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CONTENTS

PLEC progress
Helen Parsons 1

PAPERS

Hybrid seed systems in the Peruvian Amazon
M. Pinedo-Vasquez, R. Sears, I. Cardama and M. Pinedo Panduro 3

Farmer associations in Ghana
Edwin A Gyasi and colleagues 9

Soil conservation technologies in Mexico
B. García-Fajardo, G. Nava-Bernal and Carlos González-Esquivel 15

NEWS

SLaM project begins 21

Chiang Mai meeting 21

UNU-INRA training course in Ghana 22

Projects building on the PLEC approach make progress

Progress has been made in securing funding for extending and up-scaling the work of PLEC colleagues. Some groups have already obtained funds. In Thailand, the project 'Agrodiversity for *in situ* Conservation and Management of Thailand's Native Rice Germplasm', with a grant from McKnight Foundation, has reported its preliminary results. In Brazil a grant from the Overbook Foundation is supporting work in the Amapá sites, and in Papua New Guinea funds from the UNDP/GEF Small Grants Programme have been provided for field activities on community-based landscape rehabilitation.

In Ghana, the 'Sustainable land management for mitigating land degradation, enhancing agricultural biodiversity and reducing poverty in Ghana (SLaM)' project expects to begin activities by October 2004 with funding mainly under the GEF medium size grant programme. The project was proposed by a University of Ghana-led group of scientists and institutes, backed by UNDP with the Government of Ghana as the executing agency. With the financial support of the United Nations University (UNU) the first implementation planning meeting for the project was held in June in Accra, attended by scientists from WAPLEC, representatives of PLEC Farmers' Associations, representatives of the Ghana Government and Liang Louhui from UNU. (see p 21 below)

In South America a proposal put forward by PLEC-Peru has obtained funding from the Tinker Foundation and demonstrations will be the main activities to be financed by the new grant. JICA has approved a project for a PLEC-Brazil proposal for floodplain management in Amapá State.

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The project will be implemented in coordination with IEPA (The Research Agency of the State of Amapá) and EMBRAPA.

There are possibilities of getting some funds from private foundations for PLEC-Jamaica. In Mexico, Octavio Castel Ortega, Centro de Investigacion Ciencias Agropecuarias, Universidad Autonomo del Estado de Mexico, will submit a proposal to study the milpa system under the US-Mexico Training, Internships, Exchanges, and Scholarships (TIES) initiative for institutional research partnerships that will focus on contributing to rural development in Mexico.

Other groups have received encouragement from potential donors. In Tanzania and Uganda, the proposals on 'Agrodiversity in development for smallholder farmers' are endorsed by national governments. The Tanzania proposal is soon to be reviewed by UNEP in Nairobi. Partnership with UNDP-FAO project on Globally-important Ingenious Agricultural Heritage Systems (GIAHS) include proposals for the pilot GIAHS case studies on the milpa-solar system in Mesoamerica, the tapade cultivation system in Fouta Djallon Highland in West Africa, the alder tree based agro-silviculture system in mountainous mainland Southeast Asia, and the rice-fish system in China. These proposals received positive comments at the second meeting of the Steering Committee of the GIAHS project, 7-9 June 2004.

The global proposal is (again) under review at UNDP. A version of the global PLEC proposal was presented to the Earth Institute at Columbia University. The main idea is to look for funds from private foundations. We are learning that it is very difficult to get GEF funds for a global proposal, but we are still trying to find ways to access GEF resources.

A proposal on Sustainable Land Management in Thailand, Lao PDR and Yunnan Province of China is under development with UNEP encouragement. A meeting to discuss the proposal was recently held in Chiang Mai, and is reported on p 21.

UNU has initiated three regional training programs based in Africa, Asia and Latin America to support PLEC follow-up activities for scaling up agrodiversity approaches, following the proposal formally endorsed by the PLEC Management Group in Paris in August 2002. Due to the delay in securing funds work with regional partners to initiate these training programs has begun separately.

One of core partners in the SLaM project, UNU-INRA organized the pilot course on 'Land degradation and management in a rural livelihoods context', 14-19 June 2004 (see p 22). PLEC-Ghana recommended three of the students who participated in the course. It is expected to further build on this pilot course for a more institutionalized program targeting professionals, policy-makers and farmers.

In Asia, UNU, PLEC-Thailand and Kyoto University are planning a pilot training course on 'Biodiversity conservation and rural livelihoods', later this year. There is also a plan to experiment a pilot course with a partner in Latin America.

By September PLECserv has reached 40 issues, sent to a mailing list of over 2000 subscribers including the Ecoagriculture Partners. The review notices have been drawn from 27 different journals. We continue to seek publications that treat a range of issues from diverse geographic regions. Our purpose is to demonstrate the diversity in rural development questions, and of approaches to these questions, but this cannot be fully achieved by the twice-monthly listserv alone. Within the Australian National University, which jointly sponsors the list, discussions to bring together the available issues in collected form, with an introduction and some signposting to the content, as a single e-publication are underway.

Compiled from various PLEC sources

Helen Parsons

Papers

A hybrid concept for understanding seed systems in smallholder societies of Peruvian Amazonia

Miguel Pinedo-Vasquez[1,2], Robin Sears[2], Italo Cardama[3] and Mario Pinedo Panduro[4]

One day in late August 1998, a discoloured elongated green bean attracted our attention while we were walking in the mixed planted fields of Manuela Tapullima, a farmer from the Peruvian Amazon. Since we were documenting agrodiversity and agrobiodiversity, we asked her the name of the bean; she told us that it was called chiclayo verdura japones *(Japanese green beans). With a bit of humor and curiosity we asked her if the beans were provided by Alberto Fujimori, at that time President of Peru who originated from Japan. To our surprise, she told us that the beans indeed came from Japan but not by way of 'El Chino' (as most farmers call Fujimori). She explained that she had obtained the beans from a comerciante de semillas (seed seller) who lives in the city of Iquitos.*

When we spoke with the seed seller he told us that his daughter worked on a farm on the island of Okinawa in Japan and she sent the seeds to him in 1994. He explained to us that since Manuela Tapullima was a very good semillera[5], a certified breeder, he gave her the seeds to test. She would determine if the seeds could grow and produce beans and if they were tastier and easier to cook than the local green beans. The seed seller explained that Manuela Tapullima experimented with that variety for two years and her results showed that the beans could be produced and consumed in the region.

Since 1997 the seed seller included the chiclayo verdura japones *among the many varieties of beans he sells to farmers. When asked if he gets his supply of this variety of bean from Japan he reported that he actually buys the seed each year from Manuela Tapullima and two other very good and reliable semilleros. He told us that he had met the semilleros when he worked for the programa de semilla certificada (certified seed programme) of the Ministry of Agriculture from 1982 to 1985.*

Introduction

This narrative serves to introduce the *comerciantes de semillas* and *semilleros,* and their roles in production, breeding and supply in the seed business in the Peruvian Amazon. These entrepreneurial seed sellers and certified breeders are key players in the process of building and maintaining seed systems[6] in a rural agricultural region of the Amazon where there has been little success with agricultural extension.

Researchers have reported that governments have had limited success in building formal seed systems in rural areas in most developing countries (Tripp 1995; Thiele 1999). Nor have NGOs been able to fill the role in helping farmers maintain functional seeds systems because their programmes are based on limited financial resources and are short-term (Brush 1992, Boef, Berg and Haverkort 1995; Wiggins and Cromwell 1995). While the state and NGOs have shown limited success, we suggest that they have had significant indirect influence on the shaping of local seed systems. We found that both information and technological resources arising from these programmes have been surreptitiously incorporated by farmers and entrepreneurs into local seed breeding and management systems resulting in what we call hybrid seed systems.

Rather than condemning the behaviour of Manuela Tapullima and the seed seller, we use their case to examine how farmers are selectively adopting (and adapting) the technologies, tools and regulations that are brought to the region by extension agents of public and private organizations whose objectives were to build formal seed systems. To analyze the enhanced functionality and composition of local seed systems in Peruvian Amazonia, we focus on the more subtle influences, rather than success or failure, of the public and private seed programmes. The three focal questions addressed in this paper are how seed systems are built, who the main players are, and how seeds and seeds technologies are exchanged.

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5. The term certified breeders we use to refer to farmers who are recognized by seed sellers as the ones who engage in experimentation and innovation in producing high quality seeds. It is based on the generic concept of expert farmers used in the PLEC project (Pinedo-Vasquez et al. 2002).
6. Seed system refers to an interrelated set of processes including breeding, management, replacement and distribution of seeds (Thiele 1999).

In the rural areas near the city of Iquitos in the northeast section of the Peru, certified breeders and seed sellers participate in loose networks that are used by farmers to procure seeds from within and outside their communities (particularly from the Iquitos markets). Both breeders and sellers adapt existing knowledge to build and maintain seed systems in which traditional and modern technologies, tools and regulations are integrated for breeding, management, replacement and distribution of seeds. They incorporate some of the technologies and knowledge that have been promoted by the hundreds of seed programmes run by NGOs and government agencies in the region since the 1960s. These hybrid systems are neither modern, traditional, formal nor informal, and as such escape the categorization and notice of the conventional agricultural research and extension programmes.

The concept of hybrid seed systems not only draws attention to the knowledge and technology often overlooked by agricultural scholars and technicians, but also necessitates them to re-evaluate the role of seed sellers. Seed sellers are often thought of simply as middlemen and are often blamed and condemned by experts for purportedly introducing seed to rural regions that is contaminated by pathogens or of low genetic quality. We further argue that future seed programmes originating from the NGO and government agencies should carefully examine social, cultural and biological dynamics of the existing local systems before introducing new technologies and seed stock.

In this analysis we have used data collected on the multiple functions of seed sellers and certified breeders to demonstrate how the hybrid concept can describe the dynamic nature of local seed systems. We incorporate a broad range of market and on-farm observational data that show how *semilleros* integrate both modern and traditional knowledge, rules and strategies into viable systems for producing, selecting and exchanging seeds. This case study should provide a new conceptual and analytical framework that can inform the design of seed policy for rural smallholder farmers in other areas of Amazonia and other regions of the world.

Methods

The data were collected as part of the activities of the global programme on People, Land Management and Environmental Change (PLEC) of the United Nations University. In Peru, data collection began in 1997 and is ongoing. The study area comprises six small villages in the Muyuy sector situated 10 to 20 km upriver from the city of Iquitos, the largest urban centre of the Peruvian Amazon. The villages lie on the banks of the Amazon River on the forested seasonal floodplain, or várzea, where fields and forests are inundated annually by the flooding whitewater river. This component of the PLEC research programme on the agrodiversity and agrobiodiversity of the region was specifically designed to understand the origin and function of local systems for breeding, storage and dissemination of agricultural seed.

Farmers, certified breeders and seed sellers participated in all phases of data collection following a research method described by Franzel (2000) and Biggs (1999). Since 1998, owners from five of the eighteen shops found to be marketing crop seed have participated in the study. They provide self-reports of their activities, the number of crops and crop varieties of seeds that they market, and the origin of the seeds that are brought to them. With the assistance of two students from the university in Iquitos, our team recorded technical information on how these seed sellers control for quality and viability of the seeds. We tested these methods.

On-farm participant observation methods were used to collect information on techniques and strategies used by *semilleros*, the certified breeders, to produce, select, store and exchange seeds. While all households in the six villages were surveyed for some information, 23 families have been participating in a more intensive manner. Among these, 12 *semilleros* have been providing continuous data since 1998 on the amount and quality of seeds per species and variety that they produce, store and sell to the seed sellers or other farmers. In addition, the *semilleros* have provided information on the mechanisms and strategies they use to exchange and procure seeds. Data collected from each *semillero* was cross-checked during group discussions and dialogues with the most knowledgeable members of each household and community.

Information on governmental and non-governmental seed programmes and incentives from 1970 to 2000 was accessed from the archives held in the municipal office of the agriculture ministry in Iquitos. A series of interviews with agronomists and other technical experts who had participated or are participating in formal seed breeding and dissemination programmes were also conducted using the actor and processes model (Cromwell, Cooper and Mulvany 2001). Results presented and discussed in this paper are part of the preliminary analysis of the data collected so far.

Results

Two seed systems are recognized by local people in the study region: the *mujo* (seed lots) and *pedido* (requested seeds) systems, referred to here by their Spanish names.

The *mujo* system

In this system all processes–breeding, management, replacement and storage–are conducted in the villages by families to supply their own needs for planting. Farmers using the *mujo* system save small portions of seed, ranging from one half to about five kilograms, from the harvest for planting the next season (Table 1). These seeds are selected based on size and colour. The two most common receptacles for storing seeds are glass bottles and plastic sacks, and sometimes maize is stored on the cob. An important method for seed preservation is the use of used motor oil. The technique consists of applying the used

Table 1. Average amount of seed of five annual crops that were stored by six farmers in the mujo system from 1998 to 2002

Crop	Variety	Storage technology	Storage unit	Quantity
Rice				
	Carolina	Bottles (glass)	Seeds	1.8 kg
	Aguja	Bottles (glass)	Seeds	1.2 kg
	Blanco	Plastic sacks painted with burnt oil	Espiga[1]	34 espigas
	Enano	Bottles (glass)	Seeds	2.4 kg
	Inti	Plastic sacks painted with burnt oil	Espiga[1]	22 espigas
Maize				
	Shishaco	Ears, end dipped in burnt oil	Ears[2]	36 ears
	Polvosara	Bottles (glass)	Seeds	1.7 kg
	Pocpoc	Bottles (glass)	Seeds	0.4 kg
	Duro	Ears, end dipped in burnt oil	Ears[2]	48 ears
Beans				
	Ojo negro	Plastic sacks painted with burnt oil	Vainas[3]	130 vainas
	Pindayo menudo	Plastic sacks painted with burnt oil	Seeds	1.8 kg
	Garbanzo	Plastic sacks painted with burnt oil	Vainas[3]	147 vainas
	Ucayalino	Plastic sacks painted with burnt oil	Seeds	3.4 kg
	Regional	Plastic sacks painted with burnt oil	Vainas[3]	98 vainas
Peanuts				
	Rojo	Plastic sacks painted with burnt oil	Vainas	272 vainas
	Blanco	Bottles	Seeds	4.6 kg

1. An average of 11 espigas of Blanco yields one kg of seed, 8 espigas of Inti yields one kg of seed.

2. An average of six ears of Shishaco maize yields one kg of seed, 4 ears of Duro yields one kg of seed.

3. An average of 33 vainas of Ojo negro is equal to one kg of seed, 37 vainas of Garbanzo is equal to one kg of seed, 23 vainas of Regional beans is equal to one kg of seed, 64 vainas of Blanco peanuts is equal to one kg of seed

oil extracted from the engine of the peque-peque (a local outboard motor) to the outside of the storage receptacle. The entire plastic bag is given a thick coating before storage, and with maize stored on the cob, the tassel end of the cop is dipped in oil. This practice is in line with what Bellon (1998) reports, that most seed selection methods include several techniques and strategies that are part of the on-farm conservation practices of poor farmers.

Although most villagers reported that the *mujo* system was widely practised in Amazonia for managing their seeds, it is evidently being employed less and less in Muyuy sector. In 1998, 37 of the 265 resident families (14%) of six villages surveyed were managing their seed lots using the *mujo* system. This number dropped to 28, or 10%, in 2002.

Women play a central role in breeding, selecting and storing seeds. In 19 of the 23 participating families using the *mujo* system, women were the seed managers. They were in charge of classifying, supervising and storing seeds to assure that the seed was not contaminated by pathogens or infested by insects. Residents reported that the reason for this is that women have the *curiosidad* (curiosity) and *dedicación* (dedication) required in the processes of testing, producing and storing seeds for planting that most men in the villages do not possess or express. Farmers also mentioned that women are more capable than men in producing seeds of high quality for planting. We observed that women are more careful to collect the seeds at the appropriate time during the harvest which is an important factor in the village certification schemes that control seed quality. Thus, women play an important role in providing the family with planting stock and in maintaining the neighbourhood certification scheme of producing quality seed.

While the seed lots managed by women in this system are relatively small and mainly directed to supply seeds to the family, farmers do exchange seed with other families for products, favours, and in a few cases for money. All 23 families have exchanged their seeds for favours such as working in their fields and helping with house construction. Five used their seeds to exchange for other products such as fish, sugar and kerosene. Only two sold their seeds to other farmers for cash.

There are several reasons why the majority of farmers are not managing their seeds using the *mujo* system. One main reason described by farmers is that most women migrate to the city as adolescents and do not have the opportunity to be trained by their mothers in these techniques. Farmers mentioned that there are no longer as many women in the villages who are capable of managing the seeds as there was in the past, and the *mujo* system is not as critical as it were in the past since it is easier to obtain seed from the city today by making a *pedido* to the *comerciantes de semillas*.

The *pedido* system

The *pedido* system is a hybrid system of selection, breeding, management, replacement, storing and supplying of seeds to rural farmers. The system engages two types of actors involved in three main stages. They are certified breeders (*semilleros*) and the seed sellers (*comerciantes de semillas*). The *semilleros* are expert farmers who practice crop breeding and seed storage on their own. They have been identified by the seed sellers as experts and are widely recognized as such by other farmers. The *comerciantes de semillas* tend to be entrepreneurial individuals residing in urban areas, perhaps originally from a village, who buy and sell seed stock to farmers. Their role, however, is much more complex than that of a simple trader or middleman. The background of the *comerciantes de semillas* is an important part of this story.

The many government and NGO seed programmes implemented in the Peruvian Amazon since the 1960s employed many local people mainly as part of the service staff. The technical staff of these seed programmes were mainly urban people trained in agricultural schools. Because of the sometimes rigid conceptual and logistical framework from which they operated, the technicians often failed to establish trusting relationships with the farmers. The service employees, who were sometimes recent migrants from rural villages, informally learned techniques and strategies for seed production, selection, storage and dissemination while driving boats, preparing plots for planting, and interviewing farmers who were the beneficiaries of credit and seed programmes. They identified the expert farmers in the villages and established and maintained good relationship with them as well as the technical staff.

Often, when their employment terminated, these individuals began to engage in producing and trading certified seeds on their own using the knowledge and technologies they learned from their involvement in the programmes. Some have gone on to build the hybrid seed systems we describe here. All 18 seed sellers interviewed in Iquitos had participated in some capacity in the formal seed programmes: 12 were formerly employed in government seed certification programmes, three were former employees of the agrarian bank that managed a credit programme for promotion of certified seeds, and two formerly worked in a development programme run by CARE that provided seeds to farmers.

The three stages of the *pedido* system (Figure 2) begins with:

- acquisition of new varieties of seed by the *comerciantes de semillas* and negotiation with breeders to work with it;
- on-farm testing by breeders of the viability, growth and yield in the local environment, on-farm breeding and certification; and
- delivery of the certified seed back to the seed seller.

The beneficiaries of the *pedido* system are the rural farmers who purchase the certified seed from the *comerciantes de semillas* at the start of the planting season. The seed seller also plays an important role in safely storing the seed stock between harvest and planting.

Acquisition of new seed stock

The first step involves seed sellers investigating the possibilities for obtaining new crop varieties or seed sources. Once a source of an interesting variety is identified, the seed seller makes a request, the *pedido* that gives the system its name, to obtain a small amount of the seed from their associate at the source. For some type of negotiated exchange, the associate delivers or sends a small amount of the seed (less than two kilograms in case of maize) to the seed seller.

Our data show that seed sellers provided an average of six new varieties of annual crops per year to breeders to test in their fields. Most of the varieties come from relatively distant regions in Peru and neighbouring countries. They also provided hybrid seeds of maize, beans, watermelon, melon, peppers, tomatoes and other vegetables that are produced and sold in the USA, Europe and Brazil.

The seed sellers have built a network of seed suppliers that allows them to obtain seeds (including programme-certified seeds) from many sources, including from Japan as in the case of the green bean featured in the opening narration of this paper. Because of the interaction of seed sellers with people in many sectors of society, the sources of knowledge, technology and seeds are varied: travellers, rural teachers, relatives working overseas, individuals working in development and conservation programmes, farmers, and other agents.

Seed sellers continue to expand their networks for getting seeds of annual crops from neighbouring countries, particularly from Brazil. *Semilleros* reported that the seeds of maize, rice and beans from Brazil are much better than the ones from other regions of Peru, particularly those from the coast of Peru. They reported that it takes only two generations to produce fertile seeds of the Duro hybrid variety of maize that comes from Brazil while it takes five for the Costeño hybrid variety.

Seed testing, breeding and certification

In the *pedido* system, genetic diversity and seed quality are the main trade characteristics used by *semilleros* and *comerciantes de semillas* for selection. In all the villages of Muyuy sector the seed sellers have developed certification schemes for the seeds produced, selected and sold by *semilleros*. This process is locally called neighbour certification and involves *semilleros* testing the growth and yield of plants from the new seeds (basic seeds[7]) in local

7 Basic seeds are those of new varieties of crops that are brought to the village by villagers or outsiders (particularly members of NGOs and government agencies).

conditions. The seed sellers recognize this system and compliment it with additional concepts, rules and standards for seed certification they learned from the formal seed programmes. In the agreement negotiated in the *pedido* system, it is expected that the breeder will follow the rules and uphold the standards established by the seed seller.

In the beginning of this second phase the seed seller provides a portion of the seeds to a few certified breeders (the *semilleros*) and makes a request (another type of *pedido*) of them to test, breed and produce a certain quantity of certified seed. Both parties agree on the quantity of certified seed to be returned to the seed seller and then how much he or she will purchase over and above that quantity. The seed seller provides information to the *semilleros* on the basic characteristics of the environment where the seed originated (e.g. locale, elevation, soil humidity). As reported elsewhere, we found that the *semilleros* strongly consider the relationship of the environment to the crop varieties in the process of breeding new varieties (Hühn, Lotito and Piepho 1993; Gaur, Joshi and Verma 1980). The *semillero* breeds the new varieties using a suite of techniques that include some learned from extension agents of seed programmes or others suggested by the seed sellers. They commonly use interbreeding schemes or planting seed plots within or separated from their fields.

If the seeds are viable through breeding for at least two generations the *semilleros* produce *semilla resistente*[8], or seeds optimized to local site conditions (soil, humidity, etc.). If the *semilla resistente* produced by the *semilleros* is suited to local conditions and resistant to local pests and disease then the certified seeds are sold to the seed seller for market distribution. Both parties negotiate throughout the process and agree on the conditions of sharing the benefits in the event that the breeding experiment yields good results. They will provide the basic information on the growth characteristics and requirements that the seller will then pass along to buyers.

We have observed that *semilleros* also have experimented with varieties of commercial seeds of different crops available in markets of the USA, Europe and Japan. All certified breeders that participated in this study reported low yields from most commercial seed and that these produce fertile seeds for only one generation. In the case of commercial maize seed brought from temperate regions most plants do not produce fruit, probably for physiological reasons related to day length.

Semilleros also indicated a familiarity with the limitations of planting hybrid seeds and have experimented with several methods of adapting and changing the agronomic characteristics of the commercial hybrid seeds. The most common method used is interplanting the hybrid seed with local varieties. The interbred seeds are given a name that reflects the origin as in the case of the *chiclayo verdura japones* described at the beginning of this paper. Both the *semilleros* and *comerciantes de semillas* then use that name.

A similar process of testing and certification by resident expert breeders is followed for new seed management technologies. Seed sellers or farmers may learn about or have seen an intriguing technique while visiting another village or talking with associates in the city and they try it. An example of this is the technique of using burnt motor oil to protect seeds from pests. In this case, two farmers from the village of Muyuy were told by a farmer from the Napo region that burnt oil is very good for controlling insect infestation of maize seeds stored for planting. This technique was first tested by *semilleros* who then demonstrated the results to other farmers. In another case, the *semilleros* tested a technique for protecting seeds of beans, peanuts and rice. They modified the burnt oil technique by using plastic bags to store the seed, coating them with the oil. They found that this technique for seed storage greatly increases the time seeds can be kept before planting. Maize, beans and peanuts can be stored for more than a year when burnt oil is employed, compared to a similar method using an extract of hot chilli pepper.

Buying and selling certified seed

The third step in the *pedido* system involves strategies for buying and selling seeds produced by the certified breeders. Seed sellers maintain the quality of their seed by buying only from the certified breeders, the *semilleros*. They employ several strategies for selling and buying seeds from other farmers. In most cases when a *semillero* produces viable seed, the seller advertises in communities that they have a new variety for sale for planting during next season. Seed sellers always tell farmers that they have a limited amount of seed and that the seeds are only available upon request (again, the *pedido*, this time by a farmer to the seller). When farmers make a request they tend to negotiate separate prices for the portion of seed for planting and another price for seed they will produce and in turn sell back to the comerciante. Such dynamic relationships among seed sellers, certified breeders and farmers makes the *pedido* system the best channel for moving seeds in and out of the communities.

A comparison of the *mujo* and *pedido* systems

There are distinct advantages to the *pedido* seed system over the *mujo* system. There is great capacity for individuals of the two groups, the *semilleros* and *comerciantes de semillas*, to learn, integrate and innovate using the knowledge and technological resources brought from different places such as the NGO and state seed programmes or neighbours. Although there is always the risk of introducing new pathogens and contaminating the local seed resources, local people have demonstrated that they are capable of developing alternative methods to avoid these problems.

Another advantage of the *pedido* seed system is in the capacity of the system to supply the increasing demand for seed by farmers both in quantity and crop diversity. The seed stock of all crop varieties offered by seed sellers was

8 *Semilla resistente* is what agricultural experts call registered seeds.

tested and produced by certified breeders in the *pedido* seed system. Seed sellers recognize the need to always maintain the diversity of seeds. Data collected during interviews of the 18 seed sellers shows that they store and sell a great diversity of crops and varieties.

The *pedido* system also provides viable and high quality seeds and more security for seed storage from harvest to the planting season. This is the main reason why most farmers procure seeds in the *pedido* system more than in the *mujo* system. The number of families that obtained maize seed through the *pedido* system in 1998, 2000 and 2002 was more than ten times higher than that of those obtaining seed through the *mujo* system.

Discussion

Where the lack of continuity and instability of seed programmes in the Peruvian Amazon has resulted in limited success in the establishment of formal seed systems, we found that local actors, through their complex and dynamic relationships, moved to fill the need for the rising demand for quality seed. Knowledge and technologies introduced by the many short-term seed programmes of governmental agencies and NGOs were integrated into a traditional seed system, the *mujo* system, through complex networks and relationships among farmers, traders, travellers, rural teachers, urban entrepreneurs, and agricultural technicians. In this region we found that the process of testing new seed varieties and technologies has neither entirely eliminated the traditional *mujo* system nor resulted in the development and adoption of a formal seed system. Rather the blending of techniques, knowledge, concepts and rules by farmers and entrepreneurs has led to the development of the hybrid *pedido* system where elements of the traditional and modern, the formal and informal are integrated by local people who possess specialized knowledge in breeding and business.

The innovative and dynamic nature of this hybrid system stems from the continual exchange of seed supply and introduction of different varieties, and the enterprising farmers who engage different sets of knowledge, rules and techniques in selecting, saving and exchanging seeds, incorporating people and resources from inside and outside the communities. The respective roles of the local actors, and their relationship based on trust and respect, allows for continual renovation of quality and diversity of seed.

Our analysis of the seed systems in smallholder societies of the Peruvian Amazon suggests a complex pattern that makes it difficult to clearly differentiate the formal from the informal categories of seed systems. Such links between the formal seed programmes and local seed breeding systems have facilitated access to seeds and seed technologies by farmers, and mechanism of control of seed quality (including standards for seed certification) used by formal seed industries. The specialization and expertise required for the control of quality, diversity and quantity of seeds supplied to farmers to plant from one season to the next is provided through the skills and experience of these two groups of local people.

This study shows that by examining the subtle influence of programmes external to the village, rather than by focusing on the limitations of formal seed programmes (Waage 2001, Van de Fliert 1998), researchers can better understand local processes and recognize where the value lies of formal programmes.

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Sustaining resource conservation and development initiatives through farmers' associations: PLEC experience in Ghana

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Introduction

Associations of farmers are a major medium through which PLEC-Ghana pursues its objective of finding optimal ways of conserving resources in farming communities by drawing on local knowledge through participatory approaches. The ultimate goal is food security and sustainable improvement in rural livelihoods (Brookfield 2001; Brookfield et al. 2002; Brookfield et al. 2003; Gyasi et al. 2004).

The farmers' associations are formal voluntary unions of farmers dedicated to the cause of PLEC in a demonstration site of conservation activities. It is forum for:

- 'farmer-scientist interactions and collaborative work
- farmer-to-farmer interactions including exchange of knowledge and germplasm
- reaching out to farmers and sensitizing them to issues of conservation and development
- mobilizing the latent knowledge, energy, and other resources of farmers for the purpose of conservation and development
- tapping or accessing external support for farmers
- carrying out demonstrations
- in general, empowering farmers politically, socially, and economically' (Gyasi et al. 2003: 98).

Through the farmers' associations, and with external financial support, especially from the Global Environmental Facility, PLEC conservation activities expanded and registered an encouraging positive impact on agrodiversity and livelihoods from 1993 to 2002 (Gyasi et al. 2003). Sustaining these associations is a major challenge, especially without financial support.

Evaluation of recent activities

In March 2003, the UNU commissioned a study to monitor and evaluate the performance of PLEC-Ghana activities in the principal demonstration sites during the post-project phase (2001 to 2002). In May and June, multidisciplinary teams of scientists visited the seven demonstration sites: Gyamfiase-Adenya, Sekesua-Osonson and Amanase-Whanabenya, (southern Ghana); Jachie and Tano-Odumase (central Ghana); and Bognayili-Dugu-Song and Nyorigu-Benguri-Gore (northern Ghana). Monitoring focused on changes in the composition and activities of the associations, status of biodiversity conservation and of income-generating activities. It was carried out by field inspection and group discussions. This paper reports the performance of the farmers' associations.

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Membership of farmers' associations

Overall, membership of the associations declined by 16 to 23 percent (Table 1), which is modest given the lack of financial support. Decline was most pronounced at Jachie in central Ghana where membership of the exclusively female association had reached 399. It has declined to 30 members within the area of Jachie, at Akwaduo (21); Nnuaso (10); Abidjan Nkawnta (3); Apinkra (5); Kokobriko (3); and Aputuogya (1). The leadership attributes this decline to disenchantment over their unfulfilled expectation of financial support. Former members will respond to calls but are not actively engaged in the association's activities and weekly meetings. The members lack confidence and skills and this has precipitated low morale and initiative. Cecilia Osei, the association leader noted that "in my absence none of the association members feels confident to even answer simple questions on our activities. I have to do everything'. This clearly suggests the need to assist them with training in organizational skills. The association still has the potential to galvanize local women farmers.

Elsewhere, the situation was more encouraging, particularly in Sekesua-Osonson, where the membership expanded by 83 percent. This large increase, the high membership retention rate elsewhere in southern Ghana, and the modest but significant increase (13 percent on average) in northern Ghana, would seem to be due to the attraction of value-adding, commercially-oriented or food security enhancing activities.

Meetings

Meetings continued to be a regular feature of the associations. In southern Ghana, there were regular meetings of all three associations. The highest number of nine was at the Amanase-Whanabenya association. Discussions focused mainly on an impending external evaluation of activities, sale of oil palm seedlings raised in the association's nursery, how to replace the seedlings sold, and maintenance of the income-generating projects. In Gyamfiase-Adenya the meetings involved mainly outreach activities to sensitize farmers to PLEC concerns and how to achieve financial self-sufficiency and self-sustainability. In Sekesua-Osonson the meetings focused on sustaining the bee-keeping industry (Gyasi and Nartey 2003).

Table 1. Membership of farmers' association during and after the PLEC project

Demonstration site association	Phase 1 Male	Phase 1 Female	Post-phase 1 Male	Post-phase 1 Female	% change
Southern Ghana					
Gyamfiase-Adenya	38	55	25	40	-30.1
Sekesua-Osonson	83	50	140	103	82.7
Amanase-Whanabenya	31	12	22	8	-30.2
Northern Ghana					
Bognayili-Dugu-Song	196	26	219	50	21.2
Nyorigu-Benguri-Gore	0	170	0	173	1.8
Central Ghana					
Jachie	0	399	0	30	-92.5
Tano-Odumase	22	18		30	25.0
Total	370	730		436	

In northern Ghana there were six meetings during the period. They discussed the protection of the dugout which serves as the primary water source for livestock, the PLEC plant nursery, and households at the Bognayili-Dugu-Song demonstration site; management of the association plant nursery and woodlot; inventorying new yam and rice varieties; celebrating the first anniversary of the founding of the PLEC Cotton Weaving and Spinning Group; and better ways of harvesting honey.

Meetings are currently held every week at Jachie and Tano-Odumase where the primary matters of discussion were: sharing knowledge and experiences in off-farm livelihoods; natural resource management; crops and livestock production; how to obtain external financial support; and planning reciprocal farm visits and group work on individual farms through an arrangement locally called *nnoboa*. A ¢20million loan, obtained by the Jachie association from the Opportunities Industrialization Centre in December 2002, has indirectly improved the cohesiveness of the group. All the 30 active members benefited from the loan with the minimum receipt being ¢200,000 and the maximum as ¢1 million. Being a group loan, the members have had to meet regularly to deliberate on repayment.

External links

Further evidence of the continued functioning of the associations is the external links they maintained. In southern Ghana these include:

- the exchange of plant genetic materials with the Plant Genetic Resources Centre (PGRC) and the Centre for Research into Plant Medicine, both members of Ghana's Council for Scientific and Industrial Research;
- supply of plant genetic materials to the PGRC;
- exchange of plant genetic materials with other farmers;
- support by the NGO Heifer Project International; and,
- collaboration with the American Peace Corps Service.

Amanase-Whanabenya played a leading role in exchange of plant genetic materials with government establishments. Through its Financial Secretary, Nana Asamoah, a national award winning chief farmer, the local farmers' association received medicinal plants for its arboretum from the Centre for Research into Plant Medicine at Mampong, while the Chairman, Mr. Freeman, obtained *bunso* seedlings (nutmeg), a rare and highly valued plant, from the PGRC for his farm. Visits by PGRC officials to Gyamfiase-Adenya to study farmer plant genetic resource management and to initiate collaboration with farmers were planned to further encourage sustainable plant genetic resource conservation. From Sekesua-Osonson, a centre of Dioscorea yam varieties (Blay 2004), the local association sent five rare varieties of yam for *ex situ* conservation at the PGRC. The farmers trained officials of the PGRC in traditional yam management practices.

The vigorous exchange of plant genetic materials among farmers and their associations both within and between the demonstration sites in southern Ghana has continued. The exchange was carried out mainly without payment but it also involved some sales.

A major external link has been developed between the farmer associations and the Heifer Project International. Through this farmer initiative, members are receiving material and training support for beekeeping in conserved forests, home gardens and fallow areas. Farmers in Sekesua-Osonson are the major beneficiaries. Recently, the Sekesua-Osonson association started hosting an American Peace Corps Volunteer under a two-year programme focused on improved management of the human living environment.

In northern Ghana the Bognayili-Dugu-Song association received support for construction of boreholes to improve drinking water under the Village Infrastructure Project (VIP) sponsored by the Ghana Government, World Bank, KFW and IFAD. PLEC communities and associations have been very enthusiastically involved in the IPGRI project on 'Community-based management of on-farm plant genetic resources in arid and semi-arid areas in Sub-Saharan Africa'. The field activities and determination of existing practices was carried out from December 2002 through to April 2003 and was expected to continue till August 2003. The associations have provided valuable information as well as help and support to the researchers. The results of the initial data collection are currently being analyzed in order to proceed with the establishment of good/best practices for yam and rice crops in the study area.

In central Ghana, the Jachie association sustained links for financial support with the local District Assembly, the District Co-operative Association and the Opportunities Industrialization Centre, which provided approximately $2,500 for a loan facility from which 30 members of the association benefited. The Tano-Odumase association is registered with the Department of Social Welfare and it has developed links with GIAT, an NGO that provides training in organization of seminars and workshops.

All the associations continued to operate bank accounts, and to maintain contacts with government extension agents and PLEC scientists through exchange visits. The farmer-university scientist collaboration was consolidated by PLEC-related studies carried out by students studying for BSc. Degrees awarded in 2002/2003 by the University for Development Studies, headquarters of northern Ghana PLEC are:

- Composting as a soil management practice to improve the fertility of the depleted soils: A case study of Dugu community in the Tolon/Kumbungu District of the Northern Region of Ghana, by Sualihu Alhassan;
- Soil fertility improvement by the use of traditional methods: use of dynamic kraals in village communities. Case study of Dugu in the Tolon/Kumbungu District of the Northern Region of Ghana, by Adjoa Xaxagbe; and,
- Agrobiodiversity and small-scale farming: a case study at Kpachi in the Tolon/Kumbungu District of the Northern Region of Ghana, by George Prah.

Other activities hosted through the farmer association included visits by farmers and school children to model farms for sharing farming experiences. Through these visits farmers extended their contacts and were motivated to try new practices. Some expert farmers, notably Mr Amponsah Kissiedu, were later engaged as consultants to other farmer groups and NGOs.

In Sekesua-Osonson a major event of the farmers' association was the hosting of 32 farmers from Adaklu, about 100 km away in the Volta Region. The purpose of the visit was to observe PLEC farmer activities. Other activities included agrodiversity demonstration and training sessions, and hosting a visit from students of the University of Ghana and Professor Gyasi. Similar demonstrations occurred at Amanase-Whanabenya. The visit promoted improved conservation of trees, especially through on-farm regeneration, biodiverse farming, wider adoption of oprowka/proka (mulching cleared vegetation instead of burning) and the split-corm technique of plant propagation.

Food fair at Odumase

The farmers association at Sekesua-Osonson mounted an exhibition of different dishes prepared from traditional food crops and vegetables during the inauguration of Manya Krobo Folklore Society at Odumase in May 2004. Planting materials, seeds, medicinal plants and honey products were also displayed. The exhibition highlighted nutritional values and created awareness of threats to endangered medicinal plants and crops through farming practices causing land degradation.

Mr. Sikapa, the District Director, Centre for National Culture was equally concerned on the threats and has advised the Folklore Society to join with PLEC to educate their members to value cultures which are aimed at protecting biodiversity. At a meeting Mr. Sikapa promised to put PLEC ideals on the agenda of Manya Krobo Centre for National Culture, to educate and promote biodiversity conservation. *E Nartey and B Kweku*

Conservation on-farm

From the end of the project phase there were continued reports of a growing number of farmers practising biodiverse farming. In southern Ghana, Mr Simon Agbayiza, a settler migrant-tenant farmer of Gyamfiase-Adenya and Financial Secretary of the association is a typical example. Before PLEC, he specialized in cassava and maize. Now he has diversified his crops to include pawpaw, pineapples, sugarcane and 12 varieties of yam with some grown in an agroforest. Another farmer, Mr E.K. Bekoe, has a mixed crop farm containing maize, six varieties of yam, four of cassava, two of pepper and eggplant, all cultivated in an agroforest featuring *wawa* (*Triplochiton scleroxylon*), *emire* (*Terminalia ivorensis*) and mahogany. Similar diversity is being sustained in farms of:

- Messrs. Opoku, Kojo Kabakaba, Bossman Kwapong, C. K. Avume, Mesdames Asiedua and Janet Sedofia and others at Gyamfiase-Adenya;
- Messrs. Abraham Ambo, John Kwasi Adolph and others at Sekesua-Osonson and Amanase-Whanabenya.

In northern Ghana, the number of varieties of rice being collected and maintained in cultivation by the women's group increased from 11 to 18. The conservation activities are particularly vigorous in the Bawku East District at Gore and Nyorigu communities. At Nyorigu-Benguri-Gore, growing the rare, highly valued local varieties provides dependable income for the women farmers. The diversity of yams grown in Bognayili-Dugu-Song was increased to 25 varieties. Some were lost in the dry unfavourable weather and are being reacquired. Germplasm was exchanged with Yapei, another community located about 70 km away along the White Volta river.

At Jachie and Tano-Odumase in central Ghana, biodiversity on-farm was being sustained by the practice of proka, alley cropping, planting of trees along farm boundaries and agroforestry. A few members at Tano-Odumase who experimented with alley cropping are practising it but most members prefer boundary planting because it takes less space. The banks of the main streams and ponds have been planted to trees. Although backyard gardening was practiced before, the intensity increased and there are about 20 backyard gardens in the village. Before the project, only a few people used poultry manure. The benefits in increasing crop yield, particularly with maize and sucker production of plantain have been tremendous and currently about 10 members regularly use it. Those not using it mentioned the constraints of transporting large quantities to their far away farms. Oil palm production at Tano-Odumase is an important commercial venture for the group.

Conservation off-farm

Off-farm conservation targets forest groves and other types of forest near homes. In the first phase, much of the effort was focused on protecting the 100 ha Gyamfiase sacred forest grove through policing and creation of a protective fire belt by the Gyamfiase-Adenya association under the patronage of Nana Oduro Darko II, the late Chief and head of the family owning the grove. However, after the death of that Chief, the effort could not be sustained because the next Chief was less concerned with conservation. This setback prompted a modification of approach to one that sought not only to conserve, but also to add economic value to the ecological functions of conserved forest. Farmers are sustaining a substantial number of forest patches through management using the PLEC approach. There are some outstanding examples. Mr. Tei Peter's forest at Sekesua-Osonson contains cocoa, *latsa* fruit (*Chrysophyllum albidum*), avocados, other trees including local species, as well as plantain, yams and beehives. Mr. Bossman Kwapong's forest at Gyamfiase-Adenya has yams, plantain, guava, citrus, *adesaa* (*C. albidum*), and local trees including an exceptionally huge tree whose shade provides a habitat for Kwapong's PLEC-sponsored snail farm. Mr. Freeman has named his forest composed of assorted trees and food crops with beehives, 'PLEC forest'.

At Jachie and Tano-Odumase in central Ghana, two sacred forest groves continue to be conserved and enhanced through tree-planting led by the PLEC farmers' associations. PLEC scientists had observed severe encroachment on the sacred groves and demonstrated conservation and revegetation methods. The group at Tano-Odumase demarcated the existing grove and revegetated the fringe areas. Degradation and encroachment have now ceased. The association planted a woodlot at the local school and are still carrying out tree planting in the town with the involvement of school children. Trees planted along the main road provide afternoon shade and a wind break. Activities are carried out also in the nearby communities of Kona and Abrankese. In Kona, trees have been planted around the hospital. In Abrankese they have planted teak trees in collaboration with the local school. The nurseries initiated by PLEC are still in operation. Some of the seedlings include, teak, cassia (*Cassia siamea*), *prekese* (*Tetrapleura tetraptera*), Acacia, and some rare species of food crops and medicinals. They also produce plantain suckers.

Experiments and demonstrations

A key component of PLEC work was demonstrations and experiments. Farmers are sustaining them independently of the scientists . In southern Ghana among the most frequent demonstration is the split-corm technique of propagating plantain. Farmer-led demonstrations were carried out for school children and farmers at all the demonstration sites and at outside locations at Anum Apapam and Nankese (near Amanase-Whanabenya) and at Aburi, Akropong, Dodowa and Mangoase (near Gyamfiase-Adenya). The popularity and high uptake of split-corm propagation is because it is effective and easy to apply. Other biodiversity conserving technologies demonstrated in various sites were the miniset technique of multiplying yam seeds, budding of plants, plant nursery management, tree planting, mulching, and poultry manure application.

An experiment being sustained by the local farmer' association in collaboration with the Centre for Research into Plant Medicine is the arboretum of Xylopia and other medicinal plants managed at Amanase (CRPM; Plant 3). There are several other important experimental activities. At Gyamfiase-Adenya, Mr. Opoku, has regenerated degraded farmland into an agroforest of cocoyams, cassava, plantains, peppers and trees including *Millettia thonningii*, *Rauvolfia vomitoria* and *Sterculia tragacantha*. Ex-Police Sergeant Nyame also has regenerated a deforested patch on his holding. Afforestation was carried out around Kaja waterfalls at Sekesua-Osonson by the farmers' association. Mr. Emmanuel Nartey, the Financial Secretary, attributes the sustained success of this association, to 'understanding and co-operation of landlords and the gradual efforts at education and awareness-creation among landlords by PLEC'.

Watershed management has also been carried out at Jachie and Tano-Odumase. Regretfully, an agroforest of *Cedrella*, mahogany and *Tetrapleura tetraptera* with plantains is overgrown by weeds because the association struggles to motivate members to carry out regular weeding.

Agrodiversity conserving activities with economic value

Conservation may not be sustained without an economic motivation. In the first phase of PLEC, farmers and associations at the demonstration sites were encouraged to promote activities with substantial economic benefits and that tangibly improve rural livelihoods while at the same time enhancing conservation. The activities included: beekeeping, plant nurseries, growing citrus and other economic trees, livestock, and processing. These activities financially strengthened the farmer associations as well as ensuring their sustainability.

Beekeeping

Beekeeping using the Kenya Top Bar hives is being sustained, especially on an individual basis in backyard forests, home gardens, nearby farms and fallow areas in all the sites where it was introduced. It is most widely adopted at Sekesua-Osonson where it was inspired by a traditional method of keeping bees in clay pots. Beekeeping was given a substantial material and training boost by Heifer Project International. In Gyamfiase-Adenya, the NGO, Women Supporters, provides similar support. The beekeeping involves both men and women and their interest is sustained by the high net return on investment. Constraints on expansion include high rotting rate of wooden beehives made of poor quality materials, pests and parasite infestation, non-colonization of some beehives for unknown reasons, absconding of bees from the hives especially during the rainy season and undersize externally sourced beehives which result in low yields. In northern Ghana three hives were donated by PLEC and now three more hives have been established using funds from the sale of honey.

Plant nurseries and tree growing

Plant nurseries were introduced on an individual basis and as group enterprises operated by farmer associations in all the sites except Nyorigu-Benguri-Gore. Because of difficulty in organizing people for the management of group ventures, eight of the nine group nurseries collapsed. The only exception is the one at Bognayili-Dugu-Song in northern Ghana. Its survival may be attributed to the high demand for the dawadawa, shea, neem and mango seedlings produced by budding and grafting under the committed leadership of the Chairman of the association. Over 20,000 tree seedlings of various tree types were transplanted by the end of February, 2002 at the various communities. An estimated 15,000 seedlings survived the dry season. Some members planted individual woodlots. Other farmers who are not members of the association are emulating their example and are also establishing their own woodlots. The farmers usually plant tree seedlings of economic trees among the field crops, therefore gradually establishing an agroforestry system.

Privately owned nurseries were expanding in all areas. Outstanding examples are those of Messrs. Zigah, Haruna, Emmanuel Odenya and Nana Asamoah, and Mesdames Lydia Manko and Gladys Donkie of Amanase-Whanabenya; and Messrs. Bossman Kwapong, Emmanuel Lazigi (Kojo Kabakaba), Etoku Amponsah Kissiedu, Henry Dake, Opoku and Bekoe of Gyamfiase-Adenya. Their sustainability is attributed to good farmer training through the farmers' associations, the inherent motivation in private enterprise, and the focus on commercially profitable plants such as oil palm, cocoa, citrus, avocado and mahogany.

On the whole economic tree growing ventures, especially individual owned ones, were being sustained. Citrus is commonly grown in association with other crops in the first three-to-four years, especially food crops, after which the canopy shades out most crops. Group-owned citrus farms survived at Amanase-Whanabenya and Gyamfiase-Adenya, but were poorly maintained.

The shea plantation and woodlots of neem and teak owned by the farmer association at Bognayili-Dugu-Song were better maintained under committed leadership. In 2002 a 10 ha plantation of shea owned by two communities, Wayamba and Yoggo, was burned by bush fires, but restored through the efforts of the Association. In the 2003 harvesting season the communities were able to harvest shea nuts for the first time.

A teak plantation established over 10 years ago by the Jachie association for the production of electric poles was being sustained. The trees have a low maintenance requirement and are being well managed. The members hoped that poles would fetch a good price when harvested.

Livestock

The livestock ventures have not met with great success. The Gyamfiase-Adenya farmers' association initiated a project rearing pigs by individual farmers. It started with a parent stock of two gilts. A total of six piglets were farrowed. One later died, one was distributed to the owner of the boar and four were raised on a share arrangement between the association and individual farmers. The association continued to manage the parent stock on a voluntary basis through two members. The principal constraint was a lack of funds for medication and feed. Feeding crop stubble and farm and household residue limits optimal performance. To overcome this, the association was considering a partnership with a private investor to sustain commercial production of breeding stock.

A similar swine project initiated with three pigs by the Jachie farmers' association could not be sustained because of difficulty in controlling the pigs which were run partly free-range. Group management problems limited an association project rearing the local breed of chickens and it was abandoned in favour of individually managed enterprises, which were more sustainable, particularly at Tano-Odumase. A sheep project initiated by the Amanase-Whanabenya association was not sustained because of the aged parent stock and group management problems.

PLEC encouraged snail farming giving material support and technical advice. One run on a semi-intensive basis in a fenced-off area under the shade of a huge tree by Mr. Bossman Kwapong at Gyamfiase-Adenya shows the most promise of success. Cost-effective modest yields were reported for the initial harvest. However at Jachie a snail-farming venture managed by the farmer association could not be sustained because members lacked sufficient knowledge of termite control. A sudden, increase in mortality of snails at the Amanase-Whanabenya farmer association, very nearly resulted in abandonment of the project, and underscores the need for good management of livestock ventures and sound and continuous technical advice.

Processing

Cassava is the leading crop in the demonstration sites in southern Ghana. Considerable value is added to the raw cassava by processing it into *gari*, *agbelima* and fine flour that may be blended with wheat flour for bread and pastries. Machine milling enhances efficiency and in December 2002 a cassava-milling machine was commissioned by Dr. Quist, District Chief Executive of Akuapem North District. It was donated to the Women's Wing of the Gyamfiase-Adenya PLEC Farmers' Association by Professor Janet Momsen, PLEC foundation member from the University of California, Davis. The mill is operating profitably and has inspired plans for a corn mill, a modern *gari* roasting facility, and a machine for squeezing liquid from milled cassava. At Jachie, PLEC introduced cassava processing for producing bread, cakes, and other pastries and this has been adopted by several women.

At Bognayili-Dugu-Song, shea harvested from the plantation of the farmers' association is holding promise as a sustainable income source. Cotton is a major cash crop there. To add value PLEC introduced cotton weaving and spinning training programme for the women's group. Trainees now number about 50 even with the limited number of looms.

Others projects

After the initial efforts at demonstrating the benefits of composting to the soils at Bognayili and Dugu, almost every compound house within the main demonstration site now has a compost pit and is applying compost during the land preparation on their farms annually.

At Jachie, mushroom production facilitated through the farmers' association is still practiced because of high demand and profit. Its sustainability is threatened because supply of the production bags from outside is irregular. The women want to begin producing the bags themselves.

Conclusion

In Ghana, the goal of developing optimal ways of sustainably conserving agrodiversity is being kept alive, with the now largely self-reliant PLEC farmers' associations playing the central role. This indicates the promise of such grassroots resource management associations. The farmers' associations provide an effective institutional framework:

- for projecting the collective image of farmers;
- for recognizing them as an important source of knowledge and
- for enhancing management of natural resources at the local level.

Through the associations resources are mobilized and channelled for the common good of the individual farmers. In a facilitating role, farmers' associations maximize impacts if activities that are targeted at the individual farmers are focused on capacity enhancement by knowledge sharing and training, value-adding ventures, and enhancing linkages to facilitate farmer access to credit and contact with external agencies. While the pathways towards conservation and development of resources are many and diverse, on the basis of the PLEC-Ghana experience, the path through farmers' associations and their individual members appears worthy of pursuit.

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Dr Quist, District Chief Executive, Akuapem North District (second from right) commissioning a cassava milling machine at Otwetiri, at Gyamfiase-Adenya demonstration site.

Local soil conservation technologies and their role within campesino rural livelihoods in San Pablo Tlalchichilpa, Mexico

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As part of the research on campesino agrodiversity in indigenous Mazahua communities in the highlands of the State of Mexico, the Centro de Investigacion en Ciencias Agropecuarias (CICA) of the Universidad Autonoma del Estado de Mexico has extended its work on the study of biophysical diversity, focusing on local soil conservation technologies adopted by expert farmers of the Barrio La Era, in the community of San Pablo Tlalchichilpa, in the municipality of San Felipe del Progreso.

Farming communities in the highlands often have living standards at subsistence level. Access to and availability of local resources, that are essential to support and maintain their livelihoods, are generally low. Steep slope areas are vulnerable to environmental problems such as soil degradation and deforestation, and soil erosion is one of the major factors affecting agricultural production. Campesinos face strong environmental and socio-economic challenges in an environment characterized by ecological fragility, high vulnerability, low resource accessibility and poverty. A continuous transformation and substitution of resources is used to survive under these conditions.

Local soil conservation technologies are part of the campesino means of production. They are part of the strategies of managing resources to cope with the environmental constraints and to diversify livelihood outcomes, and represent the results of farmer-conducted trials using limited assets. This study examined successful local soil conservation technologies and their role in influencing livelihoods outcomes.

Methodology

This work employed a case study approach. Looking for unusual and innovative resource-management techniques, the emphasis was put on the dynamics of utilization and management rather than just conservation. Primary and secondary data to identify and select sites were used. Two expert farmers and 6 plots that highlight 'best practice' examples of local knowledge were studied. The sampling was deliberately biased to select interesting cases. Methods to collect primary data from the original research sites were mainly participatory observation, semi-structured interviews, transect walks and mapping.

Twelve soil conservation technologies were adopted by campesinos in the sample sites. Four technologies considered by campesinos to be more relevant to their livelihoods were selected. These technologies were described applying customary technology summaries (Clark and Stocking 1997; Clark et al. 1998), which allowed highlighting essential aspects about assets needed, their biophysical performance, construction, maintenance, benefits and constraints on adoption (Stocking and Murnaghan 2001).

The Sustainable Livelihoods Framework (Scoones 1998) was employed to understand campesino livelihoods and the processes involved. Assets used to adopt the technologies, as well as past and present campesino asset bases, were analyzed to identify the contributions of local soil conservation technologies on campesino livelihood outcomes. The outcomes generated by the technologies were determined according to their impacts on land, agricultural production, and campesinos' households. These three indicators allowed the outcomes of technologies on well-being, vulnerability, food security and natural resource use to be assessed.

Figure 1. Typical landscape of La Era

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San Pablo Tlalchichilpa

San Pablo Tlalchichilpa, particularly the neighbourhood La Era, has been one of the demonstration sites of the PLEC project in the highlands of central Mexico (Chávez et al. 1997, 1998). The community was established by the Mazahuas, one of the most important indigenous groups in the State of Mexico (Woodgate 1997). The Mazahuas were regarded as 'good' campesinos who specialized in maize and agave crops. The group was characterized by strong social networks based on good relationships that enable them to to cope with adverse events (Soustelle 1973). However, conflicts between Mazahua members of Catholic and Protestant religions have undermined the social network. Nowadays, the social support comes through church membership, and in La Era most people are Protestants.

This region is vulnerable to soil degradation with slopes of 15 to 35 percent. The physical characteristics, especially the soil erodibility combined with the rapid down cutting of rivers on steep slopes have caused the widespread occurrence of gullies and sheet erosion. This process was intensified by deforestation carried out in previous decades. In particular, in La Era the landscape has been dissected by gullies (see Figure 1). Unreliable rainfall, decline in soil fertility and severe soil erosion all contribute to low agricultural productivity, and soil conservation practices have become important (Arriaga et al. 1997).

Agricultural production is now insufficient to fulfil the consumption requirements of many households. The constrained economic situation has contributed to an out-migration of mainly men and young people to urban centres such as Mexico City or Atlacomulco, and a decrease of labour availability for cultivation and conservation practices. Children and adults, especially old people, represent the most available labour to carry out household activities (Chavez et al. 1998). Significantly, older members of the community also possess a good deal of local knowledge about their environment (Woodgate 1997).

Most campesinos in San Pablo Tlalchichilpa remain dependent upon subsistence farming as their main source of income, growing maize, beans and faba beans. They constantly experiment and restructure the use of the farming space and assets to respond to changing needs and opportunities, leading to adoption or rejection of new soil conservation practices. Through this process, the expert farmers, Olegario and Teodoro Gonzalez have implemented different soil conservation technologies to deal with the constraints of farming on sloping land.

Mr. Olegario and Mr. Teodoro Gonzalez inherited land (ejido) from their parents. However, the area was insufficient to pass on viable farming units to their children. In the past, they migrated and worked in off-farm activities. The income earned allowed them to buy more land, but it was badly affected by gully erosion and not used for farming. They started adopting local soil conservation technologies more than 20 years ago. In 1992, reform of the ejido system allowed farmers to have property rights to their plots and this has influenced land management, increasing the use of soil conservation technologies as campesinos invested more resources in restoration of land with secure tenure.

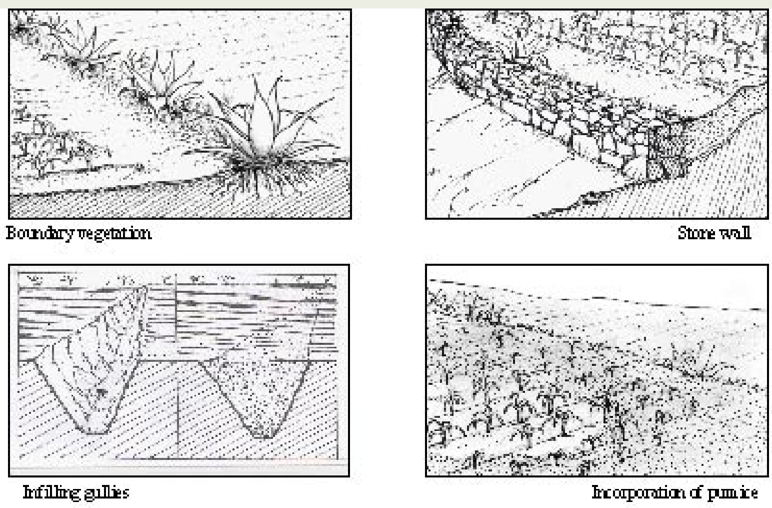
Local soil conservation technologies in La Era

The study was based on six sample sites in which the campesinos manage 12 soil conservation technologies. The type and distribution of the technologies vary according to the location of sample sites. Generally, sites near houses are managed more intensively. Although soil conservation technologies are used in far away fields, these are less labour-intensive ones. Olegario and Teodoro considered that the most relevant technologies in terms of positive impacts in their livelihoods are the infilling of gullies by reinstating sediments, growing boundary vegetation, incorporating pumice (white sand) and building stone walls (see Figure 2). Improvement of soil quality, increase of agricultural production, expansion of land, and religious beliefs are some of the reasons they gave for adopting soil conservation.

Infilling gullies and reinstating of sediments

Material collected in sediment traps is placed in the gullies until the infilling of the gully is completed. Since the material used is highly erodible, it is necessary to reinstate sediments at least three times per year to control erosion. The infilling can be done by hand or by hiring a road machine. It can take up to 15 years for infilling to be completed by hand, depending on the area. Mechanical infilling may take between four to eight hours, but has a high financial cost (400 pesos per hour).

Figure 2. Local soil conservation technologies



One of the most important reasons for adoption of this technology is the need to expand land available for agriculture. By infilling gullies, Olegario had a 14.8 per cent gain in land area on the 10,000 m^2 of plots at the sample sites, and Teodoro had a 22.6 percent gain on his 3920 m^2 of plots (the area lost through walls and hedges was discounted).

Religious beliefs also promote adoption. Campesinos believe 'Es la voluntad de Dios que el agua corte la tierra y haga barrancas, por eso mandó al hombre para trabajarlas, rellenarlas y producir en ellas' (It is God´s will that water makes gullies on the land, but God also sent men to work the land and infill the gullies to produce on it). Therefore, converting gullies into productive land is perceived as a religious commitment.

Boundary vegetation

Planting boundary vegetation is a traditional practice. In particular, maguey (Agave spp) has been the most common species used in hedges, and is an effective way to retain soil. The maguey is used to make pulque, a traditional and popular alcoholic drink in rural areas of central Mexico. Pulque can be used as a substitute for milk in people's nutrition (Nava 1999; Guerrero 2000). A maguey live fence acts as a barrier to sediment movement down the slope, and supports soil accumulation. Farmers plant maguey and/or fruit trees such as prune (*Prunus domestica* L.), capulín (*Prunus capuli* Cav.) and peach (*Prunus persica* L.) along field edges, especially downslope.

Incorporation of pumice

Campesinos have noticed that soil erosion removes topsoil and changes surface hydrology. To mitigate the effect, they incorporate pumice (white sand) on their fields as it helps to keep soil humidity levels high and protect against erosion, acting as an extra layer of topsoil. Sand can be collected from communal lands or bought from nearby towns. The incorporation is done before the cropping season. Pumice changes soil texture and the high calcium content reduces soil acidity and increases P and K availability to plants. The amount of sand used depends on need and the availability of time. The amount of labour and time required to transport and spread pumice is high, therefore, this technology has only been carried out on fields close to houses that are often the primary source of household food. Nevertheless, the practice has become widely adopted by campesinos in La Era.

Stone walls

The stone wall is another traditional soil conservation practice of the Mazahua indigenous groups since early periods (Blanquel and Hernandez 1999). Walls are an effective way to avoid soil loss and protect the crops and for that reason they are still being constructed. A stone wall acts as a physical barrier across the slope at the bottom edge of the field and retains sediments transported by erosion from upper slopes.

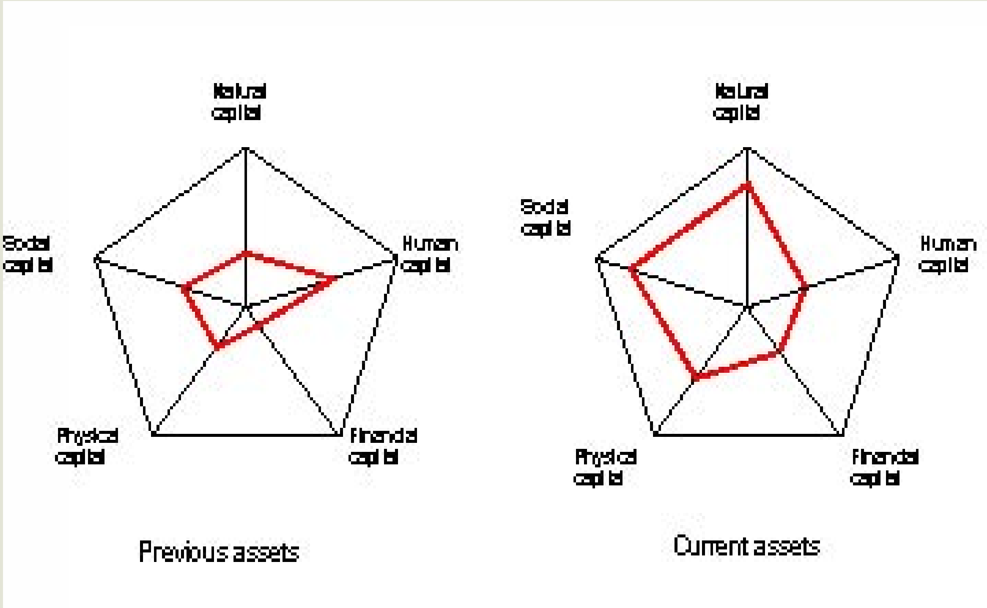
Sustainable livelihood framework

The Sustainable Livelihood Framework (SLF) is a useful tool to understand rural poor livelihoods and the dynamic and transforming processes involved. It centres on the idea that livelihood strategies of households depend on access to, use, and combination of different assets to build and improve livelihood outcomes, according to immediate and longer-term needs. Nevertheless, factors such as vulnerability, institutions, structures and processes affect levels of access to assets, and influence choices made and outcomes achieved (Scoones 1998; Ellis 2000; Pretty 2000).

People endeavour to convert their assets into positive livelihood outcomes and no single category of asset on its own is sufficient to produce all the varied livelihood outcomes that people expect. This is particularly true for poor households living in marginal environments that often have limited assets from which strategies to improve livelihood outcomes are carried out. As a result, they have to seek different alternatives, nurturing and combining assets in innovative ways in order to ensure survival (Jewsbury 2001). Each household possesses or has access to a varying degree of assets which change over time. Assets can be represented in an 'assets Pentagon' which lies at the core of the SLF. The pentagon is a visual representation which enables an understanding of the important relationships between the various assets and how they relate to building livelihoods.

Past and current asset bases of the expert farmers are illustrated by pentagons (Figure 3). As accessibility of endowments are constantly changing, pentagons are constantly shifting. The shape of the pentagon shows schematically the variation in people's access to assets. In the past, expert farmers' households were poorly endowed with natural, physical, social and financial capital. The campesinos said 'We were very poor when we started our families, only having food to survive'. They did not have enough land to produce. As they used to have several children, they had only moderate access to human capital. Current asset bases show an increase in natural, social and physical capital. The campesinos were able to afford land and tools which allowed them to improve their agricultural production and their natural assets. Social links with Protestant church members, researchers and governmental institutions have been developed, enhancing the accessibility to social support. Migration of young people has led to a decrease in human capital. Financial capital has slightly increased. They do not need to support a large number of family members and may receive remittances from migrant relatives. Furthermore, they have obtained income from selling surplus production of maize, beans, and fruit (from boundary vegetation), and from renting magueys to other people to extract pulque. Financial assets are still low as subsistence agriculture does not allow them to gain high profits.

Figure 3 Campesino asset base pentagons



Linking LSCT and Sustainable livelihoods

With the adoption of soil conservation technologies, campesinos have transformed and substituted their available assets contributing to a change in their asset base. To identify how adopted technologies have influenced livelihood outcomes, some examples of the impacts of technologies on land, agricultural production and households are described.

Impacts on land

Local soil conservation practices reduce soil loss. Topsoil retention in sample sites was estimated up to 127 ton/ha/year of soil with the adoption of stone walls and boundary vegetation. This can be compared with the estimated soil loss of 130 ton/ha/year from fields with maize in sloping areas of Central Mexico (Maass 1992). The adopted technologies led to an improvement of both soil fertility and productivity because of higher humidity (pumice), increased organic matter (boundary vegetation), more soil nutrients and thicker topsoil (sediments). The improvement is particularly observed in those sample sites in which management has been constant during the last 20 years, and in which pumice has been incorporated. A significant increase in agricultural area (from 2 to 13%) has been achieved by infilling gullies and reinstating sediments. Although sediment deposition reincorporates nutrients into the fields, the area gained lacks organic matter and soil nutrients.

Impacts on agricultural production

Yield has increased by two processes (Table 1). Enhanced soil fertility has allowed higher plant density, and the increased area allowed more crops to be grown. The first crops were produced under the constraints of steep slopes, gully erosion, compacted soil, lack of soil and no access to fertilisers or manures. Current production is enough to feed the household, to store seed and grain, and in some cases, to sell surplus production.

Impacts on campesinos' households

The benefits of local technologies have led to direct and indirect changes in nutrition, household finances and labour organization. An increase in production (mainly maize, beans and faba beans) and access to fruit trees used for hedges have also resulted in a diversification of diet. The adoption of boundary vegetation has provided an alternative source of income, which has complemented the household economy. Concerning labour organization within households, males are responsible for the adoption of the technologies, therefore the role of women and children is limited. This is mainly cultural, since men consider that women should be in charge of household duties. However, low labour availability is changing the role of women.

Campesinos noticed that land improvement has reduced labour requirements for farming activities. In contrast, an increase of yields required more labour for harvesting. Currently, decisions about continuing with soil conservation technologies are changing. The increase of production and their religious beliefs strengthen their interest to carry on with technologies, especially in their most degraded fields. However, current production satisfies food needs, and since maize prices are low and labour in short supply, their interest in soil conservation is being undermined. This is consistent with findings that labour availability is one of the most important factors in conservation decision-making (Lu, 2001). Although their current financial situation allows better nutrition, improved ability to afford health services and investments in conservation, and to maintain their households' well-being at an acceptable level, investment in soil conservation is highly correlated with the profitability of maize production.

Table 1. Differential yields among sample sites (considering a 20 year-period of soil conservation technology adoption

Plot	Area (m^2)	Maize colour	Other crops	Before adoption: Seeded maize (kg)	Before adoption: Maize yield (ton)	After adoption: Seeded maize (kg)	After adoption: Yield
Teodoro Gonzalez							
Casa Teodoro	3500	white yellow	Faba beans Beans	0.5	0.08	7.5	2.50 ton maize 100 kg Faba
La Era	3200	white black	Faba beans	4.5	0.33	4.5	2.10 ton maize 200 kg Faba
El Calvario	3300	black	Vetch	4.5	0.08	4	0.83 ton maize
Total	10000			10.0	0.50	16	5.42 ton maize
Olegario Gonzalez							
Casa Olegario	1400	white	Faba beans Beans	0.8	0.02	4.5	1.50 ton maize
Bombaro	1600	black	Vetch Faba beans Beans Oats	19.5	1.5	39	3.00 ton maize 10 kg Faba 2kg beans
Terneria	920	black pink yellow	Beans Faba beans Vetch Oats	4	0.25	1.5	0.33 ton maize
Total	3920			24.3 kg	1.92	45	4.83 ton maize

These benefits, generated from technology adoption, show how campesinos have been able to build and improve their asset bases, especially natural assets. The results indicate that technologies are developed according to the availability and access to capital or assets. While campesinos were poorly endowed with financial capital, the first stage of soil conservation technology adoption relied on the access to communal lands, which provided the material needed for their implementation. Likewise, due to the scarcity of human capital, campesinos needed to adopt technologies in different phases, in which substitution and transformation of assets were necessary. The main substitutions observed were from natural, human and social assets to financial capital and then back into natural capital. Olegario and Teodoro are recognised as good land managers within the community, which strengthens availability of social assets.

Vulnerability

Although campesinos are now less vulnerable and have better access to services (e.g. electricity and telephone), and links with social networks and institutions, they are still susceptible to constrained conditions of small-scale subsistence farming in sloping highlands. Financial capital to invest in taking care of the land is limited. Farmers are aging, young people are migrating, crops prices in the local markets are low and government policies maintain low agricultural subsides. Severe drought or frosts and illness are significant risks. Their financial situation is being affected by the national economic policy, for example, free trade under the NAFTA agreement has decreased maize prices in the local markets (1000 pesos per ton of maize). The economical situation encourages young people to migrate because they do not perceive a secure future in agricultural activities, particularly among those who have not adopted soil conservation technologies. A reduction of available 'young and productive' labour is a concern expressed, since labour will not be enough to continue farming activities due to old age. Mr Olegario believes that the improvements of land could increase of yields even more and would provide incomes and more opportunities and then young people could consider returning to farming as a livelihood.

Conservation technologies are time-consuming before and after the cropping season. Time and labour availability to carry out off-farm or non-farm activities during this period is reduced. Opportunities to spread the risk of a crop failure or loss of labour through alternative incomes are therefore limited.

Current asset bases allow households to cope with some crop loss. Campesinos store seeds from previous years, and social capital can generally support recovery. However, the future is uncertain. If the market price of maize continues to fall, campesinos will have to rely more heavily on other income sources. In the case of shocks such as sickness or loss of male labour, women or children would take charge of land husbandry, adding to their normal activities carried out within the households or off-farm. The impacts of these shocks may be temporary depending on the social support provided by their relatives and the cohesion of the religious community. Traditionally, local people usually help each other in adverse situations. The role of soil conservation technologies have been important for increasing sustainability of livelihoods since they involve a dynamic transformation of their assets providing different choices, however, campesinos still show concern.

Conclusion

Implementing local technologies requires a deep local knowledge of the biophysical processes and a high interest in conserving the natural resource base. Campesinos can identify better strategies to keep a balance between agricultural practices and the resource base, while at the same time improving their livelihoods. However, social problems such as religious conflicts and migration have undermined the transfer of knowledge between generations in La Era. The benefits of soil conservation are usually achieved in the long term and other households, especially those which require short-term benefits or have a low asset availability are more limited in their ability to adopt new technologies. Better-off households and those with access to economic support from other activities or remittances are more able to invest in conservation technology adoption.

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News

SLaM project underway in Ghana

The 4-year *Sustainable land management for mitigating land degradation, enhancing agricultural biodiversity and reducing poverty* project addresses sustainable management and its ability to stem the accelerated land degradation, which threatens the global environment and peoples' livelihoods, particularly as a result of deforestation, soil erosion, biodiversity loss and climate change. In Ghana, 70 percent of the land is subject to severe erosion, and is the leading factor undermining agricultural productivity. Biodiversity alone, lost through deforestation and land degradation, amounts to 4% of the GDP. A challenge is to stimulate popular involvement in recovering degraded lands and protecting threatened ones, in order to secure the environmental basis of livelihoods in impoverished communities, and to achieve overall environmental protection. The overarching goal of the project is sustainable integrated land management in globally, nationally and locally significant land resources in agricultural areas under threat of land degradation, for greater ecosystem stability, enhanced food security and improved rural livelihoods. The expected outcomes of the project are:

- a participatory methodological framework for identifying and prioritizing threatened lands, criteria for identifying sustainable (good/best) land management practices, and land use plans developed and applied using appropriate methodologies;
- sustainable (good/best) land management practices put into practice to recover degraded lands, protect lands under threat and enhance the ecological functions of the land, and improved agricultural production capacity and rural livelihoods;
- an enhanced capacity and enabling environment for mitigating land degradation and promoting sustainable land management.

SLaM builds upon its successful predecessor, the mainly GEF-funded UNU project, People, Land Management and Environmental Change. Multidisciplinary teams of scientists from the University of Ghana, University for Development Studies, Kwame Nkrumah University of Science and Technology and the Council for Scientific and Industrial Research, will collaborate with the UNU-Institute for Natural Resources in Africa, the Ministry of Environment and Science, Ministries of Food and Agriculture and Lands and Forestry, as well as other governmental and non-governmental agencies. The network of farmers groups organized during the PLEC project will participate to implement the project activities. SLaM will be linked also to the other new PLEC projects.

Activities are expected to begin October 2004. The UNU financed the initial implementation planning meeting held on 21 June 2004 at in Accra. The implementation strategy was discussed, in particular the project goals and objectives. An integrated workplan elaborating activities for achieving planned outputs and assignment of major responsibilities was developed. Discussion groups were organized according to the three geographical operational sectors of the project (southern, central and northern Ghana).

Professor Edwin A. Gyasi
Co-ordinating Leader, PLEC/SLaM-Ghana

Chiang Mai Meeting

An *International Meeting of Experts on Biodiversity, Land Degradation and Livelihood* was held from 15-17 July 2004 at the Highland Research and Training Centre, Faculty of Agriculture, Chiang Mai University in Thailand. The meeting, organized by Kanok Rerkasem and colleagues, gathered together people from various fields concerned with issues of management of land and biodiversity for the benefit of rural people's livelihoods. Participants came from the Faculty of Agriculture, Chiang Mai University, the National Agriculture and Forestry Research Institute of Lao PDR, the Department of Anthropology and the Anthropology Museum of Yunnan University, China, the Centre for Southeast Asian Studies, Kyoto University, the Kagoshima University Museum, Kagoshima University in Japan, UNU, the Institute of Economic Botany at the New York Botanical Gardens, and the Australian National University. Scientific Coordinator of PLEC, Miguel Pinedo Vasquez, from Center for Environmental Research and Conservation, Columbia University, New York attended the meeting.

Much has been learned and a great number of different experiences accumulated regarding biodiversity and rural livelihoods over the past 15 years from many different projects.[1] Biodiversity conservation, land management and improvement of rural livelihoods are varied and complex and can be approached at various levels. Some projects have a narrow focus such as the management and conservation of intraspecific diversity, while others have a broader perspective concerned with conservation of ecosystems.

1 Issues and outcomes have been discussed at a number of international fora.These include the international symposium on Managing Biodiversity in Agricultural Ecosystems in Montreal, November 2001, organised by UNU and IPGRI; the consultative meeting on Bridging Natural Resources and Human landscapes, Biosphere Reserves for Agrodiversity Conservation, Paris, June 2003, organized by UNESCO-MAB and IPGRI; the meeting for CGIAR centres and institutions and stakeholders on the South and North on Managing Agricultural biodiversity for Sustainable Development, October 2003, Nairobi, IPGRI/Sub-Saharan Africa office; and the international symposium on Alternative Approaches to Enhancing Small-Scale Livelihoods and Natural Resources Management in Marginal Areas – Experiences in Monsoon Asia, October 2003, Tokyo, organized by UNU, Center for Southeast Asian Studies, Kyoto University and Japan International Research Center for Agricultural Sciences.

There are many knowledge gaps at all levels. This meeting aimed to raise discussion on approaches to research, scaling up past success, and mainstreaming ideas, concepts and experiences at regional, national and international levels with the view to develop future collaborative research and training projects in the montane regions of Southeast Asia and Yunnan Province in China.

The meeting participants discussed training as a way of upscaling and mainstreaming the valuable research approaches and experiences gained through working with smallholder farmers in order to influence the next generation of researchers, technicians and policy-makers. Training will enable those who work with and make policy that affects smallholders to appreciate the complexity and variety of smallholder systems, the innovative capacity of farmers in times of change, and to recognise the individuality and expertise that can be found among smallholder farmers. Participants identified who the targets of training would be, the concepts that should form part of a training schedule, and the important approaches, tools, methods and issues, emphasizing the temporal and spatial components.

The meeting endorsed PLEC demonstration approaches and methods that were tested in Thailand. It was noted that the these approaches and methods help to identify the experts among smallholder farmers and the technologies and conservation practices they use that enhance the conservation of biodiversity while increasing household income. PLEC concepts, such as agrodiversity, were mentioned as tools for looking at the conservation of crop diversity as processes rather than products.

A PDF Block A Proposal, *Sustainable land management in montane regions of Thailand, Lao PDR and Yunnan Province in China*, had been developed prior to the meeting by Louhui Liang and Kanok Rerkasem and this formed the basis of discussion for collaboration in research and training. This meeting was the first opportunity that members from the collaborating institutions have had to come together. Participants presented their views and the comments and discussion will be used for project planning, documentation of field activity and in drafting the full proposal for GEF funding.

Helen Parsons

UNU-INRA training course in Ghana

A pilot multidisciplinary training course entitled *Land degradation and management in a rural livelihoods context* was held in Accra, Ghana, 14-19 June, 2004. It was sponsored by UNU-Institute for Natural Resources in Africa, UNU-Environment and Sustainable Development Programme, and FAO Regional Office for Africa with special acknowledgement of PLEC-Ghana contribution. The course was coordinated by Dr. David Niemeijer, Wageningen University. Many PLEC colleagues participated as lecturers, including Dr. Edwin A. Gyasi, Professor of Geography and Resource Development, University of Ghana, Dr. Essie Blay, Associate Professor of Crop Science, University of Ghana, and Dr G. Kranjac – Berisavljevic', Head of the Department of Agricultural Mechanisation and Irrigation Technology at the University for Development Studies in Tamale, Ghana. Other lecturers included Mr. Andrew Wardell of the University of Copenhagen, Dr. Lamourdia Thiombiano, FAO, and Dr. Tsatsu Adogla-Bessa, University of Ghana, Agricultural Research Station-Legon. The 18 participants were from 5 countries, including Burkina Faso, Ghana, Guinea, Nigeria and Togo.

The course aimed to address land degradation in West Africa in the broadest possible sense by promoting the crossing of conventional boundaries between natural and social sciences, exploring technical issues as well as the role of local knowledge and resource conservation systems, and the relationship between rural livelihood systems and land degradation. The focus was on how cultural, geographical, technological and religious backgrounds influence and shape views of the environment and land degradation, how to deal with differences and similarities between indigenous knowledge and scientific knowledge, and when to rely on local knowledge and to apply scientific knowledge.

Participants looked at:

- how to interpret and evaluate techniques for measuring land degradation in the field through experimental studies
- modeling, and remote sensing
- identification of different perceptions of land degradation and perceived causes and extent
- the kind of practices land users employ to conserve the land; and
- how they adapt their practices to changing circumstances.

Historical analyses of land degradation assist understand ing of current land-use patterns and practices, and can shed new light on old narratives revealing the linkages between historical, political, economic, cultural, social and religious issues. These linkages need to be addressed when planning and implementing rural development projects and programmes that address land degradation.

Evaluation of the course was generally positive. Participants valued the group discussions and interaction as a way to clarify, learn and appreciate multiple perspectives. As a pilot programme, the course provided useful feedback for planning and mainstreaming the course. Recommendations were to increase the length of the course to allow more time for group exercises, analysis and discussion, and for a fieldwork component.

While the aim was to have about half the participants from social sciences background, there was an over representation from natural sciences, particularly soil science. The course was conducted in the English language although there were participants from Francophone countries. To obtain a better balance in future courses it was stressed that participating institutions should promote greater participation by women and social scientists.

Compiled from the course CD-rom record and evaluation report

Helen Parsons

Editors invite suggestions for featuring in PLECserv

PLECserv provides an introduction to recent articles or other publications of interest to people working among developing-country farmers, and concerned about development and conservation. PLECserv, can be found at **http://c3.unu.edu/plec/index.html**. Recent titles are:

30. Why don't China's farmers grow more timber? April 01 2004. (Runsheng Yin, Jintao Xu and Zhou Li, Building institutions for markets: experiences and lessons from China's rural forest sector. *Environment, Development and Sustainability* 5 (2003): 333-351.)

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