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## *Efforts to upscale PLEC approaches are paying dividends*

**Miguel Pinedo-Vasquez**

Scientific Coordinator

From the local to global scale, PLEC members are helping institutions and people to use demonstration approaches that have been proved to facilitate the exchange of integrated resource use knowledge and techniques among the rural poor. As a result of these efforts, PLEC's 'expert farmers' are becoming key players in extension programmes in several countries. Agrobiodiversity produced and conserved by expert farmers is also becoming a very important resource for diversifying production in communities affected by the collapse of single crop economies such as coffee in Kenya and sugar cane in Jamaica. In a number of international and regional meetings that I have participated in the last couple of months, I emphasized PLEC achievements and the focal points of PLEC methodology. Outlined below is the essence of what I presented.

PLEC has particular aspects of its work that are different from what our colleagues do in other institutions. PLEC focuses on biodiversity at the landscape level. We look at the biodiversity in fields (both planted and not planted) as well as in the fallows, forests, edges, streams – the entire landscape, both cropped, managed, and not managed. We focus on management diversity, the many ways in which resources are managed, and this diversity is included together with biodiversity in our central concept which is 'agrobiodiversity'. We especially focus on what we call 'hybrid systems' – those that combine traditional management with new forms of production and management technologies. So, although we understand the value of 'traditional' or 'indigenous' practices, we are most interested in management systems that use biodiversity to solve production problems, systems that are productive and beneficial to all small-scale farmers, whatever category they fall into. We try to understand and value the integrity of smallholder systems. Separation into production categories such as agriculture, forestry, etc., is unhelpful when working with farmers.



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We recognize that farmers are all very different and we value their diversity. We identify and work with those exceptional individuals and households that are successful in producing and conserving crops and other forms of biodiversity, while getting higher incomes than their neighbours. We call them 'expert' farmers.

We focus on what may be regarded as 'invisible' management systems. In most agricultural landscapes, it is not just the central plot that is managed, there are fallows, forests, edges and other features that are managed in subtle, and unusual ways. We also focus on the varied functions of smallholder farms, not just crop production, but also maintenance of wildlife habitat, watershed protection, social space, insurance against difficult times, and others.

We research and use a great variety of demonstration approaches with expert farmers as the main teachers. We have small and large demonstrations, we have formal and informal demonstrations, and we demonstrate to other farmers, researchers, and policymakers. Traditional social gatherings are used for demonstrations when appropriate. Most of our demonstrations, like most of our research, is done in the landholdings of expert farmers.

PLEC aims to upscale and mainstream these results and

approaches. To reach the future generations, particular attention is paid to education.

Summary of the meetings in which I have participated:

- In-situ conservation of crop diversity: Organized by IPGRI in February in Marakesh, Morocco.
- Foresta e Familia (Forest and Families): Organized by IPAM, PLEC-Brazil, Ford Foundation and USAID in March in Belem, Brazil.
- Forest Genetics and Conservation; Organized by GTZ, FAO and IPGRI in March in Bariloche, Argentina.
- Forest and Poverty: Organized by CIFOR, GTZ, ICRAF and FAO in May in Bonn, Germany.
- Seed systems and crop genetic diversity on-farm: Organized by IPGRI in September (from 16 to 20) in Pucallpa, Peru.
- Agrodiversidad Regional (Regional Agrodiversity). Organized by PLEC-Peru and Instituto Nacional de Investigacion Agricola (INIA) from 24 to 25 September in Iquitos, Peru. One of the results of this meeting was the formation of the Cadena Latinoamericana de Agrodiversidad (CLA). Members of CLA include INIA (Peru), IICA (Colombia), IPAM and SUDAM (Brazil)

## NOW AVAILABLE

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# Papers

## The dynamics of population change and land management in the savanna transition zone of Ghana.

Paul Sarfo-Mensah<sup>1</sup> and William Oduro<sup>2</sup>

In several areas of the forest-savanna transitional zone, changes in the ethnic composition of the population with accompanying change in resource use, along with increasing population pressure and commercialization of agriculture, are altering natural resource management practices (Gyasi 1997; Hill 1963). In this paper, quantitative and qualitative changes in population, and the consequent livelihood changes and land management, are analysed. Blaming migrants for natural resource degradation and changes in local resource management is a much too simplistic conclusion. It will be argued that migrants are part of a range of complex changes in resource use and management. The indigenous institutional arrangements for access, use and management of natural resources, and changes in the attitudes and aspirations of local people have facilitated the practices of migrants and the change in natural resource management.

### Methods

Anthropological fieldwork was conducted by the first author between April 1999 and March 2000 in selected communities as part of his PhD thesis at the Natural Resources Institute, University of Greenwich, UK. The study examined the dynamics of change and sustainability of traditional natural resources management practices. The communities studied are in the Brong Ahafo region, Bofie and Nchiraa in the Wenchi District, and Buabeng-Fiema and Dotobaa in the Nkoranza District (Figure 1). Participant observation and key informant interviews were the main field methods. Other informal methods were participatory natural resource and social mapping, transect walks and semi-structured interviews. A household survey using structured interviews was used to collect quantitative data.

### Dynamics of local population

Buabeng Fiema, Dotobaa, Bofie and Nchiraa are middle-sized predominantly food crop farming communities located in the northern forest-savanna transition zone.

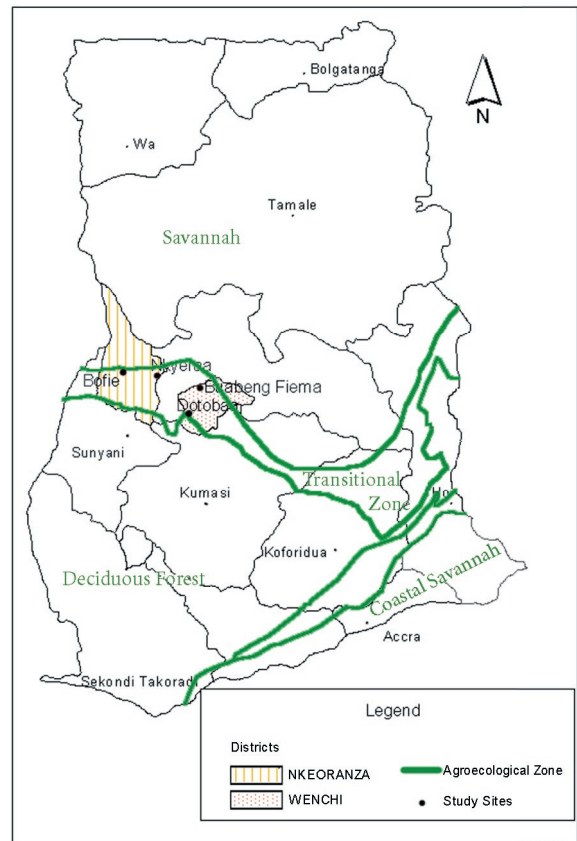


Figure 1. Location of the research area

While the region is still one of the least densely populated areas in the zone there has been significant population increase and an influx of migrants (Table 1). Nchiraa serves as a zonal centre (BIRD 1996), but none of the communities qualify as an urban centre because they all have populations below 5000 (Ghana Statistical Services 1984). Local estimates of population are much higher because they include the satellite communities which local people regard as an integral part of the parent settlements (Table 1). Large migrant populations mainly from northern Ghana reside in these scattered hamlets.

The study communities have very limited social and economic infrastructure, mainly confined to schools and water supplies, which are inadequate. Although rural electrification is on-going, the most reliable form of energy

1. Bureau of Integrated Rural Development, K.N. University of Science and Technology, Kumasi, Ghana.

2. Institute of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Table 1. Population increase in the study communities

Community	Population <sup>1</sup>			Local population estimates	
	1960	1984	2000*	10 years ago	Present
Buabeng Fiema	1771	2029	3161	3500	5000
Bofie	520	529	829	750	1000
Nchiraa	1894	3865	6022	11000	15000
Dotobaa	1130	1170	1823	3000	4500

<sup>1</sup>Source: Ghana Statistical Service Census data, 1984.

\*Projected at a growth rate of 3%

is kerosene for lighting, heating and cooking. Extensive use of firewood has had tremendous ecological impact in all the study settlements. Accessibility to the communities is poor, and is worse during the rainy season from May to September.

In the past, the lack of infrastructure discouraged immigration and favoured out-migration. According to local people, rural migration was prominent in the 1970s and early 1980s when several farmers, especially in Nchiraa, Dotobaa and Buabeng Fiema, lost their cocoa farms through *egahyehye bre* (the period of frequent wild fires).

Rural-urban migration amongst the sampled household members has significantly increased within the past ten years (Table 2) predominantly amongst men aged between 18 and 30 years. In Buabeng Fiema this was attributed partly to a scarcity of land. People claimed that the Monkey Sanctuary had taken the greater part of the fertile arable land. Fields outside the sanctuary had suffered from degradation with more intensive use, and crops were destroyed by the monkeys. In Bofie, the Moslem community which comprises about 20 per cent of the population, have relations in larger towns but on festive occasions they come home and demonstrate the flashiness of urban life, which has encouraged others to emigrate. In Nchiraa and Dotobaa, employment in the tobacco industry was mentioned as a key factor that has slowed down emigration, and easy access to the major markets has enhanced agricultural activities. Nevertheless, some

Table 2. Number of people emigrating to urban centres from study communities

Community	Number of people emigrating	
	1990-1994	1995-2000
Buabeng Fiema	7	23
Bofie	6	29
Nchiraa	16	24
Dotobaa	5	24

youths still leave because of the attraction of better social amenities and their perception of better job opportunities and life-styles.

Emigration of the youth is not only influenced by the attraction of better job opportunities and life-styles (Ghana Statistical Service 1995; BIRD 1996), but has a spiritual undertone according to some. This was captured in the words of a primary school teacher: *'Most of the youth are leaving because they think they would not achieve their aims in life in the village because of the influence of witches (abayifo)'* (Thomas Amponsaah).

Although no study has been conducted on the impact of witchcraft, the belief in the influence of *abayifo* in the success or failure of the endeavours of an individual in life is prevalent in many traditional and tribal societies (Lewis 1996). Protection against the misfortunes emanating from powerful spirits in normal daily and business life, for instance, has been observed amongst women entrepreneurs (Chamlee-Wright 1997). This view was corroborated by another informant: *'Not only do the youth think that they would not succeed in life when they stay in the community, but that those who seem to be doing well fear that they might be "killed" because of envy through witchcraft and thus tend to leave the community'* (Kwaku Akowuah). Whatever the causes of emigration, it compounds the scarcity of agricultural labour during the peak periods of the farming season and this partly serves as a pull-factor attracting more immigrants (Amanor 1994).

### Migrant populations

'Migrant' is used to denote immigrants from the northern regions of Ghana, which represent the predominant migrant community in the study area. The Akans, the second largest group of migrants, are usually fully integrated into the society. The northern migrants include the ethnic groups of Dagarti, Sissala, Dagomba, Grushi, Baasare and Mamprusi. Most come initially as seasonal farm labourers, and then become tenant farmers either by renting land or sharecropping.

### Access to resources

Natural resources are tied up within the local traditional religious, social and political arrangements. Local chiefs are the custodians of resources on behalf of the living (*ateasefo*), the dead ancestors or ancestral spirits (*nannomnsamanfo*), and the future generations (*nnkyeremma*). *Nannomnsamanfo* are the real landowners; the living are only their tenants at will (Rattray 1923; Frazer 1926). Access to natural resources is still determined largely through membership of social institutions of lineage and communities (Norton and Bortei-Doku 1993). Access to resources by migrants operates within this context.

In the study area, no matter how long a person has lived within a community, they are still considered a stranger (Afikorah-Dankwa 1998) and have no political status in

Table 3 Types of access to land of indigenous farmers (n=132)

Type of land access	Number of respondents*
<i>Abusua asase</i> <sup>1</sup>	52
<i>Abusua asase</i> <sup>2</sup>	50
<i>Esere</i>	75
Block farm <sup>3</sup>	8
Private or stumped land	41
Purchased	1
Gifted	26
Sharecropped	1
Rented	7

\*Some farmers had more than one type of tenure  
1 *Abusua asase* of respondent; 2 *Abusua asase* of spouse; 3 Land owned by tobacco firms

the traditional kinship-based organization. However, this has not prevented the customary system from responding to the migrant demands for land. The system also has responded to the changes in demand by the indigenous people.

#### Access to land by indigenous people

Indigenous people have usufructual rights to land through the extended family (*abusua*) whose head (*abusua panin*) supervises the allocation (*abusua asase*) (Table 3). According to oral tradition, the size of *abusua asase* is indicative of the amount of forest (*kwae*) that the ancestors were able to cultivate. *Kwae* was abundant and individuals could farm anywhere and whatever area they wished. These lands became their 'private property' (Benneh 1988; Afikorah-Dankwa 1998). The forest was considered an area suffused with supernatural powers (*tumi*) and spirits (*sunsum*) and the community needed to capture and exploit it to expand (McLeod 1981). Those who were able to expand the frontier of the community, or established farm holdings and hamlets within the forest, were allowed to own those areas on account of their bravery (Nana Dotobaahene personal communication). With the introduction of cocoa there was massive colonization and cultivation of forest (Amanor 1994), and the established trees granted relatively strong individual ownership rights (Quisumbing et al. 1998). For example, in Nchiraa, Dotobaa and Buabeng Fiema, the *abusua*, whose ancestors established large cocoa farms, are those who presently have large tracts of *abusua asase*. The other land types good for cultivation, *Mpe* (transition land) and *nfofoa* (fallow land), are mostly the sites of past cocoa farms, which have been consciously and deliberately managed by individual families through long fallow. *Kwae* is the most preferred land (*asasebedee*) for cultivation.

Indigenous people also have open access to the common pool of land, *esere*, which is predominantly grassland. Although *esere* still applies in the study area, intensification and commercialization of farming has undermined the

tenets of tenure. Increasingly, *esere* is being alienated for private use, particularly for tree crops, tobacco, vegetables and maize production. In the past open access to *esere* minimized pressure on *abusua asase*, enhanced fallow management and ensured that every member of the community had adequate land for subsistence food crops. Title to *esere* was considered temporary. Once the crops were harvested the land reverted to the community pool. Local chiefs and elders ensured compliance.

With the introduction of commercial crops, individuals who stumped and ploughed *esere* assumed 'private ownership'. Appropriated *esere* and *abusua asase* are then passed on as 'gifts' to wives and children even though it is contrary to traditional land tenure. Informants in Nchiraa, Dotobaa and Buabeng Fiema indicated that through continuous alienation of *esere* there has been tremendous change in the traditional mode of land acquisition by indigenous people (Table 3).

#### Access to land by migrants

Migrants generally obtain land through renting or sharecropping (Table 4). Most agreements are oral and normally negotiated for short periods of time (Manuh 1989; BRIDGE 1994). Commonly new migrants acquire land through their relations, who introduce them to the prospective landlord and serve as guarantor. Landlords then must inform the chief or his representative, who explains to the migrant their traditional tribute or rent (*ntow*) obligation. *Ntow* is not fixed and is usually paid

Table 4 Types of access to land of sampled migrants (n=49)

Type of land access	Number of respondents*
Rented	36
Sharecropped	12
Patron-client	8
Spouse	3

\*Some farmers had more than one type of tenure

as part of the harvest. Migrants are expected to present their *ntow* during the annual yam festival, when the chief and his elders are supposed to make a presentation to their paramount chiefs. The status of a migrant may be enhanced greatly by the value of *ntow* he presents.

In sharecropping, there is an agreed sharing ratio, usually *abunu* (equal shares) or *abusua* (tenant gets two-thirds and landlord a third) of whatever the tenant declares as the harvest. For renting land there are no stipulated arrangements. Within the contract period deviations from the verbal tenancy agreement may occur, often involving the landlord increasing rent or unexpectedly requesting a cash advance. Most migrants perceive renting as weighted in favour of the landlord and very arbitrary. For example, in the Botenso, a satellite of Nchiraa, for a piece of land

(usually unmeasured), the landlord estimates the yield, and an oral agreement is reached on what is to be given to the landlord, irrespective of the actual yield. Rent is paid in kind (maize or yam) or as cash. There were reported instances where landlords have taken their due even when crops failed. Some migrants indicated that the majority of landlords overestimate the yield. Specific renting rates have been exorbitant and varied between 100,000 and 400,000 cedis per annum (12 to 48 US\$). In addition, the tenant has to pay *ntow* of 30,000 cedis to the village chief. It is also common to gift some farm produce to landlords to foster a good bond and relationship. Several migrants indicated that the system was exploitative, but they are compelled to accept these terms because of increasing land scarcity. Land scarcity has compelled some indigenous people to rent land (see Table 3 above) and adopt tenancy arrangements traditionally applied only to migrant or 'stranger' farmers.

Migrants may also obtain access to land through marriage and patron-client relationships. It was mostly migrants from the south, the Akan group, who obtained land through marriage as they share similar cultural and linguistic characteristics to the Brongs. However, the situation is changing and more migrants from the north are gaining access to resources through conjugal and affinal relationships, particularly in Dotobaa. Under the patron-client relationships, migrants are 'adopted' as *abusua* members and allowed to crop *abusua asase* in return for services rendered to the landlord, particularly farm labour. This was predominant in Bofie, where the migrant

population is comparatively small and most indigenous people still had access to vast tracts of *abusua asase*. There the patron-client relationship arrangements minimize over-exploitation associated with other tenancy arrangements (Nana Okyeame Donkor personal communication). In the other study communities, local people stated that the practice was common in the past when land was abundant, but most landlords were now more interested in renting.

Migrants increasingly are losing leverage in the type of crops that can be cultivated. Under sharecropping, the tenant can only cultivate a crop with the consent of the landowner. Flexibility in crop type is also increasingly being withdrawn under renting. Migrant farmers were being restricted to the crops for which they originally acquired the land, usually maize and yams. For example, in Dotobaa, some landlords denied migrants the right to grow sorghum and millet; crops they perceive as responsible for land degradation (Iddrissu Agyapong personal communication), but which are used to prepare the traditional foods of northern groups. Tenure arrangements also do not permit migrants to invest in tree crops even under sharecropping. Some migrants argued that the cashew is being promoted in the north by the government, and claimed to have the expertise to grow the crop.

## Livelihoods and resource use

### Household economies of indigenous people

Indigenous men usually pursued cash-oriented farming, whilst women engaged mainly in subsistence food production (*aduanefuo*). Men cultivate maize and yam, the greater proportion of which is sold, whereas *aduanefuo* produce a variety of subsistence staples under rain-fed slash-and-burn agriculture. Surplus food is sold.

Local people make a distinction between *aduanefuo* and modern farming (*abefokuo*). The latter is dependent on the use of modern inputs and is associated with commercial farming. Most households depend mainly on their own labour using simple hand tools, but land clearing and preparation, and mounding and ridging depend on hired labour and/or the use of the tractor. Tractors are used mainly for commercial enterprises. Land is prepared by slashing the vegetation and burning the debris. Most trees are not felled during land preparation. Normally smaller trees are pruned while bigger ones are set on fire at the base (*eduatoo*) to hasten defoliation (Figure 2). Pruning and defoliation prevent shading while the standing trees are used as stakes for the yam vines. The gradual decomposition of the biomass improves soil structure and fertility. According to local people, larger trees stand for about two or three years serving as a yam stake. When the tree eventually falls, it usually triggers spontaneous growth of mushrooms (*mmere*), which are an important food supplement. The dead wood also provides some firewood. Some farmers indicated that burnt trees may recover if the fallow period is long enough. Local people, in Bofie especially, emphasized that tree burning improves soil fertility and allows other smaller trees to grow. The practice is selective and trees considered



Figure 2. A food farm at Bofie showing the practice of *eduatoo*

to have spiritual, economic and ecological significance are not burnt. However, other informants indicated that fire was a major problem when farmers who burn early for 'early yam' have started bushfires (Nsiah-Gyabaah et. al. 1996). Recurrent bushfires are blamed for the expansion of spear grass (*Imperata cylindrica*) which not only fuels the cycle of annual bushfires, but stubbornly resists subsequent colonization by other plants.

The major crops grown under *aduanefuo* are yams, maize, cassava and vegetables (aubergines, beans, pepper and tomatoes). These crops are predominantly inter-cropped in rotations. Yams and cassava are the major staples while maize is grown normally for cash. The yam also is the spiritual food for gods and deities, and is eaten on all festive occasions; every household tries to grow some yams. Cassava is very important because of its adaptation to declining soil fertility and, increasingly, plantain and cocoyam are being substituted by cassava. The mature cassava may be left unharvested in the ground for several months with little or no loss in quality. The dried chips are usually processed into flour and used for an important staple, *konkonte*, during the famine period. Cocoyam and plantain are grown on a limited scale, being restricted to *kwae* and *mpe* land types with better soil fertility.

The sustainability of *aduanefuo* is threatened. Women do not have control of their lands, and are gradually being displaced by commercial farming. In Dotobaa, Nchiraa and Buabeng Fiema, fallow periods were shorter than five years, the traditional length, and were said to be falling below the minimum of two or three years for trees and shrubs to grow to about 90 centimetres, which indicates that the soil has regained fertility (Kwaku Gjan personal communication). *Aduanefuo* is increasingly being done as continuous cropping. Some farmers compensate with fertilizer but most consider the use of fertilizer in *aduanefuo* as inappropriate, because they believe that crops lose their natural taste and also have reduced shelf-life. Informants also mentioned that the high cost of fertilizers for food crops is uneconomical.

Local people attributed changes to wider changes driven by the changes in the biophysical, socio-economic and cultural conditions including religious beliefs. They emphasized two key issues:

- the introduction of highly 'commoditized crops' and the growing of staple food crops on a commercial scale; and
- the changes in the local population, especially the influx of migrants and its effect on allocation, use and management of natural resources.

### **Livelihood strategies of migrants**

The migrants live in separate sections of the communities with heads who are regarded as 'chiefs'. For example, in Dotobaa and Nchiraa, there are Dagarti headmen who are referred to as '*Dagartihene*'. Although the title '*hene*' does not give political status, the headman serves as the conduit

for local chiefs to levy and collect *ntom*, and to solicit other assistance from the migrant population. This structure is more important to the traditional local chiefs, as they are supposed to monitor natural resource management and ensure respect for traditional beliefs and local taboos.

Migrant households are also based on the extended family structure and the households are patrilineal. Apart from the children of the man and his wife, other dependants were male relations of the male head who had followed his brother or uncle. The mode of land acquisition is the principal factor that influences the household livelihood strategy. Most rent land, principally for cash cropping yam, although maize is also important. They grow some sorghum and millet for domestic consumption and for the brewing *pito* by their wives. Migrant women also cultivate groundnuts for cash on a portion of the field allocated by the husband. Most of the migrant women did not have farms of their own, but assisted their husbands. Women in northern Ghana tend to cultivate crops together with their husbands although they may also have separate plots (Whitehead 1993).

Unlike the indigenous people, the migrants rely on the frequent use of the hoe and ridging for crop production. They make exceedingly large mounds for yams and ridges for their maize (Figure 3). Indigenous people perceived that these two practices were partly responsible for increasing deterioration in soil conditions. Migrants also cultivated larger fields than the indigenous people because they used co-operative labour, *nnoboa*, for initial land clearing, mounding and weeding. Migrants would not normally enter into such arrangements with indigenous people as they consider that they are not strong enough for such co-operative work and not able to work as hard.

Apart from the production of maize and yams for sale, migrants also keep livestock; a common practice with the



Figure 3. A migrant yam farm at Dotobaa

agro-pastoral systems in northern Ghana (Sarris and Shams 1991). In Dotobaa and Nchiraa, migrants keep large herds of cattle and flocks of sheep and goats. Indigenous people suggested that the increasing numbers of livestock was an important cause of land degradation. It was observed that most migrants still obtained useful additional income by selling their labour to indigenous people. Some indigenous people including women were increasingly selling their labour during the peak farming periods.

The Dargatis, particularly were observed to make money from the major cash crops and use the money to rent larger tracts of land. They send an appreciable proportion of their incomes home, where they own houses and other properties. The indigenous people increasingly perceive Dargatis as wealthy and their changing socio-economic status is causing disquiet. Perhaps the principal difference between them and the southern cocoa migrant farmers is the mode of land acquisition. Unlike the cocoa farmers who had long-term leases, the northern migrants obtain land predominantly on short-term rent, which does not enable them to make long-term investments such as tree cultivation and leads to the alleged lack of investment in land improvement, especially fallow management.

## Emerging livelihood strategies

### Early yam cultivation

The increasing shift from *aduanefuo* to commercial production has become a source of contention. However, the indigenous people patronise the practices of the migrants. As noted by Gyasi (1996), some landlords in the Mampong valley in the Eastern region of Ghana, were more interested in their annual rent than the alleged damage that was being done to the soil. Neither did they care about the burning. Moreover, landlords with large tracts of land were more interested in renting than sharecropping, because of the higher return. In this study some migrants also blamed the landlords, as one migrant informant argued :

*'If I do not crop the land my landlord will take it away from me and give it to another person. When one migrant leaves the land because of declining fertility, the landlord rents it to another land-hungry migrant'* (Mr. Despwri).

Without many options, migrant tenants maximize returns through practices such as early yam cultivation. Fields are prepared early as farmers take advantage of the dry weather to burn weeds and the practice has caused bushfires. The excessively large yam mounds and the frequent use of the hoe are also criticized. One indigenous informant in Dotobaa noted:

*'The natural spontaneous sprouting of cocoyam which follows after the clearing of a piece of land does not occur anymore. This is because migrant farmers make their mounds in such a way that most of the seeds (corms) in the soil are uprooted; they do not care to put them back in the soil because they do not eat cocoyam. This is part of the*

*reason we think the migrants are destroying the land'* (Mr Efa).

### Livestock rearing

While livestock rearing is not traditional, in the satellite communities of Asunkwaa in Dotobaa and Botenso in Nchiraa, migrants, especially Fulani herdsmen, tend cattle for indigenous people under patron-client relationships. The cattle owners in return meet the subsistence needs of the herdsmen and their family. For example, a Fulani herdsmen who tends cattle may be given shelter, food and a cash allowance of 500 cedis per month per animal. In Nchiraa, some indigenous people even give land for farming in exchange for livestock herding.

The increasing interest of indigenous people in manure for fields and abandoned kraals for production of some food crops, has facilitated herding. In Bofie, there are three big kraals that are rotated every three years for cropping. Maize and vegetables are grown and every community member has equal rights to the land and manure. In Nchiraa, several backyard gardens are located in abandoned kraals. There are still some misgivings expressed about migrants and their herding as one informant stated:

*'They [migrants] have been given the ultimatum to desist from dispersing in several isolated areas where their activities cannot be monitored. This is to prevent them from carrying out widespread destruction of the land and vegetation.'* (Malam Yahaya).

Efforts of the Unit Committee to enforce the by-law of the District Assembly were not successful, due partly to the tacit support of some indigenous people who have livestock.

### Charcoal production and chainsaw operations

Charcoal is produced mainly for the urban market and demand has increased (Ardayfio Schandorf 1993). Although the Sissalas are the traditional producers of charcoal (Afikorah-Dankwa 1998), there is a complex connection with the local and district economies as it is an important livelihood for indigenous people as well. Many youths (including women) make charcoal and are sometimes organized co-operatively. The district assemblies monitor the charcoal producer associations and members pay annual levies, which go partly to the traditional authorities as royalties, and the rest to the district assembly as tax. The district assembly derives extra revenue through levies on trucks.

It would be incorrect to attribute charcoal production and its effects to migrants alone. Local chiefs selling charcoal contracts to migrants without reference to local farmers might underlie the discontent (Amanor 1993). In Bofie, it was mentioned that some local elders sold charcoal contracts to Sissala migrants without accounting for the money to the community. Subsequently, youths in the settlement stopped the Sissalas from operating. In the other settlements indigenous people have collaborated with migrants to clandestinely operate charcoal businesses. This



type of collaboration has made monitoring for conservation difficult (Kwaku Akowuah personal communication).

Chainsaw operators are connected mainly with the tobacco industry in Nchiraa and Dotobaa. In Nchiraa there are ten chainsaw operators, all of whom are indigenous youths and in Dotobaa, there are four local operators and others who operate seasonally from major commercial centres. They fell and chop the trees for tobacco curing. They also provide services to charcoal producers and some are connected with illegal logging and fuelwood cutting. Consequently, they are the target of the environmental managers of district assemblies. Operators are supposed to register with the district assembly, to facilitate monitoring and for taxation. Monitoring is difficult especially of the non-resident operators who usually work at night in very remote areas. It was also mentioned the noise from the chainsaws have driven away some benevolent spirits from the forest.

### Hunting

Hunting has important economic, social and cultural linkages. In all of the study settlements it is traditional that hunters who kill a large animal should present it to the local chief and elders. With the increasing demand for 'bush meat', hunting is becoming a major occupation, particularly during the dry season (EPA 1994; Nsiah-Gyabaah 1996). Apart from Buabeng Fiema, where hunting is restricted because of the monkey sanctuary, there are no restrictions. Both migrants and indigenous men, young and old, hunt to supplement household protein and for cash.

Group hunting with dogs, guns and fire (*atwea*), has started bushfires and is banned (EPA 1994), but it is dangerous for people to enforce the ban because group hunters usually threatened those who confronted them. Monitoring was also difficult because of the collaboration of local people with outsiders and powerful traders.

### Agro-processing activities

Agro-processing activities are considered as minor occupations because few people are involved. However, they have of significant social, economic, cultural and environmental significance, and are becoming increasingly popular for both indigenous people and migrants. The principal livelihoods include gathering and processing of shea nut and palm fruits, *pito* brewing, palm wine tapping, and distilling of local gin (*akpeteshi*).

The shea tree (*loloo*) only grows wild in Bofie. Females traditionally collect and process the fruits (Sarris and Shams 1991; BRIDGE 1994). Men assist by carting the loaded sacks on the back of their bicycles to the house. Processing involves boiling the fruit, drying for one week, peeling off the cover, pounding, frying, grinding at the mill and boiling to skim off the oil. The oil is cooled over night to form fat aggregates, which are stored in containers as butter (*simebere*). The women described it as being hard work and requiring some tutelage. *Simebere* can be stored for two years and is used as a pomade, for cooking (frying),



Figure 4. Processing *loloo* in Bofie

local soap (*mumu samina*) production, and for soothing wounds and skin diseases. The importance of the activity was summed up accordingly:

*'Everybody in the community benefits from loloo because of its multiple uses. Income from the sale of simebere and mumu samina is particularly important to women because it helps us to support our families before harvesting of yams and maize'* (Yaa Nsiah).

*Simebere* has a ready market and fetches good prices at a time when the sale of crops is not due for about six months. Therefore, most men in the community encourage their wives and children to participate in the collection and processing of *loloo* (Figure 4).

In all the study communities women harvest oil palm fruits from the wild and process them into palm oil mostly for domestic consumption. The wild palms are considered fruits planted by the ancestors that have multiplied through dispersal over the years, therefore, they can be harvested by any member of the community. Unlike the *loloo*, the oil palms are widely dispersed and not particularly protected against fire. With the competing use of the wild palm tree for tapping by men, the palms are declining in number.

Indigenous people dominate palm wine tapping and distilling of *akpeteshi*. Apart from lacking expertise, migrants are restricted from appropriating wild oil palms. Palm wine, *nsajufuo*, is tapped mainly from felled palms in fallow lands or fields, and is either drunk fresh (very sweet but intoxicating) or distilled into *akpeteshi*. Both the wine and the gin are highly prized. The gin is extremely popular with the majority of migrant men, who consider it as a 'real man's drink'. *Akpeteshi* may be used also in prayers to deities and in general libation pouring. Palm wine, on the other hand, is served to chiefs and elders as a royal drink during funerals. It is usually a 'delicacy' during such occasions for women. There are district and local rules and regulations that control and ban the tapping of palm wine in the dry season (EPA 1994) as the activities can start bushfires. It has been difficult to control tappers and distillers, who with the connivance of local people circumvent the regulations and the sanctions that go with them.

The migrant population dominate the brewing of the

traditional northern drink, *pito*, which is prepared from sorghum or millet (Sarris and Shams 1991; BRIDGE 1994). Both migrants and indigenous people enjoy *pito*. Brewing uses a great deal of fuelwood. Wood is collected mostly from the wild, but is sometimes purchased from chainsaw operators.

### Trading and other activities

Trading is dominated by a small number of indigenous women and young men who trade in assorted goods (groceries and clothing). Little attention has been paid to the development of alternative income sources as part of conservation strategies and improving the living conditions in rural areas (Kwaku Akowuah pers. comm.). Some isolated opportunities exist. At the Monkey Sanctuary, an American Peace Corps volunteer has been able to improve the incomes of two local kente weavers who sell their products (mostly bookmarks) to tourists. Other opportunities exist in basketry, pottery, dress-making, masonry and carpentry. Diversification of agriculture to include intensive farming of non-traditional high-value crops such as carrots, cabbages and green peppers would also be of interest. In Nchiraa, a group of young female informants indicated that most people in the settlement end up in farming because there are no other viable alternatives.

### Conclusions

The natural resources management practices of migrants are partly the product of the changes in land and tree tenure systems. Changes in the attitudes, needs and aspirations of local people, particularly the need for more cash income, have driven both indigenous people and migrants to overexploit the natural resources.

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## Why farmers in Tanzania continue to identify with PLEC

Fidelis B.S. Kaihura

In October 2002 in Paris, Edwin Gyasi and I expressed the value farmers put on PLEC and the negative effects it could mean if the name was changed. After considerable discussion, the PLEC acronym was retained but changed to represent People, Land Management and Ecosystem Conservation. It was a rewarding compromise meeting the needs of farmers and scientists. In Tanzania PLEC placards at demonstration sites and farmer groups maintain the identity, and anybody else who would like to join or support them can only do so in the name of PLEC. The closing activities of the project between November 2001 and February 2002 included establishing a steering committees for different farmer groups involved in demonstration activities.

Visiting the sites in August 2003, farmers still recognize that changes in understanding, technologies and practices, are all associated with PLEC. They do not want to see PLEC go away and leave them alone. This is the message to the scientific community on behalf of PLEC farmers. Farmers in Ghana and Tanzania as well as elsewhere still want to be associated with what according to them was a project that touched and strongly addressed their daily life issues.

### What was special about PLEC that farmers do not want to lose.

From the very start, the PLEC approach collaborated with farmers and local communities in identifying appropriate conservation strategies that are environmentally, socially, and financially sustainable; that sustain biodiversity, while improving production and income. By integrating locally developed knowledge of soil, climate, biological resources and physical factors with scientific assessment of their quality in relation to crop production, a set of sustainable agricultural technologies are devised so that crop diversity and management diversity are maintained. The PLEC focus was on developing farmers' own innovations and good management models on their own farms and did not introduce completely new things. The project worked to open farmers' eyes by finding reasons why some of their practices are very successful and why others are not. Where relevant, different options were found to test and improve on the poorly performing technologies. It was indeed farmers' business with facilitation from scientists and extension staff. Where this has been successfully achieved, farmers do not want to dissociate themselves from PLEC.

### Finding new ways to communicate

In Tanzania we took time to identify farmers with good management, with strong communication skills, who were well accepted by other farmers, and were willing to share their knowledge and good practices. They were asked to train other farmers using their good models and experiences. Researchers and extension staff gave away

their sticks of power and left the driver's seat to the expert farmers to drive PLEC towards sustainable livelihoods. PLEC-Tanzanian scientists strongly believe that whatever farmers practice in most cases is appropriate to their situations. As a result they do not dare anymore to bring with them technologies developed elsewhere by other people for total adoption. The same goes with extension staff, who in the past visited farmers to teach them how to do things best. They had never noticed that farmers were in most cases skeptical of the technologies brought to them by the so-called experts. Farmers never told the extension staff that they did not believe in them. They just continued with their own practices. At this point both researchers and extension staff had failed to be effective as agents of change. The PLEC approach enabled researchers, extension staff and farmers to establish different relationships and mutual trust through empowering farmers to manage, lead and train their colleagues for improved productivity and production. With this trust there was no more skepticism, as both were talking at an equal level, each learning from the other and truly helping each other. This is another attribute that makes farmers hesitant to lose PLEC. They do not like to lose their good friends to interact with; those who recognize them as equal experts in resource management.

### Opening new lines of communication

On a different event PLEC farmers in Ng'iresi organized a day visiting experimenting farmers in their village. One of the farmers visited was breeding against Coffee Berry Disease (CBD). It was his seventh year of experimentation. Another farmer from the same village told the farmer-breeder that it was best to go to the coffee research station and collect CBD tolerant coffee as he did himself seven years ago. He pointed out that the coffee in the breeder's field was collected from farmers' fields with susceptible varieties. He told the group that CBD tolerant coffee was on the market for more than eight years, and available at a research station less than 80 km from their village. In this way PLEC was able to make use of expertise from a farmer within the same village to save time and money for a fellow farmer. This information was not only helpful to the breeding farmer but to many others at that gathering. In that way PLEC came closer to many farmers.

In addition, it was through PLEC that many ordinary farmers in Arumeru came to know what the local research institutions were doing that addressed their daily farming problems. PLEC made it possible for them to visit the research centres and learn from the experiments being conducted. Other projects had conducted training or exchange visits but it was the type of farmers that made the difference. Usually well to do farmers are the beneficiaries. PLEC worked with those who sometimes may not be good at speaking in public and not financially able to be

key members of the groups; those normally left out by most projects. The poorest of the poor were among very important members and leaders of PLEC farmer groups. I remember a day when the poorest lady in Olgilai was given the opportunity to address the audience of more than 200 people at the PLEC annual workshop in the New Arusha Hotel about how she manages on a farm of less than 0.1 ha to bring up two children and pay their school fees. She was grateful to PLEC because they were the first among all projects she had heard of to visit her and encourage her to work with them. She thanked the project for enabling her to enter the hotel, sit there, address very senior people and eat with them. She said she had often heard of leaders meeting in big towns and talking about improving smallholder production practices without having farmers in the meetings. This is another point of view of the poor that through PLEC they were taken on-board, and now they do not like to be detached from the project.

Another poor farmer had established stone bands with naturally growing indigenous trees along them. He used the abundant stones to control erosion locally. He was encouraged by PLEC support and was given the chance to train others. Formerly, extension staff from the land-use planning unit had visited the farmer and constructed *fanya chimi* bands in the same field and planted them with elephant grass. The structures constructed were no better than the farmer's own bands. However the extension staff were not as keen about the farmers own initiatives as PLEC was.

### Choosing leaders

Some farmers and leaders quickly understood the PLEC message that one of the pillars of implementation of the project was to share information. They elected the leaders who they considered committed to work for themselves and for the people. They believed information or knowledge and demonstrating good management practices empowered them to change their own environments and conserve biodiversity for their own livelihoods. During the PLEC Tanzania inauguration meeting, where zonal, regional and



Figure 1. The PLEC management team visited Ms Lomyaki in Ng'iresi village. Lomyaki is a very poor farmer who other projects in Arumeru never bothered with. She was approached to work with PLEC and became instrumental in promoting local chicken raising. Being visited by the international group of scientists overwhelmed her but energized her to work more.

district leaders and NGO representatives had been invited, the Arumeru district leadership was asked to propose a farmer who could lead the implementation programme. They proposed a very progressive farmer, with a good well-conserved farm, with well managed cattle and who was also employed with the regional game office. When the farmers were introduced to this man, they all unanimously rejected him saying that he was rich, and his farm was well managed but he did not know what grows where on his farm. Labourers largely manage his farm, and he depends on his off-farm income to improve it. They said he did not belong to them and therefore could not represent them. They chose their own leaders who were real representatives. These are the ones that still emphasize that PLEC for them was an eye opener and they would not like their eyes closed by other projects. Examples include PLEC KUMO group, Muungano land rehabilitation group and committed individuals like Kisioko and Konyokyo.

### An example of PLEC contribution to community development and environmental conservation

The government at district and regional level in Arusha has used the dynamism and activities of PLEC-KUMO group in Olgilai/Ng'iresi to sensitize people to conserve biodiversity and the environment. This year KUMO was involved in regional and district activities. The group planted 600 seedlings in the water sources under the village and over 2000 seedlings in the water sources owned by the Arumeru District Water Company. They provided 200 seedlings to two primary schools for planting in the school compounds. Each of the members of the group has planted a minimum of 300 trees at their homes. Other farmers who have visited KUMO took more than 700 seedlings. Five District Commissioners from outside Arumeru and Arusha region visited and took 60 seedlings for experimenting at their homes. Twenty seedlings were also issued to 'Fide farmer group' from Babati district, Manyara Region. A total of 263 people including national, regional and district leaders have visited and learned or obtained seedlings from the group since 2001. The trees planted in the degraded catchments of the village are taken care of by the village government and not the group. The village and district leadership also endorsed KUMO application to become an official biodiversity and environmental conservation group. They were officially registered in December 2002. They were also supported by the Arumeru District Poverty Reduction Fund with US\$500 (500,000 TShs) for investing in poverty reduction activities. They have opened a bank account with the National Micro-finance Bank, which is for smallholder farmers. During the period 2002/03 KUMO was invited by the regional and district leadership to participate in International Waters Day and sang songs to promote environmental and biodiversity conservation. Through KUMO's messages to the government, the Regional Commissioner for Arusha, committed to provide Olgilai/Ng'iresi villages with piped water, contribute to rehabilitation of primary schools by building one new classroom at Olgilai primary school and to support village efforts in rehabilitating village roads. The group was invited

to participate in the Mother and Child Day in March 2003 and in various workshops and meetings including: HIV/AIDS, and The Child of Africa day. During the Regional Water Week, the regional commissioner supported their efforts and with the local leadership established a by-law to stop agricultural practices in the Themis river catchment which has several water sources.

The group has received several rewards in recognition of their efforts in mobilizing people to plant trees, rehabilitate water sources, regenerate endangered tree species, conserve soils and improve on-farm biodiversity. Since the inception of the group in 2000, they are working with 50 tree and plant species with value for firewood and construction, medicinal use for humans and livestock, soil fertility improvement, cultural ceremonies, making beehives and furniture. Talking to the Ward Executive Secretary on behalf of the District Executive, the director said PLEC-KUMO was the torch of the entire district in promoting biodiversity and environmental conservation. She also thanked PLEC leadership for initiating and supporting the process.

Looking into the future, KUMO farmers emphasized the need for more training in on-farm biodiversity improvement, soil conservation, and agricultural intensification technologies in land-scarce areas, so that more farmers can train others. They also want to visit groups that came for training at their site and see what they are doing. They would like to visit PLEC farmers outside Tanzania, to share knowledge and learn from their experiences. They often have similar problems with marketing and KUMO would like address the marketing of smallholder farm products including new products such as apriary products.

Messrs Kisioky Sambweti, expert in pastures conservation, and Daniel Konyokyo, expert in traditional woodlots conservation, are typical examples of committed individuals. They have educated farmers and village leaders about the importance of their activities. At times, they were misunderstood but gradually gained influence and support. They are also instrumental in encouraging farmer groups to work hard with PLEC. The village and ward



Figure 2. The District Commissioner for Arumeru, listening carefully to the PLEC-KUMO chairman (centre) and secretary (left) as they explain the uses of the different trees raised in the tree nursery at the Chairman's home. The DC, contributed US\$300 to the group to help them continue their work.

leadership have invited and allocated plots to Kisioky and Konyokyo to plant and show what they and the groups for the September 2003 agricultural shows. Kisioky has started planting four plots, one with improved natural pastures, another on correct planting and management of cassava and sweet potatoes.

PLEC farmers in 2001 visited Ukiriguru Agricultural Research and Development Institute and returned with three cassava varieties (TM 30237, TM 4/2/1425 and TM 30337), four sweet potato varieties (Jitihada, Vumilia, Mavuno and SPN/0) and two sunflower varieties. The objective was to improve food security and cash income through crop diversification and to reintroduce the crops that in the past were grown but disappeared partly due to marketing problems. More than 15 farmers received the introduced varieties but only 5 successfully established them in their fields.

Konyokyo on the other hand will make a collection of different medicinal plants from his woodlot and will demonstrate how to manage a seedbed of indigenous medicinal trees. He plans to explain to the politicians the



Figure 3. Expert farmer for *in situ* conservation of pastures is pictured here in one of the conserved pastures with his children. The pastures are green and flourishing during the dry season. He makes hay and supplements the pastures with bean stover to feed 3 cows and 4 heifers throughout the year. He sells extra pasture to friends.

kind of support he and other woodlot conservationists expect from the government leaders. This is because woodlot conservation mostly conflicts with local agropastoralists wanting free grazing and firewood collection.

The efforts of rehabilitation of degraded grazing lands by Muungano group is also working well under the leadership of Kisioky Sambweti with support from the village government and other committed villagers. In 2001, the Muungano group requested and was allocated 6 ha of degraded grazing land for rehabilitation. The main activities were to plant trees and recover vegetation while restricting grazing cattle. The group faced a lot of opposition from the majority of the villagers as planting trees meant preventing animals from grazing. They also thought outsiders (PLEC staff) were government representatives who would eventually take away land from the village and allocate it to non-grazing uses. They later became

convinced Muungano was doing a good thing when they saw their own children of Oldenderit PLEC group singing and supporting PLEC activities in environmental conservation. The group has 10 types of indigenous trees seeds brought from the National Tree Seed Company (NTSC) including Apple ring Acacia (*Faidherbia albida*), Mgunga (*Acacia nilotica*), Kyaya *anthotheca*, *Acacia polyacantha*, Large leaved cordia (*Cordia africana*), Umbrella thorn, Gum arabic (*Acacia senegal*) and Womans tongue (*Albizia lebbek*). The Agroforestry unit of LZARDI at Ukiriguru also provided Kiserian farmers with *Gliricidia* seeds for planting. *Gliricidia* has the potential to improve soil fertility especially in areas of low rainfall. Trees have been planted in various parts of Kiserian including the rehabilitated degraded grazing land.

Looking at the area in August 2003, more than half of the 6 ha has over 90 per cent cover with natural grass. This cover is maintained during the dry period of the year! Some farmers close to the land joined forces to support the group leader in monitoring those who may graze their cattle in the area. Those caught are brought to the group leader or village government for reprimand. They are normally asked to plant five trees and water them to full development along with other trees being planted and managed by the group. Because the number of farmers believing in conservation of their grazing lands is increasing, monitoring becoming easier.

### PLEC and other projects

In early 2003, the Heifer Project International (HPI) was providing improved goats for milk production to well organized farmers. Looking at the lists at the village and ward offices in Kiserian, they noticed several PLEC farmer groups one of which had 5 improved goats managed centrally by the group. The group had received two improved goats from PLEC and had started with four local ones on their own. The two improved goats had increased to five. HPI provided the group with 15 goats such that each person got one to keep at home and the buck remained at the central position as a breeding centre. Discussing with the group in August, HPI said they would not have given their support if the group had not been already active keeping improved goats.

### Gender sensitivity within PLEC

In 1995 in Arumeru while doing pilot work with PLEC, we had problems interviewing women. Customarily they were not allowed to talk to foreigners, particularly men. Most of the households visited during early PRAs where men not found were left out. Nowadays we get served with tea and meals in the absence of husbands and can discuss project matters and make some decisions without husbands being around. The few daring women who previously passively participated in village meetings today can actively contribute to decisions and plans made by the village. One of the women confirmed recently that enabling women to actively contribute to the project implementation plans and contribute effectively in



Figure 4: An area regenerating well after one year of conservation by the Muungano group. Natural grass is about 90%. The group chairman (right) is showing a one year old *Gliricidia* tree, centre is a one year old locally-raised tree (*Olmotoo*). The larger tree is a local Acacia. The others in the picture are the caretakers of the

workshops and meetings has weakened unfair traditional beliefs that women cannot talk in public. She further indicated that at family level some farmers now sit and plan with their husbands issues related to family planning, resource allocation, and education for their children without violating the norms of mutual respect as wife and husband. One of the women in Oldenderit youngsters group is also in the forefront fighting the Waarusha culture of female genital mutilation and because of that she has been sponsored by an NGO to continue secondary school. Farmers associate all these changes and opportunities with PLEC.

Retaining the PLEC name met the needs of the farmers. As a scientist in the project, I feel very proud to see farmers satisfied with what we did together, to see them wish to continue working with scientists and to continue the work without facilitation by scientists and extensionists. Farmers recognize and respect project staff for the kind of partnerships developed between us. Bringing change in farmers attitudes and practices is a great satisfaction that pushes me to try all I can to continue working with PLEC farmers in the future.

Arumeru farmers consider the PLEC scientific community as equal partners in business working towards sustainable smallholder livelihood. They request the future PLEC to strengthen the developed capacity and to upscale it. They are thirsty of more knowledge. They want exchange visits, local and international workshops for experiences to cross over frontiers of continents. They condemn workshops and meetings that convene people to discuss agricultural development in the absence of farmers. Is this not a challenge for us to think of developing a global forum of smallholder farmers to deepen the roots of farmer, researcher and extensionist partnerships? Long live PLEC.

# Reports

## PLEC-Tanzania capacity building: evidence on the ground

**Fidelis B.S. Kaihura and E. Kahembe**

Being in Mwanza, which is quite distant from Arumeru, several farmers phoned me occasionally asking when I was planning to visit. They also wanted to know when PLEC 2 would start. In August 2003, we visited several of the PLEC farmers in Arumeru. We were pleased with the spirit and motivation all visited farmers have and how they still consider PLEC a continuing agent of change in their lives. The visit included conducting further farmer to farmer training and compilation of the previous farmer-developed technologies in order to prepare leaflets for extended dissemination for use by other farming communities. They thought I had come with PLEC 2 but we agreed to continue working hard until funding is obtained.

The farmers all had different activities on their farms. They clearly stated that much as the project ended in 2002, they still apply the knowledge and practices adopted from colleagues and experts in their day to day life and are enjoying the fruits. They are mostly combining theory and practice learned from farmer to farmer training and exchange visit programmes to demonstrate good practices to other farmers while earning some income with reliable food supply for their families. Some of the things farmers had to show and say follows.

### Julius M Mollel

Julius Mollel is an outstanding retired government extensionist. He had the belief that farmers need to be told what to do and how to do it. This attitude however changed after six months of working with the PLEC project. Some of the technologies he was preaching could not be found on his own farm. He started practicing what he learned from farmers and researchers in PLEC demonstration sites at his home in Moshono and subsequently became a more effective facilitator.

He is proud to show what he is practicing. He previously had organized two demonstrations for PLEC farmers from Kiserian and one for the environmental conservation women group for Kiserian. Some of them took various types of tree seedlings and cassava cuttings to plant in their own farms. One thousand seedlings of mandela (*Morus alba*) and 50 mijohoro (*Senna siamea*) were issued to the womens' group, and 300 seedlings of mipopote (*Leucaena leucocephala*) were issued for planting in the areas around the homesteads. Mr. Kisioky, an individual farmer, took 200 cassava cuttings to plant at his home.

Table 1. Crops grown in the cassava/tree field type

Crop	Type	Comment
Cassava	2 varieties	Long storage underground without spoilage Drought tolerant High biomass for mulch Increases land value
Trees	Grevillea and Mringaringa	Soil fertility improvement, firewood and construction
	Mandela	Animal feed and firewood
	Olivoni	Making stamp pads
Fruits	Mango	Sale, home consumption and increasing land value

We found more than 12 field types on his farm. They all aimed at ensuring food security, household income, crop/livestock integration for soil productivity improvement, and improved crop storage. Like most farmers in middle and high altitude areas of Arumeru, land pressure is a major constraint. He deals with this by optimizing plant space and intercropping different crops. He introduced contract floriculture for seed production with a commercial farmer to rapidly raise his income. The new field types on his farm included cassava, sweet potatoes and flowers. Crops one field type are shown in Table 1

Mollel grew four types of flowers each with a different management requirements and value per kilo of clean seed:

- *Tagetes patula* nana giant (5,200 TShs/kg),
- *Tagetes patula* nana orange (4,900 TShs/kg)
- *Lupinus cruckshanksii* pink (3000 TShs/kg),
- *Zinnia angustifolia* white (9000 TShs/kg).

Last season, for example, he harvested 75 kg of *Tagetes patula* nana giant from 0.7 acres of land (Figure 1). He obtained 390,000 TShs (approximately to US\$390). Under



Figure 1. Mr Mollel's family harvesting *Tagetes patula* nana

traditional crops 0.7 acres would produce about 5.6 bags maize grain and 3.5 bags of dry beans (100 kg bags). The price of maize and beans are 8,000 and 22,000 TShs/kg respectively. By selling both maize and beans Mollel would get 121,800 TShs from the same 0.7 acres. He obtained close to 268,000 TShs more by growing flowers than maize and beans. As a result flowers are becoming a popular crop in Arusha, but it does not completely replace maize and beans production because of the labour demand of flower production.

Besides cassava and flowers Mollel constructed two improved grain storage structures known as 'Vihenge', one with 5,000 and another for 2500 kg grain dry grain capacity. As his wife is a teacher and has no time to collect firewood, one plot was planted with trees for firewood and construction (Figure 2).



Figure 2. Mr Mollel in his woodlot begun in 1999. Piles of firewood in the background

He has several plots variously combined with cassava and other crops and a heap of more than 1000 cassava cuttings available for any farmer to pick and plant on the farm. He said through working with PLEC, he got both knowledge and money as payments from PLEC and sales from highly diversified cropping systems. He used the money to complete roofing his improved house.

### From the farmer - Lomayani Kimasian Sarao

'I am very grateful to PLEC. By being a member of PLEC my family has made a lot of improvement. Benefits include effective use of land which is very scarce, and appropriate use of animal manure and associated increase in crop yield, something we did not do before PLEC although we had manure with us. We knew our soils were fertile and did not need fertilization. We also thought what we harvested was the best one can obtain from such small pieces of land. But banana production has increased from 60 bunches (June 2001 to May 2002) to 193 bunches during June 2002 to May 2003. Round potato production increased from 3 bags of 100 kg each during the year 2000 growing season to 12.5 bags in 2003. This was a result of improved use of manure. The same small piece of land previously used at low production level is the same area cultivated till now.

Based on the 1999 annual workshop of PLEC stakeholders in New Arusha Hotel, farmers agreed to stop feeding the dairy cattle under zero grazing with banana stems (locally known as mkokoi). Banana stems were indicated to have low nutritional quality, resulting in low milk production and the milk had a characteristic bad smell that put off most buyers. Based on that information, I increased the leguminous grasses on the contours and planted more elephant grass such that it was possible to make hay to feed my cows. This has improved the health of my cattle, milk production and quality have increased. The milk has more cream than before. My customers are very satisfied. I would therefore like PLEC 2 to expose me to processing of milk to make cheese and butter using low-tech equipment.

PLEC gave a lot of importance to the traditional crops that had lost value and were disappearing due to much emphasis being put on improved crop varieties. Taro for example is a food security crop. Similarly cassava, sweet potatoes and indigenous fruits (e.g wild berries) are now interplanted with commercial forests and largely eaten by children. The community in which we live is well informed of the importance of restoration of the degraded vegetation especially in water sources and steep slopes. The community is also happy with replanting of endangered economic trees of which we still carry out as a group once a week. Some of the young men and women did not know the uses of different trees and shrubs. Neither did many of the older farmers know how to grow the indigenous trees from their seeds. Where a tree or plant has disappeared in the area, a few old people could describe areas and ecological niches where the youths could go and find these trees. The elderly also know the time of the year when the trees produce seeds so that they can be collected and grown under special nursery management to obtain seedlings. I personally spend a lot of time visiting and encouraging colleagues and other farmers to conserve their land by attending KUMO group community development activities like planting grass along steep slopes and planting trees along river banks. I do this for my own benefit and for the benefit of the society I live in. On 12th January 2003, I was awarded a certificate as second environment conservationist in the ward by the District Commissioner on behalf of the district forestry office in Arumeru.

There are technologies I completed with PLEC support including the "construction of a plastic bio-digester" which is used for cooking using gas from cow dung. One to two cows are required to provide gas for the kitchen. At the beginning 3 tons of fresh manure is put in the system, this works for fourteen days. From then on two 20 litre buckets of fresh manure are applied everyday, one in the morning and another in the evening. This is enough to make daily morning tea, lunch and dinner for a small family of about 3 to 4 people. The use of bio-gas reduces the firewood demand by 25 per cent and makes time available for the family to do other things instead of collecting firewood. Future plans are to change the system to enable it to provide both cooking gas and electricity.



Other technologies I developed with PLEC support or training include the use of firewood conserving cooking stoves, improved machete for cutting and carrying grass for zero-grazed cattle and soil conservation using well constructed fanya chini structures. The cooking stove is constructed inside or outside the kitchen using burnt bricks. It carries 2 to 3 pots at a time and only a small amount of wood is needed for making both ugali (stiff porridge) and soup for the family. Again it saves time and reduces the temptations of clearing forests and bushes in search of firewood. The two technologies were introduced during PLEC time as strategies to reduce deforestation while planting trees in degraded catchments. With this stove utilization of firewood is reduced by 35 per cent.

For PLEC future, I would like to see the project facilitating farmer exchange programmes, to allow them to compare their technologies with those of others and get more experiences of managing their own agro-ecosystems; and to organize more seminars especially for farmers taking into consideration men and women and the established farmer groups. I would like to be enabled to train other farmers in the area of traditional medicine. We have identified and documented many plants with different uses particularly medicinal uses and would like to share this knowledge with others. So far I am happy with the knowledge I got from PLEC and I do share it with other farmers. As chairman for KUMO-PLEC group, I also want to see that the whole of Arusha and Tanzania in general is conserved and indigenous trees regenerated.'

### Joseph Sumayan Mollel

Mr. Joseph Sumayan Mollel was among the last members who joined PLEC in late 2000. He however became very active and rose to among the cornerstones of PLEC activities in Olgilai/Ng'iresi site. During that time he had a few vegetables, two varieties of beans and few shrubs of traditional medicine in the farm. Together with his wife, their farm crop diversity has increased to include lablab beans, more local bean varieties that include Kamba variety, two varieties each of cassava and sweet potatoes which were never grown in the entire village, Magimbi and mizabibu fruits (indigenous grape vine) Figure 3).

With the increase of indigenous medicinal plants in the entire farm, treating patients is done for a modest charge, which adds to family income. In order to conserve endangered indigenous economic trees most of which have medicinal and cultural values, he seriously participated in the KUMO environmental conservation PLEC group. There he learned from the elders how to raise indigenous seedlings using seeds. He works today as KUMO secretary but has a nursery at home for producing and planting at home but also selling to others. Many of the seedlings have however not been sold. He is very grateful to PLEC for improving his knowledge and practices. The technologies gained through PLEC that they consider relevant to the

family include: use of fuelwood conserving cooking stoves, optimization of plant density through planned intercropping, and raising of introduced and indigenous trees in nurseries before transplanting in the field.

During 2002/2003 period it was possible to include a shed for 3 new sheep, and improve the management of well spaced bananas (in specified lines) with an increase in harvest from the same area. The crop diversity has increased with both introduced and indigenous fruits planted in the boundaries of the farm, including cassava in the boundary strips, and various trees with different uses in the farm boundary areas. The optimization of plants, trees and shrubs was a result of the training by the Matatu expert farmer Mr. Gidiel Loivoi Laiser who died last year, two months after fully participating in the PLEC technical and policy recommendations workshop. In addition Mr. Joseph constructed a small fishpond at his home. The fish have improved his family and neighbouring farmers nutrition and they obtain some money from fish sales. He has harvested fish 3 times. With respect to other sources of getting more knowledge and technologies for improving his and neighbours livelihood, Joseph said he used to visit different places and farmers with PLEC facilitation. He is now concentrating on exchange of information among the project members. He would like to see PLEC 2 concentrate efforts on more training and improving farmers knowledge in resources management through workshops, exchange visits and inviting experts of different backgrounds to equip PLEC farmers with more production and management techniques.



Figure 3: Mr. Joseph threshing a newly introduced local variety of Kamba beans, also known as Maulas, for the day's meal.

## Principal component analysis as a statistical tool for analysing agrodiversity resources in Mexico

Gabino Nava-Bernal, Cristina Chávez-Mejía, Carlos Arriaga-Jordán and Carlos González-Esquivel<sup>1</sup>

This paper presents the results of a household survey exploring maize diversity choices by campesinos in the community of San Pablo Tlalchichilpa, México. Farm specific characteristics arise from variations in resources and family circumstances. The variables conditioning household strategies range from demographic and economic, to political and ecological. The analysis of agrodiversity resources attempts to identify a portfolio of strategies used by farmers, and their contribution to livelihood sustainability in the face of adverse trends or sudden stocks. The campesino households and their choice of maize diversity are treated as the basic unit of analysis. The household not only represents the living space; it is also the area where agricultural production decisions take place.

The aim of the study was to achieve a general understanding of campesinos' resources and how this understanding is related to decisions on growing one or more maize varieties. The household survey was carried out between August and September 1999 in four community neighbourhoods or *barrios*, Barrio Santa Cruz, Barrio La

Era, Barrio San Francisco and Barrio San Pablo Centro. Campesinos were previously asked if they were willing and had time to take part in this study. One hundred and ninety households were surveyed during the fieldwork, and useable data were gathered for one hundred and twenty households. A Principal Component Analysis (PCA) was used as a statistical test. Nine original variables were defined, that are features of the resources available in campesino households. Table 1 summarises the main characteristics of each variable studied.

PCA groups large numbers of variables into a smaller sets of new variables called principal components that contain all the significant information described in the original variables. Coffey (2002) suggests that PCA can identify clusters when the data is collected for a large set of variables. According to Kaiser's criteria, the analysis identifies statistically significant components in the reduction of variables (Solano et al. 2001; Tacq 1997). The PCA technique begins by computing the correlation between all variables in the study. PCA also provides a method for finding structures in the data set. In this study, PCA was used as an exploratory analysis that illustrated the patterns of available household resource endowment. The analysis was carried out using the Statistical Programme for Social Sciences (SPSS).

Three main components were identified relative to aspects of agrodiversity. These components explain 70 per cent of the variance between households. The values of PC1

Table 1. Description of original variables

Variable	Description
Family size	Number of family members in the household
Number of adults	Number of adults available for labour
Age	Age of the household head. This is the man or woman identified as responsible for making decisions inside the household
Migration	Number of family members who worked outside the community. Either seasonal, during periods of less work in the household, or permanent work outside the community
Soil diversity	Number of different soil types identified by campesinos criteria
Livestock diversity	Number of animal species in the household
Plots	Number of plots cultivated by the household head
Total area	Area available for crop production in the household
Wealth	Wealth ranking by campesinos

Note: Campesinos were asked by which categories they identify the richest and poorest households in the community. The wealth index generated is a combination of different household resources, including 1) Livestock – campesinos considered the richest were those who have the most animal species in the household; 2) The number of family members who work outside of the community; and 3) the size of the house. Each of these elements was ranked for availability, accessibility and quality on a five points whose ranges were considered during a workshop with campesinos.

1. Centro de Investigación en Ciencias Agropecuarias, Universidad Autónoma del Estado de México. a/c CGIEA, Instituto Literario 100, Toluca, México 50000. caj@uaemex.mx

are particularly those variables related to agricultural production, such as soil diversity, area available, number of plots, livestock diversity and wealth. PC1 was labelled as the 'farming resources' component. Family size and structure appear in a group with high influence on PC2, labelled as a 'demographic' component. The households in PC2 based their strategies on the availability of demographic elements. Migration dominates the third component (PC3), which is represented by the number of family members who worked outside of the community and wealth in the households. PC3 is labelled as the 'off-farm employment' component.

From these results, it is possible to identify the main influences on change in maize diversity. The following scenarios can be inferred in relation to the number of maize varieties managed in the community:

- The maintenance of farming resources will maintain or increase the number of maize varieties cultivated by the households.
- An increase in family size or a decrease in off-farm employment could result in an increase of demographic components and natural resources would be less concentrated (e.g. increased land fragmentation and reduced access to farming resources). It is likely that the

number of maize varieties would decrease, or land would be used more intensively.

- An increase in off-farm employment could result in a decrease in demographic components. Older people could have more decision-making influence in cultivating more than one maize variety, and farming resources could become more concentrated in a few households. The result would be an increase in household maize diversity.

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## Activities in demonstration sites of PLEC-China during 2003

**Dao Zhiling<sup>1</sup>, Guo Huijun<sup>2</sup>, Yin Liwei<sup>2</sup>, Fu Hong<sup>2</sup>, Chen Aiguo<sup>2</sup>**

Although PLEC-China did not find alternative funding sources from November 2002 through 2003, some activities are still going on in the demonstration sites established in the first phase of PLEC. Professor Guo Huijun obtained funding in 2002 for a joint project between the Chinese Academy of Sciences and Yunnan Province for an agrobiodiversity study in old tea gardens in Lancang county of Simao prefecture, southwest Yunnan. The project area is not far from Xishuangbanna, and some PLEC members have been working in this area since June of 2002. More than fifty samples of old tea garden have been investigated. Professor Dao Zhiling has led a project on agroforestry demonstration in Gongshan county, north Gaoligongshan for the GTZ China project.

## Training workshops: the long-term approach for PLEC demonstration sites

Since Gaoligongshan Farmers' Association was established in December of 1995, sponsored by the PLEC project and Macarthur Foundation, three training workshops for biodiversity conservation and practical technology for crop management and rural development have been organized by the association each year. A field training workshop on walnut tree and chestnut tree grafting and pruning took place in Baihualing village in January 2003, attended by the innovative farmers and most of villagers. In the Baihualing demonstration site, more and more farmers are inspired to develop their agrobiodiversity under leadership and demonstration by the PLEC expert farmers. The farmers also seek some other practical agricultural techniques apart from the indigenous techniques. Using the PLEC ideas and methodologies, farmer to farmer training workshops and practical rural technology training will be the long-term approach of China PLEC.

## Graduate student research results

Two PLEC Graduate Students finished their research and presented their theses at the end of June.

Mr. Yin Liwei, supervised by Professor Guo Huijun (former leader of PLEC-China), studied 'Community

<sup>1</sup> Kunming Institute of Botany, Chinese Academy of Sciences.

<sup>2</sup> Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences.



Farmers watching a demonstration of pruning techniques at Baihualing

forest management and biodiversity assessment in Gaoligong Mountains'. His research was based on the two demonstration sites at Baihualing village and Shabadi village in Gaoligongshan. After the three years research, his findings are as follows:

- Under the influence of the Chinese Forest Policy, the community forestry presents great variety in all aspects. After nearly twenty years of independent management, there is a very big difference in management techniques between the villagers' own forestland and the ones they were assigned.
- For the community forests with different owners, the contract and responsibility system which separates ownership from managerial authority, has been proved to be commendable.
- For the community forest of the same owners, there are good methods for managing the forest resources, such as cutting firewood at 2 or 3 year intervals in the natural secondary forest and reforestation with high value timber trees.
- The community forest is an ecosystem of rich biodiversity resources. It is the basic source for biodiversity development, but also the base from where the natural ecosystem provides a constant source of species for the transitional ecosystems and agricultural ecosystems.
- There are many species of rare and endemic plants in the community forests, and because of the threats from human disturbance and interference, protecting the plants in the community forest becomes more difficult than protecting the species in nature reserve.

Ms Fu Hong, supervised by Professor Chen Aiguo (former vice-leader of PLEC-China), focused on 'Alder-based shifting cultivation in Ximeng county, south-west Yunnan'. Her research results showed that:

- Alder as a multipurpose tree is widely cultivated in the fallow fields in Ximeng county. In A-mo Wa village, 86 per cent of households cultivated alder in their shifting cultivation land. Alder improves the soil fertility and makes the nutrient absorption by crops easier. The above-ground biomass of alder fallows was higher than that of unmanaged fallows. The crop yields following alder fallows were higher than the yields of unmanaged fallows, especially the yields of ragi millet (*Eleusine coracana*) and maize which increased by 35 per cent and 28 per cent respectively.

### PLEC methodology introduced to other projects

A GTZ project on Biodiversity Management and Rural Development is being carried out in Gongshan county, north Gaoligongshan. Kunming Institute of Botany is one of participating organizations for implementation. For successful and productive implementation, the Yunnan Office of GTZ organized a training workshop. Dao Zhiling, leader of PLEC phase 2 was invited to give a course on the community approach for nature reserve management. He presented PLEC methodologies and demonstration activities in Baihualing village, especially expert farmer demonstration, HH-ABA, agroforestry systems, and the four roles of the 'Farmers' Association for Biodiversity Conservation'. These are:

- to coordinate biodiversity conservation and sustainable rural development;
- to create a bridge between government departments (State Nature Reserve) and communities, and between projects and farmers;
- to organize training courses for practical management techniques of agriculture and biodiversity conservation; and
- to identify expert farmers in agrobiodiversity management and take an important role in the organization of demonstration activities.



Mapping community forests

## Enthusiasm for PLEC continues in northern Ghana

G. Kranjac-Berisavljevic<sup>1</sup>

PLEC work started in northern Ghana in 1995, 2 years after the other areas of Ghana. Work centred on the response of smallholder farmers to environmental change. Participatory approaches were used at all times during the project life, where the scientists and farmers worked hand in hand to find solutions to problems of agro-biodiversity conservation in the face of a multitude of natural and social transformations. The PLEC approach is strongly rooted in local knowledge and is an effective way of achieving sustainable natural resource management.

### Achievements by the end of the first phase

The PLEC project in northern Ghana included many field activities, centred at two main demonstration sites, Bognayili-Dugu-Song at Tolon/Kumbungu District in the Northern Region and Nyorigu-Gore in the Bawku East District of the Upper East Region. The main work at both sites included the establishment of community tree nurseries with local tree species and medicinal plants, management of watersheds by stone bunding, and tree planting for community and individual woodlots. Economic activities included bee-keeping, cotton spinning and weaving, and woodlots harvested using coppicing. Collection and management of traditional crops, such as yam and rice, was carried out to conserve varieties of these important species from extinction. Social analyses of demonstration sites were undertaken, and a database was developed to compare these sites and their environmental management practices with others within and outside the north Ghana environment. Several workshops, training programmes and other activities were also carried out during the first phase of PLEC.

### Farmers' Associations continue to grow

The expectation of the communities that participated in the PLEC work in northern Ghana is that the project will continue, and even spread into communities where it was not active before. Recent examples (2003 growing season) of this positive attitude include community members from Kumbungu area, in Tolon/Kumbungu district, coming to visit the PLEC demonstration site at Bognayili-Dugu-Song and expressing interest in forming their own PLEC CAMP Association<sup>2</sup>.

The number of members in existing groups has increased (see Table 1), even though funding is not existent at present. This is due to the farmers from neighbouring communities coming to join the already formed groups. Neighbouring individual farmers have also noticed that

social benefits (construction of boreholes, KVIPs<sup>3</sup> and other social amenities) are to be obtained after forming organized PLEC associations and participating actively, and therefore they join the groups.

The team found only one group, at Kusanaba in the Upper East Region, that had dissolved. This was the newest group to join PLEC activities and it is possible that the group cohesion in this particular case was not sufficiently established to carry the group through the interim period.

### Biodiversity conservation sustained

#### Rice

The rice types studied and collected during the project have been maintained by the women groups. From an initial number of about 11 rice types, the women have been able to increase their stock to 18 varieties actively cultivated at present. The conservation activities are particularly vigorous in the Bawku East District at Gore, Nyorigu and Narongo communities.

#### Yam

About 23 yam types were originally identified and collected at the demonstration farm of the main demonstration site at Bognayili-Dugu-Song. A committee drawn from the association is responsible for the organization and maintenance of a 'seed' bank. The committee members are from the interested communities within the demonstration site. At the end of the 2002 cultivation season (October 2002), the seed bank had about 25 yam types. However, very dry and unfavourable weather conditions in the 2002/2003 dry season have caused the loss of some yam types. The farmers' committee was actively working on the

Table 1 Membership of PLEC Farmers' Associations

Village	Membership 2002	Membership 2003
<b>Mens groups</b>		
Dugu	34	40
Song	30	30
Bognayili	22	30
Wayamba	26	28
Bihinayili	27	29
Koblimagu	42	42
Gbullung	15	20
<b>Total</b>	<b>196</b>	<b>219</b>
<b>Womens Groups</b>		
Gore (Gore Bawku West)	72	75
Narongo (Gore Bawku East)	50	50
Nyorugu (Gore Bawku East)	48	48
Bognayili-Dugu-Song	26	50
<b>Total</b>	<b>196</b>	<b>223</b>

1. University for Development Studies, Tamale, Ghana

2. Collaborative Agroecosystems Management Project

3. Kumasi ventilated improved pit latrine

acquisition of the lost types from the surrounding area in order to re-establish the collection in the 2003 cultivation season.

### **Exchanges of plant materials**

The farmers' association of PLEC-CAMP at Bognayili-Dugu-Song has been involved in the exchange of yam planting materials with communities near Yapei (on the shores of White Volta River). PLEC Associations at Nyorigu and Narongo have been involved in the exchange of rice types with Kologo community.

### **Composting**

After the initial efforts at demonstrating the benefits of composting for the soils at Bognayili and Dugu, almost every compound house within the main demonstration site now has a compost pit and is applying compost on their farms annually, during the land preparation stage. About 4 communities are involved in this activity on regular basis, namely, Dugu, Song, Bognayili and Bihinayili.

## **Progress in income-generating activities**

### **Beekeeping**

As part of the PLEC project, three bee hives were acquired and given to the community in the main demonstration site at Gbullung to establish a pilot income generating activity in 2001. This inspired other farmers in the community to start their own hives. The number of hives at present is six. The additional hives were acquired through the sale of honey.

### **Woodlots**

Over 20,000 tree seedlings of various types were transplanted at the end of February 2002 at the communities of the main PLEC demonstration site at Bognayili-Dugu-Song. Seedlings were distributed to the communities and to privately owned woodlots. Out of this number, an estimated 15,000 seedlings have survived the 2002/2003 dry season and become established. Some members of the PLEC CAMP association have planted individual woodlots, while other farmers in the demonstration site area who are not members of the association are emulating their example and are also establishing woodlots. The farmers

usually plant tree seedlings of economic trees among the field crops gradually establishing agroforestry systems.

### **Shea plantation**

A shea plantation of about 10 ha owned by two communities within the main demonstration site (Wayamba and Yoggo) was burned by bush fires, but restored through the efforts of PLEC-CAMP association in 2002. In the 2003 harvesting season in May, the communities were able to harvest shea nuts from the plantation for the first time.

### **Cotton spinning and weaving**

The cotton spinning and weaving womens' group celebrated its first anniversary in November 2002. The number of participating members is approaching 50. About 10 young women have been trained since the start of the programme, in batches of about 5 at a time because the group has only two wide looms. Trainees have to run shifts to have access to looms. Bognayili-Dugu-Song women's group is responsible for the training and has put in place a five member committee to run the training programme. Urgent support is needed if the activities of the group are to be sustained and enlarged.

### **Plant nursery**

The main nursery at Bognayili-Dugu-Song is actively producing new seedlings for members. The main tree species include dawadawa, shea and neem, while grafted mango is also produced in small quantities in response to requests by individual members. Grafted tree production has been made possible because of the training given to PLEC CAMP members in grafting and nursery management techniques.

## **Lessons learned through the PLEC project**

PLEC Farmers' Associations in Northern Ghana have remained active since the project ended in 2002 at both the main demonstration sites at Bognayili-Dugu-Song and the Gore-Nyorigu-Narango (see Table 2). For some groups, the number of farmers has increased, due to inflow from neighbouring communities. All the activities carried out by farmers, which characterized the PLEC demonstrations sites in the past are still on-going in anticipation that the work will endure and continue.

Table 2. Association meetings since the end of the of the UNU/GEF phase of PLEC, February 2002

Farmers' association	Time	Activity
Dugu, Bognayili, Bihinayili and Song	April-November 2002	Protection of main water source; dug out for domestic users, livestock and plant nursery use
Dugu, Bognayili, Bihinayili and Song	May-August 2002	Nursery and woodlot management practices
Gore and Nyorigu	June-July 2002	Inventory of new rice types
Dugu, Bognayili, Bihinayili and Song	June-August 2002	Inventory of yam types
Bognayili-Dugu-Song womens' group	November 2002	Anniversary of cotton spinning and weaving group
Gbullung	March 2003	Honey harvesting, precautions and safe handling of bees

PLEC work in northern Ghana shows a way to a lasting and sustainable farming structure and the relationship of farmers and researchers will definitely continue, since there is the interest from both sides.

### Links between the farmers' associations and outside

Villages of Dugu and Bognayili have received support from Village Infrastructure Project (supported by Government of Ghana together with World Bank, KfW and IFAD) for construction of two boreholes to resolve urgent drinking water problems in the area.

Assemblies of God, an NGO operating in the project area, has invited members of the PLEC-CAMP Association from Dugu for training at Damongo in the construction of KVIP toilets and the improvement of sanitation in the community. At present, almost every compound house in Dugu has constructed its own KVIP facility.

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 March – April 2003 and is expected to continue till August 2003.

The associations have provided valuable information, and help and support to the researchers in the organization of the field activities. The results of the initial data collection are currently being analysed in order to proceed with the establishment of 'good/ best practices' for particular crops (yam and rice) in the study area.

### Links with the University

Three students from the Faculty of Agriculture at the University for Development Studies have carried out research work during 2002 and 2003 in the PLEC communities as part of their bachelor theses. Their studies investigated composting effects on poor soils, use of



Yams at the northern Ghana demonstration site

organic manure, and the biodiversity status and perception of farmers regarding the threats to its maintenance in the Kpachi community in the Tolon/Kumbungu District. Methodology used for the assessment evolved from the work carried out at the main demonstration site at Bognayili-Dugu-Song.

### Details of theses

Mr Sualihu Alhassan. 2003 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. BSc thesis, Faculty of Agriculture, University for Development Studies, Tamale.

Ms Adjoa Xaxagbe. 2003 Soil fertility improvement by the use of traditional methods: use of dynamic kraals in village communities: case study Dugu in the Tolon/Kumbungu, District of the Northern Region of Ghana. BSc thesis, BSc thesis, Faculty of Agriculture, University for Development Studies, Tamale.

Mr George Prah. 2003 Agro biodiversity and small-scale farming: a case study at Kpachi in the Tolon/Kumbungu District of the Northern Region of Ghana. BSc thesis, BSc thesis, Faculty of Agriculture, University for Development Studies, Tamale.

## PLECserv

PLECserv, can be found at <http://c3.unu.edu/plec/index.html>. PLECserv provides an introduction to recent articles or other publications of interest to people working among developing-country farmers, and concerned about development with conservation. Issues appear twice in each month. Each issue provides the means of obtaining the publication and corresponding with the authors. Recent titles are:

15. Participatory sustainable land management stands the test of time
16. Escaping poverty: learning from those who have succeeded
17. China's farm economy again at the crossroads
18. Corn Culture, Dangerous DNA, and the consequences of "free" trade
19. Bunaji cattle to frizzle-feathered chickens: livelihood security for the rural poor.
20. The challenge of carbon trading: 6 years of a carbon project in Chiapas, Mexico

## Collaboration with Ecoagriculture Partners

Ecoagriculture encompasses 'sustainable agriculture and associated natural resource management systems that embrace and simultaneously enhance productivity, sustainability of production, rural livelihoods, ecosystem services and wild biodiversity conservation. Distinctive features of ecoagriculture are its focus on landscape-scale as well as farm-scale design and management of production systems.'

PLEC and Ecoagriculture Partners have established informal collaboration. PLECserv and *PLEC News and Views* are forwarded to the Ecoagriculture Partners list. Ecoagriculture Partners recently launched their new website at [www.ecoagriculturepartners.org](http://www.ecoagriculturepartners.org) which they are developing as 'a premier source of useful information on ecoagriculture' and communication tool for the organization. Information will be posted about conferences and workshops and upcoming events related to ecoagriculture.

## ILEIA - Call for contributions to LEISA magazine

ILEIA (Centre for Information on Low External Input and Sustainable Agriculture) is an independent organization with the mandate to contribute to poverty alleviation through the promotion of agro-ecological approaches. Their website is at [www.ileia.org](http://www.ileia.org) where details about the organization and back issues of LEISA magazine can be obtained.

The LEISA magazine is published quarterly and has 70,000 readers in 173 countries. The next theme for the magazine is: **Underutilised plant species** Issue 20 (1), March 2004

LEISA invites contributions of articles, suggestions of possible authors, and information about publications, training courses, meetings and websites related to this theme. Editorial support is provided by ILEIA. Authors of published articles are entitled to a standard fee of USD 75. Deadline for contributions is 1 December, 2003.

### About the theme

Many underutilized species are particularly useful in marginal lands where they have been selected over generations to increase productivity and withstand stress. They contribute to biodiversity and sustainable production and usually require less external inputs than high yielding varieties. Many rural people and development organizations have recognized the importance of these underutilized and neglected species and have successfully increased their production and utilization, thereby improving livelihoods, providing more options to small farmers and increasing diversity within the agricultural system. This next issue of LEISA will present some successful cases and they invite articles on experiences with revival, conservation, cultivation, utilization and marketing of underutilized plant species. Further details can be obtained at [www.ileia.org/2/papers.html/papers.html](http://www.ileia.org/2/papers.html/papers.html).

**People Land Management and Ecosystem Conservation (PLEC)**, a UNU project, involves a collaborative effort between scientists and smallholder farmers from across the developing world to develop sustainable and participatory approaches to conservation, especially of biodiversity, based on farmers' technologies and knowledge within the agricultural systems of the farmers.

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Editors: Harold Brookfield at [harold.brookfield@anu.edu.au](mailto:harold.brookfield@anu.edu.au) , or  
Helen Parsons, [helen.parsons@anu.edu.au](mailto:helen.parsons@anu.edu.au)  
Department of Anthropology  
Research School of Pacific and Asian Studies  
The Australian National University  
Canberra, ACT 0200, Australia  
fax: (+61-2) 6125 4688.

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