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No. 8 – May 1997

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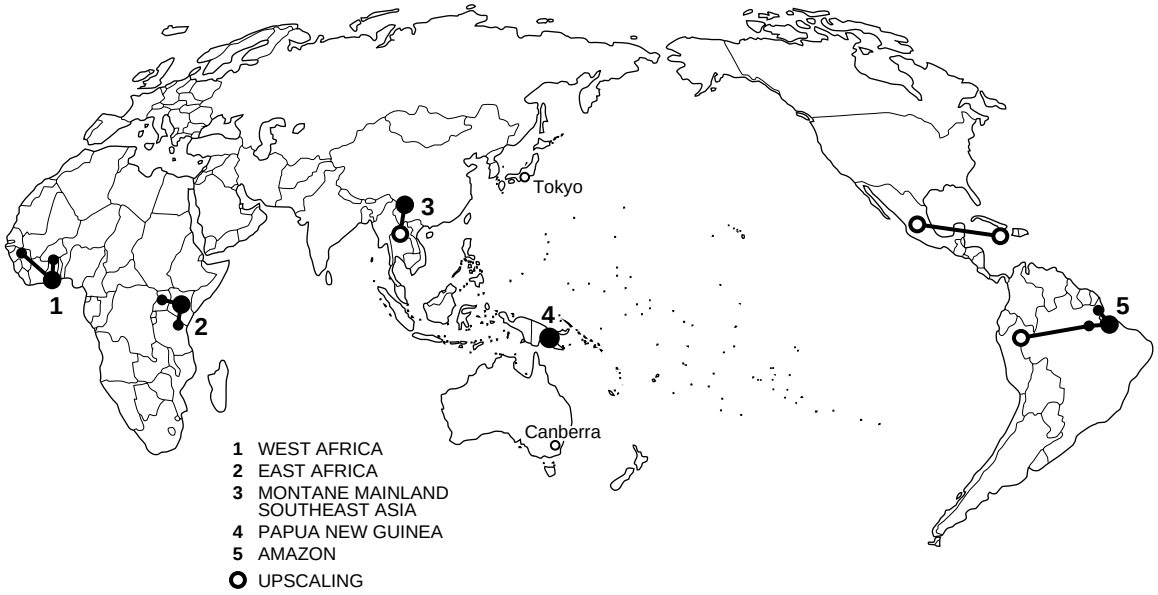


The Clusters of PLEC

P L E C N E W S A N D V I E W S **No.8, May 1997**

SCIENTIFIC COORDINATOR'S REPORT

PAPER BY PROJECT MEMBERS

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

No.8, MAY 1997

SCIENTIFIC COORDINATOR'S REPORT

UNU/PLEC and the Global Environmental Facility (GEF)

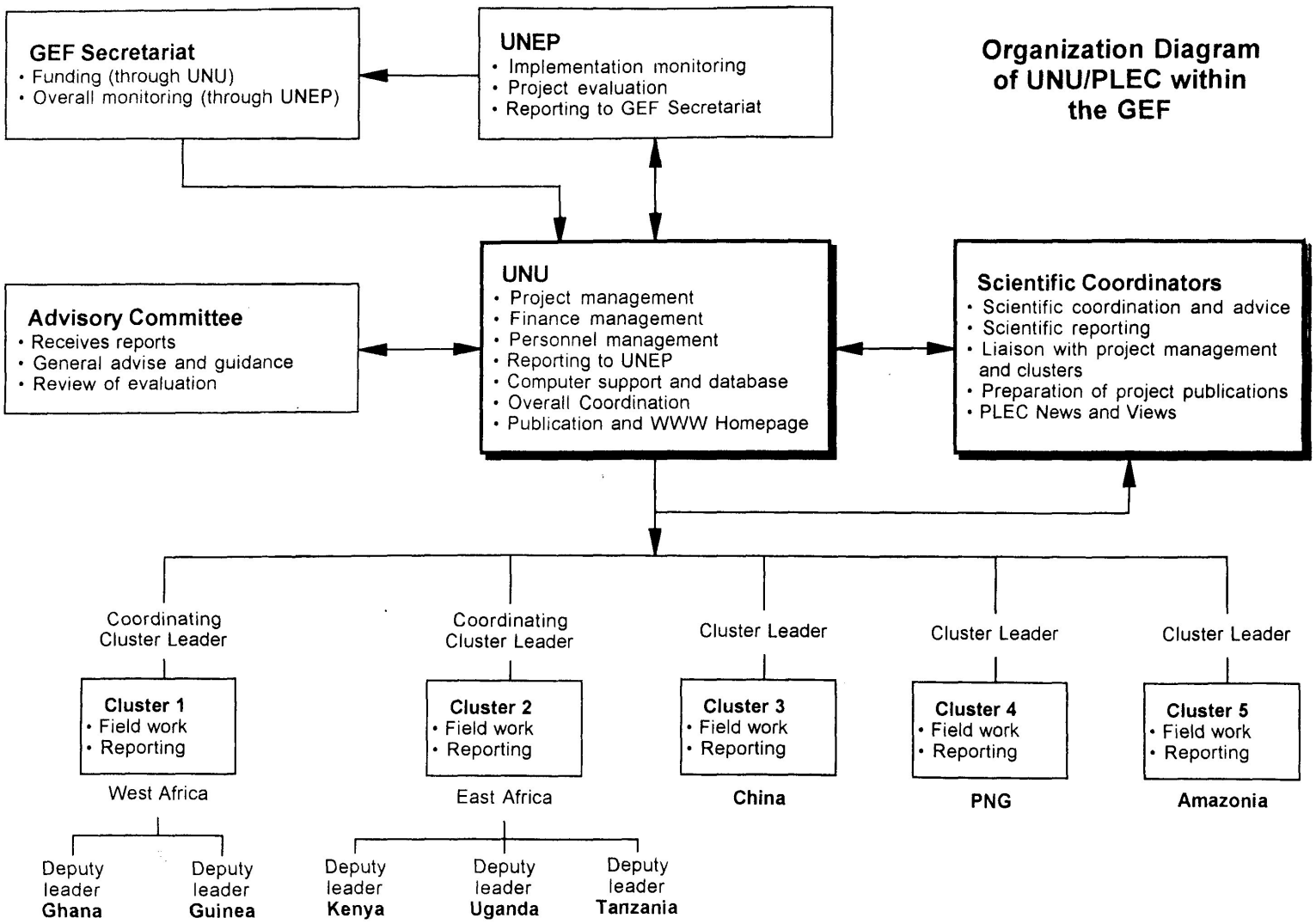
We have almost made it. We have GOOD NEWS to report. PLEC has been successful with the GEF. We delayed this issue of *PLEC News and Views* until we had word from the meeting of the GEF Council on 30 April - 2 May 1997, at which PLEC was listed for discussion. Council then approved PLEC, subject to normal conditions and the provision that – like four other projects with substantial scientific content – we be the subject of ongoing 'selective review' by the Scientific and Technical Advisory Panel of GEF. What now remains to be done is to develop a full implementation and management plan, and get this agreed between the executing agency (UNU), the implementing agency (UNEP - the UN Environment Programme) and the GEF Secretariat. This could take a little more time yet. Meantime, within UNU, we are now formally retitled UNU/PLEC, in parallel with other major UNU activities.

This result is the culmination of a long process that in effect began with the preparation of draft project plans under the 'project preparation contract' in 1994-95, involving all Clusters. For a good part of 1995 we had to await the new GEF 'biodiversity strategy'. Draft documentation prepared in late 1995 was reviewed in and for UNEP and twice modified before being submitted by UNEP to the GEF operational panel, representatives of the three GEF institutions, the World Bank, UNDP (UN Development Programme) and UNEP, in May 1996. After further review, it was discussed by the panel in July and August 1996 and approved subject to substantial changes in presentation, to be made under the guidance of the GEF Secretariat in Washington. These changes included creation (in the Secretariat) of a comprehensive and professionally sound logical framework matrix as the central guiding document. This was distributed among Cluster leaders in November 1996 and is printed on pages 6 and 7 below for a wider audience. The revised documentation was sent out to all members of the Council at the end of January 1997 and placed before the April-May meeting.

We must specifically thank four people on whom the project has relied heavily in the last year. Their contribution to the outcome has been at least as critical as that of any of the project's own principals and Cluster leaders. These are Timo Maukonen and Cyrie Sendashonga at UNEP in Nairobi, Rohit Khanna of UNEP in Washington, and above all Chona Cruz in the GEF Secretariat. Nothing would have been achieved without the enormous help of these good friends.

The immediate future

We now proceed forward from this point to the development of an implementation plan which will maximize the benefit of PLEC's decentralized structure, while ensuring **balanced progress and cohesion in the project as a whole.** We have already prepared the first draft of a **detailed implementation and management plan**, Cluster by Cluster as well as for the project as a whole, based on the work activities in


GEF Secretariat
• Funding (through UNU)
• Overall monitoring (through UNEP)
UNEP
• Implementation monitoring
• Project evaluation
• Reporting to GEF Secretariat
Organization Diagram of UNU/PLEC within the GEF
Advisory Committee
• Receives reports
• General advise and guidance
• Review of evaluation
UNU
• Project management
• Finance management
• Personnel management
• Reporting to UNEP
• Computer support and database
• Overall Coordination
• Publication and WWW Homepage
Scientific Coordinators
• Scientific coordination and advice
• Scientific reporting
• Liaison with project management and clusters
• Preparation of project publications
• PLEC News and Views
Coordinating Cluster Leader
Coordinating Cluster Leader
Cluster Leader
Cluster Leader
Cluster Leader
Cluster 1
• Field work
• Reporting
Cluster 2
• Field work
• Reporting
Cluster 3
• Field work
• Reporting
Cluster 4
• Field work
• Reporting
Cluster 5
• Field work
• Reporting
West Africa
East Africa
China
PNG
Amazonia
Deputy leader Ghana
Deputy leader Guinea
Deputy leader Kenya
Deputy leader Uganda
Deputy leader Tanzania

the project matrix adapted to the conditions of each Cluster. We shall also have to amend the main project document in the light of critiques made by some Council delegations on the basis of their own reviews. For management we shall have to shift to institutional contracts for Clusters, both for political reasons and the better to ensure financial reporting according to a fairly rigid schedule. This will, however, have certain other advantages. Discussions are in progress with UNEP about relative responsibilities of themselves and UNU. All this will take at least two months for completion, involving further discussion with UNEP and the GEF Secretariat. When final documentation, including most importantly the implementation and management plan, is agreed by the Chief Executive Officer (CEO) of the GEF, it then has to go again to Council members for their approval within three or four weeks. Only when this is complete can the formal papers be signed, and funds made available. The schedule of all this is not in our hands. While the project as such is approved, therefore, it will be August or September, and possibly even later, before full implementation can begin.

Management and coordination

UNU will execute the project and all planning is being prepared on this basis. All funding, including that required by UNEP for its own monitoring, will be handled through UNU. Included in the budget is a Task Manager with responsibility for PLEC, in UNU, who will work in collaboration with the Managing Coordinator, Juha Uitto and the Financial Management Officer, Audrey Yuse. UNU will also provide back-up support in financial and personnel management through its established system, and will additionally provide computer support in new areas – in the management of the database that is to be generated, and in the creation and maintenance of a WWW homepage. Scientific coordination will remain as at present, with Harold Brookfield as Scientific Coordinator and Christine Padoch and Michael Stocking as Associate Scientific Coordinators. *PLEC News and Views* will continue to be edited from Canberra. The structure is set out in the diagram facing this page. This includes an advisory committee, widely drawn, to help guide the project in its work.

Management Group

There will be a **Management Group**, including the Coordinators and the leaders of each of the five regional Clusters or their deputies, which will meet once in each year. There will also be a UNEP representative. The question of Scientific Advisors and their attendance at meetings will be considered at the first full meeting of the Management Group. It is planned to hold the first such meeting as soon as possible after implementation begins, and it will probably be held in Tokyo. The Coordinators may also use other opportunities to meet. A list of the Coordinators, Cluster leaders and deputy leaders, with the addresses, fax and (where available) e-mail numbers, is printed at p. 14.

Geographical responsibility

There is one important change, already welcomed by several Cluster leaders. A recent meeting of the Coordinators in New York (reported below) agreed that a measure of ***geographical division of responsibility will be instituted among the Coordinators***, with Brookfield and Stocking sharing primary responsibility for liaison with **African Clusters**, Brookfield and Padoch with **Asian-Pacific Clusters**, and Padoch and Stocking with **American Clusters**. 'Up-scaling' groups in each region are included.

Upscaling

The project is approved in the form as presented in May 1996 and endorsed in August 1996, that is without areas then listed as 'in development' (Mexico and the island Caribbean). It is also approved without the long-established group in

Thailand, since Thailand has still not ratified the Convention on Biological Diversity, a pre-condition for eligibility under the biodiversity programme of GEF. It is approved without the Amazonian sub-group formed in Peru where there were difficulties in obtaining government support, also necessary and everywhere else obtained. **Provision is made in the budget for 'upscaling'** and by upscaling we principally mean formal incorporation of work in areas where it is already established and proceeding in a satisfactory manner, subject to approval. Upscaling means enlargement of approved activities, not the creation of formal additional Clusters. **The cover map of this issue therefore draws a distinction between the areas included in the GEF approval, and areas which have to be listed for 'upscaling'**. The upscaling areas are part of UNU/PLEC, and there remains no problem about supporting work in them from UNU funding.

Demonstration sites

Our success, both in August 1996 and May 1997, was due to the speed with which collaborative research with farmers led to initiation of farmer-led projects, in collaboration with PLEC scientists (and local authorites and especially agriculture departments). These have the purpose of developing sustainable and conservationist production and management strategies. **In most areas the necessary 'targeted research', which forms the basis of site selection for fully-participatory work, has largely been completed.** It has been the central product of UNU funding which has amounted to more than half-a-million dollars since the foundation of PLEC, with small beginnings, in 1992. Research (other than that involved in monitoring) remains as a minor element involving not more than 10 per cent of the GEF budget.

What we initially termed 'focus sites' now become, more accurately, '**demonstration sites**'. This has the dual meaning that these are areas in which we work with farmers in the creation of projects that are their own, and areas in which we together demonstrate the value of locally-developed techniques and technologies. The sites vary in size and some already include several sub-sites, but all are essentially at local scale. Those to whom PLEC must aim to 'demonstrate' its methodology therefore include other communities, national agricultural and conservation authorities, and the global conservation community.

Also printed below at page 8, therefore, is the Annex which describes these 'demonstration sites' at the stage of development they had reached by January 1997 (some have gone further since), and their ecological and institutional contexts. The Annex is not updated, but **the next issue of *PLEC News and Views* will have as its focus a set of articles on these demonstration sites at the time when project implementation begins**. This will also cover demonstration sites in the 'up-scaling' areas, already initiated in Thailand, Peru and Mexico. *This note provides advance warning of what will be needed.*

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PLEC Project Matrix

On pages 6-7 we print the Logistical Framework (Log Frame) Matrix which was submitted to GEF. It summarizes the expected inputs and outputs of the PLEC Project.

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RECENT MEETINGS AND ACTIVITIES

No Cluster reports are printed or summarized in this issue; they will be presented in the next issue along with articles about demonstration sites. At the time of writing, substantial reports on present contracts are starting to come in, but not all are yet received. Comprehensive interim reports have been received from West Africa (Ghana, Guinea), Tanzania, China, Amazonia and Mexico. Updated, re-

written and edited versions of major 1996 reports from Ghana and Guinea, together probably with two others, will be published, after review, by UNU Press. Hopefully, this will happen by the end of 1997. The only major Cluster meetings held in recent months have been the annual working meeting of the MacArthur/PLEC Gaoligongshan forest management and biodiversity conservation programme at Baoshan, Yunnan, China, on January 21-22 1997, and of the Ghana members of the West Africa Cluster at Legon, Ghana, on 3-4 May 1997. The latter meeting welcomed the new Director of UNU's Institute for Natural Resources in Africa (UNU/INRA), Dr Uzo Mokwunye, as an adviser to the Cluster.

The Coordinators (Uitto, Brookfield, Padoch, Stocking) met in New York on 19-21 March 1997, mainly to plan future work under different possible scenarios. The 'with-GEF-support' scenario is now being prepared for implementation. It will include a full Management Group meeting, as described above, a Second General Meeting, described below, and two regional meetings, also reviewed below. We reviewed Cluster progress, and decided to introduce a simpler system for interim reporting on Cluster contracts, which will be implemented when contracts are next issued. We also planned the allocation of the small remaining sum in the UNU/PLEC 1996-97 budget, and there has since been correspondence with certain Cluster leaders about this. Uitto, Brookfield and Padoch then continued to Washington for important discussions with UNEP and the GEF Secretariat. We also visited staff of the Biodiversity Support Program to discuss possible Cluster applications for addtional support of their demonstration site activities. The Biodiversity Support Program now has a specific Biodiversity and Agriculture project, active especially in Africa.

PLANNED GENERAL AND REGIONAL MEETINGS

In New York we confirmed acceptance of the generous invitation by Joy Tumuhairwe to host a second **general meeting of PLEC at Mbarara, western Uganda, in April 1998**. This meeting, close to the developing demonstration sites of the Uganda group of EAPLEC, will be of about the same size as the Chiang Mai meeting in 1994 – up to 35 project members, and a few others. Planning for this meeting has now begun, and will quicken during the coming months. This now becomes a very important meeting to advance the implementation of PLEC. Invitations will be issued later in the year to ensure that members of all Clusters have the opportunity to participate. More details will appear in the next issue of *PLEC News and Views*.

The continued association of PLEC with the South/South Cooperation Programme of UNESCO, UNU and the Third World Academy of Sciences opens up the chance to hold **a small regional meeting to bring together the Asian and Pacific groups (MMSEA and PNG)**, in association with the South/South Cooperation Programme meeting to be held at **Kunming, Yunnan, China, from 8-13 December 1997**. PLEC regional discussion will be at the end of this week, on 13 December, but presentations will be fitted into the South/South meeting agenda. Limited Japanese funding is available for PLEC participation in this meeting, and makes it possible. Invitations, to come from UNESCO in Paris, will be issued at an early date.

We also plan to hold a **regional meeting of the American groups (Amazonia, Mexico, Caribbean),** but no date for this is yet determined. It will have an important role in upscaling. Arrangements will be made through Christine Padoch and Michael Stocking. Finally, as a part of the capacity building element in the PLEC/GEF programme, we hope to hold a ''**PLEC young scientists' meeting'** within 1998. Plans will be one topic for the first full Management Group meeting.

PLEC PROJECT MATRIX

Narrative Summary	Verifiable Indicators	Means of Verification	Assumptions
Project Goal: to achieve world food security while protecting global biodiversity through development of sustainable and participatory approaches to biodiversity conservation within agricultural systems;	By the end of the project, multiple replicable models of agrodiversity management in a variety of ecosystems, landscapes and regions.	Demonstration sites in five ecologically different regions (West Africa, East Africa, China, Papua New Guinea, and Amazonia);	Government endorsements and commitments of national collaborating institutions are in place;
Project Objectives:			
1. To establish historical and baseline comparative information on agrodiversity at the landscape level in representative diverse regions;	1. By Year 1, database programs in place for cross-country exchanges of information;	1. Primary data gathered by villagers and Plec scientists using on-farm trials and social methods in the following representative countries: Ghana, Guinea, Kenya, Tanzania, Uganda, China, Papua New Guinea, Brazil.	1. Memoranda of Agreements or cooperative arrangements across countries already established;
2. To develop participatory and sustainable models of biodiversity management based on farmers' technologies and knowledge, within agricultural systems at community and landscape level.	2. By Year 2, descriptions and comparisons of management regimes of demonstration sites completed;	2. Participatory rural appraisals and land use planning with farmers; in-situ biodiversity conservation; field trials;	2. Partnerships between community and scientific teams established;
3. To recommend policies and approaches to sustainable agrodiversity management to key government decision makers, farmers, and field practitioners;	3. By Year 3, initial policies and approaches developed; By Year 4, advice and feedback integrated into final set of recommendations;	3. Integrations of scientific and community social information; multidisciplinary analysis of findings done at village, national, and cross-country workshops;	3. Cooperative arrangements for field trials and community outreach completed;
Outputs:			
1. Tested models of on-farm participatory management of agrodiversity in different landscapes or ecosystems;	1. In-situ conservation of biodiversity in areas at risk due to agricultural production and population pressures using adaptive farmers' practices and village participatory land use planning;	1. Inventories of number and types of plant and animal species maintained per unit area; descriptive and quantitative analysis of sustainability of farmers' practices in relation to crop outputs and effects on biodiversity;	1. Scientific data and social analysis completed; community participation is strong and sustainable;
2. Data on biodiversity, agrodiversity and degradation in vulnerable small farm environments, based on methodologies elaborated and tested in different landscapes and ecosystems;	2. Data made available to villagers, governments, regional scientists and the network in Years 2 and 3, and internationally in Year 4;	2. Descriptive and quantitative analysis of resource-management types, biodiversity within them, and trends of degradation, with analysis of the proximate causes of trends;	2. Scientific data and social analysis in each region completed by Year 3;

3. Policy recommendations communicated to government decision makers, extension workers, NGOs, and local groups;	3. High level government participation in policy workshops; broad based participation of stakeholders in consultations;	3. Identification of key government decision makers and assessment of their commitment to follow-up; review of types and number of stakeholders involved;	3. Initial commitments of government officials done prior to start of field operations; stake-holders informed of project;
4. Information exchange and networking across participating countries.	4. Volume of data on agrodiversity in demonstration sites increases; comparisons with global patterns and other cases increase;	4. Field trial surveys in demonstration sites; information networking on global data on agrobiodiversity;	4. Data collection and analysis in demonstration sites already completed;
5. National and regional networks established for capacity building within participating institutions;	5. Number of trainees and cross-country exchange and training increases;	5. Verification of network information and completed training and other related programs;	5. PLEC network effectively working in participating countries;

Activities:

1. Village outreach and experimental work, including gathering of scientific information by local farmers and scientists in identifiying demonstration sites in countries;
2. Scientific assessments of biodiversity in different landscapes;
3. Participatory rural appraisal and social assessment in demonstration sites;
4. Community outreach, experimental work, including collection and analysis of data and comparison of information across landscapes;
5. Reports on models of participatory management of agrodiversity in different landscapes, where findings and recommendations are presented and disseminated to stakeholders, especially local groups, policy makers and NGOs;
6. Capacity strengthening, including training and skilling local scientists and village groups;
7. Networking and dissemination of findings and recommendations;
8. Coordination and planning of network activities;
9. Monitoring and evaluation.

Inputs:

Cross-Country Coordination:

1. Network of scientists from various disciplines providing technical and social expertise;
2. Advice from government and inter-country counterparts;
3. Training and capacity-strengthening components;
4. Equipment and premises;
5. Published materials and other resources.

In-country collaborating institutions:

1. Local scientists in collaborating institutions working closely with residents;
2. Counterpart NGOs and other groups engaging in policy dialoguesand in awareness and dissemination;
3. Equipment and premises;
4. Locally-available resources and materials.

IN-COUNTRY INSTITUTIONS AND DEMONSTRATION SITES WITHIN CLUSTERS

(From PLEC Project Document, Annex 4, January 1997)

The information that follows is summarized from material provided by Cluster leaders.

WEST AFRICA

Ecosystem and institutional context

The modern distribution of forest, savanna and Sahel vegetation zones in West Africa is greatly influenced by changing human impact over a long historical period. Within a larger region of some 200 million people, the Cluster concentrates its work in two countries, Ghana and Guinea; especially in the forest-savanna transition zone, and in the savanna, including the montane savanna of the Futa Jalon plateau in Guinea. Even in the historical period, there has been great dynamism in the status of soil and vegetation in these regions, and commercialization of the economy ranges from very small to almost complete in different parts of the two areas. Although relief exceeds 1,500m, all areas are geologically old and deeply weathered. However, the quality of the soils varies as much as in most other parts of the tropics. Over large areas the forest has been cleared, and remnants are mostly sacred sites, or groves, most of which are important for the conservation of rare plant and animal species.

This Cluster consists of over 20 West African scientists. With their associates and students the total number exceeds 30, making this the largest Cluster in PLEC. The principal in-country institutions are the University of Ghana, Legon, and the Centre d'Etudes et de Recherche en Environnement, Université de Conakry. There are collaborating members in the Ghana Rural Reconstruction Movement; the Ghana Association for the Conservation of Nature; the UNU Institute for Natural Resources in Africa; the Ministry of Environment, Science and Technology; the Ministry of Lands and Forestry and the Ministry of Food and Agriculture. Small groups have been formed in the University of Science and Technology, Kumasi, and the University of Development Studies, Tamale, in collaboration with the Savanna Agricultural Research Institute.

Established or initiated demonstration sites

Four sites are described, of which the first is operational and the other three are in various stages of development.

Gyamfiase-Adenya

Two adjacent villages, with a combined population of 850, are within a 100 km^2 region of 16,000 Akuapem and tenant people, living in a relatively dry wedge of semi-deciduous forest-savanna transition, about 70 km northeast of Accra. Settled since the 18th century, this became a cocoa-growing area around 1900, then a food-crop area from 1940 onward. Severe degradation of both vegetation and soil is now evident, especially in tenant-farmed areas. At Gyamfiase is a conserved grove of closed-canopy forest with continued practice of traditional agroforestry in its vicinity, now unique in the immediate region. Treating these as respectively core area and its buffer, a 'Collaborative Agro-ecosystems Management Project' aims to use traditional agroforestry to rehabilitate the peripheral area and then extend its results more widely. A management committee comprises the Chief of Gyamfiase as chair, headmen and senior women from Gyamfiase, Adenya and other nearby communities, and three tenant farmers.

Amanase

This area in southern Akyem, more humid than Gyamfiase-Adenya, was colonized about 1915 by Akuapem and Siade/Shai migrant cocoa farmers. It has individual land tenure both on the *huza* (strip farm) and family-farm (mosaic) systems. It is now a food crop area with only limited and degraded tracts of remaining forest. There is severe land shortage. Among a core population of over 100 farmers and their families, about 20 are active participants in PLEC, seeking to modify their land use in the direction of greater sustainability and conservation. Preliminary work has been undertaken and several meetings with farmers have been held. One area of secondary woodland, conserved by its owner with advice by PLEC, is being monitored for change in biodiversity.

Sekesua

Lying further north in the Manya Krobo region, this drier area is entirely settled on the *huza* system, without villages. Settlement dates from the late 1800s. There are recent migrants from the northern parts of Ghana. The former semi-deciduous woodland is now entirely in farms and expanding savanna. Savannization is seen as a

major problem by the farmers. Population density is about 120 per km^2. With awareness that the rotational fallow system is failing, there is keen interest among farmers in experimentation in managed fallow, agroforestry using indigenous species, and other forms of intensification. About 100 farmers and their families have been contacted frequently, and a core group of 15-20 has been identified. In an embryo management group the agricultural extension and forestry services are already involved, together with the Catholic diocese.

Jachie, near Kumasi

A PLEC sub-group has been in existence at Kumasi since 1995. It moved quickly and spontaneously into outreach work. The focus has been on remaining sacred groves and the agriculture around them; soil erosion, drought and poverty are widespread. With high male absenteeism, most active farmers are women. At Jachie, southeast of Kumasi, a demonstration site has been set up to mobilize people for conservation of their environment while also improving income, reducing loss of forest for firewood, and halting encroachment on remaining forest. During 1996, a 'grove management committee' has been set up under the Chief, and a 'women's tree-planting association' has been formed among 15 women farmers to develop agroforestry, in this case for firewood on a sustained-yield basis. Other activities include assistance with environmental education in the school, and promotion of improved cooking stoves to reduce fuelwood consumption and female labour. PLEC's role is to advise and provide concrete assistance, while at the same time conducting experimental work.

Planned demonstration sites

In Guinea, investigation of a complex system of agriculture in the Pita-Kollagui basin in the Futa Jalon, and its ecology, has completed the targeted research stage. The region is long-occupied, and an intensive 'infield' system was initiated more than a century ago, while degraded 'outfield' areas continue in use on a shifting cultivation basis, together with pastoralism.

The Kumasi group is investigating a second site at Bofie village in the Brong-Ahafo region north of Kumasi, where a range of indigenous management strategies has been identified. One site in northern Ghana is in the planning stage by a new PLEC group based in Tamale, under guidance from Legon.

EAST AFRICA

Ecosystem and institutional context

Groups in each of Uganda, Kenya and Tanzania have undertaken basic investigation along transects from higher to lower, and wetter to drier areas. East Africa has a remarkable range of agroecological zones, closely spaced. There is severe degradation in many areas, but in others farmers have been able to adapt to environmental change and population growth while even increasing production and accepting new natural-resource management methods.

The East Africa Cluster is coordinated from the Kenya Agricultural Research Institute (KARI) in Nairobi, and has groups in each country, managed from the University of Nairobi, Kenya; Makerere University, Uganda, and the Tanzania National Soil Service in Tanga. Kenya Agricultural Research Institute and Makerere University have formal twinning arrangements with the University of East Anglia School of Development Studies. In Tanzania, the PLEC group has liaison with the GEF national project on biodiversity under the National Environmental Council, and with another GEF project based at the Faculty of Forestry, Sokoine University of Agriculture. There is linkage to the Norwegian-supported Soil Conservation and Agroforestry Project at Arameru. In Uganda, team members work with the IUCN Conservation and Development Project around Mt Elgon, and with the World Bank GEF project on conservation in the Bwindi Impenetrable Forest National Park

Established or initiated demonstration sites

Work has not yet advanced to this stage, although it has advanced to the stage of holding feedback seminars with groups of farmers in Uganda and Tanzania.

Planned demonstration sites

Mbarara District, western Uganda

This area of notable demographic dynamism is characterized by `farming systems domains', (broadly homogenous areas of population, land use and environment) within a context of great physical and biological diversity, which have been studied by participatory rural appraisal and transect methods. Pastoral areas are included. Local knowledge of plants, soils and ecology in general is extensive. The area has experienced a variety of interventions by projects, government extensionists and NGOs. The reasons for

acceptance or non-acceptance of conservation measures are a focus for discussions with farmers leading toward participatory planning.

Communities on Mt Meru, Tanzania

Transect studies on both windward and leeward sides of Mt Meru, Arameru District, running from the limits of cultivation at 1,950 m onto the semi-arid plains below 1,700 m, have led to identification of two village communities, occupied at respectively 200 and 60-80 per km^2 (Ngiresi and Kiserian). Discussions with farmers there have laid the foundations for demonstration site work.

Sites in Kenya have not yet been identified, but preliminary work in Kiambu, Laikipia and Embu Districts will lead to such identification during 1997.

CHINA

Ecosystem and institutional context

The eastern Himalayan mountains extend into Yunnan, where they are deeply dissected by south-flowing rivers. While mountains rise above 4,000 metres, valleys fall only a few hundred metres. Yunnan includes both montane forests of the eastern Himalaya and, at lower altitudes, one of the very few regions of remaining tropical-margin rain forest and monsoon forest, between latitudes 21° to 23° N. The initial work of the Cluster has identified demonstration sites within larger focus sites both at high and low altitudes, respectively in Baoshan and Xishuangbanna counties. Both areas are close or adjacent to the buffer zones of large remaining forest reserves (Gaoligongshan National Nature Reserve, and Xishuangbanna UNESCO Biosphere Reserve). Areas around these reserves have lost forest cover at a very high rate since 1950 as pressure on the land has increased.

The Cluster is based in the Chinese Academy of Sciences/Kunming (CAS), the Kunming Institute of Botany (CAS), with the participation of Xishuangbanna Tropical Botanical Garden (CAS). It has working links with the Institute of Ecology (CAS); the Yunnan Institute of Geography and Yunnan Academy of Forestry Science, Kunming University (Baoshan Division); Gaoligongshan State Nature Reserve; the Provincial Government of Yunnan; and the Baoshan prefectural government.

Established or initiated demonstration sites

Targeted research into land use, biodiversity and indigenous agroforestry has been conducted in thirteen minority-group villages since 1992, by a multidisciplinary group based in institutes of the Chinese Academy of Sciences/Kunming, supported by the Ford Foundation and MacArthur Foundation as well as by UNU. Of these thirteen, two have been selected as initial demonstration sites. The first of these is already fully operational.

Hanlong, Gaoligongshan, Baoshan Prefecture

This community of 196 people, part of the larger administrative village of Baihualing in western Yunnan, is at 1,200-1,600 m on the edge of the mountainous Gaoligongshan Nature Reserve in the extreme-eastern Himalaya. For protection of the Reserve and the Community Forest, and advancement of the people, efforts are being made to establish agroforestry-based intensification. The Yunnan Provincial Government participates in the enterprise, already providing some funding as well as personnel. A Gaoligongshan Farmers' Biodiversity Conservation Association has been formed to provide the instrument of local management. Problems of resource tenure are being encountered due to conflicting claims between government, community and individuals since privatization of land in 1982-83. During the collectivization period and in the 1980s there was substantial forest clearance, and there is still penetration of the Reserve.

Daka, Xishuangbanna Prefecture

A community close to the Menglun portion of Xishuangbanna Biosphere Reserve in southern Yunnan will become the second main Yunnan site. The site has been the subject of targeted research. The population is 304, at an elevation of 1,000 m, and hence in the tropical margin. The community, like many other minority-group communities in Yunnan, was relocated during the collectivization period, and the site is in transition from shifting cultivation to more permanent forms of land use, but has limited scope for irrigation. Rubber planting for commercial purposes is taking up an increasing proportion of land, but the present main cash crop is cardamom, grown under forest with creation of significant ecological problems. Land tenure problems have not yet been fully explored, but the lessons learned at Hanlong will be applied. Collaboration of specialists from the Xishuangbanna Tropical Botanical Garden, and the Provincial authorities, will be important.

Planned demonstration sites

It is planned to replicate the Hanlong model in another village close to the large Gaoligongshan State Nature Reserve. A second site will also be developed in Xishuangbanna.

Minzudi, Tengcong County, Baoshan Prefecture

This community, with a population of 59 Lisu minority people, is characterized by tobacco growing (since 1989). Degradation of the collective community forest since 1982-83, due to fuelwood collection (cooking and tobacco drying), is threatening the nature reserve. Minzudi is at 1800-2000 m, close to the western edge of Gaoligongshan State Nature Reserve. Efforts will be made to establish agroforestry using Alder (*Alnus nepalensis*, a fast growing nitrogen-fixing tree of good fire quality). Also proposed is afforestation based on the Gingo tree and possibly *Taxus yunnanensis* (a yew), which is a rare native species threatened by logging demand. Work will be supported by the Provincial biological resource development programme.

Baka Community, Jinghong County, Xishuangbanna Prefecture

This community of 258 people is characterized by swidden cultivation, with a very limited area of irrigation. Arable land is limited since the nature reserve boundary has been re-fixed twice. Most cash income was from Chinese cardamon in the 1980's, from rubber in the 1990's, and most recently passionfruit. Changes in policy and land use have impacted the swidden fallow forest and the community primary forest, with heavy fragmentation of ownership and biodiversity loss. Efforts will be made to regenerate the 'window' cleared plots within the community forest through natural recovery and to develop agroforestry.

Method

The Cluster sets out its methodology in the following way:

Activities	Contents	Output
1. Joint Inventory of resources and their utilization	By scientists and village people, paying particular attention to local resource-using practices and knowledge	1. Policy papers, technical reports and recommendations; 2. Resource mapping through GIS; 3. Inventory booklet of local resource management.
2. Participatory Appraisals	Through focus group and individual meetings, on social, cultural, economic and political factors that influence selection of farming strategies, paying particular attention to access and property rights	1. Policy papers and recommendations for sustainable resource management, both for the local government and community; 2. Understanding between the local community, nature reserve administration, and the authorities.
3. Participatory land use planning	The central objective is to participate with local people in the design of their own projects for sustainable resource management.	1. Conservationist community development planning guidelines and community rules; 2. Community oriented project proposals.
4. Alternatives to Swidden cultivation through agroforestry or plantation	The objective is to seek and experimentally try out potentially successful market-oriented agroforestry or mixed plantations of native species on the sloping upland. These will eliminate forest invasion for food cropping, cash cropping, timber or fuel wood plantation.	1. Increase of cash income with high productivity; 2. Technical guidelines. (Some trials have been done in Hanlong village, using MacArthur funds)
5. Conservation of existing Community Forest (including swidden fallow forest)	The objective is to reduce fragmention in community forest (which disturbs the gene flow) through building corridors , using both institutional and technical approaches.	1. Methodology formulation on recovery of fragmentation (including institutional and technical methodology); 2. Understanding the impacts of fragmentation on biodiversity.
6. Training in practical technology and participatory appraisal, and setting up Participatory Farmers' Associations	The objective is to build the local community capacity for conservation organization, introduction of new crops cultivation favouring conservationist technology, and building the framework of participatory strategies.	1. One farmers association has been set up in Baihualing village (Hanlong). This framework has been accepted and popularized in the province; it could be extended to all related sites; 2. Participatory framework popularized among policy makers and in communities.

PAPUA NEW GUINEA

Ecosystem and institutional context

The island of New Guinea lies in a geologically-mobile region and has a great variety of landscapes, climates and ecosystems. Forty-three per cent of the total land area of PNG comprises foothills and mountains from sea level to 1000 m altitude, and a further 25 per cent lies between 1000 m and 3000 m. The great majority of people live in these two environments. Except in the coastlands, differences in floristics and structure are largely related to climate. At low altitudes, tropical rain forest covers most areas except those with strongly seasonal climates. With increasing altitude, species diversity falls progressively through lower-montane, upper-montane and sub-alpine forests. Most, but not all, of the intensive farming systems are in the Mountain Ecosystem. Within the Forest Ecosystem there is considerable variation among shifting systems, some people making use of fire, others cultivating without fire. There are major contrasts in population density, degree of commercialization, and land-management methods. Well over one-quarter of the total forested area in the country is the successional component of fallow-based cultivation systems.

This Cluster is made up of two main groups. The first comprises the Land Management Group at the Research School of Pacific and Asian Studies, The Australian National University (ANU) in Canberra, together with a collaborating group based in the National Research Institute (NRI) and at the University of Papua New Guinea (UPNG), in Port Moresby. This group works closely with the Research Division of the PNG Department of Agriculture and Livestock, which is in the process of becoming a semi-autonomous National Agricultural Research Institute (NARI). The second main group is based at the Department of Human Ecology at the University of Tokyo. The scientists at the Australian National University and in Papua New Guinea are informally 'twinned'; there are frequent sponsored exchange visits between personnel from the two countries, and there is close involvement with senior PNG public servants setting up NARI, concerned primarily with food-crop agriculture in what is known as the 'semi-subsistence sector'. NARI will become responsible for policy and management of research in this sector and for offering advice to outreach and extension organizations in provinces and in NGOs. The ANU group is involved in assisting NARI to identify agroecological zones and farming systems, and within them systems at greatest risk of land degradation. The ANU group will then become involved in the transfer of both indigenous and introduced agrotechnology into other areas where it might be useful. This will involve experimental work on farmers' land. The group is also involved in agricultural aspects of a national sample survey of poverty in PNG for the World Bank.

Established or initiated demonstration sites

To date, the Cluster has concentrated on creating a national database of agricultural systems, linked to a database on natural resources. The next stage of the work is to define both agroecological zones and farming systems. From within these frameworks, sites will be selected which are representative of all parts of the country, and from which research outcomes can be extrapolated with a considerable degree of confidence.

Planned demonstration sites

Demonstration sites will be selected from within these zones and systems. As well as being representative of systems and agroecological zones elsewhere in the country, sites will be selected on the basis of the availability of existing information, such as air photographs and previous research and technical reports. The group is concerned with farmers' responses to environmental change and with rates of change; empirical evidence of change over time is very important.

The project has been in direct contact with a number of provincial governments. Workshops on the use of the agricultural systems database have been held in two provinces and at two research stations. The next stage is the selection of specific sites, where work will be undertaken in close cooperation with both NARI and provincial staff, and local organizations, such as councils and church organizations.

AMAZONIA

Ecosystem and institutional context

Work of the Cluster concentrates on the *várzea* of the Amazon River. The *várzea* floodplain can be defined as the area that is periodically inundated by the lateral overflow of the sediment-rich waters of the major white-water rivers of Amazonia. Reflecting stages in the evolution of the river, the *várzea* undergoes continuous change as the river winds its way across the continent. In the Upper Amazon, flood amplitude is greater, flood peaks are usually of shorter duration, sediment loads are higher, and landforms are less stable. Topography is more complex than is the case in the *várzea* of the

middle and lower portions of the basin. In the delta and estuary zone, daily tidal fluctuation can exceed the amplitude of the seasonal flood regime. Close integration of terrestrial and aquatic environments is characteristic of the ecosystem.

With fertile soils and abundant aquatic resources, floodplain economic activities (farming, forestry and agroforestry, animal husbandry and fisheries) have sustained the highest Amazonian population densities since the pre-Columbian period. Over generations, *ribeirinhos,* the current majority residents of the *várzea*, maintained the productivity, resilience and biodiversity of the floodplain ecosystems. In the last three decades, new land-use pressures and intensification of resource exploitation have begun to threaten the terrestrial and aquatic components of the ecosystem. Increasingly, large-scale logging, commercial fishing and water buffalo ranching are coming to dominate *várzea* resource use. These uses have potentially serious consequences for the biodiversity and long-term productivity of *várzea* ecosystems, as well as the economic viability of diverse resource management and productive systems. The nature and extent of these pressures varies considerably over the 3,000 km distance separating headwater and estuary regions of the floodplain. In this regard, the management systems devised by *ribeirinhos* in response to distinctive local conditions, represent a storehouse of valuable information in devising more productive and sustainable systems for all parts of the Amazon *várzea*.

The Amazonia Cluster is directed by Dr. Tereza Ximenes-Ponte, Vice-Coordinator of the Nucleo de Altos Estudos Amazônicos (NAEA) at the Federal University of Pará (UFPa) in Belém (Brazil), with Dr. David McGrath (also of NAEA) as Deputy Cluster Leader. Administration and coordination will be carried out by the Instituto de Pesquisa Ambiental da Amazonia (IPAM), a privately funded research institute based on the UFPa campus in Belém. There are three groups, presently working near the city of Macapá, near the mouth of the Amazon; and near the city of Santarém on the middle Amazon. The Macapá group works closely with the Sindicato dos Trabalhadores Rurais do Amapá. The Santarém group is a collaborative programme involving NAEA, IPAM, and the Colonia de Pescadores Z-10, the principal fishermen's union of Santarém. Other bodies involved in Brazil include the Museu Paraense Emílio Goeldi. There are also connections with EMBRAPA. The project is also working with Projeto Iara of IBAMA, giving it connection to a body concerned with policy at the federal level.

Established or initiated demonstration sites

The following sites are already operational.

Projeto Varza, Ituqui, Santarém, Brazil

This large demonstration site will embrace a group of some 20 communities around three *várzea* lake systems in which the management of fishing resources is more important than the management of land resources. A pilot programme at Ituqui Lake covers some 2,000 people in eight communities. It is based on the setting up of the Conselho de Pesca de Ituqui as an organizational model for intercommunity resource management, including both lake resources and floodplain land-management systems, by the Colonia de Pescadores Z-10, in collaboration with project scientists. A research and extension programme has been initiated among 20 farmers to increase the productivity of annual production systems focusing on manioc, maize and beans, as the nucleus of a larger effort. Also involved are an environmental education programme for school leavers, and a family and community sub-programme seeking to improve the nutritional level of children.

Mazagao and Ipixuna, Macapá, Brazil

In these two areas near the mouth of the Amazon, the daily rise and fall of the tide exceeds the annual flood of the river and creates a very complex and risky environment for smallholder resource managers and producers. The project focuses on testing flood resistant crops, management of plant disease, and sustainable production of fast-growing timber species in agroforests and fallow sites. There are four *ribeirinhos* communities, with 56 households, at Mazagao, and three communities with 42 households, at Ipixuna. In both communities an active programme of training, monitoring, and experimentation is carried out in the plots of selected cooperating households under the guidance of the communities' own experts, i.e. the best farmers, agroforesters, and forest managers. All work is done in close collaboration with project personnel, the farmers and the union representing them, the Sindicato dos Trabalhadores Rurais do Amapá.

Planned demonstration sites

Extension of work outward from well-chosen initial sites is the principal planned path of expansion, and there will also be an additional site or sites in the upper Amazon region, where preliminary work has already been undertaken. Training and extension programmes are planned to be expanded in the near future.

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THE 'GREY LITERATURE' OF PLEC, 1993-96

Explanation

PLEC News and Views 7 (November 1996) printed details of a considerable number of titles published by members of PLEC between 1993 and 1996. In this issue, we supplement that list by presenting details of many of the 'grey literature' titles published during the same period. The distinction between 'full publication' and 'grey publication' is not always easy to make. Properly, full publication demands that peer-referees have commented on the texts before their publication. However, refereeing is very variable, sometimes by only one and sometimes by several referees. Some editorial handling is as rigorous as the work of any referee. The list that follows is broken up by geographical area (here listed alphabetically), principally because many of these 'grey' titles are available only from the place where they were issued. Further information on the titles listed under each geographical area can be obtained from Cluster Leaders or Deputy Leaders listed above.

AMAZONIA

Hiraoka, M.
1993 Sustainable resource management in the Amazon floodplain: report on the first stage of the *'Várzea* Project'. *PLEC News and Views* 1: 11-13.

Pinedo-Vasquez, M.
1996 Local experts and local leaders: lessons from Amazonia. *PLEC News and Views* 6: 30-32.

Serrão, E. A. S.
1994 The Amazon floodplain: the next major frontier for food production. *PLEC News and Views* 2: 25-26.

Uitto, J. I.
1995 PLEC Amazonia: a mission report. *PLEC News and Views* 4: 6-8.

CARIBBEAN

Gumbs, F.
1996 *Farmers and soil conservation methods in the Caribbean.*UWICED Occasional Paper Series No. 2. Kingston: Canoe Press. [In press].

EAST AFRICA

EAPLEC-Tanzania
1996 Population, land management and environmental change and their influence on farming systems response, biodiversity and adaptation to conservation. The case of Arumeru District, Arusha, Tanzania. EAPLEC Tanzania Final Report.

Kiwanuka, F.
1995 A study of the effects of land use systems on environment change in Mbulamuti sub-county, Kamuli District, Uganda. Student Report.

Lindblade, K., J. K. Tumuhairwe, G. Carswell, C. Nkwiine and D. Bwamiki
1996 More people, more fallow. Report of a special study repeating the Pursglove study of 1945 to expose the myth of population growth and overcultivation in Kabale District, S.W. Uganda. Funded by Rockefeller Foundation, CARE International and Makerere University.

Mbago, F. M.
1995 Preliminary assessment of plant species diversity around Arumeru District. Report for EAPLEC, Tanzania and National Soil Service, Mlingano.

Mugwisagye, B. J.
1996 Effects of agriculture practices on the environment in Nyabihoko sub-county, Ntungamo District. Student Report.

Ojok, P.
1995 Land use activities and their effects on the environment in Chawente sub-county, Apac District, Uganda. Student Report.

Stocking, M.
1994 Assessing erosion quickly and (hopefully) cleanly. *PLEC News and Views* 3: 17-21.
Stocking, M.
1996 International dimensions to common property resource management. Presented to the East African Regional Symposium on Common Property Resource Management, 26-28 March, 1996, Kampala, Uganda.
Stocking, M. and J. K. Tumuhairwe
1996 People, Land Management and Environmental Change: (PLEC)/UNU Project work on environment in Uganda. Paper presented to the East African Regional Symposium on Common Property Resources Management. Convened by MISR and The Ford Foundation, 26-28 March 1996, Kampala.
Tumuhairwe, J. K.
1995 Acceptance and impact of soil and biodiversity conservation approaches. Research report on the UNU collaborative project on PLEC, submitted to Makerere University Faculty of Agriculture and Forestry Annual Report 1995.
Tumuhairwe, J. K., E. Nsubuga and F. Kahembwe
1996 Participatory characterisation of the linkages between people, land, and acceptance of soil and biodiversity conservation approaches in Mwizi sub-county, S.W. Uganda. Uganda Technical Report No. 2. to EAPLEC and PLEC/UNU [forthcoming].
Tumuhairwe, J. K., E. Nsubuga and F. Kahembwe
1996 Preliminary assessment of landuse, soils, agrodiversity and biodiversity of three pilot PLEC study sites in western Uganda. Technical Report No.1 to EAPLEC and PLEC/UNU.
Twesigye, B. C.
1996 The impact of land use practices on soil and water conservation, and the environment in Rwampara County, Mbarara District. Student Report.

GENERAL

Brookfield, M.
1996 Indigenous knowledge: a long history and an uncertain future. *PLEC News and Views* 6: 23-29.
Brookfield, M.
1996 Indigenous knowledge: a long history and an uncertain future. *Indigenous Knowledge and Development Monitor* 4 (2):31.
Uitto, J. I.
1995 Population-environment nexus in smallholder agriculture in Southeast Asia. Paper presented to the XVIII Pacific Science Congress: Population, Resources and Environment, Beijing, China, 5-12 June 1995.
Uitto, J. I.
1996 Agrodiversity, land management, and indigenous knowledge: keys to sustainable agricultural development. Paper presented at the 28th International Geographical Congress, The Hague, The Netherlands, 4-10 August 1996.
Zarin, D. J.
1995 Diversity measurement methods for the PLEC clusters. *PLEC News and Views* 4: 11-21.

MMSEA

Thailand

Rerkasem, B. and K. Rerkasem
1996 Influence of demographic, socio-economic and cultural factors on sustainable land use. Paper presented to the 9th International Soil Conservation Organization Conference, Bonn, Germany.
Rerkasem, B., K. Rerkasem and B. Shinawatra
1995 A note on mixed cropping by a hill-tribe people in northern Thailand. *PLEC News and Views* 5: 31-32.
Rerkasem, K. and B. Rerkasem
1993 Land use changes in the highlands of northern Thailand. *PLEC News and Views* 1: 17-18.

Stocking, M.
1996 The rapid appraisal of land degradation - from biophysical to socioeconomic impacts. Paper presented to the symposium on Montane Mainland Southeast Asia in transition, Chiang Mai University, Thailand, 12-16 November 1995.

Thong-Ngam, C., B. Shinawatra, S. Healy and G. Trebuil
1996 Farmer's resource management and decision-making in the context of changes in the Thai highlands. Paper presented to the symposium on Montane Mainland Southeast Asia in transition, Chiang Mai, Thailand, 12-16 November 1995, pp. 462-487. Chiang Mai University.

Yunnan

Ai, H.
1996 A new approach to biodiversity monitoring: through farmers' participation and farmers association on biodiversity conservation. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Cheng, A., Guo Huijun and Cui Jingyun
1996 Agricultural diversity in the tropical mountain. Paper presented to the International Symposium on Environment and Natural Resources Management for the Upper Mekong Basin, Bangkok, Thailand, 10-11 August 1996.

Dao, Zhiling
1996 Minor products and potential industry: non-timber forest products in Gaoligongshan Mountains. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Guan Yuqing, Dao Zhiling and Cui Jingyun
1995 Evaluation of the cultivation of *Amomum villosum* under tropical forest in southern Yunnan, China. *PLEC News and Views* 4: 22-28.

Guo, Huijun
1993 The traditional land management systems research programme in Yunnan, China. *PLEC News and Views* 1: 19-20.

Guo Huijun
1996 Traditional agrodiversity systems of Yunnan. Paper presented to the symposium on Montane Mainland Southeast Asia in transition, Chiang Mai, Thailand, 12-16 November 1995, pp. 426-435. Chiang Mai University.

Guo, Huijun
1996 Forest belt for nature reserve buffer zone: utilization of indigenous technology on rare tree species. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Guo Huijun, Dao Zhiling and H. Brookfield
1996 Agrodiversity and biodiversity on the ground and among the people: methodology from Yunnan. *PLEC News and Views* 6: 14-22.

Guo Huijun, Dao Zhiling, Yang Shixiong, Le Zhengbo
1996 Impacts of forest ownership and policy changes on biodiversity in Gaoligongshan Mountains. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Guo Huijun, Shen Lixin, Dao Zhiling, Liang Luohui, Li Zhengbo
1996 Small farmer's strategy with land use policy change and economic development in Baihualing village, Gaoligongshan Mountain, western Yunnan. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Li Heng and Yang Shixiong
1996 Unaware corner in the world biodiversity: 3500 species of flowering plants found in Gaoligongshan Mountains. Annual Meeting of Forest

Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Li Zhengbo
1996 Agroforestation in Baihualing village: an approach for rural development and biodiversity conservation. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Li Zhengbo
1996 The first farmers' association on biodiversity conservation: Gaoligongshan farmers' association on biodiversity conservation. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Li Zhengbo
1996 Plants endemic to Gaoligongshan Mountains: construction of rare and endemic botanic garden. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Long Biyun
1996 Impacts of land management patterns on forest residues in the soils in Gaoligongshan Mountains. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Menzies, N. K.
1996 The changing dynamics of shifting cultivation practises in upland southwest China. Paper presented to the symposium on Montane Mainland Southeast Asia in transition, Chiang Mai University, Thailand, 12-16 November 1995.

Shen, Lixin
1996 Rural economic changes and forest management changes in Yutang and Taoyuan villages in Baihualing area, Gaoligongshan Mountains. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Shen, Lixin and Yang Wenzhong
1996 Community forest management in Baihualing village, Gaoligongshan Mountains. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

Zhang, Ping
1996 Impacts of forest policy on micro-organism diversity in Gaoligongshan Mountain, western Yunnan, China. Annual Meeting of Forest Management and Biodiversity Conservation in Gaoligongshan (FMBC/GLG) Programme, 22-23 January, 1996, Kunming, PRC.

PAPUA NEW GUINEA

Allen, B. J.
1993 Agriculture in Papua New Guinea: background for PLEC. *PLEC News and Views* 1: 21-25.

Allen, B. J., R. M. Bourke and R. L. Hide
1995 Agricultural systems in Papua New Guinea project: approaches and methods. *PLEC News and Views* 5: 16-25.

Allen, B. J., R. L. Hide, R. M. Bourke, W. Akus, D. Fritsch, R. Grau, G. Ling and E. Lowes
1993 *Western province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 4. Canberra: Department of Human Geography, Australian National University.

Allen, B. J., T. Nen, R. M. Bourke, R. L. Hide, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon
1996 *Central province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 15. Canberra: Department of Human Geography, Australian National University.

Allen, B. J., R. L. Hide, R. M. Bourke, C. Ballard, D. Fritsch, R. Grau, P. Hobsbawn, G. S. Humphreys and D. Kandasan

1995 *Enga province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 9. Canberra: Department of Human Geography, Australian National University.

Allen, B. J., T. Nen, R. L. Hide, R. M. Bourke, D. Fritsch, R. Grau, P. Hobsbawn, S. Lyon and G. Sem

1996 *Northern province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 16. Canberra: Department of Human Geography, Australian National University.

Allen, B. J., R. L. Hide, R. M. Bourke, D. Fritsch, R. Grau, E. Lowes, T. Nen, E. Nirsie, J. Risimeri and M. Woruba

1993 *East Sepik province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 2. Canberra: Department of Human Geography, Australian National University.

Allen, B. J., R. L. Hide, R. M. Bourke, D. Fritsch, R. Grau, P. Hobsbawn, M. P. Levett, I. S. Majnep, V. Mangi, T. Nen and G. Sem

1994 *Madang province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 7. Canberra: Department of Human Geography, Australian National University.

Bourke, R. M.

1996 Edible indigenous nuts in Papua New Guinea. In M. L. Stevens, R. M. Bourke and B. R. Evans (eds) *South Pacific indigenous nuts*, pp. 45-55. Canberra: Australian Centre for International Agricultural Research.

Bourke, R. M., B. J. Allen, R. L. Hide, D. Fritsch, R. Grau, P. Hobsbawn, E. Lowes and D. Stannard

1994 *Eastern Highlands province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 8. Canberra: Department of Human Geography, Australian National University.

Bourke, R. M., B. J. Allen, R. L. Hide, D. Fritsch, R. Grau, E. Lowes, T. Nen, E. Nirsie, J. Risimeri and M. Woruba

1993 *West Sepik province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 3. Canberra: Department of Human Geography, Australian National University.

Bourke, R. M., B. J. Allen, R. L. Hide, D. Fritsch, R. Grau, P. Hobsbawn, B. Konabe, M. P. Levett, S. Lyon and A. Varvaliu

1995 *Southern Highlands province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 11. Canberra: Department of Human Geography, Australian National University.

Bourke, R. M., R. L. Hide, B. J. Allen, D. Fritsch, R. Grau, P. Hobsbawn, M. Levett, S. Lyon, L. Nama and T. Nen

1996 *West New Britain province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 13. Canberra: Department of Human Geography, Australian National University.

Bourke, R. M., B. J. Allen, R. L. Hide, D. Fritsch, T. Geob, R. Grau, S. Heai, P. Hobsbawn, G. Ling, S. Lyon and M. Poienou

1996 *East New Britain province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 14. Canberra: Department of Human Geography, Australian National University.

Hide, R. L., R. M. Bourke, B. J. Allen, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon

1995 *Western Highlands province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 10. Canberra: Department of Human Geography, Australian National University.

Hide, R. L., R. M. Bourke, B. J. Allen, D. Fritsch, R. Grau, P. Hobsbawn and S. Lyon
1995 *Chimbu province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 12. Canberra: Department of Human Geography, Australian National University.

Hide, R. L., R. M. Bourke, B. J. Allen, N. Fereday, D. Fritsch, R. Grau, E. Lowes and M. Woruba
1993 *Gulf province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 5. Canberra: Department of Human Geography, Australian National University.

Hide, R. L., R. M. Bourke, B. J. Allen, T. Betitis, D. Fritsch, R. Grau, L. Kurika, E. Lowes, D. K. Mitchell, S. S. Rangai, M. Sakiasi, G. Sem and B. Suma
1994 *Milne Bay province: text summaries, maps, code lists and village identification.* Agricultural Systems of Papua New Guinea Working Paper No. 6. Canberra: Department of Human Geography, Australian National University.

Humphreys, G. S.
1994 Deciphering land use history from hillslopes: an example from New Guinea. *PLEC News and Views* 2: 21-25.

Ohtsuka, R.
1993 The human ecologists' contribution to PLEC. *PLEC News and Views* 1: 26-27.

Ohtsuka, R.
1993 PLEC project and human ecological research. *Newsletter of Japanese Association of Tropical Ecology* 13: 1-4.

WEST AFRICA

Amanor, K. S.
1995 Indigenous knowledge in space and time. *PLEC News and Views* 5: 26-30.

Ardayfio-Schandorf, E.
1994 Women as farmers in Ghana. *PLEC News and Views* 2: 19-21.

Gyasi, E. A.
1993 Environmental endangerment in the forest-savanna zone of southern Ghana. *PLEC News and Views* 1: 14-15.

Gyasi, E. A.
1996 Collaborative multidisciplinary approach to environmental management research: experiences of the PLEC project in West Africa. [Proceedings of International Seminar on the Coastal Zone of West Africa: Problems and Management]. Department of Oceanography and Fisheries, University of Ghana in collaboration with Department of Marine Science and Coastal Management, University of Newcastle, 25-29 March 1996. [forthcoming].

Gyasi, E. A.
1996 Gyamfiase, Ghana: a study in threat and counteracting threat to indigenous forest groves and sustainable management systems. Paper presented to the conference 'Contested Terrain: West African Forestry Relations, Landscapes and Processes', Edgbaston, Centre of West African Studies, University of Birmingham.

Gyasi, E. A.
1996 Land holding and its relationship with biophysical status: case study of tenancy and non-tenancy farming in Ghana. *PLEC News and Views* 7: 21-25.

Gyasi, E. A. and L. Enu-Kwesi
1996 Collaborative agroecosystems management project (CAMP): a proposed community-based initiative in Ghana, by WAPLEC in collaboration with the Chief and the people of Gyamfiase. *PLEC News and Views* 6: 11-13.

PAPER BY PROJECT MEMBERS

ITUQUI: A TRADITIONAL LAKE FISHERY OF THE LOWER AMAZON *VÁRZEA*[1]

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Introduction

Though PLEC has tended to concentrate on smallholder production systems, especially the complex of crops and techniques employed to adapt these systems to local environmental and market conditions, traditional knowledge and management of natural resources and habitats constitute another important dimension of PLEC work. These two factors play a major part in the smallholders' role in the conservation of regional biodiversity. In the Amazon basin with its relatively low population densities, extractive activities are an especially important aspect of smallholder management strategies, and access to extractive resources has had a strong influence on the distribution of the rural population. In recent years public attention has focused on traditional extraction of forest resources, but historically access to the aquatic resources of the Amazon river system has been a deciding factor in regional population distribution. Due to the high productivity of *várzea* fisheries and other aquatic resources and to the fertility of its alluvial soils, the Amazon floodplain, or *várzea* as it is called locally, has supported some of the highest population densities in the basin. In contrast to the upland frontier where settlement is dominated by colonists from outside the region, the *várzea* has a strong tradition of smallholder settlement based on manage-ment systems that have evolved from indigenous origins over the course of 300 years of European presence in the region.

These management systems are typically quite diversified, integrating farming, small animal husbandry, cattle raising, forest extraction and fishing. The relative importance of the different activities comprising the household economy has changed over time, as a result of resource exhaustion or changes in regional market demand (Chibnik 1994, Ross 1978). Continuing this cyclical pattern, fishing has become, over the last two decades, an increasingly important component of the *várzea* smallholder economy, especially in the Lower Amazon (Smith 1981). Due to the decline of jute farming, the major cash crop since the 1950s, and the development of the commercial fisheries, fishing has become the major source of both animal protein and cash income for the great majority of *várzea* smallholders (Goulding et al. 1996, McGrath et al. 1993). As such it has come to occupy a strategic position in the *várzea* household economy, one which is critical to the basic economic strategy of *várzea* smallholders (McGrath et al. 1996).

This paper describes smallholder fishing activity on the Amazon *várzea* with the objective of shedding light on how fish resources are utilized, and on the role of this extractive activity in the household economy. It draws on targetted research during the past few years which underpins the development of participatory manage-ment, in collaboration with the Colonia de Pescadores Z-10, at Santarém. The study is part of a larger PLEC/WWF- ODA funded project whose objective is to increase the effectiveness of community-

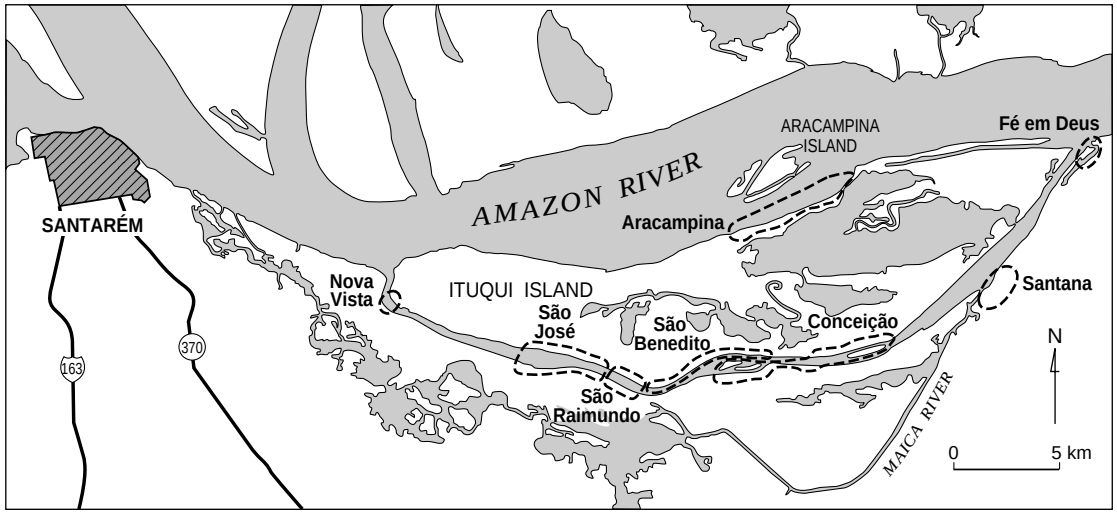
[1] Research on which this paper is based was funded by the United Nations University, WWF-UK/ODA Joint Funding Scheme, and CNPQ (Brazilian National Research Council).

based management systems for *várzea* lake fisheries through a program of research and extension.

Study site

This study is based on the region of Ituqui, an island of 30,000 ha on the south shore of the Amazon river, some twenty kilometres downstream from Santarém, the major urban centre of the Lower Amazon (Figure 1). The Ituqui region has a population of approximately 2,200 people distributed in eight communities, four of which are located on the island and four on the facing shore of the side channel formed by the island.

FIGURE 1: LOCATION MAP



The four island communities covered here vary in size from 37 to 68 households strung out along the levee bordering the river. In addition to these communities, there are approximately twenty rural properties, of which about a dozen larger ranches control more than 50% of the island (Camara 1996). Table 1 presents a summary of the main economic activities of households in the communities studied. As is the case elsewhere on the *várzea*, Ituqui smallholders have diversified management strategies combining fishing, farming, and the raising of small animals and cattle. Virtually all households fish for subsistence and approximately two-thirds of Ituqui households also sell fish on a full or part time basis (Table 1).

The lower Amazon *várzea* is composed of four major landscape features: river channels, natural levees, seasonally innundated grasslands and lake systems (Figure 2). Natural levees, or *restingas* as they are called locally, border the river and its major side channels. Inland from the *restingas* the land slopes gently downward towards the large shallow lakes which occupy much of the floodplain interior. The natural vegetation of the *restingas* is *várzea* forest while the transitional zone between the *restingas* and the permanent lakes is covered by natural grasslands. Household resource management strategies exploit all four environmental zones. Because of their higher elevation, *restingas* are the preferred sites for houses and most agricultural activity. The natural grasslands are used for grazing cattle during the low water season, and the *várzea* lakes are the focus of most fishing activity. The river, in addition to its role in transportation, is the site of a seasonal commercial fishery.

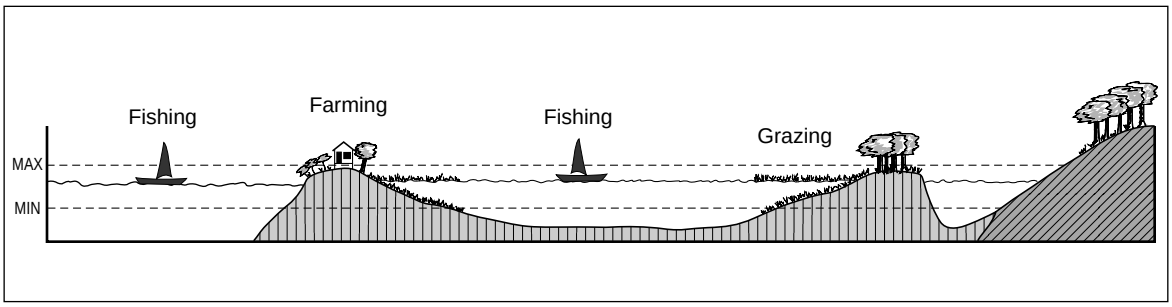
Table 1

Major subsistence activities of the Ituqui population

		PERCENT OF TOTAL HOUSEHOLDS				FISHING	
COMMUNITY	HOUSES %	AGRIC %	SMALL ANIMALS %	CATTLE %	FISHING %	SUBS %	S/C* %
ARACAMPINA (ARA)	64	97	88	72	97	6	91
SANTANA (SAN)	68	69	78	31	82	24	59
SÃO BENEDITO (SBO)	37	73	92	81	70	38	32
SÃO JOSÉ (SJE)	37	89	89	43	97	22	76
TOTAL	206	82	85	55	87	20	67

* Subsistence and Commercial

FIGURE 2: FLOODPLAIN LAND USE



Várzea fisheries

Major fisheries

Ituqui fishers are involved in two major fisheries, the river and lake fisheries, which involve overlapping groups of species. In the Ituqui region, the river fishery is associated primarily with migratory catfish, and the lake fishery with a variety of species of which the cichlids and characins are the most important. Fishing in the river fishery concentrates on the exploitation of migrating schools of catfish which begins as water levels start to fall in June, reaches a peak in August and September and drops off rapidly in October and November (Barthem et al. 1991). This fishery supplies a handful of processing plants which export frozen catfish to other parts of Brazil and the exterior. Since the local population consumes very little catfish, these species tend to be of little signficance for either subsistence or local consumer markets. A second river fishery, equally seasonal, includes various species of migratory characins which spend the flood season in *várzea* lakes and undertake seasonal spawning and dispersal migrations over the course of the year (Goulding 1980, Ribeiro and Petere 1990).

While the river fishery is oriented towards the export market, the lake fishery tends to be oriented towards local subsistence needs and regional consumer markets. Although the productivity of the lake fishery also exhibits a strong seasonal pattern, fishing activity in the lake is fairly constant throughout the year, reflecting both availability as well as the lake fishery's importance for local consumption. The data presented here include activity in both river and lake fisheries, with the emphasis on the lake fishery, which is the focus of local community management efforts.

Fishing activity

The Ituqui fishery is a typical, traditional artisanal fishery in that it is small scale, involving part-time fishers using simple fishing gear and unspecialized fishing vessels (Smith 1979). Virtually all fishing activity is carried out in dugout and plank canoes 3-6 metres in length, powered by paddle and, when the wind permits, sail. The smaller dugout canoes are used in the lake fishery while the larger plank canoes, frequently with a simple removable mast and sail, are used in the river fishery where conditions are rougher. Fishers, working either singly or in pairs, undertake daily fishing trips from their homes. Most fishers store their catch in styrofoam ice chests with a capacity of 50-70 kilos of fish. They either transport their catch to market on a weekly basis, or sell it to local fish buyers with motorized boats and larger storage capacity.

Fishing gear

Some ten different types of fishing gear are utilized on a regular basis in the Ituqui fisheries, of which three account for 90% of total catch (Table 2). The most fequently used fishing gear is the gill net which accounts for 51% of the total. In addition to the gill nets, a variety of traditional fishing gear are employed in local fisheries. The cast net or *tarrafa* is the second most important gear type, accounting for 31% of the annual catch, followed by the fishing pole (*caniço*) with baited hook, which accounts for an additional 9%. A second group of traditional gear types includes the harpoon, used to catch the large, air breathing *pirarucu* (*Arapaima gigas*), and the longline (*espinhel*), used primarily for large catfish in the river. Finally, the bow and arrow and trident continue to play minor but seasonally significant roles in local fisheries.

The large variety of gear types reflects the selectivity of fishing strategies, enabling *várzea* fishers to exploit individual species in the wide range of micro-environments available over the course of the year. The mix of gear types also reflects the degree of orientation towards subsistence and commercial fishing. For example, in communities such as São José (SJE), where fishers are more commercially oriented, gill nets account for 78% of the annual catch, while in the subsistence oriented community of São Benedito (SBO), gill nets are considerably less important. Here traditional gear types such as the cast net, fishing pole and harpoon account for almost two-thirds of the annual catch (Table 2).

Table 2
Catch per type of gear

	COMMUNITY				
GEAR TYPES	ARA %	SBO %	SJE %	SAN %	TOTAL %
Gill Net	38	34	78	45	51
Cast Net	16	21	9	49	31
Fishing Pole	22	28	2	4	9
Harpoon	6	10	2	2	3
Long Line	4	5	8	0	3
Bow & Arrow	11	0	0	0	2
Trident	3	0	0	0	1
Fixed Hook & Line	0	0	1	0	0
Fishing Corral	0	1	0	0	0
Hand Line	1	0	0	0	0
TOTAL	100	100	100	100	100

Frequency and duration of fishing trips

In general, fishing trips are of fairly short duration, rarely exceeding twenty-four hours, reflecting the fact that most fishing activity is conducted within a relatively short distance of the fisher's home. For the sample as a whole, fishing trips averaged just under 7 hours (Table 3). However, within the sample the duration of fishing trips varies considerably, with communities such as São Benedito undertaking trips that are only half as long as those of fishers in the neighboring community of São José. The frequency of fishing trips per month varies between 8 and 22 trips per month, for an average for the four study communities of 17 per month, or four per week. This relatively high frequency of fishing trips reflects the importance of fishing in the household economy, especially when one

takes into account the fact that the number of days spent fishing only partially reflects the time invested in the activity, since time spent repairing equipment or collecting bait is not included.

Table 3
Fishing strategies: subsistence vs commercial

	HRS/TRIP	TRIPS/M	CATCH/TP	CATCH/M	CATCH/YR	CONSUM/YR	SALE/YR
ITUQUI (ave)	6.8	17	15	244	2927	632	2295
SBO (SUB)	4.2	20	7	139	1669	632	1037
SJE (COM)	8.6	18	18	295	3542	632	2910

There are clear differences between communities in the frequency and duration of fishing trips which are typical of the differing strategies of subsistence and commercial fishers (Table 3). The subsistence fishers of São Benedito, for example, take a larger number of shorter trips, with the goal of maintaining a steady supply of fresh fish for family consumption. The commercially oriented fishers with ice chests, such as those of São José, stay twice as long and catch as many fish as they can store.

Fishing locations

Although fishers occasionally undertake fishing trips to other regions, virtually all the fishing trips recorded in this study took place within the Ituqui region, which includes the Ituqui lake systems, the adjacent Maicá lake system, the Amazon river and the sidechannel which forms Ituqui island (Figure 1). Within the region, most fishing effort was concentrated in the Ituqui lake system which accounted for approximately 77% of the total catch. The Amazon river and the Maicá lake system accounted for 17% and 6% respectively of the total. Within the Ituqui lake system some 110 fishing sites were visited by fishers, suggesting that fishers are spreading their effort fairly widely throughout the system over the course of the year. Of this total, however, about 10 sites are especially important, accounting for about 30% of the total catch. When the data on fishing sites are classified by community, a distinct territorial pattern of fishing activity emerges with fishers of each community tending to fish in the lakes and channels nearest their community.

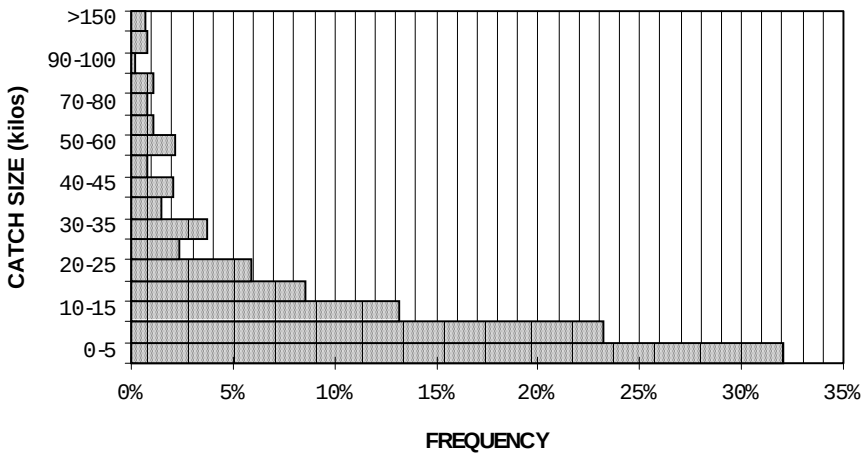
Catch

Catch per fishing trip is highly variable ranging from zero to over 150 kilograms, for an average of 13.5 kilos. However, this average masks another characteristic feature of the fishery, the small scale of fishing activity. While there is great variability in catch size, almost one third of all fishing trips result in catches between 0 and 5 kilos, and 50% between 0 and 10 kilos (Figure 3). In fact, the median daily catch for fishers is only 6.5 kilos. As in other aspects of the fishery, there are striking differences between communities. In the more commercially oriented communities of Santana (SAN) and São José modal catch is between 5-10 kilos, and almost 40% of catches are over 20 kilos. Variability in catch size is greater, with a higher frequency of both catches in which no fish are caught as well as of catches over 50 kilos. Conversely, in the more subsistence oriented communities of Aracampina (ARA) and São Benedito modal catch is between 0-5 kilos, with only a small fraction of the total over 20 kilos. Variability is lower, with a lower frequency of trips with no catch and of trips with a catch over 50 kilos.

Average monthly catch for Ituqui fishers is 244 kg for an annual total of nearly 3000 kilos (Table 3). Of this total, about 20% is consumed by the household. The remaining

2,300 kg is sold or exchanged with neighbors and relatives. As in other aspects of the fishery, there is considerable variation around this mean. In the subsistence oriented communities monthly catch is less than half that of commercially oriented communities, 139 versus 295 kilos, resulting in a total annual catch per household of 1,700 kilos in São Benedito and of 3,500 in São José(Table 3). It should be noted that the term 'subsistence' is used loosely, since even in the 'subsistence' oriented community of São Benedito, about two-thirds of the annual catch is either sold or exchanged with neighbors. In this respect at least, the difference between subsistence and commercially oriented communities is one of degree, rather than type.

FIGURE 3: SIZE DISTRIBUTION OF CATCH PER FISHING TRIP



Catch composition

The annual catch of the Ituqui fishery is composed of some 40 species, but just four species account for 50% of total catch and 13 species for 90%. This follows the pattern identified by other researchers studying the Amazon commercial fisheries (Bayley and Petrere 1989, Saint-Paul and Bayley 1979). Almost half of the 40 species are caught in negligible quantities, together accounting for only 1% of the total. The largely commercial orientation of the Ituqui fishery is revealed by the fact that catch composition, with two important exceptions, is essentially the same as that landed at Santarém.

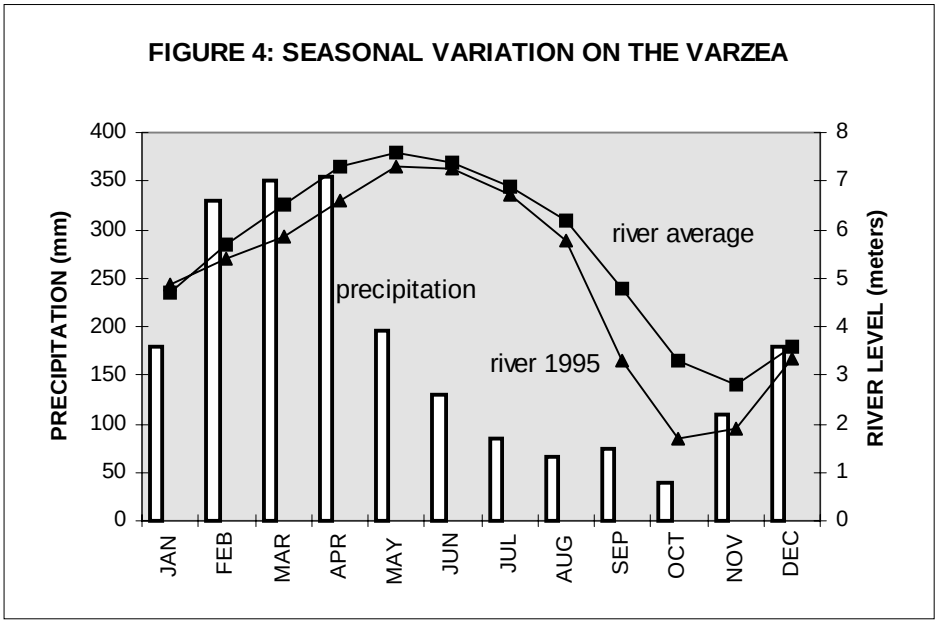
There is a marked difference in catch composition between the lake and river fisheries. The three main species in the river fishery are all large catfish which are largely absent from the lake fishery. Another group of species which is significant in the Ituqui regional catch occurs in both lake and river fisheries, albeit in smaller quantities in the river fishery. This is the lake species, which spend most of their lifecycle in *várzea* lakes but undertake seasonal migrations upriver to spawn. The lake fishery catch, with one important exception, is composed of species which are largely sedentary, reproducing in floodplain lakes and appearing in insignificant quantities in the catch of the river fishery. These species are among the ten most important in the lake fishery. The most important species in the lake fishery is the acarí, an armored catfish much regarded by the local population, which accounts for 30% of the total catch.[5]

[5] The high proportion of acarí in the 1995 catch may reflect extreme low water conditions during the dry season (Figure 4).

Seasonality in várzea fisheries

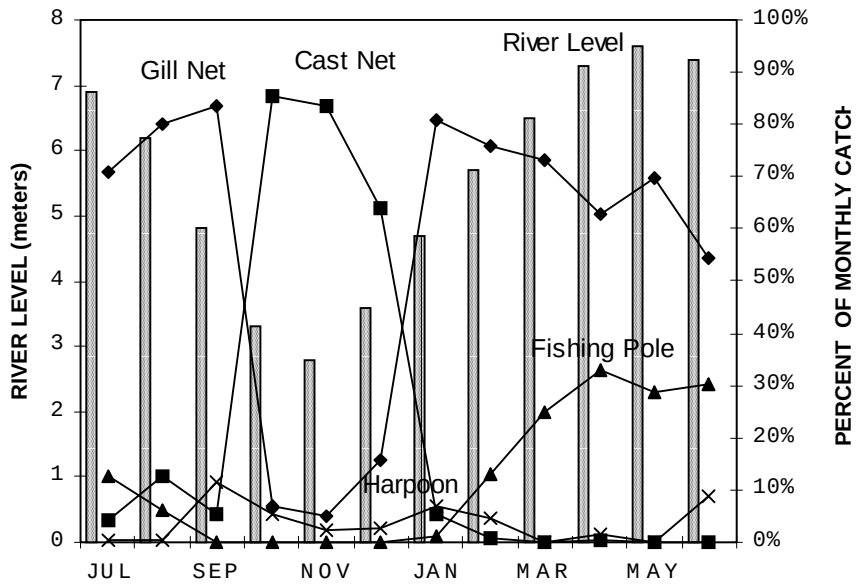
As noted earlier, there is a marked seasonality to *várzea* fisheries that is reflected in varzeiro fishing strategies in terms of total catch, catch composition, fishing gear and the types of environments exploited over the course of the year (Smith 1980, Merona 1990). This seasonal variation in local fisheries is driven by the annual cycle of the river and resulting changes in the abundance and distribution of fish. Based on this cycle, we can distinguish four periods that are characterized by different patterns and intensities of fishing activity. These are: the period of falling river level between July and September; a low water period between October and December; rising water between January and March; and a period of high water from April to June (Figure 4).

FIGURE 4: SEASONAL VARIATION ON THE VARZEA



The period of falling water level, July through September, coincides with the upstream migration of several species of large catfish, and much fishing activity in riverside communities such as Aracampina concentrates on the river fishery. The drifting gill net and longlines are used (Figure 5). During the subsequent low water season, fishing activity shifts to the lake fishery. Many lakes become too shallow for efficient use of gill nets and fishers switch to cast nets. This is also the season when the *pirarucu* fishery is most intense, as fish concentrated in the deeper lakes and channels are relatively easy to harpoon or net. When the water levels begin to rise, fishers continue fishing in the lakes, but turn to gill nets again as the dispersal of fish throughout the increasing volume of the lake reduces the effectiveness of cast nets. In the final phase the expanding lake system enters the surrounding *várzea* forest. Under these conditions, fishing poles can be very effective in both forest and floating meadow habitats, accounting for up to 30% of the monthly catch in some communities.

FIGURE 5: SEASONAL VARIATION IN USE OF FISHING GEAR



Variation in monthly catch follows a strongly seasonal pattern. Overall, total catch in 1995 during the six month 'summer dry season' of falling and low water (July through December), was 2,075 kilos, two and a half times the 862 kilos caught during the 'winter rainy season' (January through June) of rising and high water levels. The summer season is not just one of higher total catch but also of higher productivity. CPUE (catch per unit effort) measured in kilos per fisher day rises steadily as water levels fall, peaking in October and November at over 30 kilos per day and then falls as water levels rise to a low of 7 kilos per day at the peak of the annual flood, May and June (Figure 6).

FIGURE 6: SEASONAL VARIATION IN CPUE (Kg/Fisher/Day)

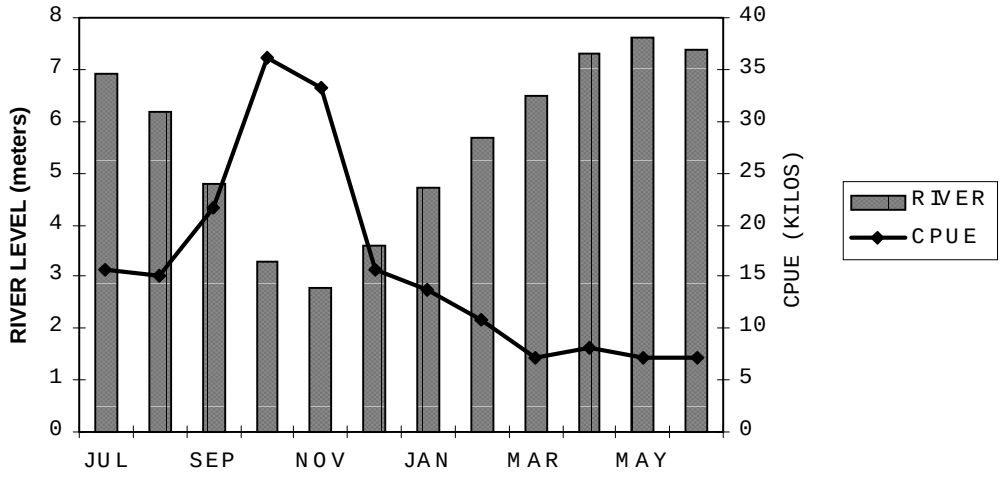
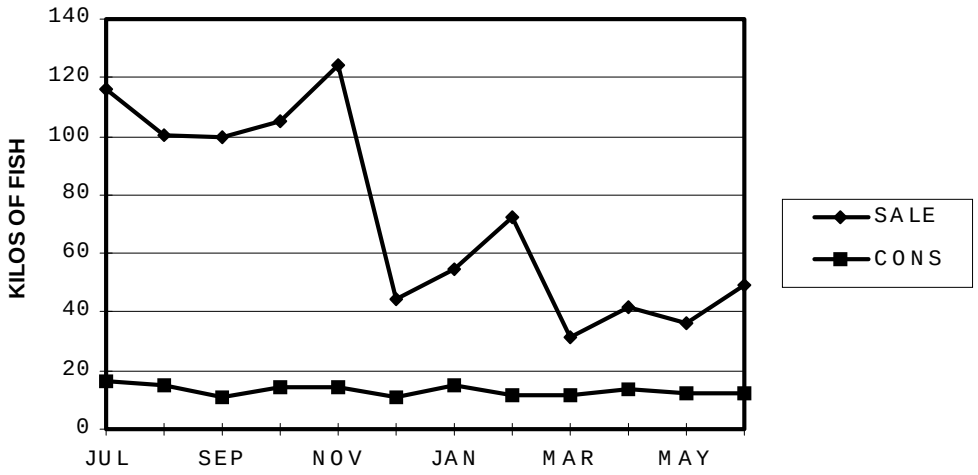


FIGURE 7: HOUSEHOLD SALE AND CONSUMPTION OF CATCH



Overall, characterization of the summer season as a time of abundance and the winter as a time of scarcity holds true for the Ituqui fishery. Household catch during the 'winter' rainy season is not much greater than household consumption so that the winter season fishing is of necessity strongly subsistence oriented (Figure 7). Most of annual cash income from fishing is obtained during the 'summer' months when total catch is highest. The contrast in 1995-96 between low and high water seasons is probably greater than in most years due to the abnormally low water levels reached during the dry season (Figure 4). The extreme low water period may have led to both higher than average rates of fish mortality and to larger than average catches, leaving many fewer fish for the subsequent flood season, thereby accentuating the contrast between dry season abundance and flood season scarcity.

The higher productivity of the dry season lake and river fisheries is important to the household economy because it provides cash income at a relatively lower cost in terms of labor just when agricultural activities are most demanding of labor and cash. Agricultural income becomes important towards the end of the low water season, when the productivity of fishing is diminishing, so that the fishing and agricultural activities of the household economy complement each other over a significant portion of the annual cycle.

Conclusion

The data summarized here reveal a typical traditonal artisanal fishery: small scale, utilizing simple technology and involving fishers with diversified economic strategies. While the household often engages in a number of economic activities, fishing tends to be the mainstay of the household economy. It is not only the main source of animal protein, but also of cash income for the purchase of household necessities and, when there is a surplus, of cash to invest in the other economic activities of the household.

The results presented here also have important implications for fisheries management. First, virtually all fishing activity is concentrated within the region, and almost two-thirds of the annual catch comes from the Ituqui lake system. Within the system fishing is also quite localized, with most fishers exploiting lakes within a short distance of their communities. The localized pattern of fishing activity, in which fishers concentrate their effort in distinct though overlapping portions of the lake system, is consistent with a community

management model in which fishers assume responsibility for regulating local fishing activity. Fishers appear to identify strongly with a distinct territory which is used almost exclusively by members of their own community. A second characteristic of the fishery is that despite the relatively large number of species captured, a small number of species accounts for most of the annual catch. Thus, while overall fishing pressure may not yet be excessive, pressure on the most sought after species is high, and in several cases may well exceed sustainable levels. Finally, there are important differences between communities in their degree of orientation towards commercial and subsistence fishing. These differing interests with regard to market and household consumption, both within and between communities, can be a major obstacle in commmunity efforts to manage local fisheries. Thus, while the overall pattern of *ribeirinho* fishing appears consistent with a community management model, a number of important issues must be addressed if communities are to manage local fisheries sustainably.

REFERENCES

Barthem, R., M. Ribeiro and M. Petrere
1991 Life histories of some long-distance migratory catfishes in the face of hydroelectric dams in the Amazon Basin. *Biological Conservation* 5: 339-345.

Bayley, P. and M. Petrere
1989 Amazon fisheries: assessment methods, current status and management options. In D.P. Dodge (ed.) Proceedings of the International Large River Symposium. *Canadian Special Publications in Fisheries and Aquatic Science*, Vol. 106, pp. 385-398.

Chibnik , M.
1994 *Risky rivers: the economics and politics of floodplain farming in Amazonia*. Tucson, AZ: University of Arizona Press.

Dyer, C. and J. McGoodwin
1994 *Folk management in the world's fisheries*. Colorado: University of Colorado Press.

Goulding, M.
1980 *The fishes and the forest: explorations in Amazonian natural history*. Berkeley: University of California Press.

Goulding, M., N. Smith and D. Mahar
1996 *Floods of fortune*. New York: Columbia University Press.

McGoodwin, J.
1990 *Crisis in the world's fisheries*. Stanford: Stanford University Press.

McGrath, D., F. Castro, C. Futemma, D. Amaral and J. Calabria
1993 Fisheries and resource management on the Lower Amazon floodplain. *Human Ecology* 21(2): 167-195.

McGrath, D., F. Castro, E. Camara and C. Futemma
1996. Community management of floodplain lakes and the sustainable development of Amazonian fisheries. In C. Padoch, M. Pinedo and M. Ayres (eds) *Diversity, development, and conservation of the Amazon floodplain*. In press.

Merona , B.
1990 Amazon fisheries: general characteristics based on two case studies. *Interciência* 15(6): 461-467.

Ribeiro, M. and M. Petere
1990 Fisheries ecology and management of the *jaraqui* (*Semaprochilodus taeniurus, S. insignis*) in Central Amazonia. *Regulated Rivers and Management* 5: 195-215.

Ross, E.
1978 The evolution of the Amazon peasantry. *Journal of Latin American Studies* 10(2): 193-218.

Saint-Paul, U. and P. Bayley
1979 A situação da pesca na Amazônia central. *Acta Amazônica* 9(4): 109-114.

Smith, N.
1981 *Man, fishes and the Amazon*. New York: Columbia University Press.

Smith , I.
1979 A research framework for traditional fisheries. *ICLARM Studies and Reviews* No. 2. Manila: ICLARM.

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