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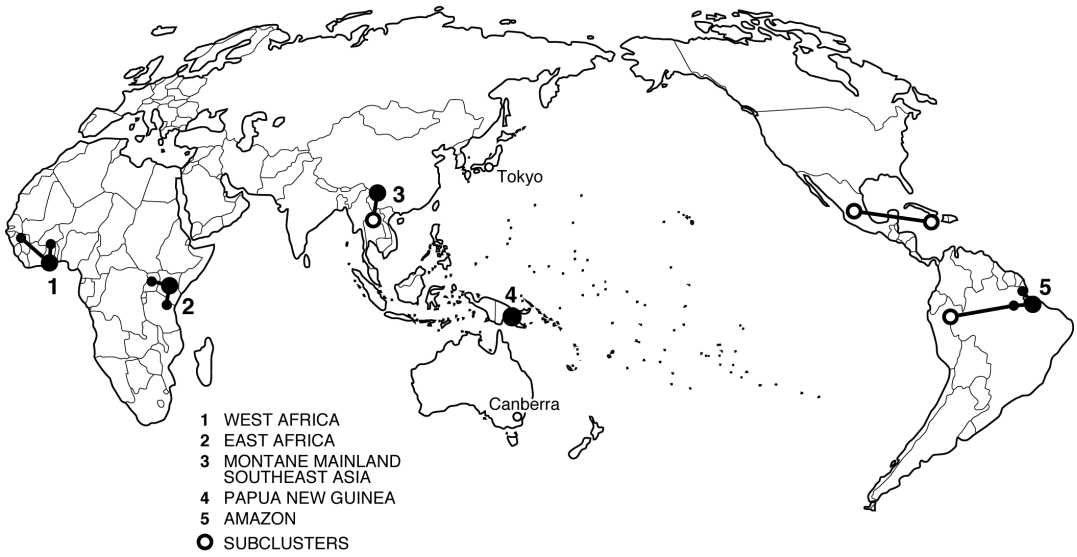

The Clusters of PLEC

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P L E C N E W S A N D V I E W S

No. 11, NOVEMBER 1998

PRINCIPAL SCIENTIFIC COORDINATOR'S REPORT

A SHORT REPORT

Harold Brookfield

Introduction

The reporting section of *PLEC News and Views* in this issue is shorter than is normal, in order to make way for an unusual number of papers. This is very much a move in the right direction, and it may be that we shall have to enlarge the size of each issue if the flow of offers is sustained. 'News from the Clusters' is omitted, but a more extended section will appear in the next issue, based on the February reports of the first full year's work within the GEF.

The first six months under GEF funding

PLEC within the GEF programme began officially on 1 March, but we did not know this until mid-March, and funds did not reach Tokyo until 13 April. Before mid-May, all but one Cluster contract for fiscal 1998 (until the end of February 1999) had been written. Signature and counter-signature took longer, and most Clusters did not get their funds until sometime in June. Although some were able to start earlier, using borrowed funds, the half-year on which work had to be reported at the end of August was shortened to only about three months for most parts of PLEC.

Despite this hold-up, the momentum carried forward from the Preliminary Phase ensured some rapid progress. Most demonstration sites are now selected, and a lot of site-characterization work has been done. A total of 21 demonstration sites is now listed, and in about half of these, collaborative work with farmers and their associations has already commenced. Most of the Clusters have held planning meetings during the first half-year.

The Management Group

The Management Group of Cluster Leaders and Coordinators, enlarged during this first GEF year to include sub-Cluster leaders and leaders of the non-GEF sub-Clusters, met twice. A short meeting was held at Mbarara, Uganda, during the Workshop there in late-March, and a major meeting took place in Tokyo on 2–4 July. The latter meeting discussed almost all aspects of PLEC work in considerable detail, and a lengthy Record has been produced and distributed to all participants. Questions of financial management alone occupied the whole of one day, and a second day saw discussion of several substantive issues, especially on the collection and processing of biodiversity information. Several decisions taken by the Management Group have already been implemented. It was not possible to arrange a first meeting of the Advisory Group within the stipulated 120 days after commencement, but a successful meeting

was held at UNESCO in Paris on 11 September.

Regional meetings and advisers

The regionalization of PLEC is already reflected in its pattern of meetings. An Asia-Pacific meeting in late 1997 was followed by use of the general International Workshop at Mbarara in April to bring together as many African members as possible. An American region meeting has been held in November. The West African regional workshop, in Ghana, from 1–5 September, also had representatives from the East Africa Cluster. A short report on this meeting appears below.

Dr Uzo Mokwunye, Director of UNU/INRA in Ghana, has been regional adviser for Africa for some time, and has been instrumental in leading two successful meetings of African members. In mid-1998, Dr Adilson Serrão became regional adviser for the American region, and Dr Kanok Rerkasem for the Asia-Pacific region.

Overcoming problems

PLEC had a lot to do in its first six months. The appointment of a Managing Coordinator became urgent. Liang Luohui joined UNU in April, and before joining attended the International Workshop in Uganda. A note about him appears on page 6. Very creditably, all Clusters and their sub-groups prepared reports, and sent them to Tokyo, within the stipulated time, but the format provided to them for reporting needs to be improved. We also need to improve a number of other procedures for smoother management of project business.

We had to overcome problems of leadership in two Clusters. Dr Romano Kiome took over management of the Kenya sub-Cluster as well as the East Africa Cluster as a whole. Mr John Sowei became leader of the Papua New Guinea Cluster in June, after a period of interim leadership following the departure of Mr Thomas Nen at the start of the year.

Biodiversity Advisory Group

Steps had to be taken to obtain greater comparability of PLEC methodology between Clusters, and to accelerate work where it had lagged. Two of the Scientific Coordinators (Brookfield and Stocking) produced a 'guidelines paper' in July on the analysis of agrodiversity. The Tokyo meeting of the Management Group took note of three rather different approaches to biodiversity survey within the project, and resolved to set up a small **Biodiversity Advisory Group** (**BAG**) to describe and relate these. It will ensure that all meet scientific standards, and provide assistance as required. Dr Daniel Zarin was appointed Convenor of BAG in August. Other members, invited to join in October, are Professor Guo Huijun (China) and Dr Lewis Enu-Kwesi (Ghana). The group will meet in Yunnan in January 1999. In East Africa, the Cluster sought the technical assistance of Dr Anna Tengberg to complete its work on site characterization, especially of biophysical diversity. Dr Tengberg did this work in October-November.

THE MEETING IN GHANA IN SEPTEMBER

The West Africa Cluster held its quasi-annual workshop at Koforidua, and in the demonstration-site villages of Gyamfiase, Amanase-Whanabenya and Sekesua-Osonson from 1–4 September. A formal report on the meeting is not yet available. This summary is derived from the report by Brookfield, who attended the meeting. Over 60 people attended the main sessions in Koforidua, and many more attended the village meetings. Those present included five members of the Guinea sub-Cluster (one of them a farmer) and two from East Africa, Joy Tumuhairwe and Barak Okoba. About half of those attending the main

sessions were Ghanaian farmers, including some from the groups near Kumasi (Jachie and Tano-Odumasi) and Tamale (Manga-Bawku and Tolon), as well as from southeastern Ghana.

There was only one formal day, at Koforidua. Dr Edward Ayensu, who first encountered PLEC in 1994, was in the chair. A formal address was given by the Deputy Minister of Agriculture, Mr Acheampong, and papers or statements were presented by members of the Cluster. There were short presentations also by the visitors, Tumuhairwe, Okoba, Brookfield and Mokwunye. Discussion of the forward work plans of the several groups was particularly lively and went on for a long time. After the end of business, participants inspected some very good poster presentations, and there was a Workshop dinner, with excellent entertainment.

The second day was spent at Gyamfiase, WAPLEC's oldest demonstration site, and the centre of its Collaborative Agroecology Management Project (CAMP). There was a 'durbar' opened by the Deputy Minister of Lands and Forestry. Proceedings then included statements by the secretary of CAMP and others, a question-and-answer session, and two entertainments together with a 'PLEC play' spontaneously produced by the villagers, on a tree-planting theme. We visited a demonstration 'agrodiverse farm' which included a number of now-rare cultivars, 'income-generating farms', and the conservation and planting of useful trees on farmers' land. We visited the tree-crop nursery that has been established. We saw the new firebreak around the Gyamfiase forest grove itself, and conservation measures such as stone lines and grass strips on sloping land. There is also revival of home gardening to enhance food security. From an initial emphasis on conserving the forest grove, CAMP is now evolving into a widening project aimed at creating an improved agroecosystem over a larger area.

Members of the Workshop inspecting a demonstration farm at Gyamfiase

On the third day we visited two new demonstration-site villages, both formally set up only in 1998. First was Amanase-Whanabenya, where we spent most of our time on the core farm of PLEC's principal collaborator, Mr Eswai Freeman. Here two hectares of secondary forest has been allowed to develop beyond the stage at which it would have been cut down in the past, and is becoming significantly more diverse in its composition. There are also several working plots on and near Mr Freeman's land. The community had assembled an excellent exhibition of endangered species. They also provided a remarkably lively and skilled cultural entertainment. The people of this community have even produced a WAPLEC T-shirt.

After lunch, we drove to Sekesua-Osonson, where farmers were very keen to take us to widely-scattered field plots and woodlots. Unfortunately, there was insufficient daylight time to see all that they wanted to show us. At the end of the afternoon we went onto the hill above Osonson, which is heavily eroded. There was another very good exhibition of endangered species, and we were given a delicious meal of food made from traditional plants, nowadays rare. After return to Koforidua, well after dark, an 'Africa meeting' was held, chaired by Mokwunye. This meeting covered a lot of ground, and in particular stressed the value of exchanging expertise between the African groups, and the need to develop common methodologies.

The 'PLEC play' at Gyamfiase: the 'good' family agrees to plant trees on its farm

On the final day, we first went to Akuse on the lower Volta (organic bananas on a commercial plantation), then to the Akosombo dam and onto a ship for a Volta lake cruise. Most time while we were aboard was taken up by concluding speeches, especially by two of the farmers' leaders, Eswai Freeman (Amanase) and Cecelia

Osei (Jachie, near Kumasi). A representative of the Minister of Environment closed the meeting.

My own visit did not end there. Together with the Guineans, I was taken to the mouth of the Volta, to an aquaculture site, then to an Ewe village, Anloga, where there is intensive commercial agriculture using heavy manuring and hand watering on sandy swales between old dune lines. Then on Monday, accompanied by the newly appointed research and managing assistant to the Cluster, Mr Ben Ofori, I went to Kumasi, where Dr William Oduro took us that afternoon to the new, but very active site at Tano-Odumasi. Next morning we visited the older site at Jachie, where a group of women farmers, numbering only 14 in 1996, now has 92 members. In both places, villagers took us to a variety of gardens, some having considerable agro-biodiversity. The strongly practical orientation of the Ghana work, both from Legon and from Kumasi, is clearly an important element in its success.

AN AMERICAN REGION MEETING

From November 6–9, a meeting of PLEC participants in the Amazonia Cluster and the sub-Clusters in Peru, Mexico and Jamaica, was held at Portland, Jamaica, with one day at the field sites of the Jamaica sub-Cluster and one day of presentations and discussions on methodology. Associate Scientific Coordinators Christine Padoch and Michael Stocking attended this meeting, together with leaders, participants and students from the American region groups. A report will appear in the next issue of *PLEC News and Views*.

PRESENTATIONS RELATED TO PLEC

Associate Scientific Coordinator Michael Stocking represented PLEC by UNEP invitation at the fourth meeting of the Conference of Parties (COP4) to the Convention on Biological Diversity. This meeting was held in Bratislava, Slovakia, in May. Michael Stocking's paper was entitled 'People, Land Management and Environmental Change – PLEC – and Agrodiversity'.

Following the Management Group meeting in Tokyo, he went to South Africa to present a keynote paper at the South African Communal Rangelands Symposium held at Fort Hare, 6–11 July. In a paper entitled 'Measuring and assessing the impact of soil erosion: the particular challenges of communal rangelands in Africa', he introduced PLEC methodologies, and generated considerable interest in the project.

Before the American region meeting in Jamaica in November (described above) he visited the Mexican group at Toluca, and gave two presentations, one on 'Agrodiversity' and one on 'Field assessments of soil degradation'. He and other participants addressed MSc students in Natural Resource Management at the University of the West Indies in Kingston the day before the PLEC meeting.

Harold Brookfield and several members of the Papua New Guinea Cluster attended a three-day 'Agricultural Intensification Workshop' in Canberra from 4–6 November. The Workshop was organized by the Mapping Agricultural Systems [in PNG] Project, and by the Resource Management in Asia-Pacific Project, both based at the Australian National University. PLEC members presenting papers were Bryant Allen ('Scope and objectives of the Workshop', and 'Relationships between agricultural intensity and crops, fallows, population density and agricultural technology in PNG'), Michael Bourke ('Recent changes in staple crops and impacts on agricultural systems'), Taro Yamauchi ('Nutrition and energy expenditure of women under conditions of environmental stress: agricultural intensification in a poor environment') and Harold Brookfield

('Intensification, and alternative approaches to agricultural change'). Geoff Humphreys was among the discussants.

COMING UP IN THE NEAR FUTURE

From 25–29 January 1999, there will be an International Conference on Land Degradation held at Khon Kaen, Thailand, organized by the Thai Department of Land Development. A keynote paper to a section on Biodiversity and Food Security will be given by Michael Stocking and Anna Tengberg. The title will be 'Land degradation, food security and biodiversity: examining an old problem in a new way'.

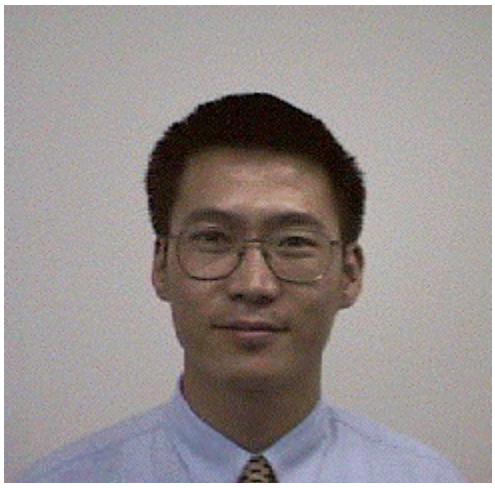
The China Cluster will hold its annual meeting in Kunming on 29–30 January 1999. Before this, the Biodiversity Advisory Group will meet, largely in the field, from 20–28 January. Brookfield, Liang, Rerkasem, Humphreys and (for part) Juha Uitto will also be present.

PROFILE OF LIANG, LUOHUI MANAGING COORDINATOR, PLEC

Mr Liang writes about himself:

I was born and grew up in Xishuangbanna, Yunnan Province, China. Xishuangbanna Nature Reserve is one of the largest nature reserves, a well-known tropical ecosystem in China. Two of the demonstration sites of the China Cluster are located in Xishuangbanna, not far from my birth place.

I earned my B.S. from Beijing University, in Geography (1984), my M.S. from the Chinese Academy of Sciences, in Geography (1987), and my Graduate Diploma in Land Use Planning from the



School of Urban and Regional Planning at the University of the Philippines (1993). I was an Honorary Research Fellow in the Department of Land Economy at the University of Aberdeen in Scotland for a year during 1995–1996.

Before joining the UNU, I had been a land-use planner with the Land Management Bureau of Yunnan Province for 11 years from 1987 to 1997. With my former colleagues, I used to lead pilot projects on land use planning in Yunnan, prepare guidelines, provide advice for local governments and researchers. My job included evaluating local land use plans before they could be adopted by government. The central issues in land use planning in Yunnan are unsustainable conversion from agricultural land to urban land, and from forest land to agricultural land. As a land use and tenure specialist, I participated in the work of the China Cluster of PLEC whenever possible.

I formally assumed duty as the Managing Coordinator in April 1998. Thank you very much for your cooperation and understanding during the past half year. I am looking forward to more interaction with all of you in the future.

Liang, Luohui
UNU, Tokyo

PAPERS ON DEMONSTRATION SITES

Editorial Note

The day-long symposium at the Mbarara meeting in April 1998 gave all present a good idea of what work in demonstration sites is about, and why it is central to the objectives of PLEC. Two of the substantive papers given on that day were printed in the last issue (*PLEC News and Views* 10, May 1998). These were (1) Miguel Pinedo-Vásquez and Mario Pinedo-Panduro: 'From forests to fields: incorporating smallholder knowledge in the camu-camu programme in Peru', and (2) Edwin A. Gyasi: 'PLEC experiences with participatory approach to biophysical resources management in Ghana'.

Four more papers on demonstration site work are printed below. The first is a methodological statement reflecting closely what Christine Padoch said as chair of the Mbarara symposium. The other three offer examples of work done and being done, coming from Amazonia, Mexico and Guinea. The papers are followed by extracts from reports by Ghanaian farmers to the leaders of WAPLEC, presenting their viewpoint on what is going on.

The strongly practical orientation of demonstration site work emerges very clearly, as does close collaboration with expert farmers, two of whom are joint authors in the paper from Guinea. Each case is different, reflecting what Christine Padoch and Miguel Pinedo-Vásquez write below, that 'there is no one correct way for all PLEC groups to engage in demonstrations'. The editors hope that the papers and notes that have now appeared on demonstration site work will prompt others to share their own experiences with the readership of *PLEC News and Views*.

DEMONSTRATING PLEC: A DIVERSITY OF APPROACHES

Christine Padoch and Miguel Pinedo-Vásquez
Amazonia Cluster

PLEC is not just a project about diversity; it is a project that thrives on the diversity of its participants and its constituent Clusters. The work of all PLEC groups focuses on the goal of helping farmers develop and conserve productive, sustainable, and biodiversity-rich agricultural, agroforestry, and forest management systems. We have each mapped a somewhat different path to that goal, and have advanced at different rates toward our common objective.

Several PLEC groups, including the Amazonia, China and West Africa Clusters, have long concentrated on demonstration activities. They have facilitated farmers' visits to regions, households, and plots where particularly expert villagers presented and explained their successful practices; they have promoted meetings among farmers and technicians; they have arranged conversations between policymakers and producers where the latter were not just listeners but teachers too; they have set up community nurseries; and they have aided farmers to form groups through which they may increase their knowledge and realize other production goals. Meanwhile, some other PLEC Clusters have concentrated on

doing the research necessary to identify the practices and the practitioners that will be important to their demonstration activities in the future.

Funds from the GEF have enhanced greatly what PLEC can accomplish. These funds also obligate all the Clusters to move in the direction of a common timetable and set of activities. All Clusters will be setting up demonstration activities in the coming months. The directive to synchronize our schedules and adjust some of our work does not, however, put an end to the flexibility and diversity that our project has fostered and benefited from. It would be foolish not to use the experience of some of our PLEC colleagues and apply many of their successful practices. But there is still the expectation that Cluster work will continue to be diverse, dynamic, flexible, and site-specific.

No one correct approach

There are ways of setting up demonstrations that would be wrong for any Cluster and in any setting, but there is **no one correct way** for all PLEC groups to engage in demonstrations. Limiting demonstration activities to an experimental plot set up at a research station, that is remote to villages and fenced against the intrusion of farmers, is not the PLEC way. But establishing any number of experimental plots in villages, on household lands, on community property, on nearby land owned by some entity that welcomes farmers' visits—these all might well be integrated into a demonstration programme.

A formal meeting where PLEC personnel present an agenda that farmers must follow is not an acceptable demonstration activity. Meetings large or small, of men, of women, of children, of landholders and labourers, or all-inclusive meetings held in the village, in the field, or at an accessible research station, all can be acceptable PLEC activities as long as they allow and encourage two-way exchange of information, learning, and benefits.

Many options are available to most PLEC Clusters in choosing what to feature in demonstration sites or demonstration activities, and whom to involve in making those choices and in carrying out the program. Based on our own experiences in PLEC work with the Macapá (Brazil)-based sub-Cluster of the Amazonia group, we can offer a few suggestions that other Clusters might consider.

Demonstrating PLEC in Amazonia

Our first major tasks in setting up our demonstration work were to identify the farmers with whom we wished to work closely, as well as the good practices we wanted to promote in the area. This work was begun during the research phase. As already discussed in an earlier article by Pinedo-Vásquez in *PLEC News and Views* (1996) we looked (and continue to look) for 'local experts': those farmers and forest managers who are exceptionally innovative, insightful, curious, observant, analytical, and successful. We looked especially for those farmers who put their expertise into patterns that combine superior production with preservation or even enhancement of biological diversity in their fields. These experts were often difficult to identify. They are not the same farmers who usually participate in development projects. They are not often those who are eager to try any 'modern' technology that is offered to them. They are frequently reluctant to discuss or even disclose their own methods. They are not the 'good, compliant' farmers other projects seek out. For our demonstration activities we need good teachers, not just good listeners.

The local experts and their insights and experience are our most important assets. They are the teachers and demonstrators; we are facilitators. We chose several experts at each of our sites in the floodplain villages,

including some women. We also selected some specialized management practices that we had observed and felt are important to make better known to local farmers. Prior to beginning any demonstration and dissemination activities, however, we consulted with both the particular farmers who had developed or were using these techniques, as well as with the group of experts.

One of our important and ongoing demonstration foci is the production of bananas using the *banana emcapoeirada* agroforestry system. This is a system that we identified several years ago as a very effective way of maintaining production of bananas in the face of a devastating epidemic of mokko disease. A husband and wife team who live in the small village of Igarape da Lontra in the PLEC Ipixuna site had been working successfully with this system. We first turned to them to inquire whether they would be willing to share their knowledge, insights and experience with other small farmers. After getting a positive response, we brought together ten of our experts from various villages to the Ipixuna site for three days. The local expert agroforesters invited the expert group to stay in their house. Each day the group accompanied the farmers to their fields, worked with them, and spent each evening in their house discussing their observations, experiences and any doubts.

As facilitators we accompanied the whole process; we also arranged for all transport, supplied all food and refreshments and paid our experts a modest stipend. Upon return to their villages, the experts disseminated their new knowledge well. In the three years since we carried out this demonstration the *banana emcapoeirada* agroforestry system has become widespread, and banana production has increased substantially in the region.

Another successful demonstration activity we carried out involved technologies and cassava varieties appropriate for low-lying areas prone to tidal inundation. Working closely with a farmer noted for his success in producing crops on these difficult lands, we again helped make locally-developed specialized knowledge more widely appreciated. In this case, we first called together a meeting of experts to evaluate the technology and the unusual varieties the farmer employed. When the assembled experts had expressed their enthusiasm, we arranged a demonstration meeting in a local church that was attended by hundreds of local farmers as well as agricultural research technicians. The techniques and varieties that were demonstrated at that meeting and subsequent discussions are now much more widely known and the technicians are working to improve the varieties further.

The above are just a few of the approaches to furthering PLEC goals that we have used. Certainly not all of our planned activities have proved successful, but relying on our 'local experts' for advice and teaching continues to be central to our activities. We are still working on new ideas and new plans. As we spend more time getting to know the farmers, the experts, and the region, we expect greater success. The key has been working as closely as possible with the farmers and forest managers on their properties. We believe that each Cluster should select at least one person to dedicate his/her time to interacting very closely with farmers. As we stated before there is **no one correct way** to conduct successful demonstration activities. We have found that it is simply not possible to carry out any successful demonstration from a comfortable research station, office, or home in the city.

Reference

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1996 Local experts and local leaders: lessons from Amazonia. *PLEC News and Views* 6: 30–32.

RESTORATION OF FLOODPLAIN LAKE HABITAT: A PLEC DEMONSTRATION PROJECT[1]

David G. McGrath[2] **and Marcelo Crossa**[3]

[2] Professor NAEA, Universidade Federal do Pará, and Coordinator Varzea Project, IPAM
[3] Coordinator Lake Management Program, Varzea Project, IPAM

Introduction

In the second phase of PLEC, the emphasis is on shifting from research on smallholder resource/land management to extension oriented activities. The aim is to promote the adoption of the sustainable resource use practices and systems that have been identified and tested in earlier phases. Demonstration projects are the principal vehicle through which PLEC intends to promote the diffusion of more sustainable management practices based on smallholder knowledge of local resources and their use.

The Varzea Project is part of the PLEC Amazon Cluster and has been studying smallholder management of floodplain lake fisheries and the factors contributing to the degradation of the varzea resource base. Over this period we have accumulated considerable information on the patterns of resource use and their environmental impacts which should enable development of management strategies to address the problems of resource and habitat degradation on the Amazon floodplain. During the last year, we have begun working with a small group of farmers to develop a project that strives to restore floodplain lake habitat, with the objective of increasing the productivity of lake fisheries.

This floodplain initiative differs from demonstration projects in other PLEC Clusters. Rather than individual smallholder management systems, this project involves the collective management of common property resources by a group of smallholders. We describe here the demonstration project and the activities that have been developed over the course of the first year of project implementation. In addition, we identify the main problems that have arisen, and discuss what seem to be the major issues relevant to this type of resource management system.

It is important to emphasize that this project is a new initiative for us, and that we, together with the participating smallholders, are learning as the project develops. Based on our evolving experience as part of the Amazon Cluster, we would argue that the demonstration project is not so much a product as a process. We are concerned with building smallholders' capacity to use their knowledge of local ecosystems to develop appropriate solutions to the management problems they encounter.

The demonstration project has three interrelated characteristics:

- it is an experiment through which smallholders develop solutions to local resource management problems which they have identified as critical;
- the demonstration project seeks to show not only what can be done, a particularly promising approach to the management of local resources, but also the steps/procedures involved in developing the management system,

[1] The project described in this report is supported with funds from UNU/PLEC and WWF/DFID.

- through participation in the demonstration project, smallholders develop the capacity to implement the system, adapting it to their needs and local conditions. In the context of our work with the management of common property resources, a fundamental dimension of this developing capability is the capacity to work together to address collective management problems. In the following sections we discuss different aspects of the overall process of developing and implementing a demonstration project that has these three major components.

This is only the first year of a long-term effort whose results will only begin to become evident over several years. However, we feel it is important to begin now to evaluate our experience, so that through this process we can identify problems and make adjustments: and also stimulate a broader discussion within PLEC of the nature of demonstration projects and how they will contribute to the attainment of PLEC's overall objectives. We look forward to the comments and suggestions of our PLEC colleagues, and hope that this discussion of our work will encourage others to relate their own experiences in dealing with the kind of smallholder management issues that are the central concern of PLEC.

The problem: degradation of floodplain lake habitat

While the lower Amazon varzea or floodplain has been fairly densely settled (by Amazonian standards) since pre-Columbian times, the major habitat modifications have occurred fairly recently. The major landscape changes began in the 1940s and 1950s with the introduction of commercial jute production which spread rapidly throughout the varzea. The preferred site for jute cultivation was the forested levees bordering the river, and over the next three decades virtually all the mature forest of the low Amazon floodplain was cut down to plant jute. Jute farming collapsed in the 1980s and since then the forest vegetation of the levees has begun to grow back.

Unfortunately, the decline of the jute coincided with the expansion of cattle and more recently water buffalo ranching. Cattle ranching grew rapidly during the 1980s due to two developments: transportation innovations which made it feasible to move large numbers of cattle on the floodplain during the low water season, since it is no longer necessary to maintain them in raised corrals or *marombas* during the flood season. Cattle ranching, from small to large scale, is now the dominant land use on the varzea. Burning and overgrazing, associated with cattle raising, are transforming floodplain vegetation. The result of burning and grazing is that unpalatable grasses such as *murim* now dominate higher elevations that were once forested, while aquatic macrophyte coverage of lake surfaces has been drastically reduced.

The effects on varzea fisheries have been equally dramatic. Because of the long slow rise and fall of the river, an intimate relationship between floodplain forest and fish populations has evolved. Fruits, nuts and forest invertebrates are an important food source for fish, including many of the most valuable species. At the same time, aquatic macrophyte communities are an important substrate for algae and aquatic invertebrates, and consequently an important nursery habitat for larval and juvenile stages of many fish species. Thus, floodplain vegetation is critical to the productivity of lake fisheries, and the habitat destruction associated with cattle and water buffalo ranching is considered to be the single most important threat to floodplain fisheries.

Reversing this process of degradation will be difficult. The floodplain is treated as a commons open to all local residents. Properties are not fenced and cattle roam at will. Few communities have rules limiting how many cattle residents can graze on floodplain pastures. Burning is also a common practice. Not only is it part of the traditional range management system, but

clearing out is also done by those afraid of snakes or searching for turtle eggs. There is no tradition of fire suppression so fires are allowed to burn until they die out.

The Aracampina demonstration project

The demonstration project described in this paper is a participatory management project which has the objective of increasing the productivity of lake fisheries by restoring forest and aquatic vegetation.

Site

The project is being developed on an eleven hectare site which includes a section of a small lake used for subsistence fishing during the low water season. The lake is on the island of Aracampina which is located in the main river channel in front of the community of the same name on the island of Ituqui, three hours downstream from Santarém (Figure 1). The island has suffered the same combination of overgrazing and burning described earlier, so that the normal successional processes have never been allowed to proceed. As a result, a *murim* grassland now dominates island vegetation and there are only a few scattered clumps of trees. The island is used by 31 families, approximately half of the community of Aracampina. Virtually all these families fish in the island lake, which is regarded as an important subsistence fishery in the dry season. Three-fourths of the families also plant on the island, and about half the families pasture their cattle there during the low water season (Table 1). Many families also collect turtles and turtle and duck eggs on the island during the low water season.

Table 1 Use of island resources by 31 Aracampina families

Activity	*N*	*%*
Grazing cattle	15	48
Total number of cattle on the island	178	
Cutting grass for fodder	6	19
Planting	23	74
Fishing	29	94
Collecting turtle and duck eggs	18	58
Hunting	4	13
Total number of families who use island resources	31	

The island was the focus of a land conflict between the community and a local rancher who tried to take over the island and expel local smallholders. After a protracted legal battle, the community obtained legal recognition of its ownership of the island. Those community members who were most actively involved in the conflict were concerned that if they did not develop more productive uses for the island than grazing their cattle, they would lose ownership to other ranchers in the future. The group sought out the Varzea Project staff to work with them to develop a project to justify their claim to the island. Their struggle for ownership of the island has been important to the formation of this group, which calls itself Grupo Renascer (reborn).

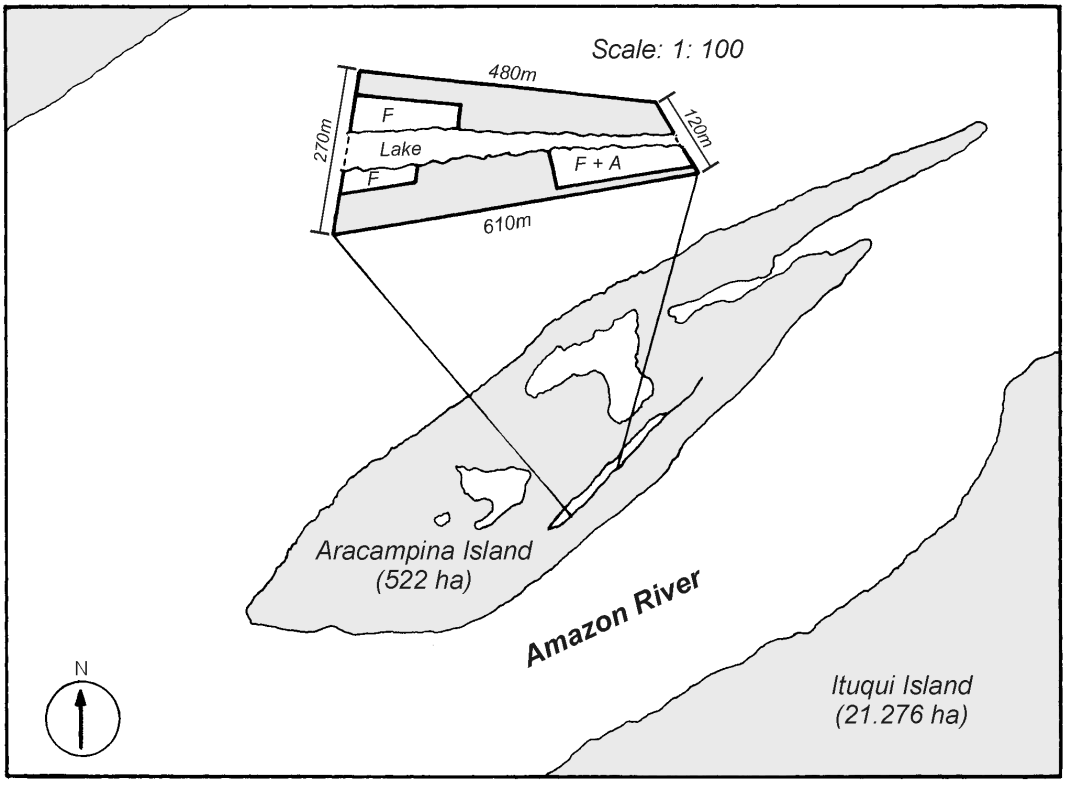
The project

The project was developed over several months during which the group met regularly with project staff to discuss what they wanted to do, and the nature of their partnership with the project. The overall objective of the

resulting project is to improve the productivity of fishing in the most important of the three small lakes on the island through the restoration of lake habitat.

We have referred to this as a habitat restoration project, but strictly speaking it is not a project to restore natural habitat. The intent here is not to recreate the species composition of the original forest vegetation. Rather it is to create levee forests which are rich in species that produce fruits, nuts and seeds consumed by fish. In this sense, the kind of habitat we are working to create is closer to what Goulding has referred to as 'fish orchards' than to a natural forest. The overall goal is a managed landscape, not a natural one, in which the management objective is to increase the productivity of lake fisheries.

The first step was the demarcation of the study area. An eleven hectare rectangular area including both sides of the lake was selected, and a barbed wire fence constructed to protect the area from cattle (Figure 1).



Note Planted area: F forest
F+A forest + agriculture

Figure 1 Study site Aracampina Island

The project has four components including:

- *reforestation*

  The objective of reforestation is to improve fish habitat through the planting of species which are important sources of food for fish. After much discussion, eleven species were selected for the first phase (Table 2) including camu-camu, seedlings of which were obtained through the efforts of PLEC Cluster member Mario Pinedo of Iquitos, Peru. The plan is to reforest the levees bordering the lake over a three year period. Targets were established for the number of seedlings to be planted of each species during the first year. Seeds of each of the other ten species were collected by group members and a 'viveiro' constructed for seedling production. Planting was undertaken in three phases over the course of the first year. Two areas were planted prior to the dry season and a third area several months later at the beginning of the rainy season;

Table 2 Species selected for reforestation

Common Name	*Scientific Name*	*Family Name*
Adão**		Gen. Indet.
Bacuri	Rheedia brasiliensis	Guttiferae
Catauari	Crateva benthamii	Capparidaceae
Ingá Xixica	Inga rubiginosa	Mimosaceae
Jará**		Gen. Indet.
Loiro	Nectandra amazonum	Lauraceae
Munguba	Pseudobombax munguba	Bombaceae
Socoró	Mouriri guianensis	Melastomaceae
Taperebá	Spondias lutea	Anacardeaceae
Tarumã	Vitex cymosa	Verbenaceae
Uruá	Cordia sp.	Boraginaceae
Camu-camu*	Psidium sp.	Myrtaceae

* species is not native to the floodplain in the Santarém area but does occur on clear water tributaries in the region.

** have not yet determined the scientific names for these species

- *restoration of aquatic macrophyte communities*

  A second objective was the restoration of the aquatic macrophyte communities of the lake margins and surface. Here the only direct intervention has been the construction of the fence to eliminate grazing and the suppression of fire. In addition to its importance as habitat for fish species, the dense cover of aquatic plants also protects fish from excessive fishing pressure during the low water season;

- *increasing the structural complexity of the lake bottom*

  A third objective is to increase the structural complexity of the lake bottom. Structures are made of old tyres lashed together with wire and are sunk in the lake. These structures, called fish attractors, provide both protection for fish, allowing them to occupy the more central areas of the lake, and a substrate for deposition of eggs by species of cichlids such as the tucunaré, one of the most valuable commercial species. It is likely

that the lack of appropriate substrate for nests is a major limiting factor for the growth of tucunaré populations. If this is the case, then these structures will contribute to the growth of cichlid populations within the lake. The structures also protect fish in the lake during the low water season by obstructing nets used to scoop out remaining fish;

- *irrigated vegetable production*

  The fourth component of the project involves the cultivation of vegetables, including cabbage, tomatoes and green pepper, using pump irrigation. The objective of this component is to generate income to offset the labour and material costs of the project. Vegetables were intercropped with seedlings of the reforestation project, to take advantage of labour for clearing the site and irrigation water to improve seedling survival during the dry season.

Group organization

An important component of the project has focused on strengthening the group's autonomy and capacity to act collectively. As noted earlier, unlike most agricultural projects which involve individual smallholder production systems, the Varzea Project is concerned with the management of collective resources belonging to one or more communities. Success, both in terms of the immediate project and in terms of its wider impact, depends on the ability of local participants to work together to achieve project objectives. As a result, a major effort of the project has involved two aspects of this problem: a) strengthening the group's ability to organize its own resources to achieve project objectives rather than looking to the Project staff for support, and b) helping the group to learn how to structure collective actions so that participants can be confident that workloads are shared equally and that benefits are distributed according to each member's contribution.

Reinforcing group autonomy

Paternalistic relations in the form of group dependence on Project staff and resources, is a problem that all community development projects must deal with. The critical element here is to specify all major aspects of the project, leaving as little scope as possible for implicit assumptions and expectations. The method used here has been to first plan activities and then to define the contributions of each partner, the Project and Grupo Renascer. Once the project had been fully planned and the contributions of each side defined, a document was prepared which specified the terms of the contract, including each side's responsibilities, conditions for termination of the contract, and the duration of the contract itself. The document was signed by the project coordinator and all twelve members of the group.

Organizational capacity

The second aspect of organizational development focused on helping the group to structure activities so as to avoid the problems of unclear division of responsibilities, work loads and benefits which frequently plague collective activities. First, a coordinator was elected for the group as a whole. This coordinator is responsible for organizing regular meetings, with or without the presence of Project staffmembers, to plan activities, define targets for each, assigning tasks to each member and scheduling activities and completion dates. In addition, the number of days worked and specific activities undertaken by each member are noted down to provide a record of the total labour contribution of each member. At the end of each stage in the project, an evaluation meeting is held to review progress to date, the degree to which targets have been achieved and to discuss problems which have arisen. Based on this evaluation, plans for the next stage are reviewed and adjustments made as needed. This kind of systematic approach is also taken for financial planning. A budget was prepared

for the project as a whole, broken down by phase and item. Individual costs were specified and the source of funds to cover each expense identified. Actual expenses and income are recorded and compared with estimates.

Costs and benefits: the economics of the project

Unlike agricultural systems which generate income to cover initial costs, habitat restoration can involve considerable expense in the short- and medium-term, while any benefits are diffuse and become available only in the medium- to long-term. This is a problem which threatens the sustainability and replicability of this kind of initiative. This particular project involves a fairly high initial investment in fence construction (labour and materials) and seedling production and planting, as well as additional labour to monitor seedling development over the long-term. Future benefits, in the form of an eventual increase in the productivity of subsistence fishing will not generate an income to offset these expenses and furthermore this benefit will not be restricted to the group.

To resolve the problem of the high initial investment needed to start the project, it was decided that the Varzea project would contribute fencing materials and use of a pump for irrigating vegetables, while group members would contribute their labour. This decision was justified because the Project also has an interest in developing the project to assess the degree to which this kind of restoration project might be an effective strategy for improving the productivity of floodplain lake fisheries. An additional problem was the large amount of time needed for fence construction and seedling production, since most members are fishers and depend on daily fishing for household subsistence. To resolve this problem, it was decided that the Project would loan the group funds to cover labour costs, at a rate equivalent to the local daily wage, to be repaid out of the income generated by the sale of vegetables.

The solution to the problem of compensating participants for the labour they invested in the project was the inclusion of a vegetable garden using pump irrigation. The plan is for the sale of vegetables to generate income to compensate members for their labour with any additional income invested in a fund to cover future material and equipment costs.

The overall solution that was adopted combined a direct contribution in the form of fencing materials, and use of the project pump, a loan for labour spent in fence construction, and a mechanism for generating income to repay the loan and develop a fund to cover future expenses. While not completely resolving the problem of costs, it does provide a potentially effective strategy for insuring the long-term sustainability of habitat restoration projects such as this, which do not of themselves generate income to compensate the expenses incurred.

Exchange of group experiences

An important aspect of the demonstration project is the exchange of experiences with groups involved in similar projects and with groups which are interested in developing their own such projects. Interaction with other groups in the Amazon Cluster has thus far been limited but important. Both Mario Pinedo and Miguel Pinedo have visited the project. Mario introduced camu-camu to the group. Miguel has met the group and discussed his experience in Iquitos, Tefé and Macapá. We are planning a visit to Macapá to learn more about management of timber species sometime in the coming year.

Another important exchange has been with a group involved in a similar project in Oriximiná. This group is a couple of years further along in their project, having formed an association and obtained a grant to finance their work. While the Aracampina

group was developing their project, two members of the Oriximiná group visited them and described their experience, including the difficulties they had encountered and solutions they had devised. Later in the year, after the first phase of planting had been completed, six members of the group visited Oriximiná to learn more about that project first hand. The experience was important. Visiting a project several years further along provided the group with a concrete example of where they were headed and a frame of reference to measure their own progress, as well as a source of experience to help them in resolving similar problems. These kinds of exchanges are especially important because they involve people like themselves, reinforcing the idea that they are capable of the same level of accomplishment. In the future we plan to invite groups from other communities to visit the project and so build interest in developing similar projects in other regions.

Monitoring and evaluation

Measuring and evaluating progress towards attainment of project objectives is a critical element of maintaining group motivation and direction. This is especially important in a process such as this where the results in terms of fish productivity are perceptible only in the medium- to long-term, if at all. The more concretely day-to-day progress can be measured, the more effective it can be in reinforcing group members' sense of accomplishment. Towards this end, it is important that the group define concrete objectives and indicators and monitor progress towards them. Regular evaluation sessions are also important to measure progress since the previous evaluation, and to identify and assess reasons why targets were or were not attained.

Conclusion

At the time of writing the project was completing its first year of implementation. Members of Grupo Renascer were making plans for the coming dry season as they waited for the flood waters to recede so work could begin again. The site is an ongoing experiment in the management of lake habitat, and each new situation that arises requires a response, be it a problem to solve or an opportunity to take advantage of. We are learning how to intervene in this system, how to reforest levees, manage aquatic vegetation and modify lake bottoms, and something about the consequences of each of these interventions.

The site itself is small and of limited consequence, isolated as it is from the much larger lake system of Ituqui Island on which the regional population depends. But it is precisely this feature which makes it a demonstration project, a place where it is possible to experiment with different interventions and evaluate their impact, always keeping in mind the larger system of which this is a microcosm.

Through this process, group members and those accompanying the Project are gaining confidence in their ability to work together to generate change, and to reverse the process of habitat degradation to which they have contributed all their lives. They are beginning to develop a very concrete vision of what could be, as in their minds they extrapolate the small changes taking place within the study site to the much larger Ituqui lake system. More than the particular outcome of the lake experiment itself, it is this combination of vision, capacity and confidence which is the ultimate objective of this demonstration project.

ELEMENTS OF BIODIVERSITY IN HOMEGARDENS IN THE HIGHLANDS OF CENTRAL MEXICO

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CICA (Centro de Investigación en Ciencias Agropecuarias) of the Autonomous University of the State of Mexico has been working since 1996 on two projects on agrodiversity: *Agrodiversity in the highlands of Central Mexico: a pilot project on maize in campesino agriculture,* and *Agrodiversity management and sustainable agriculture in the hill slopes of the highlands of Central Mexico*. Both research projects are supported by the United Nations University, as CICA´s participation in UNU/PLEC.

The projects have been carried out in the *Mazahua* communities of Mayorazgo and San Pablo Tlachichilpa of the municipality of San Felipe del Progreso, Mexico.

Cultivated areas range in altitude from 2500 to 3000 metres above sea level, on steeply sloping land. Precipitation is uncertain: annual average precipitation is 800 mm, concentrated in the summer rainy season with July as the month with most rain. Early and late frosts can damage crops, which are also at risk from strong winds and heavy rain storms. Soils are poor. Organic content can be good but because of the low microbial population there are not enough nutrients available for the plants (Reyes 1993).

The main crop is maize of different varieties, identified by colour. Pumpkins, beans, faba beans, oats and wheat are also grown. Biodiversity is increased in these areas by homegardens, where *campesinos* grow numbers of varied plants.

Campesino homegardens

The CICA projects are undertaken following a participatory approach, through close links with the *campesino* families. The results show how tastes and interests of the different members of the *campesino* families contribute to increased biodiversity in the homegardens which are called *traspatio, solar* or *huerto* in Spanish. They are areas of great importance for *campesinos*, spaces where experiments and innovations are carried out. They are also places where staple crops are cultivated, and where medicinal, ornamental and food species, firewood and stimulants are grown. Besides that, *solares* are places where people have enjoyment and pleasure (Hoogerbrugge and Fresco 1993; Espejel 1993).

The homegardens are composed of several parts: house, areas of trees and herbaceous plants, *milpa* (area where maize is cultivated) and an area for animals (corral). The size of the *solares* in the community varies from 500 m^2 to 15,000 m^2. The house is adjacent to the area of trees, while the corral can be located behind the house or animals can be tied to agaves or trees. The *milpa* is near the house and is surrounded by wild herbaceous plants, agaves and/or trees.

We found that there are particular names for the plants in the homegarden: ornamental plants are known as **flowers,** medicinal plants as **medicine;** others not in use are called **forage**. ***Quelites*** (the generic

name for weeds or wild plants used as food) are normally those used as fresh vegetables.

As pointed out by Hoogerbrugge and Fresco (1993) and Espejel (1993), homegardens are a place for innovation and experimentation. A member of one of the collaborating families from Mayorazgo, Sra Maura Cruz, likes to try new species. She lives with her son, her daughter in law, her daughter of fourteen years old, and two grandchildren. Sra Maura has bought a plant of chilli (*Capsicum)*, and says that it is for preparing daily food. She wants to see whether this species will grow in their homegarden. She also likes to have ornamental species, some of which are bought but most of them are from the community; 'we are used to asking our neighbours for plants; everyone gives you a flower or a medicine, whatever you want'.

Her daughter-in-law went to the mountain in August to pick mushrooms. She brought back also two ornamental plants. 'I liked them so I planted them in my garden, their flowers are beautiful', she said.

Her son has also contributed to the biodiversity of the *solar*. He goes to work in the city temporarily and there he saw a plant. 'I liked it, then I brought it home with me and planted it in the garden. I love how it looks'. There is another case where a weed is now an ornamental species. Sr Domingo Sánchez found a weed which was beautiful to him so he planted it in his garden. These are just two examples of how preferences and interests of the family have an effect on the biodiversity within a *campesino* household.

Sra Cristina Venegas from San Pablo Tlachichilpa enjoys creating a colourful garden with flowers and trees. 'I have many flowers but I have not bought them, my neighbours gave them to me'. She added that her peaches were 'for my sons who live in Mexico City. Every September I go to the city to give fruit to my sons, the fruits grown naturally here taste better'.

In regards to food production women try to cultivate new food species that are not traditionally grown in their communities. These include tomatoes (*Lycopersicon esculentum* Mill.) and green tomatoes (*Physalis ixocarpa* L.). 'When a tomato is spoiled I throw it in the soil and then I have tomatoes for preparing my food', we were told.

The interest of the local people in growing new food and ornamental species, and in making homegardens beautiful and the area more enjoyable, has resulted in an increase of the number of species cultivated. This is reflected in an over-all increase in biodiversity.

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ENLARGEMENT AND DEVELOPMENT OF *TAPADES* BY USE OF COMPOST IN THE FOUTA DJALLON, RÉPUBLIQUE DE GUINÉE

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Editors' note

This short paper has been re-drafted in English by Harold Brookfield, from a longer original written by the authors in French. Some relevant additional matter from the March-August 1998 progress report of the WAPLEC-Guinée sub-Cluster has been incorporated. The text has been approved by the original authors.

Introduction

The *tapades*, or enclosed infields, of the Fouta Djallon are permanently cultivated, with a large range of mixed crops, their fertility maintained by manual tillage using large inputs of livestock manure, domestic refuse and mulch.[1] The outfields, which grow little but fonio (*Digitaria exilis*), yield poorly and need long fallow periods. The soils underlying both are of low quality, and the creation and maintenance of the *tapades* is entirely the work of human hands. The contrast is very sharp, but *tapades* occupy less than one-fifth of the whole area, and their extension is costly in terms of labour and time.

The region has suffered severe degradation over a long period, reducing its biodiversity, and leading to pauperization of rural society, which in turn creates growing inequalities, and social tensions. Moving on after its preliminary research in the Fouta Djallon, WAPLEC-Guinée has been seeking accessible, acceptable and low-cost models to restore the soil, making use of all available organic residues. One important resource is the manure created by livestock, already centrally important in the *tapades*, and we seek means by which organic inputs into the restoration and improvement of soils can be extended over a wider area.

Working with villagers of Bantignel subdivision, the WAPLEC-Guinée team has given its support to the two farmers who join them in writing this paper, who are reviving and improving traditional methods of making compost. We see it as having great potential value for improving production and the soil, using natural materials rather than expensive imports, and thus reducing the impact of land-rotational cultivation on the vegetation and fauna. The priority of priorities in rural Guinée is to improve food production, and this in turn requires creating more good soil that can be permanently cultivated.

In two villages, Missidé Héïré and Tioukoungol, a controlled experiment in production and use of compost has been set up in 1998. In addition, we are working at Kollangui with a local NGO which is experimenting with production of a compost made from cattle manure, using semi-modern methods and permanent construction of a cattle-shed. The work at Missidé Héïré and Tioukoungol is described here.

[1] *Tapades* are also the villages, combining residence, production and consumption, relatively independently from each other. The cattle pass the night within them. Internally, they are divided into plots separated by live hedges or fences, within which soils are enriched by manure, domestic wastes and mulch.

The technique

Compost is made in open sites, not in pits. Materials used are straw, dead leaves, the unconsumed parts of crop plants, green grass, the manure of cattle, sheep, other domestic animals and poultry, ash and decomposing humus. The technique is to lay alternate layers of finely cut plant material with animal manure, together with 2 to 5 per cent of earth, which greatly improves the fermentation process. To obtain good decomposition, it is particularly important to cut plant material into 10–50 mm sections. The smaller are the pieces, the larger is the surface area available to the micro-organisms. Laid in rows in each layer, they leave very little space for the penetration of air, or loss of carbon compounds. Care taken in this respect is fundamentally important to the quality of the compost and the speed of its decomposition.

Figure 1 Open compost heap at Tioukoungol, Bantignel

Mounds are made about 2 m in length, 1m in width and 1m in height (Figure1). The whole is covered with a thin layer of earth mixed with straw to protect against both drying out and rain damage. The mound sites are on well-drained ground, with a slight slope, protected from the wind and sun by trees or bushes. In the fermentation process the fibrous structure of the plant material is quickly broken down by worms and micro-fauna. Turning over of the mounds is necessary only if the pile is too wet and fermentation too slow. Seldom is more than a single turning required, and sometimes none is needed. Within the mound, the metabolism of an enormous mass of micro-organisms generates significant heat, so that the internal temperature may rise to between 75° and 80°C, especially when the mixture contains a lot of manure and young plant tissues. As the compost matures, its colour changing to a very dark brown, and its

texture becoming fine, granular, and spongy, the temperature declines to a little above the ambient temperature, and an agreeable smell develops.

The first compost was spread on land intended for market vegetables and potatoes, already prepared by the collaborating farmers, during October 1998. Over the coming months , and through subsequent cycles, the site will be monitored for crop yield and changes in soil properties. Already, considerable interest has been generated among other farmers, in these and other villages.

Some problems to be resolved

Organic compost of animal or vegetable origin occupies a large volume for its weight, requiring a means of transport if it is to be carried any distance for spreading on the fields. Carts and wheelbarrows are costly, often beyond the buying power of Guinée farmers. To carry quantities of compost needs more labour days than the peasants can spare from other activities. Moreover, farmers use hoes and only a few have ploughs. With such a tool kit it is not easy to dig organic matter deeply into the soil. While this is achieved by manual means over the small areas within the *tapades*, the wider use of compost would create considerable difficulties.

On the other hand, use of locally produced organic fertilizer would give the peasant farmer some shelter from inflation in the price of mineral fertilizers. For this reason the extension service puts considerable emphasis on substituting organic for mineral soil-fertility supplements. In those parts of Guinée where commercial cropping is practised, there is an almost total reliance on mineral fertilizers. In a country in which agriculture is the main driving force of the economy, even a partial replacement of purchased fertilizers by home-produced compost and manure would lead to substantial savings in cash outlays.

Conclusion

Our objective at Bantignel, and our second planned PLEC site at Kourassa in the semi-arid zone close to the upper Niger, is to develop collaboration with groups of farmers in which augmentation of productivity must be an important aim alongside conservation. Our hope is that successful compost producers will encourage other farmers to follow their methods. One idea, drawn from the semi-modern experiment at Kollangui, is to encourage digging and lining of ditches in the cattle corrals for better collection of urine and dung, with or without the construction of cattle sheds. In common with the extension service, we also hope to encourage changes in the agricultural calendar. These might include re-scheduling to create an adequate period for making of compost to work into the land at the beginning of the next crop cycle, and tillage at the end of the crop cycle to permit better incorporation of crop residues into the soil.

More immediately and more modestly, we hope to find ways of overcoming the problems that lie in the way of wider use of well-made compost that will not quickly lose its nutrient qualities. The practical and organizational skills that are necessary are not beyond farmers' abilities. Compost making can take place during slack periods of the agricultural year. The only way to make progress in the Fouta Djallon is to work on improvement of the soil through recycling, and thus extend the good management of the *tapades* over a wider area. Composting has an important role to play in this design, and can become a veritable 'gold mine' for the farmers of Guinée.

Further information can be found in S. Fofana, 'Le compostage aérien et l'étable fumière, moyens efficaces pour l'extension et le développement des *tapades* au Fouta Djallon'. Conakry: CERE, Ms, 1998 (Copies are available from the first author of this paper).

REPORTS FROM FARMERS ON DEMONSTRATION SITES IN GHANA

Editors' note

PLEC-CAMP is an active community-based association of farmers at Gyamfiase, Amanare and Sekesua in the southeastern region of Ghana. It includes strong women's groups. The following extracts are from reports sent to the leader of WAPLEC, Professor E.A. Gyasi. They are reproduced in the words of the farmers' reporters.

Excerpts from 1995–1998 WAPLEC–CAMP progress reports (Gyamfiase)

CAMP stands for Collaborative Agroecology Management Project. The project aims at protecting agriculture and biological diversity and the environment in the Gyamfiase area.

Problems

Our lands were in for total grass, rampant bush-fires and cutting down of trees.

The local people decided to form a committee of 10 people, 6 men and 4 women, with the chief as chairman. He gave CAMP 15 acres of land to work on free of charge.

We decided to educate the people about the importance of leaving trees on our farms to check the invasion of the grass: we now have 52 serious farmers and we want to increase to 100. They say that the practice is very good to them because they get firewood, some are medicinal trees and they use some to build their houses and many more.

In 1996 we started with the transect from Akokoa through to the forest grove at Gyamfiase. We moved on to the mapping of our working area to find landowners and tenant farmers. We found out that the Ewes are predominantly the tenant farmers in the area of operation.

After these two exercises, we started actual work with a ½ acre pepper farm and agroforestry farm. We intercropped the trees with foodstuffs such as cocoyam, plantain and maize. This pepper farm helped us a lot to get some funds and with our little monthly contributions, we were able to open a savings account at the Akuapem Rural Bank with an initial amount of ¢ 150,000 in 1997.

We then sent letters to Ministries and Departments to come to our aid to establish our own nursery to boost the agroforestry programme. They responded quickly with:

27 machetes, 4 shovels and 10 watering cans;

2 wheelbarrows, 6 rakes, 6 head pans, 6 mattocks, 6 trowels;

10,000 cashew seeds and 10,000 nursery rubbers;

102 different tree seedlings;

half bag of teak seeds.

We have been able to establish our own plant nursery at Bewasa with the following: cashew 540, prekese 625, teak 450, mahogany 500, opepew 100, ankye 250, palm 2200 (total 4665).

We have been able to make a fire-belt around the grove at Gyamfiase, with the support of the workers. We found out that there are a lot of medicinal plants and trees in the grove.

The committee has decided to build a store and office for the association, and we are going to mobilize the members to mould the bricks for the project as soon as the rains set in.

There are plans to help members of CAMP to have their own projects, such as

wood-lots, snail farming and others. The management has also decided to mobilize 250 school pupils in tree planting.

We have two different kinds of women's associations now, the Freedom Women and Bowohomoden Women Associations of Bewasa and Gyamfiase. Their aim is to improve rural living conditions for women through biodiversity defence within and off-farm, with sustainable farming practices, village industries and other activities. The associations have separate bank accounts.

This year we have been able to make a three-acre farm on our land which we have intercropped with different tree seedlings and foodstuffs. We have also started a citrus farm with improved seedlings from the university farm in Kade.

Report from PLEC–CAMP (Sekesua)

CAMP is a nongovernmental organization purposely organized to protect biodiversity.

Area of operation is (10) ten kilometres radius with Sekesua as the centre core.

Environmental problems

1. Bush fires are the leading element of environmental degradation in our area now, its trail of destruction encourages topsoil erosion and the emergence of strange weeds. Secondly, extinction of tree species and wild life, rivers are also included.
2. Indiscriminate hunting such as fence trapping and sometimes poisoning of the animals.
3. Pressures on farm lands: the effect of this causes (a) soil erosion, extinction of some valuable species; (b) infertility of the soil, which brings poor yield.
4. Indiscriminate felling of trees, contributing factor of degradation of the environment and also causes the extinction of wild life and most tree species like adawra, odum, emmre, wawa, mahogany and many others.

Agricultural Problems

Contributing factors are:

poor rainfall pattern

As against the previous decades the rainfall pattern upon which we rely on our day-to-day farming activities is in recent times disappointing;

lack of education

The farmers are lacking in education to adopt improved methods of farming technology in the area;

poor yield

In farm produce is a major problem facing farmers here as a result of infertility of the land;

pest infestation

Strange disease identified on some crops like cassava, yams, cocoyam and even on the trees;

post harvest losses

(a) Lack of storage facilities;

(b) difficult means of evacuating produce from farm lands;

(c) lack of education on method to preserve produce;

(d) bad roads to the farm lands.

PLEC–CAMP activities 1998/99

(a) Groups are formed in almost all the communities in the Sekesua zone with the prime aim of nursing various tree species to be provided by CAMP with assistance from PLEC.

(b) Farms are ready for the nursed trees to be transplanted.

(c) Alongside the industrial trees farmers preferred other economic trees like mangoes, cashew, orange, teak and other beneficial trees.

(d) Livestock and poultry farming, bee-keeping, mushroom production, snail-keeping are other areas where farmers in the area wish to supplement the traditional farming activity.

(e) To crown the success of all these activities in respect to their proper coordination and monitoring, means of transport, financial assistance, among others will be needed for the smooth running of the programme.

State of Executives

Representatives are drawn from fourteen communities with twenty-one members serving as executive members

Gender Balance

It's quite unfortunate that the entire executive was a 100 per cent male dominance. The executive board is very active as at now. The entire executive members volunteered in championing the education on the aims and objectives of PLEC–CAMP.

Constitution

A constitution has been drawn to serve as a guideline in our day-to-day activities to fulfil the mission of PLEC and to serve also.

Conclusion

This paper clearly reflects on issues affecting our area and with hope I know PLEC will arise above expectation to help us solve these problems.

Thank you

GOD BLESS YOU

AIMS OF CAMP (SEKESUA)

1. To preserve the land and propagate tree planting within the vicinity of operation.
2. To prevent bush fires.
3. To encourage communities and affiliated groups under CAMP to embark on tree planting and environmental protection.
4. To encourage farmers within CAMP zone to cultivate ecofriendly species such as Odum, Wawa, Mahogany etc.
5. To help eradicate poverty within the area of operation.
6. To supplement our traditional farming with snail-keeping, mushroom production, bee-keeping, livestock production, piggery etc.
7. To discourage the indiscriminate cutting down of trees.
8. (a) That any affiliated group should register under CAMP;

   (b) must open an account with a recognized bank.
9. This constitution is subject to amendment when the need arises.

METHODOLOGICAL PAPER BY PROJECT MEMBERS

DEVELOPMENT AND USE OF A METHODOLOGY TO ANALYSE THE BIOPHYSICAL AND ECONOMIC PERFORMANCE OF SOIL MANAGEMENT TECHNOLOGIES

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A nice problem

Readers of *PLEC News and Views* may be familiar with a typical problem of much field-based research: lots of data but little idea what to do with it, other than compiling tables and drawing maps. An embarrassment of riches, and nothing to spend them on! As PLEC gets into full implementation with GEF funding and demonstration sites are developed, the problem of how to analyse diverse items of information in an integrative and holistic manner will surely arise.

This was the very problem we were faced with on the Loess Plateau, China. Our collaborators had amassed a large body of experimental information from soil loss and runoff plots; they had undertaken comprehensive social surveys of farmers in the Niehegou Catchment; and they needed a method to assess the biophysical and economic potential of existing and new conservation technologies. So, supported by the UK Department for International Development and the Chinese Ministry of Forestry, we have recently completed a project to develop appropriate policy-relevant methodologies for just such situations. A full account of our work is published by Lu and Stocking (1998), available from us freely to all who ask. A PC-based computer model will also shortly be available.

A not-so-nice problem and research challenge

Soil erosion is widely recognized as the most important type of land degradation (Oldeman 1994). Approaches to this degradation are now adopting more holistic ways of bringing together technical, environmental, social, economic, political and cultural variables (Hudson 1991; IFAD 1992; Hudson and Cheatle 1993; Pretty 1995). Yet still the barriers to effective control are large (Hurni 1996), indicating that many recommend-ations fail to address local needs, especially at farm and household levels in developing countries. Evidence for this includes low rates of adoption of improved conservation technologies (Napier and Sommers 1993) and the inability of some indigenously-derived techniques to cope with increasing populations and land pressure (IFAD 1992).

One of the primary reasons at farm and household level for the limited acceptability of many soil conservation techniques rests with poor professional ability to analyse the whole array of circumstances and to diagnose the best point of intervention. Soil conservation measures vary enormously in scope, complexity, cost, technical demands and ongoing maintenance needs. The possible permutations of measures and their site conditions, including socio-economic

contexts, are immense. Which soil conservation measure is most appropriate to the site and to the people? Is the measure going to be economically feasible and socially acceptable? Often, there are no immediate and simple answers.

Therefore, we have developed a methodology that integrates the principal technical and non-technical aspects which may affect the uptake of soil conservation measures at farm level. A model has been developed to represent technical, productivity, and socio-economic considerations for the specific purpose of soil erosion and conservation assessment. By using the model, productivity impact and economic costs of erosion are simulated with different scenarios of slope gradient, initial soil condition and management practices. Three conservation measures, bench terraces, ridge tillage and grass strips, are assessed in their improvement in soil quality and their economic profitability. Decision-making and land use policies should be considerably enhanced if the impact of erosion on soil productivity and the benefit of conservation were known (Bishop 1995; Bojö 1996). Policy recommendations are, therefore, drawn based on model performance.

The methodology

Not every conservation technique is willingly accepted by local people. The true potential of any technique is the product of a complex of biophysical and socio-economic criteria, perceived through the eyes of local people, including most importantly the ability of the practice to support the preferred local farming system. For adoption of conservation, the following criteria are important:

- *relevance to farm enterprise*
  If a conservation technique does not support the farm, it will not (should not) be adopted;
- *profitability*
  Farmers voluntarily adopt techniques that are profitable;
- *complexity*
  Complex techniques often involve unacceptable risks and extra burdens;
- *observability and predictability*
  Innovations are more readily accepted if potential adopters are able to observe (directly or indirectly) their use and benefits.

For the approach in this research the integrative criteria for adoption of a conservation technique include:

(1) *erosion hazard and biophysical efficiency*
Long- and short-term assessment to assess the degree of seriousness and the resources to be devoted to the problem;

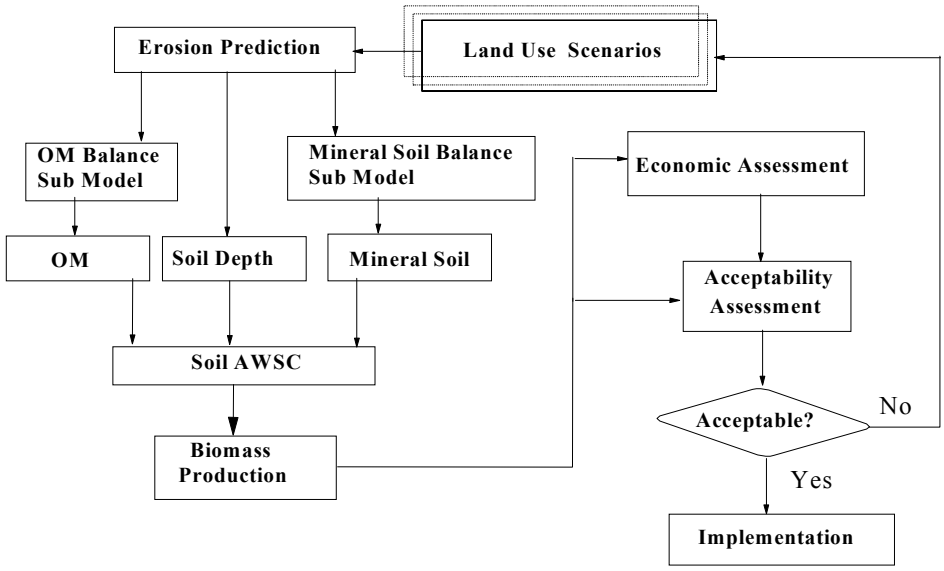
(2) *productivity issues and sustainability*
The effectiveness in maintaining and improving soil quality and in ensuring future production;

(3) *socio-economic acceptability*
The economic efficiency of conservation measures and socio-economic factors which improve/limit uptake of conservation.

Using soil available water storage capacity as an index of intrinsic productivity, the impact of erosion on economic profitability under different land use scenarios may be assessed at farm level in terms of changes in soil physical properties (Figure 1). There are two major parts in the general framework: the biophysical section includes a set of submodels that quantify the effect of erosion on soil productivity and link the changes in soil productivity to crop production; the economic section translates the output of the biophysical section into economic terms.

The model in action and major findings

Based on locally-validated productivity-yield relationships from experiments on the Loess Plateau, a simulation was conducted to assess quantitatively the erosion/conservation–productivity–economic relationship. It relates to a continuous winter wheat crop grown under natural environmental conditions in Nihegou Catchment, Chunhua, Southern Loess Plateau (108° 30′ E, 35° 03′ N). Mean annual rainfall is 591 mm, concentrated in July, August and September when 52 per cent of the year's rainfall occurs. Mean annual temperature is 9.8°C. The topography is a complex of deeply dissected plateaux and



Note: OM organic matter
AWSC available water storage capacity

Figure 1 The framework of the model

gullies with a range of slope gradients. Over 70 per cent of surface soil consists of residual eroded loess, locally called *Huang-mian-tu*, which is loess subsoil exhumed after removal of the original cultivated fertile layer. To represent the natural biophysical diversity, the following initial conditions and management scenarios were selected as inputs for the model:

- *topography*

  Slope length 100 m; slope gradient 0, 9, and 47 per cent to represent flat, gentle and steep slopes. Since slope gradient is the only erosion factor that varies in the scenarios, it is also a surrogate for erosion rate;

- *initial soil condition*

  Initial soil organic matter content (average in 0–50 cm horizon) 0.5 and 2.0 per cent to represent poor and good initial soil condition;

- *management indicator*

  The return of organic residues is a proxy for management level. Two levels: high

and low, according to amount of organic matter returned annually;

- *conservation measures*

  Bench terraces, grass strips and ridge tillage, to represent mechanical, agronomic and land preparation approaches;

- *subsidies and alternative cropping strategies*

  With and without labour costs included to represent without and with subsidies. Conversion of wheat cultivation to apple orchards is the alternative cropping strategy.

These scenario conditions were then processed by our model and the following major results were obtained (Note: in our full write-up we present graphically 100-year scenarios, but these are not included here for reasons of space):

(1) with erosion, productivity (indicated by biomass yield) of the deep loess soil will eventually reach an equilibrial level, either sooner or later, whatever the initial condition. For winter wheat, this level is 720 to 940 kg/ha, indicating that the higher the initial soil productivity, the more serious the potential damage by erosion;

(2) initially poor soils immediately bear high erosion costs in terms of biomass yield decline. In the long term, the biomass yield foregone is low. In contrast, initially good soils have higher resistance to erosion damage in the early stages, but the long-term biomass yield decline is high. On 47 per cent slope with low organic matter input, for example, cumulative biomass yield decline is 8707 and 108095 kg/ha in 10-year and 100-year periods respectively, on soils with initial organic matter content of 0.5 per cent. The corresponding cumulative biomass yield losses are 698 and 297156 kg/ha respectively, on highly productive soils with initial organic matter content of 2.0 per cent;

(3) increasing organic matter input maintains soil productivity and thus prolongs soil productive life (the time in years a soil can provide acceptable crop production). With initial organic matter content of 2.0 per cent, soil productive life is 136 years longer in a high organic matter input system than on a 9 per cent slope with a low input system. On a 47 per cent slope, with high organic matter input, soil productive half-life can only be prolonged by 18 years;

(4) without effective erosion control and by increasing organic matter input, soil productivity can be maintained, but the erosion cost of doing so is high. For a soil with initial organic matter content of 0.5 per cent on a 47 per cent slope, cumulative biomass yield decline due to erosion in a high organic matter input system is greater than that in a low organic matter input system, by 1205 and 173410 kg/ha in 10- and 100-year periods respectively;

(5) erosion damage varies according to initial soil condition, the time horizon and continuing organic matter input levels. Erosion-induced decline in productivity tends to be low in the short-term, but high in the long-term. Initially good soils have a lower proportion of erosion-induced productivity decline in the short-term, but a higher proportion in the long-term compared with initially poor soils. High organic matter input systems have consistently higher erosion damage than low organic matter input systems, indicating that it is vital to control erosion in high input systems in order to protect the yield benefit gained from the investment in inputs. Conversely, low input systems have a lower imperative for conservation because of the limited saving in biomass yields;

(6) economic costs of erosion, calculated as Net Present Value, show initially poor soils with low organic matter input have the highest erosion costs because the decline in biomass yield comes soon,

although the cumulative foregone biomass production is relatively low. In contrast, initially good soils with high organic matter input have the lowest erosion cost because the decline in biomass yield comes rather late, but the cumulative foregone biomass yield is high in the long-term;

(7) conservation measures vary considerably in their effectiveness in erosion control, productivity maintenance/improvement, and consequently economic performance. For the three tested measures, bench terraces give the best performance in erosion control, followed by ridge tillage and grass strips. Grass strips, however, by improving organic matter, have the highest capability in maintaining soil productivity;

(8) grass strips, as measured in net present value (NPV), internal rate of return (IRR) and the length of break-even period, are the most economically profitable because of their (i) direct effect on soil quality improvement; (ii) low cost; and (iii) immediate improvement in biomass yield;

(9) without substantial improvement in soil quality, direct subsidies for conservation could be very expensive. Even when the construction costs of terraces are removed, representing a high subsidy scenario, the costs of maintenance and land foregone cannot be compensated under winter wheat. However, when the winter wheat system is replaced by apple orchards, a popular land use in the research area, the costs of terraces can be repaid within less than ten years even at a high discount rate of 20 per cent.

Policy relevance

In the full version of our analysis (Lu and Stocking 1998), we develop a set of major implications of the findings for the design of technical and policy interventions for improved land use and rural livelihoods. The following is a much abbreviated version.

Three key aspects have evolved from the analysis which need to be considered. First, there is the dynamic and variable nature of erosion-productivity-time relationships. Soils vary considerably in their resilience and sensitivity, and this needs to be reflected in land use planning. Secondly, this variability means that recommendations must always be made specific to the site. It is often a rational strategy for farmers to 'mine' their soils, as van der Pol (1992) found also for Mali. In other places and under other conditions, it is also rational to undertake conservation works or to follow a wholly organic system or both. Thirdly, this research has revealed the complex relationships between erosion control and soil quality improvement. Effective erosion control is always important for long-term sustainability, but immediate improvement in soil quality which translates to significant increases in biomass yield is vital for economic profitability and livelihoods.

From these aspects, four important issues were identified:

- *erosion control vs. input increase*

  Land managers and policy-makers need to target their farming practice recommendations to the appropriate biophysical site condition, farming system and resource endowment of the land users. This research has shown that initial soil condition, erosion rate, availability of organic residues and labour requirements all affect what approach should be promoted;

- *immediate economic cost vs. long-term productivity impact*

  Time perspective is important. Short-term and long-term rationalities differ both for the land users and for society as a whole. The chosen time perspective must be made explicit, as well as whether a private or social perspective is taken, in

order to identify the most appropriate conservation and land use measures to promote;

- *inevitable degradation vs farmers' choice*

  Land users will degrade (or 'mine') their soils under some conditions if free choice is allowed. This inevitability could be manipulated by subsidies, pricing policies, legislation or other coercive measures. Should farmers' choice be restricted and is this feasible in the market economy of China today?

- *direct subsidies vs. self-help capability enhancement*

  Related to the previous issue is the question of subsidies (e.g. to build terraces) derived from public funds to benefit the private individual. Subsidies and similar incentives are widely criticized as they not only benefit the individual but also create dependency on external finance and a reduction in personal responsibility. As argued by IFAD (1992): 'An inappropriate approach towards subsidies and incentives can destroy the long-term prospects of any development programme—however well designed it may be technically'. Subsidies should not be used to coerce people into uneconomic and unsustainable conservation practices but to facilitate people's participation in conservation.

What technical and policy interventions can address these contending issues? It is a dilemma for society that private rationality may be at odds with the public good. Policy intervention may include legislative frameworks that make it less attractive to land users to pursue private economic rationality. The disadvantage is that this puts the economic burden of conservation onto the farmers. Other interventions could include incentives and subsidies, but these also have risks. Perhaps the best way forward is to examine technical options of erosion control which also bring production benefits. Examples could include green manuring, cover crops, intercropping and agroforestry—in short, some of the practices that PLEC is studying which use biological diversity principles. These will need the sort of analysis demonstrated in this paper in order to determine either why they are already accepted by farmers or, if proposed as an intervention, what is the likelihood of their acceptance.

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A BOOK ON YUNNAN BIODIVERSITY

A major survey of biodiversity in Yunnan has been prepared by the Kunming Institute of Botany under the auspices of the United Nations University and the [Yunnan] Center for Resource, Environment and Development. The book is beautifully illustrated, with a text in Chinese. Details are: Guo Huijun and Long Chunlin (eds), *Biodiversity of Yunnan, SW China*. Kunming: Yunnan Science and Technology Press, 1998. 141 pp.

INTERNET RESOURCES ON AFRICA

With the Internet becoming so large, it is often useful to have guides or indexes to home pages. The following offer indexes of Internet resources on Africa, including links to on-line newspapers and journals, UN and government agencies, other organizations, educational institutions, libraries, and much more. The indexes are organized in different ways, and the links and new sites are updated with varying frequency. The choice of which to use will depend on how easy it is to connect and use the site, whether it is regularly updated, and the type of information being sought.

African Studies WWW (University of Pennsylvania)
http://www.sas.upenn.edu/African_Studies/AS.html
Offers a comprehensive index to sites as well as some information.

African Studies Internet Resources - Columbia University
http://www.columbia.edu/cu/libraries/indiv/area/Africa/

Index on Africa: is maintained by the Norwegian Council for Africa (NCA)
http://www.fellesraadet.africainfo.no/africaindex/

The Electronic African Bookworm: A Web Navigator
http://www.hanszell.co.uk/navtitle.htm
Especially good on publishing.

Stanford University Libraries - Academic Information Resources
http://www-sul.stanford.edu/depts/ssrg/africa/africa.html
Not so strong on agriculture and the environment.

Yahoo Regional Directory
http://dir.yahoo.com/Regional/Regions/Africa/Countries_and_Regions/
This one has more commercial links.

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