties). The farmers' varieties are generally taller (2-5 meters) and farmers are equally interested in stalk as the grain harvest. Stalk has multipurpose use being main source of feed for the livestock, fuel, source of income, construction material for fences and stores, among others.

4.1.3 Management Right

Farmer communities are the ultimate owners and managers of the CSBs. The facilities are set locally to promote easy access and provide a back-up function to the formal *ex situ* conservation activities of the gene bank. Relevant trainings were offered to the management committee on ways of handling the formal paper works and administering financial resources. A Development Agent (DA) was hired by IBCR to assist farmers in the day-to-day routines. Internal bylaws were developed to ensure commitment of members towards strengthening the services of CSBs and retain their integrity as a local institution.

For the CSBs to function as an autonomous institution, the requirement by the government is that the CCAs should be registered as voluntary community based organization by the Cooperative Development Bureau and obtain a legal status. All of the CCAs are on the process of getting their legal status and IBCR is facilitating the formalization process. Financial support from IBCR would be fully withdrawn once the CCAs attain their legal status and become full-fledged covering running costs from internal income. The CSBs would generate sufficient money once they are able to store grains and market when prices rise during the wet season. As an institution, the CSBs have better bargaining power for grain price than individual farmers.

4.2 REST and the Community Seed Banks in Tigray

4.2.1 Establishment

The Community Seed Banks in Tigray have been operational since the late 80's - when drought was a recurrent and widespread phenomenon. Their establishment came about through the rural development activities of the Relief Society of Tigray (REST – a local

NGO). The seed banks were sought as a solution to the prevailing seed shortage problem faced after a disaster and were meant to relieve farmers from the exploitation of rural money lenders who often charge as high as 200-400%. Seeds handled by the seed bank were good quality local varieties obtained initially from traditional seed selector farmers through purchase. Elaborate overview the community seed banks and their potential as community-based institutions were made by Berg (1992).

Presently, the community seed banks serve three basic functions: (i) they make available locally adapted seed varieties of major food crops to poor farmers at affordable price, (ii) they act as a buffer stock following a disaster during periods of seed shortage, and (iii) they help to preserve farmers' varieties of major food crops and support the self-reliance of communities (i.e reduce reliance on expensive external chemical inputs).

4.2.2 Access and Use

Traditional seed selectors (men and women) have rich knowledge about crop varieties and this information is shared whenever seeds are exchanged within the village. These seed selectors play vital role in the on-farm crop conservation effort. They identify good quality seeds for purchase by the CSB and later distribution to needy families on loan.

Farmer households residing in the locality where the CSBs are located have the right to access seed varieties available in the seed bank. Both men and women headed households have the right to borrow seed from the CSB. Loan is repaid after harvest and an interest charge of 15% is included.

The local crop varieties stored in the seed banks are widely grown by the farmer communities because the seeds meet the specific needs of the resource-poor households. This is evidenced by the fact that all seed stock is lent out every year and the quantity stored often times fails to meet the local demand. Hence, priority is given to the most needy households as identified by the seed bank committee. The following table indicates the growing number of beneficiaries over the years. Compared with the number of beneficiaries in 1997/98, the subsequent three years showed an increment of 82%, 66% and 89% (table 6).

Table 6. Distribution of Community Seed Banks in Tigray and Number of Beneficiaries

Locality	No. of CSBs	1997/98		1998/99		1999/00		2000/01	
		Qt	No	Qt	No	Qt	No	Qt	No
Tanqa Abergele	2	1,109	1,232	1,050	1,534	1,474	2,126	1,100	5,006
Kolla Tembien	2	913	1,014	1,395	2,449	1,432	2,291	855	700
Degua Tembien	1	960	469	925	1,350	973	1,391	919	1,310
Ahferom	2	1,686	1,872	2,449	3,574	1,631	2,615	1,525	2,440
Embassneity	1	712	810	777	1,134	855	1,368	738	1,180
Maiknetal	1	825	917	1,258	1,802	792	902	825	1,650
Endaba Tsahama	1	750	831	799	1,164	881	1,226	759	1,220
Total	10	6,955	**7,145**	8,653	**13,007**	8,038	**11,919**	6,721	**13,506**

Source: REST Liaison office

3.2.3 **Management Right**

The CSBs are owned by the local community and are managed by a seed bank committee. Traditional seed selectors are members of the management committee and have crucial role in ensuring that seed quality is maintained to its best standard. They follow-up performance of varieties out in the field through out the growing period and identify which ones should be purchased to restore the seed stock.

The committee members received relevant training on the practical implementation strategy of the CSB at district, sub-district and village levels. Bylaws were established to guide and facilitate the routine activities of the management committee and beneficiaries. Experts from the Bureau of Agriculture, agricultural extension agents and others take part in the planning and implementation of the seed bank activities. The CSBs make part of the overall food security and livelihood improvement activities that include other sectoral development initiatives.

5. PROPERTY RIGHT OF LAND AND CROP DIVERSITY

5.1 Access and Use

Since the 1975 Proclamation, ownership of land is vested on the state and farmers have usufruct right. Use right could be transferred to family members through inheritance. Officially there is no market for land i.e land cannot be bought or sold. Use right of an individual could be violated anytime. Hence, there is no secure tenure system and no tenure policy as such.

Individuals have the right to access land in the Peasant Association (PA) where they reside. Criteria for obtaining land from PA include: permanent physical residence, ability to farm continuously and ability to meet administrative dues and obligations (Teklu 2003). However, land is a fixed and limited resource. Hence, it is not practically possible to accommodate new allocation requests indefinitely. In many cases, such requests were entertained by reallocating communal grazing lands to private holding and at times reallocating abandoned farms due to death with no heir, permanent migration or tax default of former user (Teklu 2003).

Currently, the options for acquiring land in East Shewa include: (i) getting a share (as a gift) from parents/relatives, (ii) renting-in from others, (iii) sharecropping arrangement, (iv) informal purchase, and (v) allocation by the local government (through reallocation of common lands or redistribution). Redistribution also raises the level of tenure insecurity as households with relatively large landholding are likely to loose some of their plots to the landless. Hence, the practice of redistribution also presents a risk and constrains farmers' interest to invest on land improvement.

Households who have relatively large sized land holdings, but have constraint in terms of labour and oxen are the ones renting out land while land constrained households having abundant labour and oxen are the ones renting-in land. Some women headed households

who have labour shortage and are cash constrained to hire labour and oxen often enter into share cropping arrangements. The terms depend on mutual agreement and both households may contribute input and share the produce. Households who are not able to farm their land for various reasons (cash and labour constraint and/or health problems) and also fail to manage through other forms of arrangements sell out land informally.

5.2 Management Right

Absence of tenure security has had negative consequences to farm households in terms of managing the land resource. The major one among others is sense of insecurity. Farmers are risk averse and are not willing to invest when the future is uncertain. Thus, farmers have less or no incentive to invest heavily on land improvement in the long run. For instance, no soil conservation structures are built and erosion is getting severe year after year. Land degradation became a widespread phenomenon not only in marginal areas, but also in relatively high potential areas. Tenure insecurity also means less incentive for conservation of crop genetic resources.

5.3 Case of Land Fragmentation and Diversity in East Shewa

As size of farmland of a household decreases (usually through sub-division to children), the level of diversity maintained on-farm also decreases. A rich household having 4 ha of land grows more number of crop types and varieties than a poor household who owns only one ha or less. The choice of growing diverse crop types and varieties decreases as the size landholding shrinks through subdivision. Given the range of prevailing production risks, poor households have relatively less freedom for taking the risk of trying new crop species or varieties. Such households prefer to go for varieties they know best and those tried by others in their neighbourhood. Less farm size means less production and more food insecurity, which in turn puts more pressure on land leading to more degradation of fragile ecosystems. As a result, farmers are caught up in a vicious circle of poverty (poor land – low production – food insecurity).

Size of landholding is generally low and decreases with the decline in wealth status (Fig 6). The level of land fragmentation in East Shewa is high and ranges from 5-10 plots per household. The rich households had many plots up to 10 plots or more while the poor had 5 plots or lesser.

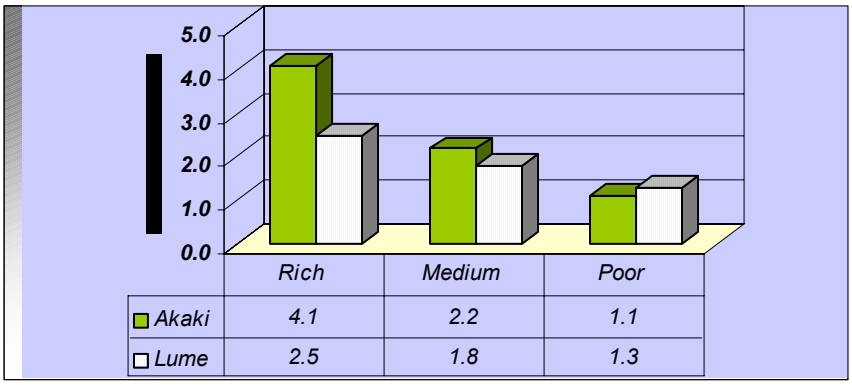

Fig. 6. Size of Farmland Holdings of Respondent Households by Locality and Wealth Group

It is clearly seen that the average number of farm plots owned by an individual household and the number of crop varieties grown decreases as one goes from the rich to the poor category as is normally expected. The rich, on the average, cultivate 8 crop types while the medium and poor households cultivate 7 and 5 crop types respectively.

The larger the farm size, the wider is the choice for farmers to grow diverse crop species. The same pattern holds true for within species level diversity. The survey results indicated that farm households having larger farmland holdings (i.e the rich group) cultivated 3 wheat varieties on the average. The medium and poor households, on the other hand, had 2 and 1 wheat variety respectively.

6. COLLECTIVE ACTION IN PLANT GENETIC RESOURCES CONSERVATION

6.1 Cost of Conservation

Collective action of farmer communities appears to be a low cost approach for conserving crop diversity on-farm. Conservation costs are higher and expensive if the available crop diversity has to be conserved institutionally by paying farmers to grow. Since, each variety needs to be grown by more than one farmer to minimize risk of loss, the cost involved gets higher with increasing number of varieties.

Thus, collective action significantly reduces conservation cost as farmers grow most of the varieties to meet their daily survival requirements. Crop variety that is not grown by one farm household for one reason or another has a chance of being grown by another farmer within the community. By so doing, quite a number of varieties are maintained in a dynamic state for the long future. No additional institutional cost is required to conserve such desirable varieties. Varieties with high local demand are grown not only by conservator farmers, but also non-conservator households as well. Wider use, therefore, ensures that diversity will be sustained for long and risk of loss is spread across geographical space and time.

6.2 Improvement of Information Flow

CSB members have regular formal meetings and also informal fora that facilitate discussion on various topics related to crop diversity or otherwise. Important information concerning varieties (planting date, soil requirement, time of weeding, field performance, maturity date, expected yield levels, cooking qualities, etc), are shared among community members. In times of seed exchange, such valuable information is also shared. Newly trying households follow-up the performance closely and share updates regularly. Building on this, CSBs could serve as an entry point to promote farmers' innovative experimentation and information sharing. Farmers are active participants in participatory crop improvement initiatives.

In East Shewa, elder members are the ones more interested in farmers' varieties of durum wheat as they knew of the valuable traits from their past experiences. They share the

knowledge with younger farmers who never tried growing farmers' varieties. If an individual farmer has to try out all the varieties on his/her own, the time and cost involved is higher. When farmers work collectively and share information, a large number of crop species and varieties could be grown out and screened in one cropping season. The knowledge of varieties is developed through interactive process and is, therefore, a common property of the community.

6.3 Enhanced Access and Use of Germplasm

The presence of diverse locally adapted planting materials through CSBs promotes wider use by the community. It is relatively cheap and easily accessible as the cost involved is within the reach of an average household. No extra cost is involved for transporting and transaction of seeds, unlike the high input commercial varieties.

In order to improve the use value of durum wheat FVs, IBCR is involved in the selection of elite materials with better performance than the original population. Some of these elite durum wheat materials in East Shewa yielded as good as the improved varieties from formal breeding and at times out-yielded especially when growing period is faced with some stress.

Production and use could also be supported through participatory technology development by encouraging farmers' innovative experimentation. The options for promotional activities would be through:

i) awareness creation (seminars, seed fairs, diversity poems, school clubs, diversity register, study tours, farmer exchange workshops, Farmers' Field Schools, etc.),
ii) innovative approaches (Arunachalam 2000). These include Participatory Plant Breeding, Integrated Pest Management, and local experimentation,
iii) active involvement of stakeholders at different levels,
iv) networking of Crop Conservators Associations at local, regional and national level, and
v) documentation and experience sharing (national and beyond).

7. COMMUNITY SEED BANKS AND PROSPECTS FOR SUSTAINABILITY

There are indications that CSBs would be sustainable local institutions. From the experiences gained so far, the following points are worth highlighting.

a. Social acceptance by the community: - Farmers feel sense of ownership and exercise management and decision-making roles. The CSB approach accommodates resource poor farmers who are often marginalized by mainstream development schemes due to resource constraint (shortage of cash, seed, land and oxen; marginal land)
b. Technical feasibility:- No complex production technologies are required as the farming practices for farmers' varieties are dependent upon farmers' experience

which passed the test of time through generations. Continuous experimentation and interaction with the environment has led to the development of adapted crop varieties.

c. Environment-friendly:- Reliance on locally adapted farmers' varieties does not require heavy dosage of chemical inputs which is compulsory with improved varieties. Hence, no environmental pollution and health risk from chemicals is expected.
d. Economic viability:- Though there is no concrete cost-benefit analysis done so far, the need for cash to purchase external inputs is none or very minimal. Hence, the production of farmers' varieties is affordable to resource-poor farmers as well.
e. Local capacity building:- Recognition of farmers as active partners builds up their self-confidence. Farmers are rational managers within a complex socio-economic setting expressed in a form of various limitations.

8. SUMMARY AND CONCLUSION

Farmers are principal mangers of crop genetic diversity while depending on it for their livelihood. Farmers need diversity to meet different household needs and minimize potential risks. Diversity in crop genetic resources has enabled the farm communities to cope with various hazards and constraints encountered in growing conditions by spreading risks across space and time. Both crop and animal genetic resources diversity are vital for daily survival and overall livelihood security of farmer communities. Diversity is the key to endurance through a range of challenging and adverse conditions. Without diversity, it is difficult to meet the diverse needs of resource poor farmers as pointed out by Almekinders and de Boef (1999).

Subsistent farmers in Ethiopia give high value to seed stock and save these even during difficult times risking their lives. This is best exemplified by what farmers in central Shewa did during severe famines of old days. They buried the seed stock in rock-hewn mortars and clay pots sealed airtight to evacuate their village in search of something to survive on (Worede 1997). The seeds are buried in secrete places either within the compound or out in the field and are safe. Survivors later came back and resumed their regular farm operations after 2-3 years or even more. This shows how the past generation made sacrifices to retain seeds of valuable crop varieties (farmers' varieties) through adversity. Berg (1992) also documented that the local culture of seed supply system in Tigray involves sharing and swapping of seeds within the community. Hence, seed stocks are results of collective effort and are common property of the community.

Crop genetic resources maintained by traditional farmers in Ethiopia have also contributed useful traits to farmers elsewhere in the world. Examples here would be resistant genes to barley yellow dwarf virus and corn blight. Economic benefits to Northern farmers from these genes were estimated at millions of US dollars annually (eg. contribution of Ethiopian barley = USD$ 150 million, of Sorghum from Ethiopia and Sudan = USD$ 12 million (RAFI undated). However, farmers of Ethiopia who developed and maintained the crop varieties were never compensated for their contribution.

Women have particular responsibility in seed storage. Keeping seeds in safe places and viable state is their mandatory task. Women inspect seed health and viability regularly until planting season is over. A traditional saying that further reinforces this role goes as follows: "senef mist yalechiw gebere besene yaleksal" – meaning that a man having a lazy wife cries in June. The implication is that June is the main planting season and if the wife is not keeping her responsibility, the man becomes helpless while others are planting.

Once a crop variety is lost for one reason or another, the knowledge about its ecological requirements, agronomic qualities, use values, etc. are naturally lost. Therefore, effort is needed towards developing comprehensive local biodiversity register i.e to document the knowledge and materials available towards exercising control of access and protecting the rights of farmers collectively for benefit sharing. The registry will help to know the level of diversity as to which materials are available as community resource. It will also be used to monitor for signs of genetic erosion in due course.

The CSBs, as a local institution, offer potential ground for mobilizing collective action towards promoting conservation and utilization of plant genetic resources at grassroots level. These include:

- Seed sourcing (currently 80-90% of seed is produced on-farm),
- Forum for collective action
  (better negotiating competence for policy lobbying, local plant genetic resources management, protecting farmers' rights and exercising equitable benefit sharing)
- Involvement in grain marketing (eg. bargaining for grain price - possibility to serve as a mid-level dealer, buy from members and sell later when prices rise; could be an income earning option for CSBs), and
- Point of linkage for continued collaboration with IBCR and formal breeders.

CSBs, therefore, offer synergy of the formal and informal seed supply systems that provide options for securing sustainable livelihood to resource-poor households.

10. REFERENCES

Almekinders, Conny and de Boef, Walter (1999). The Challenge of Collaboration in the Mnagement of Crop Genetic Diversity. ILEIA Newsletter Dec. 1999. pp: 5-7.

Arunachalam, V. (2000). Participatory Conservation: a Means of Encouraging Community Biodiversity. Plant Genetic Resources Newsletter No. 122:1-6.

Berg, Trygve (1992). Indigenous Knowledge and Plant Breeding in Tigray, Ethiopia. Forum for Development Studies.

Brush 2000. GENES IN THE FIELD. On-farm Conservation of Crop Diversity. IPGRI and IDRC.

CSA 2002. Statistical Abstract 2001. Federal Democratic Republic of Ethiopia, Central Statistical Autority. March 2002. Addis Ababa, Ethiopia.

Demissie, Abebe (1999). *In Situ* Conservation: the Ethiopian Experience. ILEIA Newsletter, December. IBCR, Addis Ababa, Ethiopia.

Feyissa, Regassa (1999). Ada *In Situ* Conservation District, Progress Report. Addis Ababa, Ethiopia.

Feyissa, Regassa (2001). Ethiopian Expereince: Community Seed Banking and Institutionalisation of On-farm Conservation. *In*: Incentive Measures for Sustainable Use and Conservation of Agrobiodiversity. International Workshop hosted by the SADDC Plant Genetic Resource Center, Lusaka, Zambia. Sept. 11-14 2001. pp:22.

IBCR (2003). A Dynamic Farmer-based Approach to the Conservation of Ethiopia's Plant Genetic Resources Project (ETH 93/G31). Terminal report.

Kibebew, Fassil (2001). Biodiversity Strategy and Action Plan Project: Breakthough of Major Significance. *In*: Biodiversity Newsletter Vol. 1, No. 1. April 2002. IBCR. Addis Ababa, Ethiopia.

Jarvis, D., B. Sthapit and L. Sears (editors) (1999). Conserving Agricultural Biodiversity *In Situ*: A Scientific Basis for Sustainable Agriculture. Proceeding a Workshop held from 5-12 July 1999. Pokhara, Nepal.

Maxted, N., Ford-Lloyd, B. V. and Hawkes, J. G. (1997). PLANT GENETIC CONSERVATION: THE *IN SITU* APPROACH. Chapman & Hall.

RAFI (undated). The SEED MAP. Value of 3rd World Crop Genes to US Farmers Per Annum.

Teklu, Tefaye (2003). Rural Lands and Evolving Tenure Arrangements in Ethiopia: Issues, Evidence and Policies. Forum for Social Studies. FSS Discussion Paper No. 10. Addis Ababa, May 2003.

Worede, M. (1997). Ethiopian *In Situ* Conservation. *In*: Plant Genetic Conservation: the *In Situ* Approach. Edited by N. Maxted, B. V. Ford-Lloyd and J. G. Hawkes. Chapman & Hall. pp: 290-301.

Worede, Melaku, Tesfaye Tessema and Regassa Feyissa (2000). Keeping Diversity Alive: an Ethiopian Perspective. *In*: Genes in the Field. On-farm Conservation of Crop Diversity (S. B. Brush ed.). IPGRI and IDRC, Lewis Publishers. Pp:143-161.

11. APPENDICES

Photo Courteousy: EARO

Fig. 1. Farmers and Researchers Evaluating Teff Varieties in the Field

Photo Courteousy: EARO

Fig. 2. Diversity in Durum Wheat Materials being Evaluated by the Debre Zeit Agricultural Research Center

Photo Courteousy: EARO

Fig. 3. Crop Diversity in a Typical Cereal Growing Landscape, in East Shewa

Photo Courteousy: IBCR

Fig. 4a. View of the Community Seed Bank in East Shewa

Photo Courteousy: IBCR

Fig 4b. Partial View of the Seeds Stored at the Community Seed Bank, East Shewa.

Photo Courteousy: EARO

Fig. 5. Diversity in Sorghum Varieties on a Farmers' Field