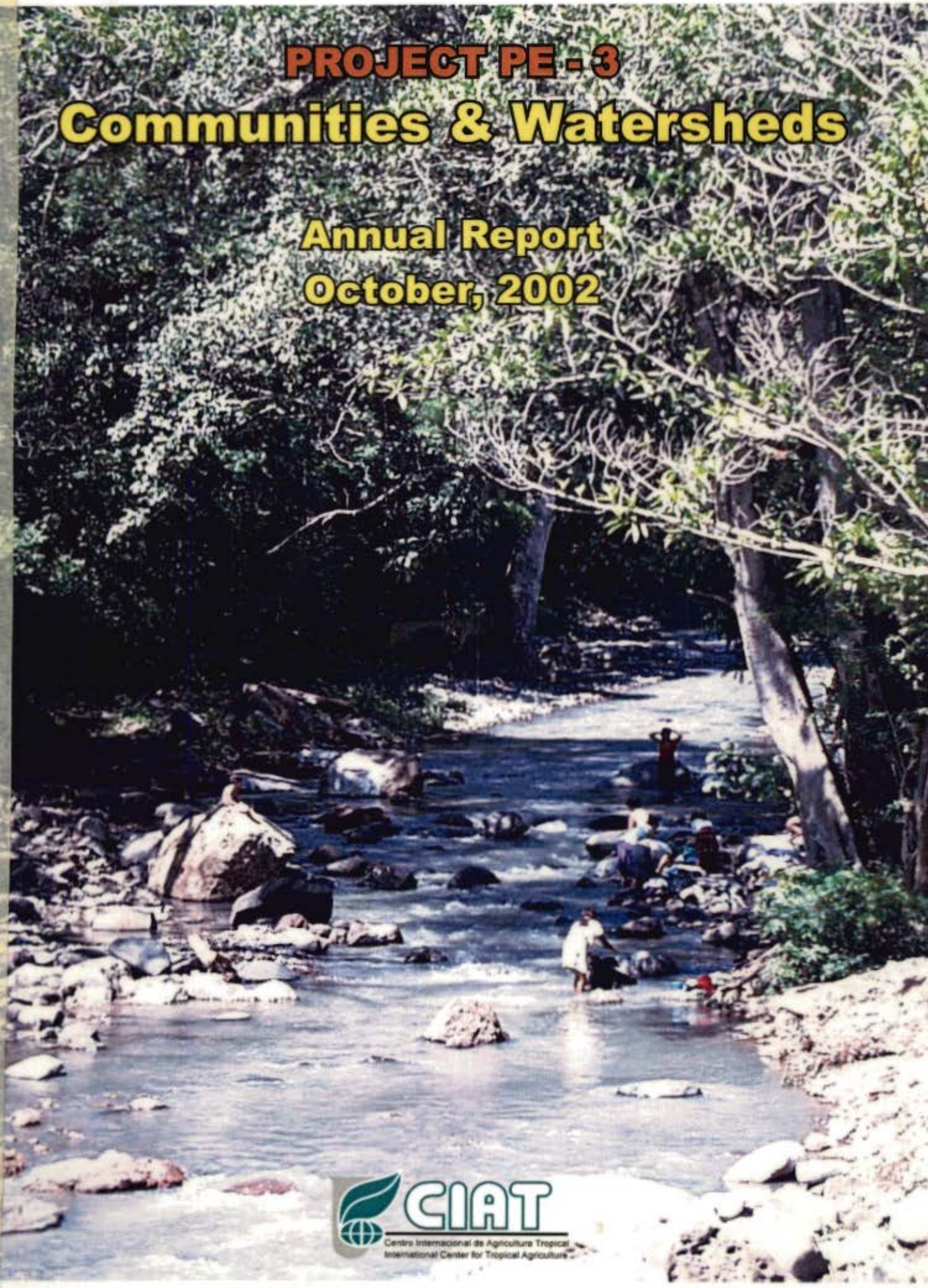
PROJECT PE - 3
Communities & Watersheds

Annual Report
October, 2002



CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

PROJECT PE-3

COMMUNITIES AND WATERSHEDS

ANNUAL REPORT 2002

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Project PE-3: Communities and Watersheds

CONTENTS

Executive Summary

This Executive Summary covers work from both the old PE-3 2001-2003 Logframe (shown starting on page 5), in Part One of this report, and the new Communities and Watersheds 2003-2005 Logframe (shown starting on page 119), in Part Two of this report.

The Hillsides Project had a mandate that was mainly Latin America, but there was only real presence in Honduras and Nicaragua, and very limited presence in Colombia. The logframe design was fragmented, and this led to many different types of research that were not contained as one standing unit. The expectation was that PE-3 would be the integrator of the activities of all other CIAT projects in Central America. However, because of its fragmented nature, it became more like a project that was expected to carry around the scientific results of other projects, with difficulties in developing its own scientific outputs.

Following the good recommendation of the Board, the Project stopped and developed its own conceptual framework. We looked at world developments, the creation of the new challenge programs, etc. In the end, we decided to concentrate around the theme of water and particularly in using the integrated watershed management approach, and logically changed our name from Hillsides to Communities and Watersheds (C&W). Our coverage moved from a regional to a global presence, with effective presence in Haiti, Vietnam, Thailand, Laos, and China. We have some presence in Africa, Ecuador, and are a little more advanced in Bolivia.

Because of all these new additions to C&W, we cannot report results in a very coherent or aggregated manner as yet. All the new additions carry a history of ongoing research that has to be adjusted without affecting work that donors already fund. The additions will move into the new framework, and the latest proposals are very much within it, and within the new Water and Food Challenge Programs. It is because of the globalization of the project, and its not being fully integrated into the new framework, that the volume of this report is large and rich.

Strategic Alliances

In times of funding shortage and a strengthened call for impact, going ahead and acting alone does not lead anywhere. It is very important to look for alliances at all levels—advanced research organizations (AROs), National Agricultural Research Systems (NARS), nongovernmental organizations (NGOs), farmer organizations, etc. This year we have worked hard on all levels. At the ARO level, we already have two working strategic alliances, one with the University of British Columbia (UBC), and one with the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE); and as a result have two shared scientists with CATIE and one shared with UBC. In terms of alliances with NGOs, we have developed a very close relationship with CARE International throughout Central America for CARE to be the partner in charge of the development part of the Mesoamerican Biological Corridor (MBC) proposal. We have developed strategic alliances with collaboration agreements (convenio de cooperación) with the countries where we work that allow them and us to plan together specific projects based on real needs. We have developed consortia within the countries (e.g., Bolivia) and have strengthened those that already have a history of consortia to include partners in different stages and scales of our work. Through the Supermercado de Opciones para Ladera (SOL) we have developed close

relationships with farmer organizations in the reference sites and areas where we work. Thus the impact goes from the trial to the farmer.

Global Mandate

CIAT has decided that C&W goes global. Personnel and projects that are ongoing in Asia have been incorporated into the new project. At the moment, integration is underway and evolving smoothly. In Africa, some preliminary activities have taken place, and a person has been assigned to C&W, but communication this year has been difficult. In the case of Central America, we are moving beyond Honduras and Nicaragua to cover other countries in the region, as well as Haiti in the Caribbean. For South America, we are strengthening our presence in Colombia with an emphasis on areas near headquarters. Actions are advanced with Bolivia, and initial steps of collaboration taken with the University of Georgia in Ecuador.

Scaling Out

Our objective in scaling out is to use work methods and products developed at reference-site level to enter into alliances with different actors (local, national, and regional) allowing us to reach more people with these benefits in less time, and a better way. As an example, scaling out from the San Dionisio, Matagalpa reference site to other regions of Nicaragua has reached the departments of Jinotega, Matagalpa, Boaco, Chontales, Managua, Estelí, Nueva Segovia, León, and Chinandega. Another example is that of the Haiti Project, which is a development project directly resulting from scaling out from germplasm projects and PE-3 in Central America.

In Asia, since we have a target to benefit at least 8000 farming households by the end of the Cassava Project in 2003, we need to expand to additional sites every year. In 2002, the project was operating in about 60 sites in Vietnam, Thailand, and China. In both Thailand and Vietnam, the Cassava Project expanded to include four new sites in each country.

Introduction of Germplasm Work with Natural Resource Management (NRM)

For good NRM, the first condition that needs to be satisfied is food requirements. When food requirements are satisfied, the next step is that additional income is sought. When farmers achieve this, then they start to care about the environment. When we attempted to work on NRM, there was always the call for improved germplasm for better food supply. So we started working with germplasm projects and scientists in the concept of SOL, and moved into participatory plant breeding and production systems with other germplasm that was prioritized by farmers and within the mandates of other partners. Our many crop options were expanded. Once these are tested and some adoption taking place, then farmers look at where in the landscape the different options would fit because the area is appropriate or good market opportunities presented. While this process takes place, different steps are becoming attracted to elsewhere (scaling out). The main reason for this is because of the numerous alliances at different scales, as mentioned above.

Training

The process of training trainers and training potential applicants of the research products has been a large effort, compensated by the positive response of professionals and applicants in several institutions of Honduras, Nicaragua, and Colombia. To date, more than 400 staff members of nearly 40 institutions have received training in the use of these research tools. A current demand for training in their use is being fulfilled with the participation of trainers in each country. Training was given on the Local Soil Quality Indicators Guide in Latin America and the Caribbean (Honduras, Nicaragua, Colombia, Peru, Venezuela, and the Dominican Republic) and Africa (Uganda and Tanzania) and it was used to identify and classify local indicators of soil quality related to permanent and modifiable factors. To date, more than 23 action plans have been initiated in Latin America and Africa.

For the Youth Project in Honduras, 35 young facilitators coming from six communities of the municipality of Yorito were trained in the first three steps of the CIAL methodology during the first 2 months of 2002. The University of British Columbia (UBC), providing the methodology for evaluation and analysis of water quality through a 3-day workshop in April, produced immediate awareness of the water problems in the Yorito urban area among participants. Thirty youngsters and several ISP teachers participated in this workshop.

This year, the Forages and Livestock Systems Project (FLSP) provided several training events for international partners to be able to help local, regional, and national organizations, including the training course, "Improving adoption of agricultural technologies – how participatory research can complement conventional research approaches," for 15 Japanese scientists at the Japan International Research Center for Agricultural Science (JIRCAS) in Japan from the 4th to the 8th of March, 2002. The FLSP also ran a training course on Participatory Diagnosis from 20–25 January 2002 for 15 staff of an International Rice Research Institute (IRRI)–managed project in northern Laos.

In Thailand, a 5-day training course was held for 30 government officials from the Land Development Dept (LDD), the Department of Agriculture (DOA), the Department of Agricultural Extension (DOAE), and the Thai Tapioca Development Institute (TTDI). In Vietnam, two farmer participatory training courses were held for local extensionists and key farmers, one in Van Yen district of Yen Bai province in north Vietnam, and one in Hue city in central Vietnam. These courses were intended to teach both extensionists and farmers about FPR methodologies as well as cassava production technologies.

Project PE-3: 2001-2003

(For new Communities and Watersheds 2003-2005 Logframe, see page 119)

Objectives: To improve the standard of living and food security of hillside farmers in tropical America, and make their interaction with the environment more sustainable.

Outputs:
(1) Improved production systems, (2) More sustainable landscapes, (3) Strengthened organizations, (4) Decision makers supported, (5) Efficient and participatory management system of the project.

Gains: Farmers and locally organized producers use technologies, tools, and methodologies developed by CIAT and its partners at the level of reference sites. Results are sustainable, production systems profitable, land use improved, and natural resources preserved at the landscape level. Partner organizations use technologies, tools, and methodologies developed by or with the project for their planning and activities at local, national, and regional levels. Decision makers at different levels have more information, tools, and methodologies, provided by the project, to support their planning, monitoring, and decisions.

Milestones:

2001: *Impact*: Sustainable and profitable production systems, improved land use, and natural resource preservation on farms, spreading to the landscape within reference sites. *Strategic research*: Partner organizations use the project's outputs for their activities at local, national, and regional levels.

2002: *Impact:* Sustainable and profitable production systems, improved land use, and natural resource preservation at the landscape level within reference sites. *Strategic research:* Decision makers at local, national, and regional levels use the project's results for their activities.

2003: Impact: Sustainable and profitable production systems, improved land use, and natural resource preservation on farms, spreading to the landscape beyond the reference sites. *Strategic research:* Decision makers at local, national, and regional levels use new results from the project for their activities.

Users: Farming families and rural communities of the Andean and Central American hillsides. Project sites profit from increased community action aimed at sustaining the productivity of the resource base. As a result, off-site stakeholders benefit. National and international development organizations involved in priority setting and investments in development.

Collaborators[1]: SDC, IDRC, DGIS, CIMMYT, CIP, IFPRI, IWMI, IICA, PASOLAC, CARE; universities of Florida, Wageningen, Edinburgh, Guelph, Nacional Agraria (Nicaragua); CURLA (Honduras); DICTA, INTA, CONDESAN, CIPASLA, Campos Verdes, CLOs, CIALs, individual farmers.

CIAT project linkages: Collaboration with the Ecoregional Program for Tropical Latin America, soils (PE-2), land use (PE-4), smallholder systems (PE-5), agroindustries (SN-1), participatory methods (SN-3), forages (IP-5), and impact assessment (BP-1) projects.

[1] See page 190 for acronyms and abbreviations used.

Project PE-3: Communities and Watersheds 2002

Project Objective
To improve the standard of living and food security of hillside farmers in tropical America and make their interaction with the environment more sustainable

Output 1
Production systems improved

- **1.1** Ex-ante evaluate improved system alternatives (identify markets, perform simulation modeling)
- **1.2** Identify new alternatives for improving production systems
- **1.3** Validate new alternatives and improved practices
- **1.4** Promote and support multiplication of successful alternatives validated at farm level
- **1.5** Monitor and evaluate the adoption of validated improvements

Output 2
More sustainable landscapes

- **2.1** Benchmark status report at the landscape level (study land use, analyze sustainability)
- **2.2** Ex-ante evaluate alternative scenarios of landscape management
- **2.3** Develop and apply the methodological tools for natural resource management at landscape level
- **2.4** Promote and implement consortia for landscape management
- **2.5** Strengthen participation of grass-roots organizations in consortia for landscape management
- **2.6** Monitor and evaluate landscape changes

Output 3
Organizations strengthened

- **3.1** Develop and/or validate methods and tools for developing and strengthening key organizations
- **3.2** Train local, regional, and national organizations in the use of methodologies and/or tools developed by CIAT
- **3.3** Strengthen small-scale producers, managers, and local, regional, and national organizations through participatory investigative methods
- **3.4** Support, through incorporating processes of participative investigation, local organizations oriented to agricultural research
- **3.5** Promote and support interinstitutional plans for sustainable rural development

Output 4
Decision makers supported

- **4.1** Identify, at different levels, decision makers related with project tasks and diagnose their needs
- **4.2** Support decision taking at different levels using the information, tools, and methods generated by the project
- **4.3** Strengthen capacity for management and use of information, tools, and methods (train, diffuse, and follow up the process)
- **4.4** Provide technical support for decision taking

Output 5
Efficient, participatory project management

- **5.1** Foster the active participation of partners in the planning of project activities in the region
- **5.2** Actively and permanently coordinate the reference sites, projects, and individuals working in the region
- **5.3** Maintain an efficient information system of the project with its partners
- **5.4** Strengthen joint work with other projects and organizations
- **5.5** Establish a participative system of monitoring and evaluation of the project to monitor its performance and feed back to planning
- **5.6** Establish an efficient and participatory administrative system within the project
- **5.7** Establish a system of efficient administration

PE-3 Logframe Work Plan, 2001-2003[a]

Narrative summary	Measurable indicators	Means of verification	Important assumptions
Goal To improve the standard of living and food security of hillside farmers in tropical America and make their interaction with the environment more sustainable.	• Reduced infant mortality • Reduced maternal mortality • Reduced soil erosion • Improved water quality in rivers and streams • Increased income (monetary and/or in kind)	National and local statistics Local research	The environmental, social, economic, and political conditions, on a macro level, are maintained.
Purpose To strengthen local processes of sustainable rural development in the hillsides of tropical America, based on the experiences of natural resource management (NRM) at benchmark sites.	• Groups residing at five work sites in Honduras and Nicaragua successfully implement land management initiatives consistent with those ones validated by the project and its partners • At least 15 key entities of the region have access to at least three tools and methods developed by the project	Field verification Institutional reports	Local partners continue project-related activities. Donors remain interested in the proposed project objectives and continue to give support.
OUTPUT 1 **Improved production systems.** Farmers use technologies developed by CIAT and its partners to establish sustainable and profitable production systems.	• Screening alternatives in demonstration parcels in San Dionisio, Yorito, and Cabuyal ("Supermarket of Options for Hillsides") • Validating alternatives in at least 25 CIALs in San Dionisio and Yorito • Alternatives adopted by at least 100 farmers at project work sites • Successful alternatives being transferred to at least 12 sites other than the initial work sites	Field verification Project reports CIAL reports	That climate variability is normal.
OUTPUT 2 **More sustainable landscapes.** Land use has improved across the landscape because locally organized farmers are using the tools and methods developed by the project and its partners.	• Three local consortia of NRM operating at work sites in Honduras, Nicaragua, and Colombia • Five local consortia of NRM in formation at other sites of Central and South America • Stable water quality (sediments and contaminants) as integrating indicator of the status of natural resources in at least three watersheds at the work sites • Environmental monitoring initiated in at least two work sites in Honduras and Nicaragua	Consortia reports Monitoring reports	

Continued.

a. For acronyms and abbreviations used, see page 190.

PE-3 Logframe Work Plan, 2001-2003[a] (Continued).

Narrative summary	Measurable indicators	Means of verification	Important assumptions
OUTPUT 3 **Strengthened organizations.** Local and national organizations involved in sustainable rural development at various levels (site, national, regional) use the technical and methodological resources developed by the project in their decision making and other activities. Interinstitutional coordination is enhanced.	• At least 25 CIALs operating at project work sites • At least 30 CIALs in formation at other work sites in the region • At least 20 national technicians trained and promoting CIALs	CIAL reports Training reports Institutional reports	
OUTPUT 4 **Decision makers supported.** Decision makers at various levels use and have access to more information, tools, and methods to use in decision making, planning, and monitoring.	• At least two technicians of each collaborating institution trained and using tools developed by the Project and its partners • Digital information (CD-ROM and Web site) available and accessible in Honduras and Nicaragua, and in process in other countries • Local decision makers at the level of three municipalities with access to site-specific information on natural resources and trained to use this information		
OUTPUT 5 ***Efficient, participatory project management***. Different internal and external partners directly participate in project management to ensure adequate and efficient use of the project's resources.	• Plans and reports opportunely prepared and approved by previously established authorities • Partners are well informed and actively participate in fieldwork at the project sites (local consortia) or elsewhere • National hillside consortia operating in Honduras and Nicaragua • Regional hillside consortium operating • Experiences and lessons learned by the project and its partners disseminated in Latin America through different channels (e.g., networks, publications, meetings) • New projects adopt methods, techniques, and experiences generated by the project and its partners	Planning documents and reports Proceedings of Consultative Group and Executive Committee meetings Reports of members and consortia Dissemination materials and project reports *Direct verification* through networks and consortia	

a. For acronyms and abbreviations used, see page190.

Major Highlights 2002

Scaling Out

Our objective in scaling out is to use work methods and products developed at reference-site level to enter into alliances with different actors (local, national and regional) allowing us to reach more people with these benefits in less time, and in a better way. As an example, "scaling out" from the San Dionisio, Matagalpa reference site moved into other regions of Nicaragua, such as the departments of Jinotega, Matagalpa, Boaco, Chontales, Managua, Estelí, Nueva Segovia, León, and Chinandega. The SOL (reference site) concept has become a valid instrument to initiate a process of approach to non-traditional partners/ donors through visits and demonstration of the products developed and offered by CIAT.

Integration of Germplasm Activities

An extensive range of improved germplasm of maize, bean, rice, soya, sweet potato, fodders, and sorghum has been evaluated during the last 4 years at SOL sites. The bean materials are part of the CIAT improvement program, and of the Ensayo Centroamericano de Apaptacion y Rendimiento (ECAR) of the Proyecto Regional de Frijol para Centro América, México y el Caribe (PROFRIJOL). The maize materials are advanced lines generated by the Regional Maize Program (PRM, the Spanish acronym) and Instituto Nacional de Tecnología Agropecuaria (INTA). The rice materials are commercial varieties and lines with tolerance to drought and *piricularia* of the CIAT-Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) Rice Project. The collection of sweet potato is composed of local materials originally introduced by the Centro Internacional de la Papa (CIP). The sorghum materials are from the International Sorghum and Millet Program (INTSORMIL) Network and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The forage species under evaluation originate from different sources (local, regional, and CIAT). The collection includes grasses, herbaceous and bushy legumes, and green manures.

An extensive range of producer interest groups evaluates the materials, including Comités de Investigación Agricola Local (CIALs), groups of experimenting producers, and groups of producers organized by support institutions. Of the selection carried out by the producer groups of interest, the improved materials pass to the communities to be evaluated in different environments, and their subsequent distribution to producers. The results obtained indicate that the selection of materials by producers based on their expressed criteria in the participative evaluations permits not only the continuous improvement of the different crops, but also the adoption and utilization of the materials on the farms of the producers. Adoption is seen to be quicker.

Extensive Training

The process of training trainers and training potential applicants of the research products has been a large effort, compensated by the positive response of professionals and applicants in several institutions of Honduras, Nicaragua, and Colombia. To date, more than 400 staff members of nearly 40 institutions have received training in the use of these research tools. A current demand for training in their use is being fulfilled with the participation of trainers in each country.

This year, the Forages for Smallholders Project (FLSP) provided several training events for international partners to be able to help local, regional, and national organizations. In a collaboration between CIAT and the Participatory Research and Gender Analysis Program (PRGA), a training course, "Improving adoption of agricultural technologies – how participatory research can complement conventional research approaches," was given for 15 Japanese scientists at the Japan International Research Center for Agricultural Science (JIRCAS) in Japan from the 4th to the 8th of March, 2002.The FLSP also ran a training course on Participatory Diagnosis from 20–25 January 2002 for 15 staff of an International Rice Research Institute (IRRI)–managed project in northern Laos.

In Thailand, a 5-day training course was held for 30 government officials from the Land Development Dept (LDD), the Department of Agriculture (DOA), the Department of Agricultural Extension (DOAE), and the Thai Tapioca Development Institute (TTDI). In Vietnam, two FPR training courses were held for local extensionists and key farmers, one in Van Yen district of Yen Bai province in north Vietnam, and one in Hue city in central Vietnam.

Cassava Development Villages in Thailand

In Thailand, the government has supported the formation of "Cassava Development Villages" in 11 of the 24 pilot sites of the Nippon Foundation Project, with the objective of empowering the local community to make their own decisions about the protection of natural resources and the development of new crops or new practices that will improve their livelihoods. After nearly 2 years, most of these Cassava Development Villages are operating very successfully. After the first year's harvest, most farmers were able to return the money of the "borrowed" fertilizers, and were thus able to "borrow" more fertilizers for the next crop. The timely availability of fertilizers at a reasonable price was considered as a very important reason for farmers to join this group. The resulting increased yields obtained, together with a relatively good price for cassava roots this year, have considerably improved farmers income from cassava. In addition, working together, farmers have markedly expanded the vetiver grass hedgerows to control erosion in their fields; they are also continuing to experiment with application of organic manures and the planting of green manures.

The Bolivian Consortium

In June 2002, a CIAT six-member team participated in a workshop with Bolivian partners. It was designed with three purposes in mind: (1) to share the final synthesis of

previous work on inter-institutional collaboration topics, (2) to prepare the narrative summary of a project platform on which a variety of specific projects could be drawn, and (3) to search for an organizational scheme to give sustainability to inter-institutional cooperation in Bolivia. As a result of this workshop, a platform was developed for project generation with multi-institutional collaboration. Three work areas were identified after completion of the analysis of previous workshops and visits. An agreement was also reached around operational aspects of collaboration. This agreement gave way to the establishment of an inter-institutional Consortium that has operational guidelines and a very modest organization. Its coordinator is in charge of promoting the Consortium among donors and national institutions and identifying opportunities for the Consortium in Bolivia.

Strategic Alliances

This year the C&W in developing strategies has made important efforts conducive to strategic alliances. At present, 11 alliances have been made with institutions throughout the world. Strategies include personal interchange, study of institutions (their roles, major activities, and missions), and visits to the sites where institutions work. Another strategy is the joint formulation and signature of technical cooperation agreements with GOs and NGOs. With lower resources, the project this year has increased coverage by forming or strengthening strategic alliances. As a result, we already have two staff positions (economists) shared with CATIE, and one (management specialist) shared with UBC. We are working with the Center for Development Research (CDR) in Denmark for a shared PhD student to work in Bolivia.

In a different area of interest, an agreement has been signed with UBC. This agreement is not only the basis for interchange of staff, but also opens doors, among other options, for the design of a training program in watershed management that can be jointly led by UBC and CIAT.

New activities with new names within the new framework have started with the Youth Projects where alliances are already working in aspects of watershed management and environmental services.

PART ONE: THE ONGOING COMMITMENTS

Output 1. Production systems improved

1.1. Ex-ante evaluate improved system alternatives (identify markets, perform simulation modeling)

See under 1.2.1. and 2.5.2.

1.2. Identify new alternatives for improving production systems 104124

1.2.1. Tool for the zoning and understanding of markets (Cross Project)

Objectives

- To carry out the zoning of agricultural crops using geographical information systems (GIS) that permit us to determine zones fit for basic grains, garden produce, and fruits.
- To provide producers and nongovernmental organizations (NGOs) with an agricultural markets intelligence system with which they can determine times of better prices, choose best market (Tegucigalpa, San Pedro Sula, San Salvador, Managua, and Guatemala), analyze price stability of each product, study import trends, and distinguish the different packaging used for transporting, marketing, and giving added value to products.

Background and Justification

The small-scale rural producers of Honduras cannot negotiate well with intermediaries because they have little knowledge of agricultural markets, do not have their own transport, are financed at high interest rates, are afraid of sales on credit, and are poor at negotiating with final buyers. Given these circumstances, they obtain very low prices for their products. This impacts directly on their profit margins because input prices always increase through devaluation (most inputs are imported). If producers were adequately informed, they would be able to:

- Choose commercial strategies such as grouping together for staggered sowing and thus harvest weekly;
- Grow high-demand products to harvest in weeks of best prices;
- Cultivate small plots of new crops (of small demand, but high value);
- Sow crops of high imports and permanent demand;
- Be aware of quality requirements, forms of payment, and frequencies of provision of market niches such as hotels, restaurants, hospitals, supermarkets, or fast food chains; and
- Improve prices with added value through packaging or through simple processing.

The first version of the market tool intends to show the potential of using GIS to carry out crop zoning and to integrate the zoning results to a markets intelligence decision system that includes the elaboration of budgets, analysis and interpretation of historical series of prices, and the study

of supply, demand, and imports of local, national, and regional markets. Through this first approximation we intend to attract strategic partners interested in participating in the development or use of the tool.

Materials and Methods

The work was carried out in two parts: agro-ecological zoning, and market intelligence. The product was tried out in pilot form in the municipalities of Yorito and Sulaco, Honduras, and based on these results it was applied countrywide.

Biophysical inputs, such as soil maps of the National Cadastre at a scale of 1:50 000, and the digital database of soils containing laboratory analyses were used for the agro-ecological zoning. To determine climatic variation for height, we used the digital elevation model (DEM) at a scale of 1:50 000 derived from the elevation model, contour maps, and relief. We also used the climatic information available, including precipitation and monthly temperatures. Using these and the DEM, we constructed temperature and potential evapotranspiration surfaces using Hargraves' method, and finally determined periods of general growth. The Food and Agriculture Organization (FAO) agro-ecological zoning guide was used for the agroclimatic adaptation. The zoning surfaces can be superimposed on political division maps of Honduras at departmental, municipal, and village level.

To analyze the agricultural markets, we used as information sources the Sistema de Información de Mercados de Productos Agrícolas de Honduras (SIMPAH), the Tegucigalpa Artisan and Producer Fair, the Red de Comercialización Comunitaria Alternativa (RED COMAL), and the Ministry of Agriculture, Livestock, and Food of Guatemala. In the case of SIMPAH, we bought the Honduran weekly average price records of 72 products from March 1996 to April 2002. Each week has a bottom and top price for the markets of Tegucigalpa and San Pedro Sula; this represents the price at which wholesalers sell to retailers (also to supermarkets, restaurants, hotels, etc.). SIMPAH has personnel conducting daily surveys at the warehouses. The tendencies of 2002 are kept updated through a subscription paid by the project; prices correspond to three days of the week. For the markets of Nicaragua and El Salvador, we bought records of 2001, and paid a subscription for 2002.

The Fair prices give a single price per product; prices are detailed and correspond to the largest size of products. Sales are only on the Friday and Saturday of each week in Tegucigalpa. These prices are published in a list (there are also prices for small and medium-size goods, but these were not graphed because they do not apply to all products). This association of producers did not charge for the information because CIAT's Agro-enterprise Project organized the file for them, working for several days chronologically ordering the lists, and then working for several weeks digitizing the prices in Microsoft Excel. Several weeks are without data because lists were not found; the information is available from January 1999; in 2002, prices are updated collecting the list at the Fair and manually digitizing it.

The prices of RED COMAL correspond to the wholesale weekly price average of the markets of Tegucigalpa and San Pedro Sula (also for 11 other regional markets that were not analyzed because they are supplied by Tegucigalpa and San Pedro Sula). There are 22 products; survey

takers provide the data by visiting the wholesalers of the retail markets. These records were bought and run from January 1999; an annual subscription was paid to update 2002.

The Guatemalan prices were downloaded via Internet at (http://www.maga.gob.gt/asp_sim/conspr01asp). Data are available for more than 100 products from January 2001 to date, updating is done in the same way, but digitizing the data on the corresponding electronic sheet.

To identify periods of better and worse prices, graphs of mobile and polynomial stocking tendencies were made in Microsoft Excel. For statistics of both national and international markets, we used graphs of actual performance and of polynomial tendencies. A digital camera was used for the photographic catalogue, taking photos of good and bad quality products, and packaging for transportation and for retail sale. A directory of buyers of agricultural products will be compiled with information on contacts and requested products.

Results and Discussion

The product includes agro-ecological zoning maps for 20 agricultural crops that are classified as vegetables, basic grains, and fruits. The vegetables are chili, tomato, potato, onion, broccoli, cauliflower, cabbage, and pumpkin. The basic grains include rice, maize, bean, and sorghum. Fruits include avocado, mango, pineapple, lemon, and orange. This only represents an initial base of analysis; the system is capable of receiving the characteristics of specific varieties and translating them as potential zones. The product to be generated is a CD-ROM in Web format that facilitates access to all the information, and permits printing of sheets with market information of each product in a language easy for small-scale producers to understand.

Contributors: O Mejía; M Vásquez (SL-1)

1.3. Validate new alternatives and improved practices

1.3.1 Rice and sorghum participatory plant breeding in Central America

Introduction

) was first discussed and agreed upon during the fifth CIRAD- Institut national de recherche agronomique (INRA)- Institut de recherche pour le développement (IRD)-CIAT meeting held in Cali, June 2001. It was further strengthened by discussions between CIAT and CIRAD- cultures annuals (CA) and by the visit of Dr Gilles Trouche to Nicaragua, Honduras, and to CIAT's Headquarters in November 2001. The project began in April 2002 with the signing of a Memorandum Of Understanding between CIAT and CIRAD-CA and further outposting of Dr Gilles Trouche in Managua, Nicaragua. The project proposes to develop participatory variety selection (PVS) and participatory plant breeding (PPB) approaches for two "model plants" (i.e., rice and sorghum) for small- and medium-scale farmers undergoing progressive crop intensification and increasing access to markets.

Upland rice, otherwise known as aerobic rice, is a developing staple crop in several Central American and Caribbean countries, mainly in plains with high rainfall (1300-1500 mm per year), but also on hillsides as a component of diversified cropping systems. The total area of rice, upland and irrigated, in Central America and the Caribbean is 630 000, ha with a global paddy production of about 2 400 000 tons (FAO, 2002)[1]. In Nicaragua, aerobic rice covers 55 000 ha of the 83 000 ha that makes up the average total rice area (MAGFOR, 2002)[2].

Because of its superior drought tolerance, sorghum provides an alternative production to maize in the driest areas and arid, non-irrigated cropping systems of Central America and the Caribbean. In four Central America countries (Honduras, El Salvador, Nicaragua, and Guatemala) sorghum-planted areas comprise about 255 000 ha, half of which is cultivated by small-scale farmers. In these semi-arid areas, sorghum grain is either used for human consumption (particularly replacing maize in tortillas) or as animal feed (poultry, pigs), while straw is an important forage for cattle during the dry season.

Objectives

The project aims to further develop PPB methodologies and to improve breeding material. The specific objectives of the project are:

(1) The PPB work will be conducted in cooperation with existing farmer organizations and other relevant local actors; through these organizations, the project activities will be organized.
(2) The PPB will be based on the genetic enhancement of locally adapted populations with a broad and/or narrow genetic base, mainly through recurrent selection, but also through more conventional breeding methods.

Segregating material and fixed lines derived from populations and crosses developed by the CIAT Rice Project will be used for rice. For sorghum, we proposed that introduced segregating and fixed material from CIRAD West-Africa Breeding Programs be used. This material is genetically and morphologically diversified. Other local improved breeding materials that are available (from the International Sorghum and Millet Program [INTSORMIL] and regional national agricultural research systems [NARS]) will also be used. All of this material would be evaluated first together with farmers for adaptation to local cropping systems. Special emphasis will be placed on environmental adaptation (response to photoperiod, drought and pest tolerance) and on grain and forage quality. Existing composite populations developed from African germplasm may be further enhanced using better local materials to correspond to local constraints and production objectives.

Participatory and decentralized plant breeding is a breeding strategy that addresses the needs and preferences of small-scale farmers in marginal areas where conventional plant breeding had little success. PPB proposes to involve farmers and other product users of a specific crop in all stages of a breeding program. Decentralization would ensure that the specific conditions of the target

[1] FAO (Food and Agriculture Organization). 2002. Datos estadísticos de producción agrícola, FAOSTAT, www.fao.org.

[2] MAGFOR (Ministerio Agropecuario y Forestal). 2002. Datos de producción sobre los granos basícos, ciclo agricola 2001-2002. Dirección de Estadísticas, MAGFOR, NI.

environment (climate, soils, agronomic practices, etc.) are respected, in order to better control genotype by environment interactions, which are often very high in traditional cropping systems in marginal areas. PPB goals may be (Sperling et al., 2001)[3]:

(1) Gains in productivity and a higher product value through quality increment values;
(2) Better effectiveness of breeding work because of effective targeting of user needs and production conditions;
(3) Biodiversity enhancement and dynamic conservation of diversity; and
(4) Capacity building and knowledge generation for farmer communities and formal research.

Stakeholders' participation in a PPB program can be characterized depending on the stages of participation during the process development of the new varieties, their degree of participation, and the role of the different actors (Sperling et al., 2001). In PPB, we used to distinguish PVS, in which farmers select for fixed lines or varieties, and PPB, in which farmers participate in the selection of segregating material (Witcombe et al., 1996)[4].

General Problematic

Rice blast (*Pyricularia grisae* Sacc.) is a major constraint to upland rice production in Central America. Other main constraints for rice production enhancement identified in Nicaragua and Honduras are a lack of improved varieties that are adapted to the diverse farming systems, insufficient weed control, drought, unsatisfactory grain quality for industry requirements, and competitive pressure from imported rice.

Factors that limit sorghum yields and farmers' gains include drought, low soil fertility, pests (midge, head bugs, fall armyworm), and diseases, as well as low straw quality and little improved varieties offered.

Materials and Methods

The first step was to identify sites and partners, and began in November 2001 with a trip to Nicaragua and Honduras. During the first 4 months of implementation of project activities, we focused our activities on these two countries. Emphasis was placed on Nicaragua, the actual project location, because of the country's greater diversity of agroclimatic and institutional environments for both rice and sorghum. For the identification of sites, existing literature from different sources was reviewed—national agricultural statistics, research publications from NARS, CIAT, and other institutions, studies from NGOs and projects, etc. Additionally, interviews and meetings were conducted with key informants such as national researchers, CIAT staff, extension services, and NGO leaders, in order to verify and complete information. Field visits in the regions during the cropping season will also be frequently organized.

[3] Sperling, L.; Ashby, J. A.; Smith, M. E.; Weltzien, E.; McGuire, S. 2001. A framework for analyzing participatory plant breeding approaches and results. Euphytica 122:439–450.

[4] Witcombe, J. R.; Joshi, A.; Joshi, K. D.; Sthapit, B. R. 1996. Farmer participatory crop improvement I. Varietal selection and breeding, methods and their impact on biodiversity. Exper Agric 32:443-460.

To identify partners, we used both CIAT's long experience and institutional relationships in the region and CIRAD's experience and relationships in Nicaragua developed during the 1990s with projects such as the Programa Regional de Reforzamiento a la Investigación Agronómica sobre los Granos en Centroamérica (PRIAG). Regarding possible NGOs as partners, we mainly looked for local organizations having good experience in technical or/and financial support to small- and medium-scale farmers in one or both crops, in training for farmer experimentation, and in farmers' organizational capacity building, and NGOs that work with various networks of farmers in the project area.

The second step was to perform a diagnostic on crop systems and farmer variety needs. For this purpose, several meetings and workshops were organized with farmer groups in the study area. For rice, knowledge on farmers' needs and results of participatory evaluation of new rice varieties, which have been underway since 1998-99, are available for the hillsides areas of Yorito in Honduras, and San Dionisio in Nicaragua. In these regions, rice is considered an alternative staple crop to the two predominant crops, bean and maize. Outside these areas, three meetings were organized jointly with Instituto Nacional de Tecnología Agropecuaria (INTA) and/or the NGO, Nitlapan, with rice growers in upland rice areas of Rivas (Ochomogo and Pueblo Nuevo villages), Jalapa, and Masaya. Three other meetings are programmed in collaboration with NGOs for September and October in the rice growing areas of Chinandega, Quilali, and Waslala.

For sorghum, very few recent data about constraints of cropping systems and farmers' variety needs are available in the existing literature. Therefore, it was considered necessary to conduct a more complete diagnostic study at the start of the project. Two students from the Centre national d'études agronomiques des regions chaudes (CNEARC) and the Universidad Centroamericana (UCA) will carry out the study in one representative production area of sorghum with small- and medium-scale farmers in Nicaragua. Felipe Martinez is conducting the first thesis work for an MSc in tropical agronomy. The work comprises a participatory diagnostic of sorghum cropping systems and variety diversity used, and proposals for developing a participatory breeding program for the Madriz Department area, in Estelí region (north central Nicaragua). This study is being carried out in collaboration with the NGO Instituto Nacional de Formación Profesional-Union Nacional de Cafetaleros (INFOP-UNICAM) in four farmer communities that represent the different sorghum production conditions in the semi-arid hillsides in relation to climate, soils, topography, ethnic skills, social organization, and institutional environment.

The second thesis work seeks to improve the understanding of cultural practices, constraints (abiotic and biotic), and potentiality for different sorghum cropping systems (including photoperiod-sensitive and -insensitive sorghum type) in three farmer communities of the same region. For the first study, workshops were organized in each community to collect general information about the community (natural resource map, social classification). Information was also gathered on the history of the sorghum crop, existing cropping systems, present and traditional varieties used, and farmers' needs to improve sorghum production and use. Individual semi-structured interviews with 10 to 12 farmers and focus interviews with key informants were held in each community. Following the workshops, local sorghum varieties were collected from each community. The main part of these varieties was planted in one of the communities for a participatory characterization and classification of these by farmers.

For the second thesis, about 40 sorghum plots will be studied during the two growing seasons of sorghum, *primera* and *postrera*, in the three selected communities.

In other regions of Nicaragua, three meetings with sorghum producers were organized in collaboration with local NGOs and with Comités de Investigación Agricola Local (CIALs) in Villa Nueva-Somotillo (one of the driest region of Nicaragua), Ciudad Dario, and San Dionisio. During each meeting, a rapid participatory diagnostic on sorghum cropping systems, use of grain and stover, existing varieties, and farmers' needs was conducted that permitted us to determine objectives, conditions, and choice of the varieties for the PVS trials during this first year. Two meetings were also organized with farmer groups in Honduras, in the El Paraiso Department in collaboration with the NGO Movimondo, and in Yorito in collaboration with Investigación Participativa para Centro América (IPCA) and the CIALs.

Rice and sorghum germplasm introduced from different sources was evaluated.

Rice

Observation nurseries:

- 323 CIAT progenies from CIAT-Peru Program and from interspecific crosses *Oryza sativa* x *O. glaberrima*, *O. sativa* x *O. barthii*, and *O. sativa* x *O. rufipogon* for lowland irrigated conditions or favorable aerobic conditions
- 24 F_4 CIAT-CIRAD progenies derived from PCT-4 population for aerobic upland conditions
- 5 CIAT-CIRAD varieties for upland conditions: CIRAD 409, 446, 447, Oryzica Sabana 6, and Oryzica Sabana 10
- 6 CIAT varieties for irrigated conditions: Fedearroz 50, Fedearroz 2000, BG90-2, Oryzica 1, Selecta 320, and Oryzica 3

Participatory breeding:

PCT-18: narrow genetic base population adapted for upland conditions for rice blast resistance and grain quality

PCT-17: narrow genetic base population adapted for high-altitude hillsides upland conditions for rice blast resistance, cold tolerance, and grain quality

Participatory varietal selection:

- 14 advanced lines and varieties from INTA Rice Program for upland and lowland conditions
- 9 CIRAD varieties from collaborative program in Ivory Coast, Brazil, and Madagascar for less favorable upland conditions
- 15 CIAT-CIRAD advanced lines for high-altitude hillsides

Sorghum

Observation nurseries:

- 21 photoperiod-sensitive landraces and improved lines from CIRAD germplasm collection (late-flowering core from different origin, Cameroon, Chad, Mali, Burkina, and Sudan)
- 30 fixed lines, landraces, and varieties from CIRAD- Institut national pour l'étude et la recherche agronomique (INERA) program in Burkina Faso, and other African origins with drought tolerance, early flowering, foliar diseases, and midge and bugs resistance or double purpose use
- 13 forage sorghum and pearl millet advanced lines and varieties from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)-CIAT program in Colombia

Participatory varietal selection:

22 improved varieties from different CIRAD collaborative programs in West Africa (14 from joint CIRAD-INERA program in Burkina Faso) with drought tolerance, foliar diseases, and sorghum midge and bugs resistance or double purpose use

5 improved varieties from INTA

Observation nurseries were planted on INTA experiment stations in Managua (Centro Nacional de Investigación Agropecuario, CNIA), Posoltega (upland rice) and Sebaco (irrigated rice), and at the CIAT SOL-San Dionisio in Nicaragua. PVS trials and PPB work were conducted at the SOL-San Dionisio and SOL-Yorito (Honduras), and in farmer fields in Madriz, Rivas, and Chinandega Departments in Nicaragua.

For rice, one observation nursery with 30 lines and varieties was planted on the Posoltega INTA experiment station. Another nursery will be planted during the 2002-2003 dry season with 342 F_6 diversified lines for lowland conditions on Sebaco INTA experiment station. Three PVS trials were planted at the CIAT reference sites of San Dionisio (low hillsides - 12 entries) and Yorito (medium hillsides - 7 entries, and high hillsides - 12 entries). Two rice populations were sown at San Dionisio (PCT-18) and Yorito (PCT-17) to start PPB work with local CIALs. Two on-farm PVS trials were planted in the Rivas region with both entries. The designs used for PVS trials were randomized complete blocks (RCBD) with two or three replications.

For sorghum, four nurseries were planted for observation and seed multiplication in Nicaragua:

(1) On the Managua CNIA station with 51 lines and varieties,
(2) At the SOL-San Dionisio, 11 lines and varieties,
(3) At an INTA site of experimentation in Madriz during the *primera* (28 lines and varieties), and
(4) As for (3) during the *postrera* (20 lines and varieties) seasons, including local checks.

Seven PVS trials were planted during the *postrera*, each trial at the SOL-San Dionisio and SOL-Yorito, while the remaining four were conducted on farm in the five different communities of Nicaragua and Honduras in which workshops and rapid participatory diagnostic of variety needs with local farmer groups were previously carried out. The designs used for PVS trials were RCBD with two replications.

Results

These are as yet preliminary and cover the period of April to September 2002. For both Nicaragua and Honduras, the CIAL farmer committees in San Dionisio and Yorito will be partners for both crops. Rice and sorghum are alternative food crops to maize and bean in these mountainous areas. Possible partners in San Dionisio and Yorito include local NGOs and farmer organizations already involved in the SOL and CIAL. INTA is considered a strong, responsible partner in Nicaragua for the research area, because it manages research programs both for rice and sorghum and recently concluded a general agreement of scientific cooperation with CIAT. A specific agreement for the project has been written and will most likely be completed between INTA and CIAT before October.

Other project partners in Nicaragua will be the NGOs Nitlapan and UNICAM-INFOP. Nitlapan is the first provider of micro-credit for small- and medium-scale farmers in Nicaragua. Besides providing micro-finance, Nitlapan also supplies training and technical assistance to a wide network of farmers. A specific agreement between CIAT and Nitlapan is currently under discussion. For the dry hillside areas in the north of Nicaragua, we have identified the local NGO, UNICAM, as a strong partner for the sorghum activities.

For Honduras, we identified the NGO Movimondo and the Alauca area as probable partner and site for sorghum activities. The traditional rice area of Camayagua department has been identified as an appropriate region to conduct PPB rice activities.

Diagnostic on crop systems and farmers' variety needs

Rice

In the traditional upland rice area of Rivas in the Pacific plains of Nicaragua, rice covers about 2000 ha. Small- and medium-scale farmers mainly carry out production. Meetings with rice producers' groups in Ochomogo and San Juan Viejo helped identify fertile soils, rice blast, bugs, climatic conditions (rainfall irregularity, drought, and drying winds in November), as well as access to credit and selling prices. These factors are the major constraints to rice production in the area. Implementation of modern improved varieties of rice from INTA or the Asociación Nacional de Arroceros (ANAR) is generally low and depends on the level of intensification and the institutional environment. In Ochomogo, with the influence of the local farmer cooperative that exploits 70 ha for rice production with irrigation, upland rice producers of this area know and partially use modern varieties. In San Juan Viejo, farmers use two modern varieties; are limited on the flattest areas with better clay soils, but still use four local or old improved varieties to plant on the hillsides' sandy and less fertile soils. Farmers ask for new varieties that will provide plants with intermediate height (80-100 cm), early flowering (90-100 days to harvest), resistant to blast rice and rice bugs, less fertilizer consuming (in comparison with INTA modern varieties), good grain and straw yields, and adequate grain quality for market. Both villages are very interested in testing new rice varieties within their own environments.

In the wet, fertile Jalapa valley in northern Nicaragua, upland rice is an important and traditional crop, the third most cultivated after maize and bean. In the 1980s, rice cultivation in the valley reached 3300 ha and then decreased to 1750 ha in the 1990s, and 1000 ha in 2002 because of lack of credit, problems of land property, and low prices on the national market. Because of a government program introduced in 2001 to increase prices paid to the farmers, in order to boost the national production of rice, prices are now more of an incentive for rice producers. In this area, medium- and large-scale farmers or firms carry out rice production. Blast rice and red rice are the main production constraints, while *Cerscosporium* and *Rhyncosporium* diseases appear to be secondary constraints. Farmers use mainly three varieties, ANAR 97, Altamira 9, and Altamira 14. In addition to increasing resistance to the diseases mentioned above, farmers are now asking for more early flowering varieties to permit different planting and harvesting dates. Farmers appear to be satisfied with grain yield potential and grain quality of the above varieties. In Masaya area, where favorable soils and climatic conditions allow diversified farming systems (including maize, rice, bean, cassava, and fruits), rice is mainly produced for family consumption. As in the San Juan Viejo area, the use of "official" modern varieties seems to be

low. Since the 1990s, farmers have been accessing new varieties and seed via informal exchange with other farmers or NGOs. The exact origin of these varieties is not known. Because of recent rainfall irregularity, farmers have been asking for more drought-resistant varieties with intermediate height (1 m) and resistance to lodging.

Sorghum

The diagnostic study carried out centered on four communities in the Madriz Department, and revealed a great diversity of sorghum cropping systems. Photoperiodic-sensitive sorghum landraces, generally referred to as *millon* in Nicaragua and *maicillo* in Honduras, are planted in combination with maize, bean, or insensitive sorghum with different geometric arrangements depending on soils, slopes, or climatic constraints, and farmers' strategies and goals. Because of its rusticity and ability to adapt to poor, unfertilized soils, and its very long cycle (May to December), which allows better support of middle season droughts, *millon* plays an important role in the kind of low-risk crop that guarantees family subsistence production when maize and/or bean production has failed. Since the mid-1980s, short-cycle and insensitive white grain sorghums have gradually been replacing maize and *millon* on the flattest and most fertile lands. As a result, *millon* sorghum is now more concentrated on the hillsides, as is the case in the Pacific area of Somotillo-Villa Nueva, and in the semi-arid central hillside area of Ciudad Dario-Terra Bona.

In the Madriz Department, an interesting connection exists between the diversity of sorghum varieties and the cropping systems with their diversity of production constraints and goals. Therefore, following the workshop organized in each community, 30 varieties were collected in the four communities taking part in this study. Among the varieties, 18 are supposedly photoperiodic-sensitive landraces and two are broomcorn varieties. All these varieties were planted both on farm and on the Managua CNIA station. Numerous varieties are thought to come from the border countries of Honduras and El Salvador, demonstrating the importance of informal exchange of seed between farmers. No improved low-height *millon* varieties were found during this survey. Among short-cycle insensitive improved varieties, *Tortillero precoz* is the most largely diffused variety in the entire Estelí region (Julio Molina, personal communication, 2002). This variety is a derived line from IRAT 204, a CIRAD-Institut Sénégalais de recherché agricole (ISRA) improved variety from Senegal that is well adapted to Sahelian conditions and has good grain quality. Short-cycle sorghum is mainly planted during the *postrera* season (August to November) to achieve three different objectives: grain for family consumption (tortilla, *pinol*), grain for chickens and pigs, and straw for ruminant alimentation (for farm needs or for selling). The importance of these objectives depends on production constraints and on the individual strategies of the farmers.

The following breeding objectives resulted from the different workshops organized with the farmer groups:

(a) Photoperiodic sorghum:
- Decrease plant height in order to reduce risks of lodging and better control head insects
- Improve grain yield
- Decrease plant cycle for harvesting in December (more early flowering and to reduce flowering-maturity duration)

Improve straw quality (more green leaves at harvest, improved stem quality)

(b) Short-cycle insensitive sorghum:
Improve grain and stover yields
Improve resistance to bugs, sorghum midge, and stocks insects
Better grain size to achieve a better price
Early cycle and drought resistance
Grain quality to give good white tortillas
Improve stover quality for ruminants

Crop improvement

Following former participatory testing and selection with farmers initially carried out by the NGO Proyecto de Desarrollo de San Dionisio (PRODESSA), and then by the CIAT-Hillsides Project in collaboration with the CIALs in San Dionisio, already farmers have adopted IRAT 301 and IRAT 364/90 in the hillside central regions of Nicaragua. Data from on-farm trials along with qualitative information from farmers were collected to convince INTA to include these two varieties in the official validation for 2003 with a view to possible official release in Nicaragua.

As a result of the last 2 years of on-farm trials with CIALs, the rice varieties IRAT 301, IRAT 362, and IRAT 364 are now in a phase of demonstration trials in the low hillside area of Yorito, Honduras. IRAT 364/90 and IRAT 392 are, meanwhile, in validation trials for high hillside conditions in the same region. An official release of the best two or three varieties has to be decided on in 2003. For all on-station and on-farm trials in 2002, the first results for participatory evaluation and selection with farmers groups and agronomic data will be available in October-November.

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1.3.2. Introduction and evaluation of new genetic materials of annual crops in the San Dionisio reference site, Nicaragua

104126

Objectives

- To determine potential performance and adaptation of improved materials of bean, maize, soya, non-irrigated rice, and sweet potato in the climatic conditions of the Supermercado de Opciones para Ladera (SOL) site.
- To evaluate the potential acceptance of the improved materials, incorporating methods of selection and participative evaluation.

Material and Methods

An extensive range of improved germplasm of maize, bean, rice, soya, sweet potato, fodders, and sorghum has been evaluated during the last 4 years at SOL sites (Table 1). The bean materials are part of the CIAT improvement program, and of the Ensayo Centroamericano de Apaptacion y Rendimiento (ECAR) of the Proyecto Regional de Frijol para Centro América, México y el

Caribe (PROFRIJOL). The maize materials are advanced lines generated by the Regional Maize Program (PRM, the Spanish acronym) and INTA. The rice materials are commercial varieties and lines with tolerance to drought and *piricularia* of the CIAT-CIRAD Rice Project. The collection of sweet potato is composed of local materials originally introduced by the Centro Internacional de la Papa (CIP). The sorghum materials are from the INTSORMIL network and ICRISAT. The forage species under evaluation originate from different sources (local, regional, and CIAT). The collection includes grasses, herbaceous and bushy legumes, and green manures.

Table 1. Types of trials evaluated on annual crops in the Supermercado de Opciones para Ladera (SOL), Nicaragua and Honduras, 1999-2002[a].

Crop	1999	2000	2001	2002
Bean	VIDAC (60 lines) ECAR (16 lines)	ECAR (16 lines)	PIF (51 lines) Verification ECAR lines (5) Drought-tolerance nursery (40 lines) Multiplication (6) lines (ECAR 2000)	PIF (16 lines of PIF 2001)
Maize	ENAR (8 materials)	ENAR (10 varieties)	ENAR (10 lines) Evaluation of varieties and hybrids (9)	ENAR (12 materials)
Soya	Adaptation, performance (3 lines)	Multiplication (1 variety by CIALs)	Adaptation and performance (6 varieties)	Verification (6 varieties)
Rice	Adaptation, performance (12 lines)	Evaluation and tolerance to *piricularia* (16 lines) Seed production of 5 best of 2001	Adaptation, performance (27 genotypes)	Trial of best lines of 1999 and 2001 (12 lines) Participative improvement based on PCT-18 population
Sweet potato	-	Adaptation, performance (2 lines)	Adaptation, performance (15 genotypes) Multiplication (2 lines)	-
Sorghum	-	-	Adaptation, performance drought tolerance (10 lines)	Adaptation and performance (10 lines) Adaptation and performance (12 sensitive lines) Participative improvement
Forages	Adaptation of legume, grass, and tree forages	Adaptation of legume, grass, and tree forages	Adaptation of legume, grass, and tree forages	Adaptation of legume, grass, and tree forages

a. For acronyms and abbreviations used, see page 190.

An extensive range of producer interest groups evaluates the materials, including CIALs, groups of experimenting producers, and groups of producers organized by support institutions. Of the selection carried out by the producer groups of interest, the improved materials pass to the communities to be evaluated in different environments, and their subsequent distribution to producers (Figure 1).

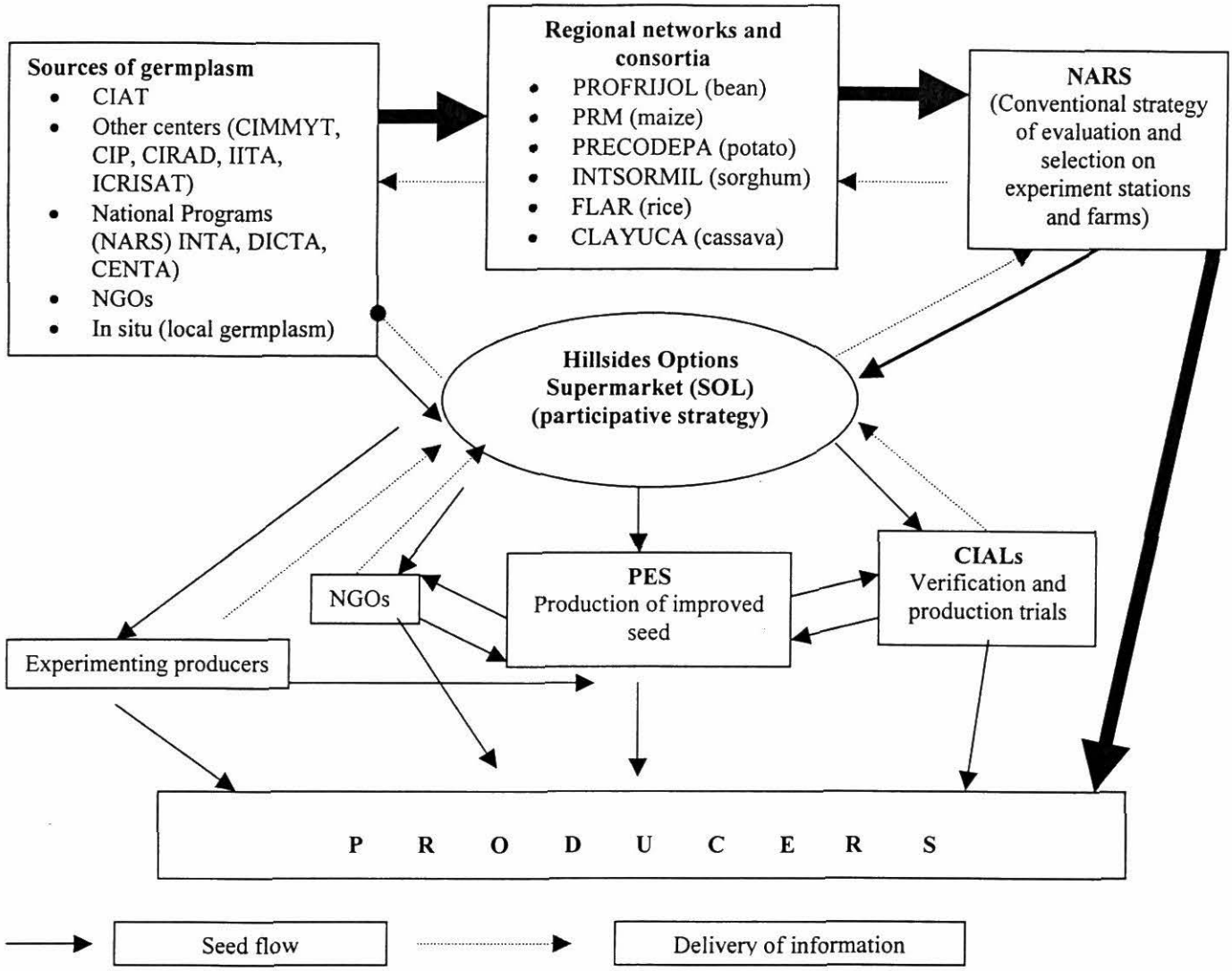

Figure 1. Flow diagram of germplasm in the Supermercado de Opciones para Ladera (SOL) reference sites.

Results

From 1999 to date, producers from the CIALs, producers of the Union de Campesinos Unidos of San Dionisio (UCOSD), and independent producers have participatively evaluated and selected about 180 bean lines, including 40 with tolerance to drought. Based on the results of participative selection (red, uniform brilliant grain color, size of grain, all characteristics highly linked to the market) producers selected EAP 9508-41, EAP 9509-29, EAP 9510-77, and PRF 9652-57-1, and these were distributed in the communities of Chile, Las Cuchillas, El Carrizal, and El Zarzal. The materials tolerant to drought, RAB 620, RAB 607, RAB 630, RJB 12, and RJB 5, were identified and selected.

Producers of the Municipality of San Dionisio have evaluated 42 materials among maize varieties and hybrids to date. HS 5G, DECAL C 343, HQ INTA 993, and H INTA 991 are among the new materials selected by producers and evaluated in the communities of El Carrizal,

Zarzal, and Jicaro 1. The flow of maize germplasm to producers was difficult because multiplication of seed of the better materials needs to be established, and seed needs to be opportunely available for distribution to producers.

Nine materials of improved soya have been evaluated since the start of the SOL, and four of these—CEA-CH-86, Ñandú, Marlen, and Obando 1—are being evaluated at the level of five communities, and especially groups of women.

To date, 32 rice lines have been evaluated. In the communities of Wibuse, Jicaro 1, Zapote, and Jicaro 2 the lines IRAT 301, IRAT 349, IRAT 361, IRAT 362, and IRAT 367 were evaluated. At present, lines are being selected for tolerance to *piricularia.*

Seventeen clones of sweet potato were evaluated in the SOL; those selected by producers are Zapallo, Cayetano, Coastal, Koitaki, Toquecito, Xushu, Excel, Angola, and Jonathan. Likewise nine of these clones were distributed to the regional trials of INTA in Matagalpa, Estelí, Chinandega and León, and Chontales and Carazo.

Sixty-two sorghum lines were evaluated at the SOL site, especially seeking conditions of selection for dry sites. This year we are emphasizing the selection of materials to be delivered to the communities.

Conclusions

The development of germplasm of different crops through participative evaluation and selection is an example of the integrated character of the SOL. The SOL gives producers more direct and extensive access to a wide range of germplasm that originates directly from the international centers and/or the national networks of research institutions in crops such as bean, maize, rice, sorghum, sweet potato, cowpea, soya, and forage plants, among others.

The results obtained indicate that the selection of materials by producers based on their expressed criteria in the participative evaluations permits not only the continuous improvement of the different crops, but also the adoption and utilization of the materials on the farms of the producers. Adoption is seen to be quicker.

In cultivations such as maize, a strategy of seed multiplication needs to be implemented because the flow of better materials to producers is impeded by the non-availability of seed opportunely.

A SOL is a solution for a site or a small area, beyond which a network of SOL sites is needed, which facilitates coverage and the possibility of genotype x environment studies. Through integration/collaboration the duplication of work by institutions is reduced, one supports the other (capacity building), and access is opened to an extensive range of germplasm, and flow of information.

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Collaborators: JA Beltrán; A Schmidt (PE-2); G Trouche (IP-4); J Bosco

1.3.3. Introduction and evaluation of new genetic materials of annual crops in the Luquigüe reference site, Honduras

104127

Objective

To evaluate whether the identification and diffusion of germplasm of annual crops of the SOL-Luquigüe site has satisfied the demand of producers by:

(1) Determining the acceptance of varieties by producers, consumers, and traders through participative evaluations;
(2) Evaluating the agronomic characteristic of advanced lines of the different crops to determine their potential to form part of the present and new systems of production; and
(3) Selecting advanced lines for evaluation by CIALs and institutions in diverse agro-ecological conditions of the subregion of Yorito-Sulaco.

Introduction

Climate changes (drought), constant reduction of soil fertility, and damage to crops by pests and diseases have considerably reduced crop productivity, which has increased food insecurity and levels of malnutrition in the population of certain communities. To reduce the effects of this problem, in the last 3 years the CIAT has evaluated, and placed at the disposition of small-scale hillsides producers in the SOL-Luquigüe, germplasm with characteristics of tolerance to drought, earliness, and high-quality protein. During this same period, participative evaluations and field tours with producers to trials at the SOL-Luquigüe were developed, which has generated much interest and demand for the materials evaluated. Part of the demand for seed and vegetative material was covered with production from small seed production lots.

Material and Methods

During 1999-2002, in the first and second seasons, the following annual trials of crops (sweet potato, bean, soya, maize, cassava, and rice) were evaluated:

- Five nurseries of lines, populations, and accessions,
- 13 evaluation and adaptation trials of varieties' elite lines,
- Four trials of validation of varieties,
- Two validations of promising varieties, and
- Seven plots of seed multiplication of varieties or advanced lines.

The trials had as main objective the identification of materials (lines, populations, or varieties) that showed characteristics of tolerance to pests and diseases, drought, earliness, and good market acceptance. Most experiments followed an RCBD with three repetitions. All trials were sown under the zero labor system, and were evaluated under management conditions that correspond to a low and middle technological level (application of fertilizer, insecticides, and fungicides) because most producers in the region have no economic resources for the purchase of inputs.

The following variables were measured: days to flowering, plant height, presence of pests and diseases, days to maturity, and yield and all its components. Participative evaluations were carried out in the different crop phases, and in some crops, such as sweet potato and bean, sampling was taken. Producer members of the CIALs of Luquigüe, Río Arriba, La Ladera, Pueblo Viejo, Mina Honda, and Santa Marta carried out the 16 evaluations; and IPCA acted as coordinator. Independent producers of the communities of Luquigüe and La Sabana de San Pedro also took part.

The annual presentation of research results and the distribution and exchange of germplasm to producers and technicians are general activities of the Network of SOL sites. To develop these activities each year the technicians of CIAT, IPCA, and Servicios Técnicos para el Desarrollo Sostenido (SERTEDESO) form the operating committee of the Network that organizes workshops of presentation of results at producer and technician level with two important objectives:

(1) To divulge the main research results generated in SOL sites during the last year; and
(2) To generate a demand for seed of the promising varieties identified.

In the development of the workshops, activities are evaluated, important research themes prioritized, collaborative activities among partners established, and participants are given forms for seed requests. Other activities that generate a demand for seed are field tours and participative evaluations carried out with producers from communities within the area of each SOL. In subsequent months, each SOL site and the Network Technical Committee receive requests for seed and vegetative material of the different crops from independent producers and technicians from different institutions. To standardize seed delivery, the Network has elaborated a seed distribution policy in which the quantity and type of material is specified.

From May 2000 to mid-September 2002 small quantities of seed of the promising varieties identified were delivered to small-scale individual producers. Also, small verification trials of varieties for evaluation in diverse agro-ecological conditions were prepared and delivered to technicians and CIALs.

Results

Identification of varieties or advanced lines through participative evaluations

Of the varieties evaluated in the 17 trials established in the SOL-Luquigüe from the second season of 1999 until spring 2001, producers selected 25 advanced lines or varieties through participative evaluations. The selection of these materials is based on the criteria shown in Table 2. Members of CIALs and independent producers in Luquigüe, La Sabana, Río Arriba, and La Ladera, which have similar agro-ecological conditions to the SOL-Luquigüe, carried out these evaluations. Producers of the CIALs in high-altitude areas that were greatly interested in evaluating the crops on their own plots also took part.

Most of these materials have good possibilities of adoption by producers whenever seed is available. Although every year we maintain small seed production plots, available seed was not

sufficient for quick impact in the adoption of these varieties (e.g., adoption of the variety Tío Canela in the region during the Seeds of Hope Project [SOH]). During an agricultural cycle, an agreement was made with the small seed enterprise, Asociación de Hombres y Mujeres Progresistas de Honduras (AHMUPROH), to produce seed of promising varieties identified in rice, soya, and maize. However, results went not satisfactory because of operating problems within AHMUPROH, and of the management of many varieties and crops at the same time. We need to count on a seed production strategy of potential varieties that is well defined to guarantee their widespread adoption.

Table 2. Farmer criteria on which selection of varieties were based, by crop.

Line, variety, or clone selected by crop	Criteria in order of importance
Sweet potato	Flavor
Xushu 18	Consistency
Toquecita	Tuber shape
Cetisa 78 32	Performance
Wong my	
Rice (high-plant type)	Earliness, size of panicle and grain, uniform maturity, flattening of plant, plant height (tall plant facilitates control of weeds)
IRAT 362	
IRAT 349	
Rice (low-plant type)	Performance, healthy foliage, uniform maturity
CR 2515	
INTA #1	
CT 9545	
P 1048	
Soya	Earliness, yield, flattening of plant
Obando 1	
FHIA-15	
Bean	Characteristics of the seed (big wide seed, brilliant clear red, healthy and uniform
EAP 9510-77	Seeds per pod
SRC 1-12-1	Presence of disease
PTC 9557-10	Uniform maturity
PTC 9558-17	
SRC 1-18-1(A)	
PCE 9351-8	
Maize	Health of cob
P 73Nic2	Size of cob (large)
Sinematiali 9423 RE	Weight and size of grain
Sintético 9521	
Across S9623	
S99TL WQ	
Bako S9623	
Poza Rich S9623	

It is important to mention that some of these varieties were used in developing new production systems (trial of rotation of annual crops). One of the most important benefits that partners of the Network of SOL sites perceive is the access to local, national, and international germplasm.

Delivery of germplasm to individual producers

Workshops for presentation of results, field tours, and participative evaluations have generated a demand for evaluated germplasm. Figure 2 shows the number of individual producers that have received germplasm of annual crops, and Figure 3 shows the communities where these producers live. It is evident that Luquigüe and the savanna of San Pedro are the communities most benefited; however, producers of six other communities have received germplasm, not counting all the region covered by the Comprobación de Variedades (COVA) trials, described later. The availability of seed and vegetative material has directly affected seed delivery to producers. More producers received varieties of sweet potato, cassava, and bean (Figure 2) because the SOL site had exclusive areas for seed production and these crops permit rapid multiplication.

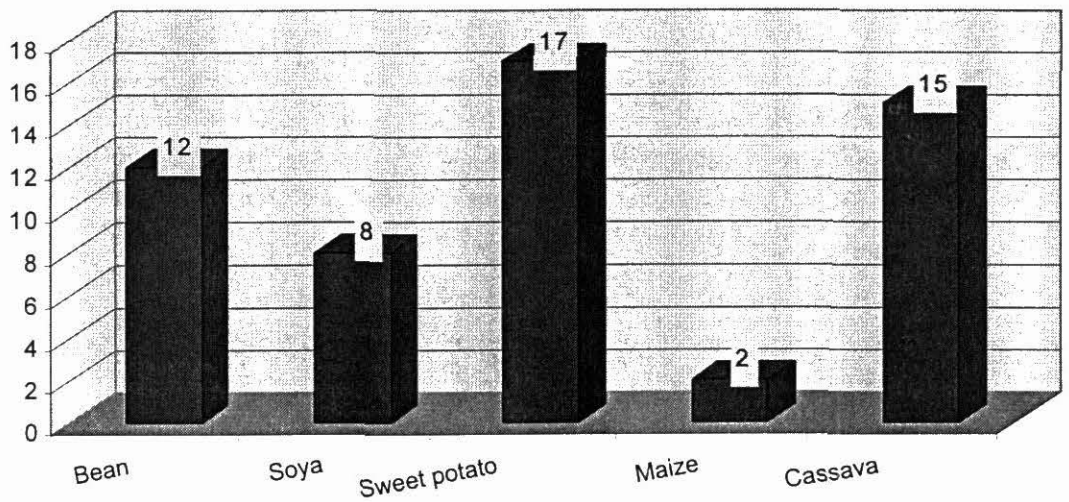

Figure 2. Individual producers that have received germplasm from the Supermercado de Opciones para Ladera (SOL).

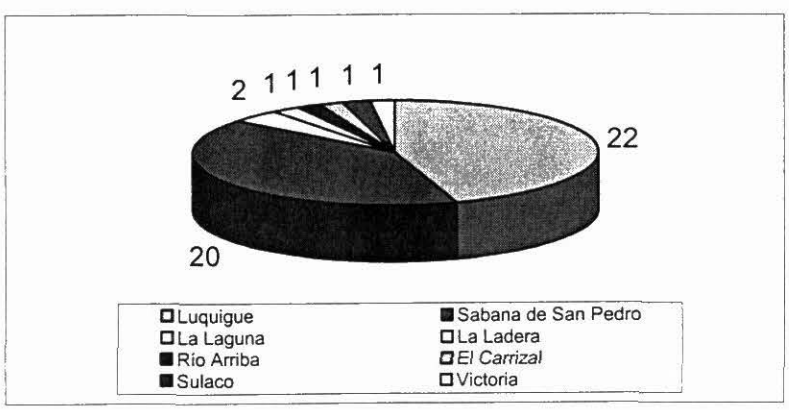

Figure 3. The communities of the individual producers that have received germplasm.

During the seed distribution process, the ideal strategy for diffusing germplasm was identified. First, identify the group of interest of an agro-ecological area by crop. Then, identify a small group of producer experts of the crop that is representative of the region, in order to build with

them an ideo-type of the crop if it is a traditional one and there is experience in growing it. Next, carry out participative evaluations in the trials established in the SOL. Finally, after the agronomic and participative evaluation, present results to producers that form the group of interest, and deliver seed of identified promising varieties. This permits the evaluation of materials in diverse agro-ecological conditions, and the identification of varieties for a region. A strategy for seed multiplication is needed, to guarantee wide adoption.

Validation of promising varieties in diverse agro-ecological conditions of the region

To select varieties and advanced lines that have passed to another level, for example from an ECAR trial to a COVA trial, the following criteria were used, in order of importance:

- Varieties should be first in producer selection made in participative evaluations.
- Seed should comply with all the characteristics required by the market for good commercialization.
- Seed should yield well, and not be tolerant to disease.

To establish verification trials of varieties, multi-institutional alliances (Network of SOL sites) were established among the following institutions: IPCA, SERTEDESO, ESA consultants, Consultores de Servicios Agropecuarios del Valle de Yoro (COSAVY), Consultores para el Desarrollo Sostenible (CODESA), Institutes of San Pedro and San Juan de Sula, Dirección de Investigación de Ciencias y Tecnología Agrícola (DICTA), and Proyecto de Desarrollo de Area (PDA)- Yoro. The farmers and technicians of these benefiting institutions participated in the results' presentation workshops and requested germplasm to evaluate in their areas of influence, municipalities of Yoro (Victoria, Yorito Sulaco, and Jocon), and other departments of the country. To satisfy this demand, CIAT and IPCA jointly prepared and delivered a series of verification trials of varieties of the crops requested. Table 3 shows the number of trials made with germplasm originating from SOL-Luquigüe.

Table 3. Number of trials made by institutions using germplasm originating from the Supermercado de Opciones para Ladera (SOL), Luquigüe[a].

Crop	No. of verification trials delivered	Institutions and organizations establishing and evaluating the crop[a]
Bean	19	SERTEDESO, CIALs of Mina Honda, Guaco, La Ladera, Pueblo Viejo, and PDA-Yoro
Soya	10	SERTEDESO, Institutes of San Juan de Sula and San Pedro, seed delivered to IPCA to prepare trials, and to COSAVY to deliver to producers
Rice	3	SERTEDESO
Sweet potato	6	CIALs in Patastera, Juvenil La Ladera, and Wisilca in Yorito; CIALs in Vallecillos, Santa Bárbara, and Danlí; CODESA; ESA Consultants; 50 plots (60 cuttings), clones of sweet potato in individual form to IPCA and SERTEDESO
Cassava	7	PDA-Yoro, CODESA Morazán, SERTEDESO, CIALs in Wisilca and La Ladera

a. For acronyms and abbreviations used, see page 190.

Altogether, 45 small verification trials of varieties were delivered; of these only some have been monitored. Our partners were asked for their support; but few institutions delivered a complete report of trial results. It is important to note that the COVAs have two purposes; first, is the adaptation of materials to diverse agro-ecological conditions, and second is to produce seed or vegetative material for those producers interested in the crop.

Conclusions

The selection of 25 varieties and advanced lines by producers shows that the offering of germplasm from SOL-Luquigüe is satisfying their demand. The SOL-Luquigüe has permitted direct access to germplasm originating from international centers, programs, and networks of investigation at the level of Central America through deliveries and exchange of germplasm to individual producers, organizations of producers, and institutional partners of the Network of SOL sites. The process of germplasm evaluation, which has been followed in the SOL, has been generally good; however, analysis has been lacking after each cycle of the crop to better identify varieties and advanced lines that can move on from ECAR to COVA trials. It is also necessary to identify groups of interest by crop, and at the same time groups of producer experts. Seed multiplication is an activity that should go parallel to the process of germplasm evaluation to guarantee the adoption of a variety or promising line.

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1.3.4. Soil erosion control in Thailand and Vietnam

Rationale

When grown on slopes, even gentle slopes of less than 10%, cassava production can result in serious erosion, both sheet erosion and rill or gully erosion. Erosion can be markedly reduced by simple agronomic practices, such as intercropping, fertilizer or manure application, mulching, closer plant spacing, minimum tillage, contour ridging, and planting of contour hedgerows of closely spaced grasses or legumes. The contour hedgerows (or any kind of contour barrier) will over time result in natural terrace formation, which reduces the slope and thus runoff and erosion. To find out which of these practices, alone or in combination, is most suitable for a certain area, farmers in project sites were encouraged and assisted in conducting simple farmer participatory research (FPR) erosion control trials on their own fields.

Methods

In both Thailand and Vietnam the cassava project expanded to include four new sites in each country. In Thailand, farmers from these new sites visited demonstration plots with many alternative options located at the Thai Tapioca Development Institute (TTDI) Research Center in Huay Bong, Nakhon Ratchasima province, as well as an older FPR pilot site nearby where farmers had already conducted many FPR trials and had planted several kilometers of vetiver grass hedgerows to control erosion. In Vietnam, farmers from new sites had previously taken part in a field day to harvest FPR trials in a nearby site. After visiting either the demonstration plots or other people's FPR trials, farmers in the new sites often wanted to conduct their own

erosion control trials. They selected as a group the treatments to be tested and each farmer established and managed the trials on a uniform slope of their own field, usually under the guidance of project staff, students, or local extension workers.

Results

Table 4 shows the results of an FPR demonstration conducted for the 4th consecutive year at Thai Nguyen University in north Vietnam. The results indicate that a combination of various improved practices, such as intercropping cassava with peanut, applying fertilizers and planting contour hedgerows of vetiver grass (Treatment 8) reduced erosion from 68 to 14 tons per ha. This treatment also resulted in the second highest cassava yield and net income. Farmers visiting these trials realize immediately that, even though these practices increase production costs, they can also double or triple net income, while markedly reducing erosion and soil degradation. Thus, there is no doubt that good agronomic and soil conservation practices will in the long term increase yields and income, thus helping to alleviate poverty.

Table 4. Results of farmer participatory research (FPR) demonstration plots at Thai Nguyen University, Thai Nguyen province, north Vietnam in 2001 (4th year).

Treatments[a]	Dry soil loss (t ha^{-1})	Yield (t ha^{-1})				Gross income[b]	Product. costs[c]	Net income
		Cassava	Peanut		Hedgerow biomass			
			Dry pods	Biomass		(mil. dong ha^{-1})		
1. No fertilizer; no ridges, C monoculture; 1 x 0.8 m; no hedgerows	67.75	2.75	-	-	-	1.375	2.800	-1.425
2. With fert.; contour ridges, C monoculture; 1 x 0.8 m; no hedgerows	19.53	13.33	-	-	-	6.665	4.364	2.301
3. With fert.; no ridges, C monoculture; 1 x 0.8 m; *Paspalum* hedgerows	20.50	14.08	-	-	1.57	7.040	4.164	2.876
4. With fert.; no ridges, C monoculture; 1 x 0.8 m; vetiver+*Teph.* hedgerows	14.96	13.91	-	-	2.94	6.955	4.164	2.791
5. With fert.; no ridges, C+P; 1 x 0.8 m; *Tephrosia* hedgerows	16.35	15.83	0.50	4.23	1.34	10.415	5.464	4.951
6. With fert.; no ridges, C+P; 1 x 0.8 m; *Tephrosia*+pineapple hedgerows	15.95	15.41	0.41	4.02	1.00	9.755	5.464	4.291
7. With fert.; no ridges, C+P; 1 x 0.8 m; natural grass hedgerows	17.98	14.83	0.38	3.95	-	9.315	5.164	4.151
8. With fert.; no ridges, C+P; 1 x 0.8 m; vetiver grass hedgerows	13.98	16.91	0.33	3.42	1.63	10.105	5.464	4.641
9. With fert.; no ridges, C+P; 1 x 0.8 m; *Panicum max.* hedgerows	17.11	14.58	0.45	4.30	1.66	9.540	5.464	4.076
10. With fert.; no ridges, C+P; 0.6x 0.8 m; *Brach. brizantha* hedgerows	15.15	18.33	-	-	1.22	9.165	4.664	4.501

a. Fertilizers = 60N+40P_2O_5+120K_2O per ha; C+P = C+peanut; Variety = KM60; Distance between hedgerows: 5m; Intercropping: 2 rows of peanut.

b. Prices (dong): cassava, 500 per kg; peanut, 5000 per kg; urea (45% N), 2100 per kg; SSP (17% P_2O_5), 950 per kg; KCl (60% K_2O), 2300 per kg; labor, 10 000 per man day;

c. Cost of cassava cultivation, 2.8 mil. dong per ha; cost of fertilizers (60N+40P_2O_5+120K_2O), 0.964 mil. dong per ha; cost of fertilizer application, 0.10 mil. dong per ha; cost of peanut seed, 0.30 mil. dong per ha; cost of contour ridging, 0.50 mil. dong per ha; cost of labor for intercropping, 1.00 mil. dong per ha; cost of hedgerow seed, planting, maintenance, 0.30 mil. dong per ha.

Tables 5 and 6 show the type and number of FPR trials conducted in 49 pilot sites in Thailand and Vietnam. Farmers in practically all villages liked to test new varieties, because this is a way to obtain planting material of new high yielding and high-starch content germplasm. Besides evaluating the new varieties and lines, they used this as the first step in multiplying the most promising material for later planting in larger areas of their farm.

In Vietnam, farmers also continue to conduct FPR erosion control, intercropping, and fertilizer trials as they realize that the combination of high-yielding varieties, balanced fertilization, intercropping, and erosion control barriers is the best way to increase yields and income, while protecting their soil from degradation. This is well illustrated by the results in Table 7 for four FPR erosion control trials conducted by farmers in Dong Rang village in north Vietnam. Highest cassava yields and net income were consistently obtained when cassava was intercropped, well fertilized, and planted with contour hedgerows of *Tephrosia candida*, vetiver grass, pineapple, or *Flemingia macrophylla*. All these treatments were very effective in reducing erosion, sometimes down to zero. In south Vietnam, similar FPR erosion control trials showed that hedgerows of *Paspalum atratum* were equally effective in reducing erosion while increasing cassava yields and net income (Tables 8 and 9). Based on these results, some farmers in the five pilot sites in south Vietnam have now planted several kilometers of contour hedgerows of *Paspalum atratum* in order to reduce erosion and produce fodder for feeding cattle or fish.

In Thailand, farmers have discontinued conducting erosion control trials because they all seem to be convinced that planting contour hedgerows of vetiver grass is the most suitable solution. When farmers from a new site visit a village where vetiver grass hedgerows have already been adopted, they become readily convinced of the benefits of this practice, and many take planting material home to start multiplying and planting in their own fields. Because cassava in Thailand is generally planted on gentle slopes, gully erosion is much more serious (and visible) than sheet erosion. Erosion control experiments are not very effective in demonstrating solutions to gully erosion, as the latter occur only in natural drainage ways in the field. Where this is a serious problem, farmers and researchers together have developed a practical and effective way to stop further gully erosion by placing soil-filled bags across the gully in-line (but slightly below) an already established vetiver hedgerow. Once soil sediments have accumulated in the gully above the soil bags, vetiver grass is planted in these sediments, in order to complete the vetiver hedgerow, which will then further reduce the speed of runoff water in the gully.

Table 5. Number and types of farmer participatory research (FPR) trials conducted by farmers in various pilot sites of the Nippon Foundation Project in Vietnam in 2002[a].

Province	District	Commune	Village	Varieties	Fertilization	Erosion control	Intercropping	Weed control	Plant spacing	Leaf product.	Pig feeding
Thai Nguyen	Pho Yen	Tien Phong		-	1	-	-	-	-	-	-
		Dac Son		-	-	-	-	-	-	-	-
		Minh Duc		1	1	1	2	-	-	-	-
		Hong Tien		2	-	-	-	-	-	-	-
Tuyen Quang	Son Duong	Thuong Am	Am Thang	5	1	1	2	-	2	-	-
			Hong Tien	5	2	3	1	-	1	-	-
Yen Bai	Van Yen		Yen Hung	1	-	-	1	-	-	-	-
			Mau A	1	-	-	1	-	-	-	-
			Dong Cuong	1	-	2	2	-	-	-	-
Phu Tho	Thanh Ba	Phuong Linh	Kieu Tung	1	-	1	-	-	1	-	-
	Phu Ninh	Thong Nhat	Phu Ho	2	1	2	2	-	3	-	-
		Bao Thanh		2	-	1	1	-	2	-	-
Hao Binh	Luong Son	Dong Xuan	Dong Rang	-	-	4	4	-	5	-	-
Ha Tay	Thach That		Thach Hoa	2	3	1	3	-	-	-	-
	Chuong My	Tran Phu	Tran Phu	5	-	-	3	-	-	-	-
Thanh Hoa	Nhu Xuan*			2	-	1	-	-	-	-	-
Thua Thien-Hue	A Luoi	Hong Ha		3	2	3	3	-	3	1	8
	Nam Dong	Thuong Long		2	2	2	2	-	2	-	-
		Tay Hoa*		1	-	-	-	-	-	1	-
	Huong Tra	Huong Van		-	-	-	-	-	-	-	8
Dong Nai	Thong Nhat		An Vien	1	3	-	-	-	-	-	-
Binh Phuoc	Phuoc Long		Dong Tam	5	2	4	-	-	-	-	-
			Minh Lap	1	2	-	-	-	-	-	-
Baria Vungtau	Chau Duc		Suoi Rao	2	2	2	2	-	-	-	-
			Son Binh	2	2	2	2	-	-	-	-
Total: 11	15	25	25	47	24	30	31	0	19	2	16

a. Total = 169 FPR trials; * = initiated in 2002.

Table 6. Number of farmer participatory research (FPR) trials conducted by farmers in various pilot sites of the Nippon Foundation Project, Thailand, 2002.

Province	District	Subdistrict	Village[a]	No. of farmers	FPR trials (no. farmers/rai)[b]						
					Varieties	Org. manures	Chem.fert.	Chem.+org. manures	Herbicides	Green manures	Intercrop
Nakhon Ratchasima	Daan Khun Thot	Baan Kaw	Khut Dook	53	1/3	1/2	1/2	-	-	-	1/2
	Thephaarak	Bueng Prue	3 and 6	-	-	-	-	-	-	-	-
	Soeng Saang	Noon Sombuun	Sapphong Phoot	-	-	-	-	-	-	-	
		Sratakhian	Sratakhian	-	-	-	-	-	-	-	-
	Khonburi	Tabaekbaan	Nong Phak Rai*	27	1/2	1/2	1/2	-	-	-	1/5
Prachinburi	Naadii	KaengDinso	Aang Thong Khao Khaat	34	1/5	-	-	-	1/5	-	-
Kalasin	Mueang	Phuu Po	Noon Sawan	-	-	-	-	-	-	-	-
		Khamin	Khamplaa	-	-	-	-	-	-	-	-
	Nongkungsri	Nong Bua	Khamsri	-	-	-	-	-	-	-	-
	Sahatsakhan	Noonburi	Noon Sawaat	-	-	-	-	-	-	-	-
		Noon Namkliang	Huay Suea Ten Paa Kluay	-	-	-	-	-	-	-	-
	Naamon	Naamon	Noon Thiang*	50	4/4	-	3/3	2/2	-	3/3	-
	Don Chaan	Dong Phayung	Noon Kokchik*	50	4/4	-	4/4	-	-	3/3	-
	Huay Phueng	Nikhom	Huay Faa*	50	4/4	-	4/4	-	-	3/3	-
Chachoengsao	Sanaamchaikhet	Thung Phrayaa	Thaa Chiwit Mai	-	-	-	-			-	-
	Thaatakiab	Khlong Takraw	Nong Yai	-	-	-	-	-	-	-	-
Kamphaengphet	Khanuwaralakburii	Bo Tham	Siiyaek Ton Thoo	30	-	-	1/5	5/10	-	-	1/5
Chaiyapuum	Thep Sathit	Naayaang Klak	Khook Anu	50	2/3	-	2/2	-	4/4	-	3/6
Kaanchanaburi	Law Khwan	Thung Krabam	Nong Kae	42	2/2	2/2	2/2	-	-	2/2	2/2
Srakaew	Wang Sombuun	Wang Sombuun	Baan Khlong Ruam	-	-	-	-	-	-	-	-
Total: 6	9	9	24	386	19/27	4/6	17/19	7/12	5/9	11/11	7/15

a. * = initiated in 2002.

b. Total = 51 FPR trials; 1 ha = 6.25 rai.

Table 7. Results of two farmer participatory research (FPR) fertilizer trials conducted by farmers in Bao Thanh village, Phu Ninh district, Phu Tho, Vietnam, 2001-02.

Treatments[a]	Dry soil loss ($t\ ha^{-1}$)	Yield		Gross income[b]	Product. costs	Net income	B/C
		Cassava ($t\ ha^{-1}$)	Intercrop ($t\ ha^{-1}$)	(mil. dong ha^{-1})			
Mr Nguyen Van Tho; 16% slope:							
1. C+T, no fert., no hedgerows	16.27	8.91	3.00	6.564	4.750	1.814	1.38
2. C+T, with NPK, vetiver hedgerows	0.25	15.19	3.04	9.166	5.680	3.486	1.61
3. C+T, with NPK, *Tephsisia* hedgerows	0.12	17.15	2.60	9.460	5.680	3.780	1.66
4. C+P, with NPK, vetiver hedgerows	0.00	14.23	0.90	9.292	6.130	3.162	1.51
5. C+P, with NPK, *Tephrosia* hedgerows	0.40	14.94	0.90	9.576	6.130	3.446	1.56
Mr Bui Thanh Mai, 12% slope							
1. C+T, no fert., no hedgerows	16.27	11.47	0.83	7.908	5.200	2.708	1.52
2. C+T, with NPK, no hedgerows	0.50	15.63	1.00	10.252	6.080	4.172	1.69
3. C+T, with NPK, *Tephasia* hedgerows	0.00	14.44	1.02	9.856	6.130	3.726	1.61
4. C+P, with NPK, *Flemingia* hedgerows	0.35	13.57	1.01	9.468	6.130	3.338	1.54
5. C+P, with NPK, vetiver hedgerows	0.00	14.65	0.83	9.180	6.130	3.050	1.50
Mr Bui Thi Bam, 16% slope							
1. C monocult, no fert., no hedgerows	48.00	8.13	-	3.252	2.740	0.512	1.19
2. C+P, with NPK, vetiver no hedgerows	0.00	14.77	0.99	9.868	6.130	3.738	1.61
Mr Nguyen Van Chanh, 20%-22% slope							
1. C, no hedgerows, with NPK	25.60	8.63		3.452	3.220	0.232	1.07
2. C, *Tephosia* hedgerows, with NPK	8.20	12.80		5.120	3.270	1.850	1.56
3. C, *Flemingia* hedgerows, with NPK	4.50	14.24		5.696	3.270	2.426	1.74
4. C, vetiver hedgerows, with NPK	5.80	12.85		5.140	3.270	1.870	1.57
5. C, pineapple hedgerows, with NPK	6.00	13.50		5.400	3.270	2.130	1.65

a. C = cassava, T = taro, P = peanut; NPK = 40 N + 40 P_2O_5 + 80 K_2O per ha.

b. Prices (dong): cassava, 400 per kg fresh roots; taro, 1000 per kg fresh corms; peanuts, 4000 per kg dry pods.

In some locations in Thailand, vetiver grass hedgerows, which were established several years ago, have subsequently been destroyed, mainly by tractor drivers that prepare the land on contract. A participatory monitoring and evaluation (PM&E) exercise with farmers in four pilot sites revealed that tractor drivers prefer plowing up-and-down the slope, and in straight lines parallel to the plot border. In same cases, they lift the plow while crossing the contour hedgerow, but this still damages the plants and destroys the effectiveness of the hedgerow. A strong community commitment to protect the hedgerows is needed to convince tractor drivers to plow along the contour, and if necessary, to blacklist or fine those that do not. A community-based Soil Conservation Group with strong leadership in the village is probably necessary to solve this problem. Alternatively, farmers should abandon the plow altogether and experiment with minimum or zero-tillage, using contact herbicides to control weeds. Replicated experiments conducted by researchers in three sites in Thailand (Table 10) indicate that there were no significant differences in cassava yield or starch content between tillage treatments (including zero tillage) in two of the three sites. The use of zero-tillage in itself is an effective soil conservation measure.

Table 8. Average results of three farmer participatory research (FPR) cassava erosion control trials conducted by farmers in Dong Tam village, Dong Phu district, Binh Phuoc, Vietnam, 2001-02.

Treatments[a]	Dry soil loss ($t\ ha^{-1}$)	Cassava yield ($t\ ha^{-1}$)	Gross income[b]	Production costs[b] ('000 dong ha^{-1})	Net income	Farmers' preference[c] (%)
1. Cassava monoculture	39.40	19.80	7524	3393	4131	20
2. Cassava + vetiver hedgerows	15.80	23.10	8778	3593	5185	30
3. Cassava + Leucaena hedgerows	21.80	21.80	8284	3593	4691	0
4. Cassava + Gliricidia hedgerows	28.10	21.20	8056	3593	4463	0
5. Cassava + Panicum hedgerows	12.70	22.60	8588	3593	4995	50

a. Fertilizers applied 80 N + 40 P_2O_5+ 80 K_2O per ha.

b. Prices (dong): cassava, 380 per kg fresh roots; urea (45% N), 2300 per kg; SSP (17% P_2O_5), 1100 per kg; KCl (60% K_2O), 2300 per kg; fertilizer cost, 1 043 000 per ha; cost of land preparation, 600 000 per ha; labor for planting, 200 000 per ha; labor for weeding by hand (3x), 1 500 000 per ha; labor for cutting hedgerows, 200 000 per ha; labor for fertilizer application, 50 000 per ha.

c. 18 farmers participated.

Table 9. Average results of three farmer participatory research (FPR) erosion control trials conducted by farmers in Suoi Rao and Son Binh villages of Chau Duc district, Baria-Vungtau, Vietnam. 2001-2002.

Treatments	Dry soil loss (t ha)	Yield ($t\ ha^{-1}$)		Gross income[a]	Production costs	Net income	Farmers' preference (%)
		Cassava	Maize or hedgerows	<----('000 dong/ha)---->			
1. C monoculture, no hedgerows	77.47	37.89	-	20 840	5836	15 004	10
2. C, pineapple hedgerows	31.94	31.10	-	17 105	6136	10 969	17
3. C, *Paspalum atratum* hedgerows	21.87	34.54	12.63	18 997	6136	12 861	43
4. C, vetiver grass hedgerows	40.43	30.99	3.68	17 045	6136	10 909	43
5. C+maize intercrop	14.50	24.94	3.53	16 894	7646	9 248	10

a. Prices (dong): cassava, 550 per kg fresh roots; maize, 900 per kg dry grain; cassava fertilizers, 1 095 600 per ha; maize fertilizers, 550 000 per ha; labor for cassava, 4 140 000 per ha (207 man days); labor for maize, 800 000 per ha (40 man days); labor for fertilizer application, 100 000 per ha (5 man days); planting and maintenance hedgerows, 300 000 per ha (15 man days); cassava stakes, 500 000 per ha; labor, 20 000 per man day.

Table 10. Effect of tillage treatments on the average fresh root yield and starch content of four cassava varieties grown in three locations, in Thailand, 2001-2002.

Tillage treatments	Cassava root yield[a] (t/ha)				Starch content (%)			
	L_1	L_2	L_3	Av.	L_1	L_2	L_3	Av.
1. No tillage; Glyphosate	11.46	21.45	19.91	17.61	20.2	18.1	25.3	21.2
2. Chisel plow; Glyphosate	12.03	20.56	17.78	16.79	21.0	17.8	25.0	21.3
3. Subsoiler; Glyphosate	13.70	19.20	16.31	16.40	19.7	18.8	25.2	21.2
4. Subsoiler+chisel; Glyphosate	14.85	19.07	21.87	18.60	21.9	19.5	27.5	23.0
5. Cassava harvester; Glyphosate	14.60	18.56	16.08	16.41	19.9	18.6	26.3	21.6
6. 3-disk plow	13.66	18.81	18.00	16.82	21.3	18.2	24.2	21.2
7. Subsoiler+3-disk plow	17.57	24.71	16.60	19.63	21.2	19.1	26.7	22.3
8. 3-disk+7-disk plow	11.93	21.27	18.15	17.12	21.0	18.5	25.2	21.6
9. 3-disk+7-disk +contour ridges	17.47	24.88	18.32	20.22	19.9	18.9	26.2	21.7
10. 3-disk+7-disk +up/down ridges	19.50	23.25	17.52	20.09	18.7	18.8	26.9	21.5
Average	14.68	21.18	18.05	17.97	20.5	18.6	25.9	21.7

a. L_1 = farmer's field in Huay Pong, Rayong, L_2 = farmer's field in Khaw Hin Sorn, Chachoengsao, and L_3 = Thai Tapioca Development Institute (TTDI) Center in Huay Bong, Nakhon Ratchasima.

Contributor: R Howeler

1.3.5. Soil fertility maintenance and improvement in Thailand and Vietnam

Hundreds of FPR fertilizer trials conducted by farmers during the past 8 years have clearly shown the importance of adequate and well-balanced fertilization to obtain high yields and net income. This is also very effective in reducing erosion. Although previously farmers in Vietnam were applying too much farmyard manure (FYM) and P, and not enough K, most farmers in the pilot sites are now applying a combination of 5-10 t per ha of pig manure with about 80 kg N, 20-40 kg P_2O_5, and 80 kg K_2O per ha as chemical fertilizers. A replicated experiment conducted for 2 years at Thai Nguyen University (Table 11) indicates that cassava yields could be increased from 3.25 to 18.70 t per ha with the combined application of 10 t per ha of pig manure and 80 kg N + 80 kg K_2O per ha as chemical fertilizers. Highest net income, however, was obtained with the application of NK fertilizers and only 5 t per ha of pig manure. Application of NK fertilizers alone, costing 0.68 million dong per ha, produced higher yields than the application of even 15 t per ha of pig manure alone, valued at 1.5 million dong per ha. Thus, the correct application of chemical fertilizers, preferably in combination with FYM, is the most effective way to increase income and maintain or improve soil productivity.

Table 11. Effect of the application of farmyard manure (FYM) and chemical fertilizers on cassava yield and economic benefit at Thai Nguyen University of Agriculture and Forestry in Thai Nguyen province, 2001 (2nd year).

Treatments	Cassava root yield (t ha^{-1})	Height at 8 months (cm)	Leaf life at 3 months (days)	HI[a]	Gross income[b]	Fertilizer costs[b] (million dong ha^{-1})	Production costs[c]	Net income
1. No fertilizers, no FYM	3.25	87.1	46.5	0.39	1.625	0	2.80	-1.175
2. 5 t FYM ha^{-1}	7.79	116.6	55.2	0.49	3.895	0.50	3.30	0.595
3. 10 t FYM ha^{-1}	10.02	133.9	65.0	0.52	5.010	1.00	3.80	1.210
4. 15 t FYM ha^{-1}	13.11	151.8	66.1	0.52	6.555	1.50	4.30	2.255
5. 80N+80K_2O ha^{-1}, no FYM	15.47	154.5	66.8	0.50	7.735	0.68	3.58	4.155
6. 80N+80K_2O/ha + 5 t FYM ha^{-1}	17.98	180.0	68.5	0.48	8.990	1.18	4.08	4.910
7. 80N+80K_2O/ha + 10 t FYM ha^{-1}	18.70	188.3	70.8	0.49	9.350	1.68	4.58	4.770
8. 80N+80K_2O/ha + 15 t FYM ha^{-1}	18.50	196.6	73.1	0.48	9.250	2.18	5.08	4.170

a. HI = harvest index.

b. Prices (dong): cassava, 500 per kg fresh roots; urea (45% N), 2100 per kg; KCl (60% K_2O), 2300 per kg; manure + application, 100 per kg.

c. Cost of cassava cultivation, 2.8 million dong per ha; cost of chemical fertilizer application, 0.10 million dong per ha.

A replicated long-term trial conducted at Hung Loc Agricultural Research Center in south Vietnam (Table 12), showed that green manures such as intercropped pigeon pea, *Mucuna pruriens*, peanut, or cowpea did not have a significant effect on yield, but that the intercropped green manure *Canavalia ensiformis*, and especially alley cropping with *Leucaena leucocephala* or *Gliricidia sepium,* increased cassava yields significantly after 10 years of consecutive cropping. The two alley cropping treatments increased net income in the 10th year 2-3 fold compared with the check treatment without alleys or intercrops.

Table 12. The effect of green manures, intercropping, and alley cropping on the yields of cassava and intercrops as well as on gross and net income when cassava was grown without fertilizers for the tenth consecutive crop at Hung Loc Agricultural Research Center in Dongnai, Vietnam, 2001-02.

Crops[a]	Cassava yield	Starch content	Intercrop yield	Gross income[b]	Production costs[c]	Net income
	(t ha^{-1})	(%)	(t ha^{-1})	('000 dong ha^{-1})		
1. Cassava monoculture	12.10c	26.6c	-	5324	3100	2224
2. C+pigeon pea green manure	13.27bc	27.0bc	8.30b	5839	3700	2139
3. C+Mucuna green manure	8.71d	25.8d	1.90d	3832	3700	132
4. C+peanut intercrop	12.21c	26.7bc	4.59c	5372	3700	1672
5. C+cowpea intercrop	13.77bc	27.2b	2.41d	6059	3700	2359
6. C+Canavalia green manure	15.87b	26.0d	2.46d	6983	3700	3283
7. C+Leucaena alley crop	21.14a	28.1a	12.67a	9367	3400	5967
8. C+Gliricidia alley crop	21.45a	26.8bc	8.35b	9438	3400	6038
cv (%)	12.00	3.85	12.82			
s (0.05)	2.62	0.51	0.95			

a. Cassava and intercrops were fertilized with a total of 100 kg N, 40 P_2O_5, and 100 K_2O ha^{-1} only for the first 7 years.

b Prices (dong): cassava, 440 per kg fresh roots.

c. Costs: cassava cultivation (without fertilizer or intercrop), 3.1 million dong per ha; intercrop planting, 200 000 per ha; intercrop seed, 200 000 per ha; intercrop harvest/cutting, 300 000 per ha; weeding with intercrop, 100 000 per ha less than without intercrop.

In Thailand, most farmers in the pilot sites have now adopted the application of chemical fertilizer to cassava, usually about 150 kg per ha of 15-15-15, 13-13-21 or 16-8-8 (Table 13). However, more and more farmers are now becoming interested in testing animal and green manures in combination with chemical fertilizers. In one village, about 50% of the cassava growing area has now adopted the planting of *Canavalia ensiformis* as a green manure to be incorporated into the soil before planting cassava. Initial attempts to plant *Canavalia* as an intercrop between cassava rows, and pulling the green manure up after about 2 months, failed because of strong competition from the green manure. Thus, farmers reverted to the traditional practice of planting the green manure first and incorporating the residues prior to planting cassava. This requires a total cropping cycle of 18 months, which is possible mainly in areas with a somewhat prolonged (6-7 months) and bimodal rainy season.

Table 13. Change in the use of new cassava production technologies[a] in four pilot sites[b] in Thailand from 1993 to 2002[c] as a result of the Nippon Foundation Project.

Technology component	Baan Khlong Ruam			Thaa Chiwit Mai			Sapphongphoot			Huay Suea Ten		
	1994	1997	2002	1996	1999	2002	1996	1999	2002	1996	1999	2002
Varieties	R90 (60%) R3 (30% R60 (10%)	R90 (60%) R5 (20%) KU50 (20%)	R5 (67%) R90 (19%) KU50 (12%) R72 (2%)	R1 (94%) R60 (3%) R5 (3%)	KU50 (41%) R60 (32%) R5 (22%) R90 (5%)	KU50 (81%) R5 (18%) R72 (1%)	R1 R60 R90	KU50 R5 R90	KU50 (91%) R90 (5%) R72 (3%) R5 (1%)	R1 R90 KU50	KU50 R5 R90	KU50 (54%) R5 (20%) R90 (15%) R72 (11%)
Chemical fertilizers	not apply	15-15-15 13-13-21	15-15-15 (35%) 13-13-21 (17%) 21-4-21 (13%) 14-4-24 (10%) 16-20-0 (5%) other (20%)	not apply	15-15-15	15-15-15 (50%) 13-13-21 (38%) other (12%)	not apply or 15-15-15 (little)	15-15-15 46-0-0	15-15-15 (44%) 46-0-0 (27%) 13-13-21 (4%) other (25%)	not apply or 15-15-15 (little)	15-15-15 and 16-8-8 mixed at 2:1 ratio	15-15-15 (47%) 16-8-8 (33%) 21-0-0 (12%) 46-0-0 (7%) 13-13-21 (1%)
Vetiver grass	not plant	46%	29%	not plant	3%	20%	not plant	70%	80%	not plant	32%	42%
Green manures	not plant	not plant	Canavalia (little) cowpea (little)	not plant	not plant	Canavalia (little)	not plant	not plant	Canavalia (little) Crotalaria (little)	not plant	Canavalia (20%)	Canavalia (50%)

a. Date collected from participatory monitoring and evaluation (PM&E) with farmers in Aug 2002; percentages are in terms of cassava area.

b. Baan Khlong Ruam village, Wang Soombuun district, Sra Kaew province; Thaa Chiwit Mai village, Sanaam Chaikhet district, Chachoengsao province; Sapphongphoot village, Soeng Saang district, Nakhon Ratchasima; and Huay Suea Ten village, Sahatsakhan district, Kalasin province.

c. Nippon Foundation Project started in these pilot sites around 1997, except in Baan Khlong Ruam where it started in 1995.

1.4. Promote and support multiplication of successful alternatives validated at farm level

1.4.1. Support the development of PES prototypes in the reference sites

104129

Objective

To present the evolution and results of applying the concept of Productores Empresarios de Semillas Artesanales (PES).

Materials and Methods

The Communities and Watersheds Project (C&W), formerly the Hillsides Project, has begun to implement seed production through small businesses as part of its operating plan to be carried out in Haiti. As a work strategy, we propose to identify within all the community-based organizations (CBOs) in north and south Haiti, those with the greatest potential for business management and strength in an operative capacity. At present, eight have begun their process of implementation, which will be supported with training in business management, organization, seed commercialization, and technologies in basic grains and forages. These training activities will give rise to implementing action plans, follow up, and monitoring.

The concept of the PES has evolved during its implementation. It began with the PES viewed as a group of farmers strengthened with training, organization, follow up, and monitoring, and connected directly with the local market (Figure 4).

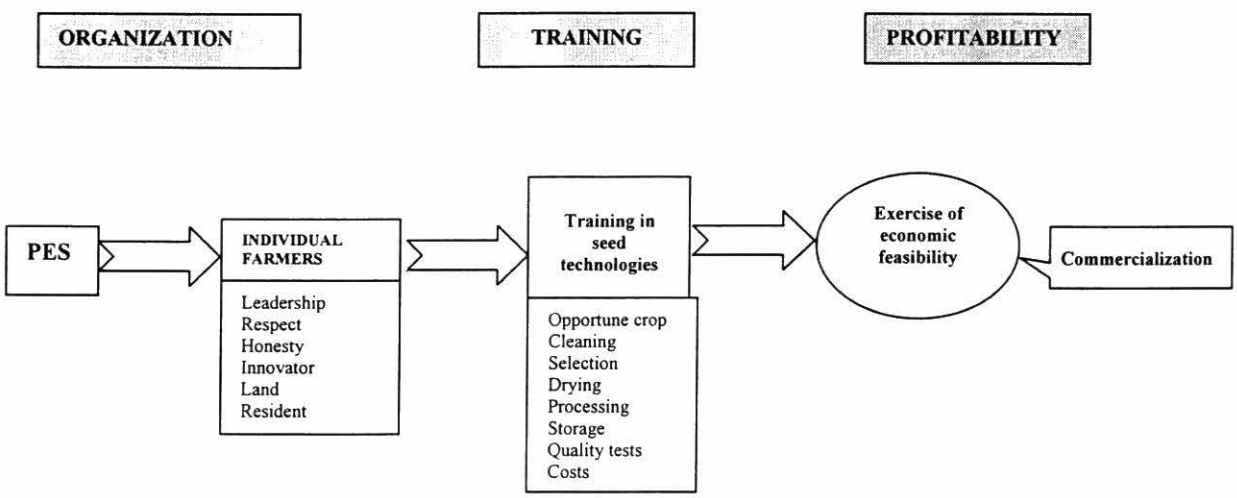

Figure 4. Plan of a Productores Empresarios de Semillas Artesanales (PES) formed by individual farmers that decided to organize as a group.

Then, the concept evolved toward connecting the PES to the market through a cooperative that makes seed production contracts with selected farmer associates (Figure 5). These farmers are strengthened in agricultural management and seed technologies; thus trained, they offer good quality seed to the cooperative. The cooperative takes charge of all processes of added value or transformation, which permits it, as well as selling at a price in agreement with the economic capacity of the farmer, to generate employment, particularly in the selection of the seed,

processing, and packing. Women and children that may be the wives or children of the same associates, or persons of the community carry out these jobs easily.

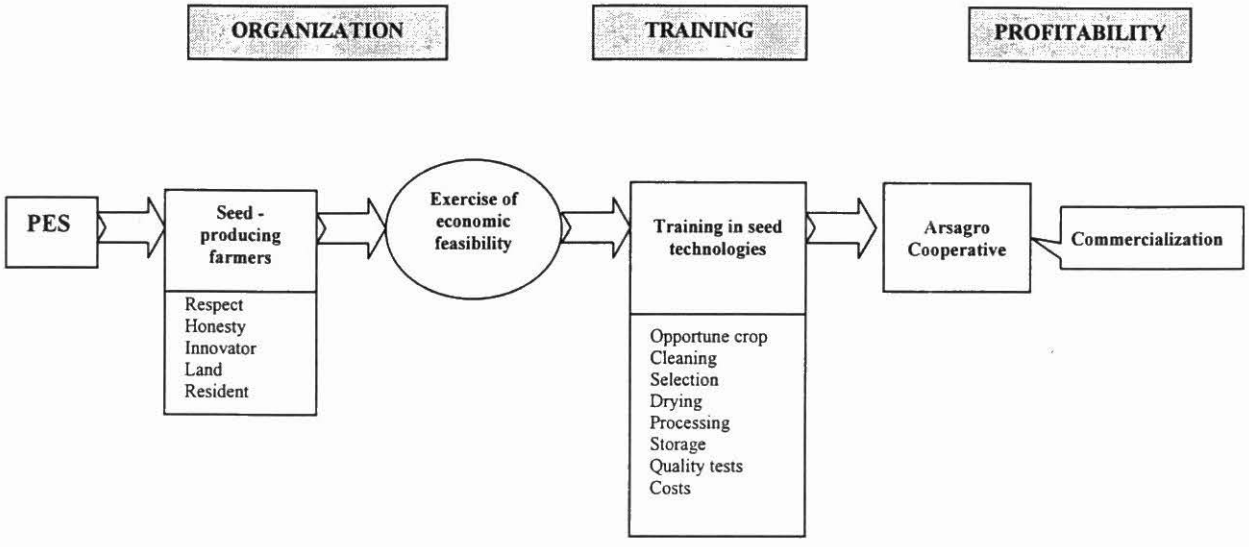

Figure 5. Plan of a Productores Empresarios de Semillas Artesanales (PES) formed by farmers that produce seed for a cooperative that carries out the commercialization among their associates.

Currently, this concept is maintained in Haiti, but now connected to germplasm through the SOL sites (Figure 6).

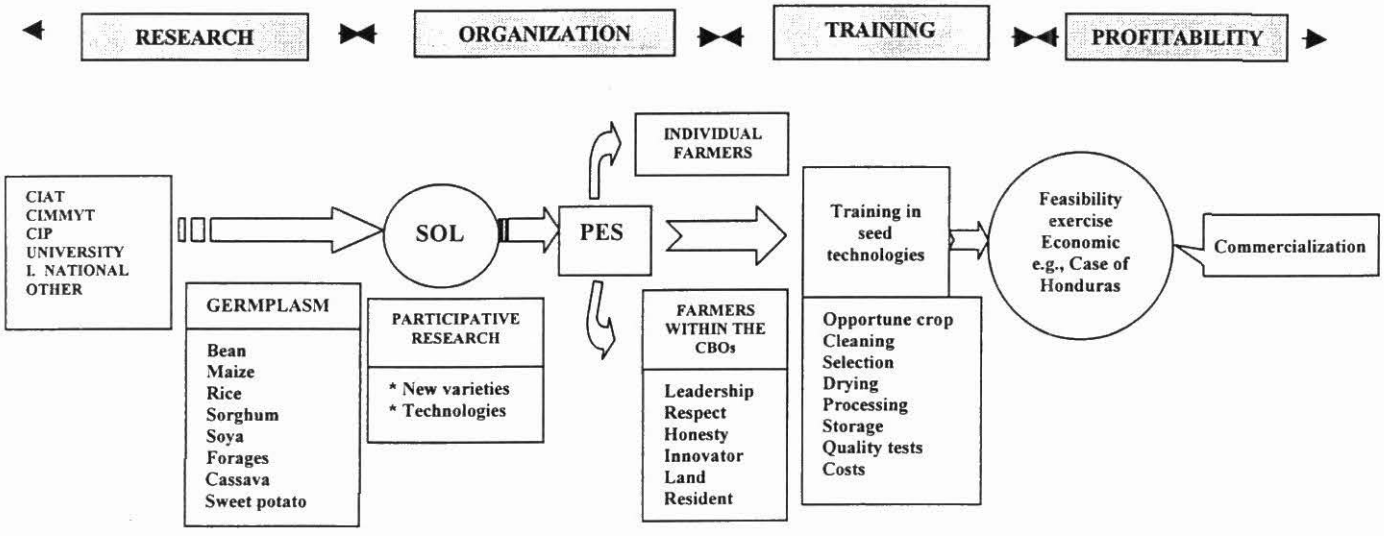

Figure 6. Plan of a Productores Empresarios de Semillas Artesanales (PES) formed by farmers that have access to improved germplasm and produce seed for the cooperative that carries out the commercialization among their associates. (For acronyms use, see page 190.)

Having access to new improved germplasm, farmers can be more efficient and productive, which permits them to make better use of the land because it is not necessary to use large areas to produce food. This reduction of area permits them to think about other crops of greater added value, or simply to have a better balanced diet by establishing diversified home gardens.

In the case of cassava, roots have economic value, and seed (stakes) has an opportunity value; as opposed to basic grains and forages, where seed has added value. For this reason, various components at present existing in Haiti should be connected in the case of cassava:

(1) The institutions: Pan American Development Foundation (PADF) – CIAT- Hillsides Agricultural Program (HAP); and
(2) The chain components: cassava producer (Vincent Foundation, Double Harvest) ⇨ market for the roots or industrially transformed products ⇨ technology transfer ⇨ CBOs ⇨ and farmers that demand the seed (stakes).

What is important in this process is to make the business attractive for the private cassava producers, assuring them the market, whether connecting them to for sale of fresh roots, or as a transformed product. In this case, farmers would have available stakes from the CBOs; in this way, stakes would have an added value for the businessmen that could also be attractive to them.

Another question would be what happens with the cassava that the CBO farmers produce? Will it be just for food security, or can a local market be established for the fresh roots, or can small industries be developed that supply a local demand? As well as being attractive to farmers, the planting of cassava both produces their food and brings in extra income by the sale of fresh or transformed cassava.

The agreements between PADF and CIAT-HAP will be important for the transference of this technology, which thus would arrive more easily to the CBOs. In this process, the participation of the CIAT Agro-enterprise Project and of the Consorcio Latinoamericano y del Caribe para la Investigación y el Desarrollo de la Yuca (CLAYUCA) is relevant, because they can help consolidate links, find markets, and offer fresh or industrially transformed products.

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1.4.2. Livestock production in the uplands of Laos

Background 104130

Inadequate feed resources and health risks largely limit livestock production in the uplands of Laos. The technical development component focuses on introducing improved forage, feed, and management systems to increase farm productivity and farm income using farmer participatory approaches. The Forages for Smallholders Project (FLSP) will target 27 villages in each of four districts over its 5-year term. It is expected that over 1400 households will receive income benefits from improved forages and better livestock management. About 450 households are expected to benefit from legumes improving soil fertility and forages reducing soil erosion.

About 400 farming women are expected to benefit from improved feeding and management systems for their small livestock.

Materials and Methods

During this second field year, participatory diagnoses (PDs) were conducted in over 30 new villages in the four target districts of northern Laos to understand the key problems and opportunities identified by farmers in their livestock systems. Each PD consisted of two village meetings—a general village PD on the first visit, and a focused problem analysis with separate groups of men and women on the second visit. Then 20 of these villages were selected for introduction of forage, feed, and livestock technologies in a participatory research and extension framework, bringing the total number of villages in the project to 38. This represents a doubling from two to four villages for each district extension team of two people. Each village was asked to nominate a small group of farmers (a farmer focus-group) to test technology options on their behalf. Table 14 shows the expected numbers of farmers, and the areas to be planted.

Table 14. Number of farmers and areas of forage to be planted in new target villages, Laos, 2002.

District and village		Number of farmers	Area (ha)
Pek			
Moun		17	0.46
Leak		12	0.40
Vieng Khoun		9	0.20
Or An		10	1.20
	Subtotal	48	2.26
Nonghet			
KeoPaTu		10	1.28
Pha 'En		8	0.23
Sandon Koe		9	1.17
Tham Toum		9	0.48
	Subtotal	36	3.16
Xieng Ngeun			
Long Or		9	0.36
Houay Hia		2	0.08
Kieu Nya		10	0.40
Nam Mouk		9	0.40
	Subtotal	30	1.24
Luang Phabang			
Nadon Koun		6	0.27
Pick Noi		7	0.30
Phadeng		5	0.23
Pick Nyai		10	0.42
Pak Pa		9	0.39
Long Lan		24	0.99
	Subtotal	61	2.60
Pak Ou			
Had Pang		10	0.55
Somsanuk		7	0.29
	Subtotal	17	0.84
	Total	192	10.10

The main forage varieties that farmers are evaluating and integrating in different ways are:

Grasses:	*Andropogon gayanus* "Gamba"	Legumes:	*Calliandra calothyrsus* "Besakih"
	Brachiaria brizantha "Marandu"		*Gliricidia sepium* "Retalhuleu", "Belen Rivas"
	Brachiaria decumbens "Basilisk"		*Stylosanthes guianensis* "Stylo 184"
	Brachiaria ruziziensis "Ruzi"		
	Panicum maximum "Si Muang"		
	Paspalum atratum "Terenos"		
	Setaria sphacelat "Solander"		

These varieties were among the most promising broadly adapted varieties identified from participatory research conducted by CIAT in the SE Asian region from 1997 to 1999. Forage technologies are, however, only one component of the livestock feeding systems that can be improved. In particular, the project is now introducing feed resources for small livestock (pigs and poultry). These new feed resources are:

(1) Sweet potato varieties sourced from CIP in Vietnam:
The FLSP introduced 4.9 tons of planting material of seven varieties of sweet potato that CIP selected for feeding pigs. The planting material was rapidly distributed to 80 farmers spread across all four districts. A CIP team in Vietnam came to Laos to provide the necessary training and technical information. Establishment has been highly successful. In early August 2002, some plants started to show signs of leaf curling. The FLSP organized for a sweet potato breeder working with CIP in Vietnam (Dr Hoanh) to visit some of the plots in Luang Phabang. He concluded that the introduced varieties have no major problems except for some minor insect attack.

(2) Cassava varieties sourced from CIAT-Thailand:
Cassava is used as a source of carbohydrate for pigs in the upper watersheds of Laos, but the local varieties have very low tuber yields compared with varieties selected by CIAT in Thailand. Eight varieties from CIAT-Thailand were introduced to on-station evaluations and multiplication of planting material is in preparation for on-farm trials in 2003.

(3) Maize varieties sourced from the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT)-India:
Maize is used as a source of carbohydrate for pigs in the upper watersheds of Laos. Farmers have only two "traditional" varieties - a yellow variety that produces reasonable yields of large cobs, and a white variety that has small cobs with low kernel yields per cob. They prefer the white variety as they say it has a better feeding value, but the yields are very low. CIMMYT provided seed of 16 open-pollinated Quality Protein Maize (QPM) project varieties, specifically selected for tropical adaptation, to be included in on-farm evaluations. Unfortunately, the seed arrived very late and, although the trials were sown, we do not expect the maize will produce cobs before the winter. The trials will be resown in 2003.

(4) Lucerne varieties sourced from the South Australian Research and Development Institute (SARDI)-Australia

There are very few broadly adapted and robust forage legumes for the tropics. Only one legume variety (*Stylosanthes guianensis* CIAT 184) is growing well at many sites. Farmers are selecting it for expansion as a source of green feed for pigs. "Stylo 184" does not grow well in all conditions, and is not adapted to all the management options that farmers have in mind, so we are searching for legumes to fill particular niches. One important niche in Laos is the use of legumes for higher altitude, cooler areas (>800m) where pig feed is in short supply. The Australian Center for International Agricultural Research (ACIAR) is funding the South Australian Research and Development Institute (SARDI) to identify lucerne varieties adapted to adverse environments. Through SARDI, we have introduced 25 of the most promising varieties for the climates and soils of northern Laos for evaluation, both in formal trials, and on farm. The abnormally high rainfall this year hampered early trials (planted in July). A lucerne specialist from SARDI will visit the sites in September and we expect to re-sow some trials in October. We plan to continue this CIAT - SARDI collaboration for at least 3 years.

(5) Animal health options sourced from the Commonwealth Scientific and Industrial Research Organisation (CSIRO)- Animal Health Laboratory (AHL), and ACIAR

In a recent participatory poverty assessment conducted in Laos, farmers in the northern mountainous regions consistently ranked livestock disease as one of the top two causes of poverty. Working on livestock feeding without tackling the equally important problem of livestock disease would threaten the FLSP's potential impacts. The project conducted livestock disease surveys in 12 focus villages at the end of 2001. Three key diseases came to light that farmers regards as a serious problem and cause many, possibly preventable, deaths:

(1) *Toxacara vitulorum* (an internal parasite) infection in young buffalo and cattle calves,
(2) Classical Swine Fever (CSF) in pigs, and
(3) Fowl Cholera (FC) in chickens and ducks.

Six other key animal health issues came to light without having the same mortality rates and immediate priority as the three diseases above: (1) Parasite burdens in pigs and cattle, (2) Hemorrhagic septicemia, (3) External parasites of cattle, (4) Dermatitis of buffalo and cattle, (5) Pasteurellosis of pigs, and (6) Blackleg.

Results

In 2001-2002, the FLSP initiated a treatment program in villages for the first priority disease problem (*Toxacara*). As treatment is straightforward, cheap, and effective, this proved to be a good entry-point to win farmers' confidence. The other two priority diseases are more difficult to control and will require a combination of strategic use of veterinary chemicals and improved housing and management of animals as part of a participatory research process. Table 15 lists the range of animal health options identified by the FLSP as possibilities for participatory research and development.

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Table 15. Animal health strategies being developed by the Forages and Livestock Systems Project (FLSP).

Disease[a]	Technology option	Training needs	Likelihood of impact						Limitations
			Short-term impact			Long-term impact			
			Low	Med	High	Low	Med	High	
Toxocara infection of buffalo calves ✓	• Oral dose of Pyrantel at 20 – 30 days of age.	• Completed			X			X	• Ready access to Pyrantel
Classical Swine Fever (CSF) ✓	• Penning sows for 1–2 days after birth to give newborns good access to colostrum • Targeted vaccination of weanling pigs 2 wks post-weaning • Vaccination of sows and weanling pigs • Introduction of in-village quarantine zones and animal movement restrictions are a possibility (but will be difficult to introduce)	• Technical information • Field training • Vaccine quality control, assurance, and transport • Animal handling		X	X	X			• Very difficult disease to control in village production systems for various reasons • "Elimination" is not a realistic option, but • Impact minimization is! • Controlled vaccination of pigs using quality vaccine administered by trained staff will have short-term impact (assuming CSF is disease agent). • Ensuring quality vaccine is administered at the correct time will be difficult to guarantee in the long term.
Dermatitis ✓	• Greater use of locally available treatments available • Commercial drugs	• How to treat • How disease is spread • How we can prevent disease		X	X		X	X	• Availability, accessibility, and cost of treatment options (will the benefits warrant the cost?)
External parasites ✓	• Locally available treatments available • Commercial drugs	• Technical information, including which treatments to use and when to use		X	X		X	X	• Availability, accessibility, and cost of treatment options (will the benefits warrant the cost?)

Continued.

Table 15. Animal health strategies being developed by the Forages and Livestock Systems Project (FLSP). (Continued)

Disease[a]	Technology option	Training needs	Likelihood of impact						Limitations
			Short-term impact			Long-term impact			
			Low	Med	High	Low	Med	High	
Ascaridosis in pigs and endo-parasite burdens in cattle	• Strategic and targeted use of anthelmintics (parasite treatment)	• Technical information including life cycles of parasites, when to treat, and how we might avoid drug resistance			X	X	X		• If parasite control is not carried out very carefully, we may create a bigger problem then we began with, i.e., creating a population of parasites resistant to cheap and available drugs.
Hemorrhagic Septicemia (HS)	• Vaccination • Antibiotic treatment and prophylaxis after early detection of HS through improved awareness of symptoms and disease recognition	• Technical information including the nature of the disease and how it can be controlled and/or treated in the event of an outbreak			X		X		• HS is a sporadically occurring disease, and as a result it is difficult to predict where, when, and if an outbreak will occur.
Fowl cholera (FC) ✶✶	• Improved housing • Improved sanitation • Vaccination	• Technical information, including disease recognition, sample collection, and submission • Vaccination strategies, vaccine quality control, and assurance		X			X		• Symptomatically difficult to distinguish FC from other diseases of poultry such as Newcastle Disease and Avian Influenza • We will need to identify the agent of disease (*Pasteurella multocida*) before exploring available options
Pasteurellosis/ Salmanellosis in pigs ✶✶	• Improved sanitation and housing • Antibiotic treatment	• Technical information, including disease recognition and sample collection		X			X		• Diagnosis and disease confirmation initially before exploring options
Blackleg (Nonghet) ✶✶	• Vaccination • Antibiotic treatment and prophylaxis after early detection	• Technical information, including disease recognition and sample collection		X			X		• Blackleg can be effectively controlled once the agent of disease is confirmed.

a. ✶✶, need disease confirmation through sample collection and analysis; ✓, ready to evaluate with farmers this year.

1.5. Monitor and evaluate the adoption of validated improvements

1.5.1 Evaluate the SOL monitoring and evaluation system 104131

Objectives

- Evaluate the monitoring system to make adjustments and changes in its implementation
- Update activities, events, and the registration of people visiting the SOL-Luquigüe, and of what they take to their farms, that allows us to design a study of technology adoption

Introduction

Yorito has four SOL sites in the communities of Luquigüe, Mina Honda, San Antonio, and Santa Cruz that form the SOL Network. It has been established to facilitate the exchange of experiences and germplasm, and to give mutual support in developing workshops and field days. The SOL "clients" (i.e., independent producers of the zone and organized producers, as in CIALs for example) are consulted in the investigation planning process, and invited to visit the sites during field days and tours. They participate in the execution and evaluation of experiments, and they take new varieties to continue experimenting on their own farms.

To systematically document this experience and have enough information to design a medium-term technologies' adoption study, a system of monitoring and evaluation (M&E) was established for the Network. Kirsten Probst developed the system in participative form with technicians and producers of the member institutions and organizations of the Network. The system began in March 2000 and concluded with an auto-evaluation in July 2001.

Material and Methods

The evaluation of the M&E system was carried out in July and September 2001. A presentation (summary) was prepared with the results. It includes only the indicators where changes have been observed, or that were important in decision taking. The information was presented to members of the Technical Committee for joint reflection. Guiding questions were elaborated to facilitate the analysis of results (Table 16).

Results

Evaluation of the M&E system of the Network and SOL

The evaluations of the technical committee of the Network were focused on making improvements to the general monitoring plan. Among the most important changes are:

- Indicators for the Network and SOL were selected and organized from the general monitoring plan, which was originally designed for a single SOL site.
- Modifications and adaptations were made to the existing formats according to the objective of the Network or SOL site.
- Forms were incorporated that were being used to register activities by trial and number of trials established in the region.

- The person responsible for filling in the Network forms was defined.
- Two evaluations or reflections on the monitoring system were programmed per year, at the end of each agricultural cycle.

Table 16. Questions for analysis and reflection for the indicators of monitoring and evaluation of the Supermercado de Opciones para Ladera (SOL).

Area of observation	Indicators	Questions
Improved inter-institutional cooperation	• Fulfillment of operative plan of the Network and SOL • Participation of other institutions and organizations in the SOL	What do we think of collaboration in the SOL sites? Are there advantages for the organizations involved? How can we strengthen and improve coordination and cooperation?
Participation of clients/producers in the SOL	• Registration of those who visit the sites and purpose of visit • Number of men and women participating in events	Who are the clients that come to the sites? Do women and welfare groups also visit? How does the quantity and intensity of participation seem?
Activities and events developed in attractive, practical, and understandable form	• Number of workshops and field days jointly organized in each SOL site • Evaluation of events from the viewpoint of producers	Is there good communication and feedback between producers and technicians? How can it be improved? Are we taking into account the feedback we receive? How can we improve producers' interest in new technologies and how can we stimulate experimentation?

Some problems confront the M&E system at present. Information for periodic reflection is not yet being used to document activities and results. The system lacks follow up by those responsible. Some indicators are not being observed with established frequency. The information compiled has not been evaluated because of a lack of indicators with specified goals or scales of evaluation. Finally, the collection of information (filling in of forms) is not supported at critical moments, for example, in the development of an event or workshop.

However, the system has achieved some relevant advances. The form for seed requests by individual and institutional producers and the record card of each producer (client) has allowed completion of germplasm demand and initiation of follow up of the same. The information obtained in the M&E system has been used in making reports and presentations. We believe that the information could be very useful for measuring the impact of activities. Finally, the M&E system is simple and easy to develop.

The following recommendations are made for improving the system:

- Establish and quantify indicators clearly to be able to evaluate the results that are being obtained.
- Train the person responsible for facilitating the system and assign that person the necessary time for developing this activity.
- Present summaries of information generated by the monitoring system at SOL-site level in a predesigned format that permits periodic feedback.

- Implement and adjust the M&E system according to the interests of those responsible for the SOL sites of Mina Honda and San Antonio.
- It would be interesting if SOL clients were to evaluate the results of the M&E system.
- To improve the system's operation, only producers that take germplasm to their farms should have a SOL client record card; remaining visitors should be registered in a visitors' book.

Analysis of the registration of activities and events developed in the SOL-Luquigüe and of visiting individual producers and organizations

The 2002 work plan of the Network has nine general activities. Table 17 shows the percentage of advance in the activities that pave the way to obtaining impact in the area of germplasm. Overall, 66% advance has been achieved in field activities, most of which are ongoing. It is important to emphasize the wide diversity of annual crops and fodders that are being promoted, and the collaboration that exists among partners in the development of workshops and joint events; for example, the results' presentation workshops have increased the demand for germplasm at the SOL sites. However, planning and follow up of the research activities and validation have been lacking outside SOL sites. Network partners monitor and document the information generated by the trials under their direct responsibility, but as yet the data have not been condensed in a single database that permits generating a regional recommendation of a particular variety.

Table 18 shows the achievements of the SOL-Luquigüe up to January 2002. Activities were 75% completed; some are being developed during this year. The documentation of the activities that have finished the field phase was carried out partially. Results were analyzed to elaborate presentations in workshops and meetings of farmers and technicians; however, a research paper has not been published.

During the last year, 18 field tours and six participative evaluations have been carried out. Overall, one event per month has taken place during the dry period of little activity (Dec-June); nevertheless, in the months (July-August) where the crop shows a good vegetative development and at harvest time (November) events have doubled and tripled, because these are the best times to show the trials and carry out participative evaluations. All events were organized by CIAT, and attended by personnel from DICTA, SERTEDESO, and producer members of 12 CIALs (Pueblo Viejo, Luquigüe, Wisilca, El Portillo, Patastera, Mina Honda, Río Arriba, Cafetales, Laguna de los Carcamos, Guaco, Jalapa, Santa Cruz, and Santa Marta) that represent 50% of the CIALs in Yorito.

Women participated well in events, especially in the field tours (38% of participants); however, men carried out 85% of the participative evaluations with the exception of a cowpea evaluation. Participants qualified events as good; the main reasons for obtaining this qualification were:

- We learned how to differentiate crops and varieties from outside the zone.
- We learned practices or techniques used in production.
- Events were well organized with the participation of all.

It was recommended that a catalogue be elaborated with the promising varieties identified per crop.

Table 17. Evaluation of Activities 1, 6, and 7 of the Hillsides Options Supermarket (SOL) Network work plan, January 2002.

General activity	Specific activities[a]	Advance (%)
1. Presentation of research results at regional level	1.1 Hold workshops, one for institutions and one for producers Presentation for technicians (26-27/4/02) Regional meeting of CIAL (4-5/4/02)	100
6. Development of research activities during Spring 2002	6.1 Presentation and discussion of research activities, validation and production of seed at committee level (29/5/02)	100
	6.2 Establishment of trials in the SOL and other locations	
	6.2.1 Beans Evaluation of tolerant and drought-resistant materials Trials with best lines of Concha Rosada in different locations (IPCA)	50
	6.2.2 Legume (SERTEDESO) Implement dual cropping maize-legume in more areas Workshops on transformation of foods based on legumes Evaluate materials of perennial legume	
	6.2.3 Soya Workshop with youths to inform on nutritional value (Youth Project)	
	6.2.4 Sweet potato Establishment of demonstration plots in all the region and promotion at the level of school gardens Evaluate sweet potato clones in the high-altitude areas	100
	6.2.5 Rice Analyze the costs of rice production in high-altitude zones Evaluate varieties for high-altitude zones (13 materials evaluated plus 2 checks, RIAT 90, CIRAD)	50
	6.2.6 LIM1C Elaborate simple field guides for producers Validate the work in other communities Release results Soils Fair	50
	6.2.7 Forages Evaluation of agropastoral systems Evaluate drought-tolerant materials Demonstration plots in different places (part A) Evaluate multi-purpose legumes (great benefit for producer)	75
	6.2.8 Sorghum Establish dual-purpose sorghum trial (San Antonio)	
7. Multiplication and interchange of germplasm	7.1 Validation trials (soya, maize, bean, rice)	100
	7.2 Multiplication plots of seed of: bean (EAP-9510-77, EAP9508-93, SRC 1-12-1, Tío Canela and Concha Rosada), soya (Obando and FHIA-15), sweet potato, rice (IRAT-362), and forages (Cratylia and Toledo)	100

a. For acronyms used, see page 190.

Table 18. Completion of the Hillsides Options Supermarket (SOL) Network operative plan, from Spring 2001.

General activity	Specific activities	Advance (%)
1.2 Identification of new alternatives for improving production systems	1.2.2 Introduce and evaluate in participative manner new genetic materials of annual crops in SOL Drought-tolerant bean at low-N levels High-altitude rice tolerant to *piricularia* Short-cycle varieties of soya Varieties of multiple-use sweet potato Comprobación de Variedades (COVA) of rice, soya, and bean Evaluation of tropical late white maize synthetics	80
	1.2.3 Design new production systems based on crops with market options and management of soil fertility	25
	1.2.4 Evaluate the compatibility of new rotation components to diversify traditional production systems	50
	1.2.5 Participative evaluation of grains and forage legumes in SOL and producers' farms	100
	1.2.6 Quantification of animal performance in traditional and improved pastures in SOL	50
	1.2.8 Quantify the efficiency of the combination of organic and inorganic sources in the production of annual crops	70
	1.2.10 Select bushy species with potential for use as improved fallow	70
1.3 Validate new alternatives and improved practices	1.3.1 Validate, on producers farms, promising management options that come from SOL	70
1.5 Monitoring and evaluation of the adoption of validated improvements	1.5.1 Evaluate the SOL system of monitoring	80

Producers' demand for training is oriented toward non-traditional crops: rice, vegetables, improved pastures, soya, sweet potato, and cowpea. The themes of greatest interest to them relating to these crops are sowing techniques, product transformation, and control of pests and diseases. One of the greatest benefits that network partners perceive is the access to local, national, and international germplasm (Figure 7).

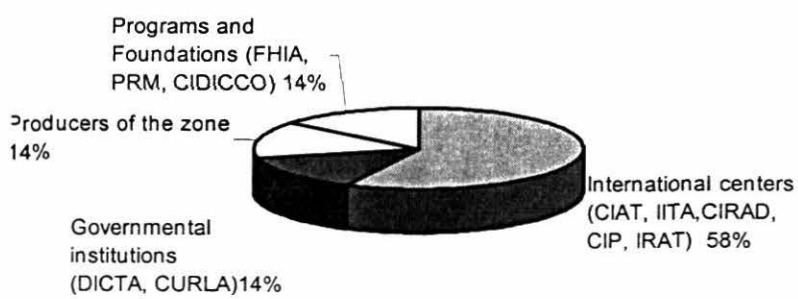

Figure 7. Origin of germplasm for Supermercado de Opciones para Ladera (SOL)-Luquigüe trials. (For acronyms used, see page 190).

CIAT was responsible for trial management, and has facilitated obtaining information, but did not permit the integration and appropriation of germplasm by institutions and producers.

Conclusions

The M&E system of the SOL Network of sites is flexible, and easy to understand and manage. However, a specific amount of time must be dedicated to this activity to feed information into the system and to make the corresponding adjustments according to Network interests, thus achieving feedback from activities at the right time. The information compiled by the monitoring system generates a base from which to measure impact in the area of observation that is of interest; however, indicators need to be quantified for comparison purposes.

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Output 2. More sustainable landscapes

2.1. Benchmark status report at the landscape level (study land use, analyze sustainability)

2.1.1. Monitoring the socioeconomic impact of land ownership on the standard of living of beneficiaries of Project Tierra

Introduction

The municipality of San Dionisio is a zone characterized for having a subsistence economy that depends mainly on maize and bean crops (basic grains), and where there is a low level of diversification of agriculture and few economic options for elevating the standard of living of the inhabitants.

Project Tierra arises as a result of an ex-ante evaluation, through a lineal programming model that increased the area of small-scale producers' plots to give more job opportunities to the poorest strata. Running the model showed that the main benefit did not relate to profit value, but with the possibility of using underused family daily wages. As well as this indicator, other studies carried out in the zone have shown that the poorest persons are those that do not own land for agricultural use, their main economic activity.

Materials and Methods

With this hypothesis, it was decided to approve an amount of US$6000 to be given on loan to nine small-scale farmers without land so that they could acquire the land and evaluate, in pilot form, the results shown by the lineal model of programming.

The project began in 1998 and the average amount of land acquired by each beneficiary, was 2 manzanas (2.8 ha). A plan of payment over 4 years with 8% annual interest was designed, to be paid in two quotas per year at sowing time. However, almost all the beneficiaries have been

unable to repay. Thus, the fund, which was expected to operate as a revolving fund to support other, or the same, producers, has not been able to become definite. At present, the Campos Verdes Association is managing the project. This is a local community organization that CIAT supports and whose board of directors are producers chosen by representatives of the communities. CIAT has followed up the development of the hypothesis that was presented at the start of the project, maintaining an annual tour of the plots acquired by beneficiaries.

Results

(1) Utilization of labor

Four years since the start of the project, no significant changes are observed because of changes or greater use of family labor. However, from the point of view of economic values for this concept, and according to the information supplied by beneficiaries, labor is one of the most important elements, in economic terms, within the costs of production.

The integration of family members to agricultural work is practiced in San Dionisio, in fact most of the labor used is from the family and not on contract (Table 19. In 4 years, the cost of local labor has remained at C$25 and sometimes C$30 daily wage (because of the devaluation of the currency, in dollars this decreased from 3 to 2).

Table 19. Use of labor by beneficiaries of Project Tierra before and after buying land.

Beneficiary[a]	Use of labor[b]							
	Before land bought				After land bought			
	Land type	D/F	D/Y	C$/year		D/F	D/Y	C$/year
1	Rented plot	1	93	2325	Own plot (coffee)	1	nd	nd
	Half plot	1	93	2325	Rented plot	1	93	2325
	Salaried work	1	12	300	Half plot	1	93	2325
2	Half plot	2	139	3475	Own plot	3	232	5800
	Salaried work	1	24	600	-	-	-	-
	Migration	1	nd	nd	-	-	-	-
3	Rented plot	1	46	1150	Own plot	1	46	1150
	Salaried work	1	47	1175	Salaried work	1	47	1175
4	Half plot	1	93	2325	Own plot	1	46	1150
	Migration (coffee cutting)	1	30	1260	Half plot	1	47	1175
	-	-	-	-	Migration	1	30	1260
5	Rented plot	2	186	4650	Own plot	2	46	1150
	Half plot	2	186	4650	Salaried work	2	47	1175
	Salaried work	1	47	1175	-	-	-	-
6	Rented plot	1	93	2325	Own plot	1	46	1150
	Migration	1	30	1260	Migration	1	30	1260
7	Rented plot	1	93	2325	Own plot	2	93	2325
	-	-	-	-	Salaried work	1	nd	nd

a. Information of seven out of nine beneficiaries presented because of difficulties in obtaining data.
b. The cost of local labor is C$25 (14.4 Cordobas/US$); D/F, days per family; D/Y, days per year; some data not reported by beneficiaries.

The difference between working a rented plot and an own plot is significant, although in some cases, such as the first one in Table 19, the farmer maintains his way of cultivating in the other two forms because the land that he acquired is just for coffee. Thus, to sow maize and beans, he has to rent land. In the remainder of cases, a half plot appearing after the purchase of land signifies the use of one half in the first season (*primera*) and the other half in the second season (*postrera*). If farmers lose their crop in the first season and remain without money, they decide to work the other half plot in the following season.

The figures for days worked are an average estimated from the two sowing seasons (about 46 for the first and 47 for the second) giving a total of 93, which increases with the integration of 1 son and of the wife (estimated as one half because she does not work all the time nor in all types of labor). This is the most that was observed for family integration in project cases in these 4 years.

2. Income

Income from production in the 4 years was very variable, mainly because of exogenous factors and the farmer's own management (Table 20).

Table 20. Income as a concept of production (4 years of Project Tierra).

Beneficiary[a]	Area (Mz)[b]	Income[c]									Obs[d]
		Year 1		Year 2		Year 3		Year 4		Ave	
		Crop	C$	Crop	C$	Crop	C$	Crop	C$		
1	1.00	Coffee	1000	Coffee	300	Coffee	500	Coffee	810	652	1 Mz scrub
	0.25	Bean	0	Bean	0	Bean	1500	Bean	1250	687	
						Maize	480	Maize	560	520	HC
2	2.00	Bean	1600	Bean	2000	Bean	1800			1800	
		Maize	600	Maize	280	Maize	560			480	HC
3	2.00	Bean	800	Bean	1200	Bean	200			733	
		Maize	280	Maize	400	Maize	80			253	
4	2.00	Bean	200	Bean	600	Bean	200			333	HC
		Maize	0	Maize	0	Maize	300			100	HC
5	2.00	Lost to pests				Bean	1280			1280	
						Maize	560			560	HC
6	2.00	Did not cultivate				Bean	0	Bean	0	0	
						Maize	280	Maize	280	280	HC
7	2.50	Bean	1000	No cultivation		Bean	0	Bean	2000	1000	1.5 Mz cult.
						Maize	320	Maize	600	460	HC

a. Information of seven out of nine beneficiaries presented because of difficulties in obtaining data.
b. Mz, manzana = 2.8 ha.
c. 14.4 C$ (Cordobas) /US$; some data not reported by beneficiaries.
d. *Obs*, observations; HC, home consumption.

The incomes correspond to annual cultivations of basic consumption—maize and bean—and coffee is presented in only one case. Maize has economic value, despite being a net product of home consumption; it is a product of the acquired land and is a cost saved in not having to buy it. The average prices are C$200 for 1 quintal (100 lb sack) of bean and C$40 for 1 quintal of

maize. The main savings with the land purchase was the non-payment of rent, which is equivalent to a cost of C$400 (about US$280 at today's prices). As can be seen, the reported amounts for crop sales, besides being variable, are low and the main problems mentioned by beneficiaries are, in order of importance:

- Lack of money for the purchase of inputs for production, which obliges them to sow in one season and not the other.
- Strong plague of slugs that attack bean (affected four of the farmers) and lack of resources for fighting it.
- Year 2 was 1999 for the majority, the year of Hurricane Mitch when almost all crops were lost.
- Most of the plots that were bought are situated in difficult places that in some cases farmers have been unable to improve; this relates to the soil type and the state in which they were when acquired. Likewise, the distance from home to plot is another obstacle.

Conclusions

The problems facing farmers of the group Project Tierra are mostly the same as those facing all farmers of San Dionisio—lack of resources to buy inputs, deterioration of the soil, lack of market options, etc. It may be said that farmers in San Dionisio have established a culture of credit for production; and the lack of credit to buy inputs is one of the causes of poor plot management.

The economic situation of farmers in general, in other regions as well as in San Dionisio, is the obvious reason behind the limitations that farmers have to stabilize their cycles of production, to improve their practices, etc. This can explain why the project's beneficiaries, even after the purchase of land (despite the small amount), in some cases maintain their previous practices of land rental, partial cultivation, and migration, among others.

Another obstacle, both to the improvement of plots and farmer relations with the Association and CIAT, is the difficulty of loan repayment, and the follow up that the Campos Verdes Association has to do to on this. At present, the debt has grown because of interest payable for most of them, and this situation has been difficult to handle. Overall, it is considered that an important change has been brought about in the life of the beneficiaries that previously owned no land and have produced crops, even with many difficulties. However, it seems that more time is needed for their economic situation to stabilize. Like all the inhabitants of the countryside, they depend greatly on exogenous factors, not only at the regional level, but also at country level, which significantly influence their activity.

Contributor: ME Baltodano
Collaborator: Campos Verdes Association, San Dionisio

2.2. Ex-ante evaluate alternative scenarios of landscape management

Activities are developing with the new alliance made with the University of British Columbia (UBC), Canada.

2.3. Develop and apply the methodological tools for natural resource management at landscape level

2.3.1. Mapping, analysis, and participative monitoring of natural resources. Case study: sub-watershed of the Río Calico, Nicaragua

Introduction

Evaluating the state of natural resources at local level is complex. It requires the clear participation of the groups of interest involved in this management, and the use of effective and simple decision tools that clearly identify local perception. The CIAT-C&W, with partners in the reference sites, has developed a series of methodological instruments for the taking of decisions in natural resource management (NRM), based on the combination of participative techniques and local indicators.

Materials and Methods

Guide 3 (Vernooy et al., 1999)[5] of the methodological instruments was used for the local community of the sub-watershed of the Calico River, Municipality of San Dionisio, Matagalpa, Nicaragua, to evaluate the state of forest, water, and soils before and after Hurricane Mitch. The tool combines several methodological techniques such as: (a) indicators of soil quality (Burpee and Turcios, 1997)[6]; (b) transect walk; and (c) participative maps.

The local association of organizations, Campos Verdes, applied the methodology with the support of the International Development Research Centre (IDRC), and selected six of the 16 micro-watersheds most affected at the level of their natural resources. This selection was based on comparisons among values of the indicators for water, soil, and forest, among others. The changes in the values of specific indicators before and after Hurricane Mitch permitted the identification of the most affected resources in each micro-watershed.

Results

This activity finalized with the development of an action plan focused on reforestation, management, soil-water conservation practices, and workshops for reflection with the communities on the natural resources (burning, deforestation, and loss of soils through erosion). Likewise it permitted local management and attainment of economic resources from national donors Ministerio de Ambiente y Recursos Naturales (MARENA) - Danish International Development Agency (DANIDA) for the execution of projects in soil conservation and water sources management.

Contributors: JA Beltrán; JC Zeledón (Campos Verdes); J Moral (UNA)

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[5] Vernooy, R.; Espinoza, N., Lamy, F. 1999. Participative mapping, analysis, and monitoring of natural resources in a watershed. Guide 3 (in Spanish) of the series "Methodological instruments for decision taking in natural resource management". CIAT, Cali, CO. 152 p.

[6] Burpee, C.G.; Turcios, W.R. 1997. Indicadores locales de la calidad del suelo. Resultados iniciales de Honduras. Documento Interno de Trabajo. CIAT, Tegucigalpa, HO. 28 p.

2.3.2. Finalize and socialize the Rural Atlas of Nicaragua

Objective

Elaborate the Atlas of Nicaragua from compiling digital databases.

Material and Methods

In the framework of CIAT's collaboration with Nicaragua, in March 2000, an agreement of technical contribution was signed between the Ministerio Agropecuario y Forestal (MAGFOR) and CIAT to elaborate the Rural Atlas of Nicaragua. In 2001, in the Proyecto Centroamericano de Información Geográfica (PROCIG) workshop, Cartagena, partners from Nicaragua decided to include in the Atlas data for more extensive analysis by clients. In this way, the Atlas will be structured from a digital database of physical, geographical, and socioeconomic data, and their corresponding management, analysis, and mapping with GIS technology, These are supplied by the five institutions involved: MAGFOR, Instituto Nacional de Estadisticas y Censos (INEC), Instituto Nacional de Estudios Territoriales (INETER), MARENA, and CIAT.

Results

The Atlas presents 130 maps and its database on the themes of:

- Geography and administration (reference mapping);
- Natural physical and environmental characteristics (relief, soils, climate, hydro-geography, man's interaction with the environment, protected areas, natural threats, and potential land use);
- Population, both social and cultural (size, fertility, Spanish speaking and others, languages, illiteracy, school attendance, level of instruction, dwellings, potable water, sanitary services, electricity); and
- Economics and production (population according to economic characteristics, land area dedicated to agriculture, cattle, and agro-economic models.

The launching of the Rural Atlas of Nicaragua counted on the participation of 120 people, among which were the Minister of MAGFOR, José August Navarro, Ingeniera Martha Loyman of the Dirección de Estrategias Territoriales, Rev. Miguel Angel Helmet, Director of INEC, Ingeniero Eduardo Marín, Viceminister of MARENA, Ingeniero Mauricio Rosales, representative of INETER, and representatives of departments and institutes of the government, embassies, international agencies, and NGOs.

Conclusions

The Atlas gives support to decision taking in matters of socioeconomic and environmental development in Nicaragua both on the geographical scale (local, departmental, and national) and at the level of technicians, policymakers, and politicians, using the relevant information that is brought together on physical, economic, social, and natural resource aspects that reflect the present status of the rural environment. A clear example of the scope of this new tool is that

among the most prominent data there is the knowledge that in the border sector between central Nicaragua and the Atlantic, where agricultural activities take place, the inhabitants have deficient services and are mostly illiterate.

The Atlas offers updated information on the identification of critical areas, regions where agriculture is practiced, concentrations of poverty, and other elements useful for analysis and for generating solutions for the different problems that are presented. Besides being the product of joint work between MAGFOR, INEC, MARENA, INETER, and CIAT, the Atlas is also tangible proof that inter-institutional collaboration is possible, and that it is the way to unite efforts, abilities, experiences, lessons learned, and interchange of information.

Contributors: M Loyman (MAGFOR); L Zúñiga (INETER); C Coronado (MARENA); MA Helmet (INEC); G Hyman (PE-4); JA Beltrán

2.4. Promote and implement consortia for landscape management

2.4.1. Bolivian Consortium and Project Platform created

As broadly described in Part 3, in June 2002, a CIAT six-member team participated in a workshop with Bolivian partners. It was designed with three purposes in mind: (1) to share the final synthesis of previous work on inter-institutional collaboration topics, (2) to prepare the narrative summary of a project platform on which a variety of specific projects could be drawn, and (3) to search for an organizational scheme to give sustainability to inter-institutional cooperation in Bolivia.

As a result of this workshop, a platform was developed for project generation with multi-institutional collaboration. Three work areas were identified after completion of the analysis of previous workshops and visits. An agreement was also reached around operational aspects of collaboration. This agreement gave way to the establishment of an inter-institutional Consortium that has operational guidelines and a very modest organization. Its coordinator is in charge of promoting the Consortium among donors and national institutions and identifying opportunities for the Consortium in Bolivia.

2.5 Strengthen participation of grass-roots organizations in consortia for landscape management

2.5.1 Organic Coffee Project

The Comité Local para el Desarrollo Sostenible de la Cuenca del río Tascalapa (CLODEST) brought together 45 traditional coffee producers to begin an organic coffee project. At present, there are 35 active members. The BIOLATINA Agency was chosen as organic certifier because it has certified the only coffee-exporting cooperatives in Honduras (Cooperativa Agrícola Cafetalera Triniteca, Ltda [CACTRIL], COHORSIL [Cooperativa Horticultores Siguatepeque Ltda.], and Regional de Agricultura Organica de la Sierra [RAOS]). The producer bears the cost of certification. Most producers have not used pesticides and at the most only chemical fertilizers, while some producers have not even used fertilizers. This helps speed the transition

process to organic farming. Producers received training on the management of organic coffee and on commercialization and exportation at RAOS in Marcala, La Paz.

The certifier will make the second inspection without notice when the grains have begun to form. Based on results, some producers may receive their organic certification in December 2002. Once export demands are calculated, producers should visit the cooperatives that export organic coffee to negotiate their organic production and transitional production. CLODEST is compiling the production plans of each producer (records of inputs and labor) as required for certification. Regarding ecological benefit, CLODEST is preparing proposals to access funding from the Proyecto de Reactivación de la Economía Rural (RERURAL) Project for the construction of ecological benefits. If funding is not achieved before the 2002 harvest, each producer will dig a pit to collect the residual water from washing the coffee, taking into account that equipment must be well cleaned. Five local inspectors have been appointed to reduce the cost of inspections and to maintain better vigilance on producers. The organic certificate could be used for banana, plantain, and citrus within the plots. The RINAGRO Company (exporter of banana puree) is asking for organic bananas.

2.5.2 Production and Commercialization of Vegetables

CIAT is finishing the Cross Project, which will generate much information about the agricultural markets of Honduras. With this information, CLODEST's commercialization group will organize the planting of test plots on some producers' farms, choosing crops whose harvesting coincides with times of highest prices. Also, tests will be made of the staggering of plantings such that a permanent demand begins to be obtained for garden produce. A village market of agricultural products will also be promoted in Yorito, a project that failed previously because of lack of supplies. One of the biggest obstacles in summer is the lack of irrigation. Thus, various systems of low-cost, micro-irrigation with low water consumption for smallholdings are being evaluated. These systems avoid hydrological stress; they reduce the use of labor for weeding and fertilizing; and reduce water use. On the Supermercado de Opciones para Ladera (SOL) farm, profit values of various crops are being evaluated based on the times of best prices. High-fertility trenches are used. These are level furrows along the slopes that have high contents of organic materials to raise crop yields.

2.5.3 Production and Commercialization of Agro-industrial Products

Various mixed groups have been formed that are interested in the transformation of fruit, bakery, milk, and meat products. One group is registered with the Rural Mobile Agro-industries of the European Union, which will begin to train it from October 2002, both providing equipment and helping in commercialization. For the transformation of fruits, CIAT's Rural Agro-enterprise Development Project designed an electric dehydrator. Samples of dry mixed fruits were produced (pieces of pineapple, banana, papaya, and raisins) and were well accepted by a small sample of 15 people, only half of which did not like the papaya. More tests are being made to measure the costs per pound and evaluate other lines and presentations. The Maxi supermarket chain of Tegucigalpa has shown some interest in this product and is prepared to buy by consignment and without bar code. They will buy and sell by the pound, labeling the prices according to weight. This is good because it avoids the cost of sanitary registration and bar code.

2.6. Monitor and evaluate landscape changes

2.6.1. Selection and characterization of reference to assess impact of traditional and improved practices

Justification

One of the greatest challenges for Consultative Group on International Agricultural Research (CGIAR) researchers, government organizations (GOs) and NGOs, and resource-poor farmers is the need to adopt perspectives that transcend field or farm boundaries and accept solutions necessitating some form of collective action among landscape users (Knapp et al, 2000)[7]. Because of this, the Manejo Integrado de los Suelos de Centro América (MIS) Consortium decided to adopt the concept of reference sites as a common framework for collaborative research and validation with the participation of stakeholders. Several watersheds were selected within these sites. Watersheds, when combined with other issues of scale, are a useful, well-demarcated, agro-ecological mosaic in which agricultural activity affects the yield and quality of water.

Purpose

To develop a common framework for research and validation for MIS partners to interact.

Materials and Methods

During the planning meeting held in Nicaragua in 2000, partners decided to develop collaborative activities in reference sites. These sites should have ongoing research and validation activities and the presence of at least one MIS partner. Four sites (two for Honduras and two for Nicaragua) were initially selected for this purpose. Later two further sites in Honduras were included. Figure 8 shows their location.

MIS partners located in the reference sites carried out the socioeconomic characterization of the reference sites. In some cases, information was already available, while in others, collection and systematization was supported with MIS funds. The biophysical characterization of the reference sites comprised several steps: (1) identification of mapping units using available cartographic information for each reference site; (2) description of representative soil profiles using methodology suggested by USDA (1975) in Leighton (1982)[8], and the Local Indicators of Soil Quality (Trejo et al., 1999)[9]. Soils were classified according to the American Soil Taxonomy System of the United States Department of Agriculture (USDA). Potential land use capability and land use conflicts were defined based on this information.

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[7] Knapp, EB; Ashby, J.; Ravnborg, H.M.; Bell, W.C. 2000. A landscape that unites: Community-led management of Andean watersheds. *In*: Lal, R. (ed.). Integrated watershed management in three global ecosystems. CRC Press, Boca Raton, FL, USA. p. 125-143.

[8] Leighton, W. L. 1982. Taxonomia de suelos. Un sistema basica de calsificación para hacer e interpretar reconocimiento de suelos. Version abreviada, SOIL Taxon (1975). SMSS Technical Monograph No. 5. 264 p.

[9] Trejo, M.T.; Barrios, E.; Turcios, W.R.; Barreto, H.J. 1999. Participatory method for identifying and classifying local indicators of soil quality at watershed level. Guide 1 (in Spanish) of the series "Methodological instruments for decision taking in natural resource management". CIAT, Cali, CO. 146 p.

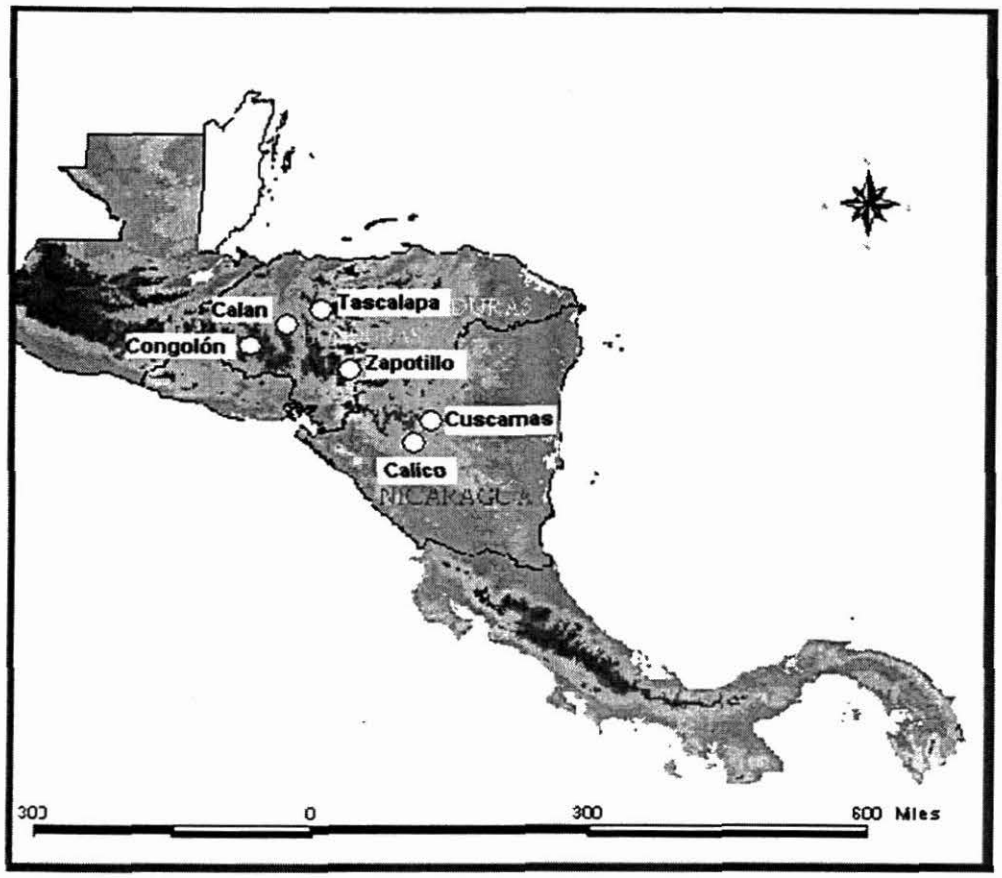


Figure 8. Location of the reference sites of the Manejo Integrado de los Suelos de Centro América (MIS) consortium in Honduran and Nicaraguan watersheds.

Results and Discussion

Table 21 summarizes the main biophysical characteristics of the reference sites. Detailed information can be accessed on request from the consortium secretary (ciathill@hondutel.hn)

Table 21. Main biophysical characteristics of the reference sites in Honduran and Nicaraguan watersheds.

Parameter	Yorito	Lempira	San Dionisio	Cuscamas	Calan	Zapotillo
Soil type	Sedimentary	Volcanic	Volcanic	Volcanic	Volcanic	Volcanic
Land use	Forest, agriculture	Agriculture, livestock	Agriculture, livestock	Coffee, crops, livestock	Forest, crops	Crops
Degradation problems[a]	Erosion Deforestation Fertility decline	Burning Erosion Fertility decline	Landslides, Erosion Fertility decline	Deforestation	Water contamination	nd
Water problems[a]	Scarcity Quality	Scarcity Quality	Scarcity Quality	Quality	Quality	nd

a. Problems arranged in order of importance.

The MIS sites have similar land and water resource problems—high deforestation rates, soil fertility depletion, erosion, and seasonal water scarcity. However, their magnitude varies among sites. The upper watershed of Yorito is highly prone to erosion because of the soil type and management practices. San Dionisio is being subjected to an accelerated rate of nutrient exhaustion because of intensive land use pressure. Water quality in the Calan Watershed is facing high contamination problems, and the La Dalia site is experiencing an increasing pressure of livestock activities. These are ideal scenarios to test improved land use practices and indicators of soil and water quality. They also afford opportunities to quantify the impact of improved agroforestry systems (Quesungual), and mixed crop-pastures systems.

Conclusions

Reference sites can be an effective way to carry out collaborative research and validation activities among the members of the consortium. They can also play an important role in the exchange of experiences and the evaluation of impact of improved land use systems within a landscape concept.

Contributor: Miguel Ayarza

An activity is beginning with the new alliance formed with the university of British Columbia in Canada.

Output 3. Organizations strengthened

3.1. Develop and/or validate methods and tools for developing and strengthening key organizations

3.1.1. Toolbook

Toolbook is computer software that is being used to develop educational material and to organize, store, and present research results. The University of British Columbia (UBC) is using it to integrate and disseminate the results of their research in the Himalayan – Andes research network, which we are interested in joining.

The characteristics of this tool are:

Flexibility: Text, maps, graphics, audio, video, animation, and links to other software programs can be combined in an interactive format. Materials can be designed for multiple purposes such as training, public presentations, and reference materials.

Addressing Multiple Audiences: Multi-media applications allow users to combine information with different levels of detail into one package, making the content applicable to multiple audiences. Information can be layered multi-dimensionally, that is, key concepts are illustrated

first and details are layered in a tree-like structure. The main trunk illustrates major points, and branches and sub-branches display greater levels of detail.

Interactive content: Information can be combined in modules, which are interlinked through a menu system. Modules can be standalone or interrelated. By building the interrelationships between modules, the complexity of systems is better illustrated.

Ease of Use: Toolbook provides a range of predesigned functions such as clickable buttons, navigation tools, animation, and drawing tools, and uses a simple script programming (similar to English). Its ease of use makes it applicable for education and research institutions, as their primary concern is content.

Free distribution: The ability to create a finished product (or drafts) that can be distributed freely to users who do not own the software is critical. Toolbook© provides functions to build a self-executable version, which can be distributed on CD-ROM. This is effective from the perspective of both distribution and cost.

Effective communication: The interactive nature of CD-ROMs produced using multi-media software makes the communication of information more effective. Social, economic, biophysical, and cultural information can be interlinked. Content including a range of maps, graphs, audio, and video enhances text-based information.

We are putting together information collected about the Herederos del Planeta Juventud, Vida y Naturaleza de Bellavista (HPB) and Asociación de Usuarios del Río Bolo (ASOBOLO) in Colombia, using toolbook. The UBC will use these case studies for its teaching course on environmental sciences, and ASOBOLO and HPB will benefit from having all their data in this easily usable form.

Contributor: MC Roa

3.1.2. Development of a digital soil database of Honduras

Rationale

The sustainable management of natural resources depends to a great extent on people's capacity to make sound decisions based on reliable information. The integration of edaphic information into GIS can be an effective way to assess spatial distribution of land resource problems and to target improved land management options.

Over the last 40 years, more than 50 major soil survey studies have been carried out in Honduras in order to characterize the resource base of the country for different purposes. This information is found scattered in many reports and is difficult to access. Since 1995, the CIAT-Hillsides Project has been working with several NARS of Honduras to collate, systematize, and georeference soil information contained in those reports.

Objective

To develop soil databases and user-friendly interfaces to allow multiple stakeholders identify areas with similar resource problems and target solutions.

Materials and Methods

A spatially linked soil database was developed for Honduras in order to assist decision makers in identifying resource problems and target solutions. The work comprised several steps over time. The first step consisted of collecting available information. This was followed by a process of hierarchical organization from the most generic to the most specific type of information. The last part of the work was devoted to the development of a user-friendly system to access the information, and to the linking of the databases to a GIS system.

Results and Discussion

The first output of the work was the publication of the information in four volumes and the release of the digital soil database HONDSOIL 1.0. With this product, users were able to access the description of 3001 soil profiles and 5678 soil horizons as a function of generic information (report number, location, type of study, institution, date of execution, etc.) and to group soil profiles as a function of a given soil horizon characteristic (chemical or physical). Table 22 shows, as one example, the result of grouping upper soil horizon characteristics into three main classes. According to these groupings, 63% of the horizons included in this work have a loamy soil texture, 57% are slightly acidic, and 46% have soil organic matter contents between 1%-4%. Seventy percent of soil horizons are located in soils with more than 30% slope.

Table 22. Percentage allocation values (in parentheses) of several soil properties of the topsoil horizons contained in the HONDSOIL 1.0 database.

Soil property[a]	Category 1	(%)	Category 2	(%)	Category 3	(%)
pH (H_2O)	<5.5	40	5.5-7.5	57	7.5	3
Texture	Sandy	23	Loamy	63	Clayey	14
SOM (%)	< 1	10	1-4	46	>4	44
Slope (%)	<15	16	15-30	14	>30	70
Soil depth (cm)	<10	26	10-15	73	>50	1

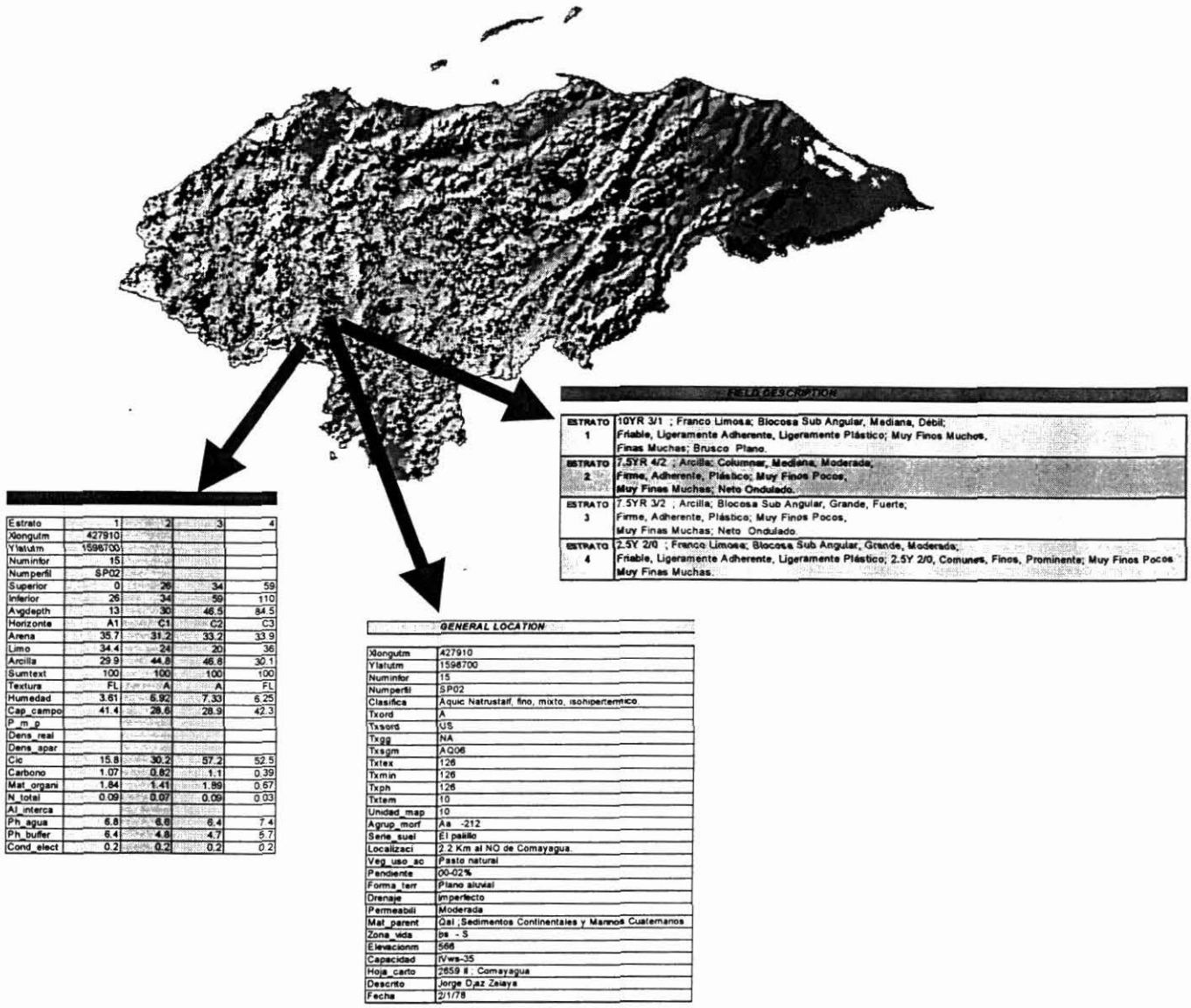
a. SOM = soil organic matter.

The linkage of the soil database to ArcView allows visualizing the distribution of soil profiles in the landscape and establishes similarities among sites. By clicking on any point on the map specific information can be accessed about any soil profile (Figure 9).

Conclusions

Most of the soil survey information for Honduras is now available in paper and electronic form. The digital database is easy to use and allows the user to search for specific soil information for a given area covered by the soil survey studies. It can be used to identify edaphic similarities in the landscape and to improve land management recommendations. Linking the database to GIS and

bio-economic models has expanded the usefulness of this database to make spatial analysis and land use scenarios.



Estrato	1	2	3	4
Xlongutm	427910			
Ylatutm	1596700			
Numinfor	15			
Numperfil	SP02			
Superior	0	26	34	59
Inferior	26	34	59	110
Avgdepth	13	30	46.5	84.5
Horizonte	A1	C1	C2	C3
Arena	35.7	31.2	33.2	33.9
Limo	34.4	24	20	36
Arcilla	29.9	44.8	46.8	30.1
Sumtext	100	100	100	100
Textura	FL	A	A	FL
Humedad	3.61	6.92	7.33	6.25
Cap_campo	41.4	28.6	28.9	42.3
P_m_p				
Dens_real				
Dens_apar				
Cic	15.8	30.2	57.2	52.5
Carbono	1.07	0.82	1.1	0.39
Mat_organi	1.84	1.41	1.89	0.67
N_total	0.09	0.07	0.09	0.03
Al_interca				
Ph_agua	6.8	6.6	6.4	7.4
Ph_buffer	6.4	4.8	4.7	5.7
Cond_elect	0.2	0.2	0.2	0.2

FIELD DESCRIPTION	
ESTRATO 1	10YR 3/1 ; Franco Limosa; Blocosa Sub Angular, Mediana, Debil; Friable, Ligeramente Adherente, Ligeramente Plástico; Muy Finos Muchos, Finas Muchas; Brusco Plano.
ESTRATO 2	7.5YR 4/2 ; Arcilla; Columnar, Mediana, Moderada; Firme, Adherente, Plástico; Muy Finos Pocos, Muy Finas Muchas; Neto Ondulado.
ESTRATO 3	7.5YR 3/2 ; Arcilla; Blocosa Sub Angular, Grande, Fuerte; Firme, Adherente, Plástico; Muy Finos Pocos, Muy Finas Muchas; Neto Ondulado.
ESTRATO 4	2.5Y 2/0 ; Franco Limosa; Blocosa Sub Angular, Grande, Moderada; Friable, Ligeramente Adherente, Ligeramente Plástico; 2.5Y 2/0, Comunes, Finos, Prominente; Muy Finos Pocos Muy Finas Muchas.

GENERAL LOCATION	
Xlongutm	427910
Ylatutm	1596700
Numinfor	15
Numperfil	SP02
Clasifica	Aquic Natrustalf, fino, mixto, isohipertermico.
Txord	A
Txsord	US
Txgg	NA
Txsgm	AQ06
Txtex	126
Txmin	126
Txph	126
Txtem	10
Unidad_map	10
Agrup_morf	Aa -212
Serie_suel	El pasillo
Localizaci	2.2 Km al NO de Comayagua.
Veg_uso_ac	Pasto natural
Pendiente	00-02%
Forma_terr	Plano aluvial
Drenaje	Imperfecto
Permeabili	Moderada
Mat_parent	Qal ;Sedimentos Continentales y Marinos Cuaternarios
Zona_vida	bs - S
Elevacionm	566
Capacidad	IVws-35
Hoja_carto	2659 II , Comayagua
Descrito	Jorge Díaz Zelaya
Fecha	2/1/78

Figure 9. Location of soil profiles included in the HONDSOIL 1.0 soil database, and profile outputs using the user-friendly interface.

Contributors: H Barreto (consultant); M Trejo; M Ayarza; O Mejia; A Iturbe (consultant)

3.1.3. Training in the use of the PCARES model

An MIS member participated in the training course given by the Managing Soil Erosion Consortium (MSEC) on the use of the GIS-assisted methodology to model soil erosion and hydrology at watershed level. The simulation model, Predicting Catchment Runoff and Soil Erosion for Sustainability (PCARES), is a physical model that can simulate runoff and soil erosion of a catchment area during a rainfall event. It can predict the spatial and temporal

distribution of soil erosion rates; thus, it can be used to identify erosion "hotspots" in a watershed. It is a tool that can help in planning, research, education, and training for resource management at watershed and community scale. The basic inputs to run the model include raster maps of the elevation, soil, and land use of the catchment, and a time series amount of rainfall. Important outputs include a map of source erosion, and runoff discharge and sediment yield at the outlet of a catchment area.

Contributor: M Ayarza

3.2. Train local, regional, and national organizations in the use of methodologies and/or tools developed by CIAT

3.2.1. Training for international partners to help local, regional, and national organizations

The FLSP Project provided several training events for international partners to be able to help local, regional, and national organizations. In a collaboration between CIAT and the Participatory Research and Gender Analysis Program (PRGA), Peter Horne and Ann Braun ran a training course, "Improving adoption of agricultural technologies – how participatory research can complement conventional research approaches," for 15 Japanese scientists at the Japan International Research Center for Agricultural Science (JIRCAS) in Japan from the 4th to the 8th of March, 2002. A CD-ROM of the training resources used in this course is available from either the PRGA or FLSP. As a follow-up to this course, a second short course will be run by FLSP for JIRCAS in northern Thailand in October 2002.

The FLSP also ran a training course on Participatory Diagnosis from 20–25 January 2002 for 15 staff of an International Rice Research Institute (IRRI)–managed project in northern Laos.

The impact of this training is evident in two ways. First, most of the technical problems experienced with forages in the field in the first year have not recurred this year because of direct supervision by the field teams. Second, the field teams have grown in confidence with the participatory research and extension methods that we are applying. They appear to have gained an overall sense of the process, and the purpose of specific activities and meetings. That they have done this within one extension cycle is very rapid and is partly because of the many activities and reviews that they have received throughout the year.

None of the field staff had previous experience in conducting extension before working with FLSP. At the beginning of 2001, they were provided with an introductory workshop giving them an overview of extension processes and the methodology to be applied. Since then, the National and Provincial staff have led them through each step, including accompanying them to the field and supporting them in the implementation of significant field activities. The staff appears to be imbued with a real sense of purpose of what they are doing, and commitment to their work.

Contributors: P Horne, P Kerridge, R Lefroy (FLSP Project); A Braun (consultant)

3.2.2. Application of the Soil Quality Indicators Guide

Justification

The increasing attention paid to local soil knowledge in recent years is the result of a greater recognition that the knowledge of people who have been interacting with their soils for a long time can offer many insights into the sustainable management of tropical soils. A participatory approach in the form of a methodological guide was developed and used in Latin America and the Caribbean (Honduras, Nicaragua, Colombia, Peru, Venezuela, and the Dominican Republic) and Africa (Uganda and Tanzania) to identify and classify local indicators of soil quality related to permanent and modifiable factors.

Materials and Methods

This methodological tool aims to empower local communities to better manage their soil resource through improved decision making and local monitoring of their environment (Figure 10). It is also designed to steer soil management towards developing practical solutions to identified soil constrains, and to monitor the impact of management strategies implemented to address such constraints. A considerable component of this approach involves improving communication between technical officers and farmers, and vice versa, by jointly constructing an effective communication channel. The participatory process used is shown to have great potential in facilitating farmer consensus about which soil-related constraints should be tackled first. Consensus building and trade-off analysis is presented as an important step prior to collective action by farming communities, resulting in the adoption of improved soil management strategies at the landscape scale.

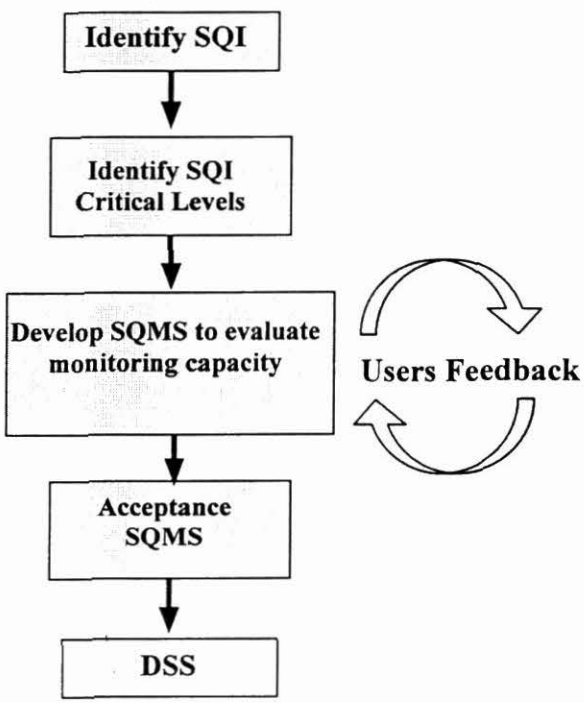


Figure 10. Process using soil quality indicators (SQIs) leading to the development of Soil Quality Monitoring Systems (SQMS) as decision support systems (DSS).

Participants in the training event associated with the guide are encouraged to develop "action plans". These show the institutional commitment made by participants to apply the guide and the gained insights in their own work plans and environments.

Results and Discussion

To date, more than 23 action plans have been initiated in Latin America and Africa. Their follow up in the coming years will provide a measure of the impact of this participatory approach in better NRM through improved soil management strategies. Table 23 shows proposed action plans in Honduras and Nicaragua, and Table 24 in Africa.

Table 23. Action plans for follow up in Honduras and Nicaragua[a].

Location	Institutions involved	Proposed objectives/results
Honduras:		
San Francisco de los Valles, San Marcos Colonia Lempira, Quimistán, Dept. Santa Bárbara	CARE	Provide farmers with the information to work on soil structure by means of mulching.
San Marcos de Colon	COHDEFOR	Undertake a soils study in this area. Train farmers to better know their soils. Take sound decisions regarding forest management plans.
Talgua River Watershed - Olancho	ENA	Improve decision making in NRM.
Five forest conservation areas	COHDEFOR	Monitor decision making of local communities in soil management.
Focal areas of institutional interest	FEPROH	Promote a collective effort in NRM.
Work with agricultural facilitators and farmers	CCP	Slow down soil degradation. Formulate an NRM plan with communities.
Farmer groups	CARE-DIPAC	Improve farmer participation in soil management practices.
South of Lempira	FAO-Honduras	Improve farmer knowledge of soil.
Francisco Morazán	SERNA	Improve NRM decision making.
Nicaragua:		
Tuma La Dalia, Matagalpa	UNICAFE	Improve local soil management practices.
Six communities in Dept. Matagalpa where the University has communal practices	UCA	35 students trained in the use of LISQ.
San Francisco de la Cruz, El Sol, and Mata de Tule, Dept. Carazo	CIEETS	Collect valuable information about the quality of soils in this area.
12 communities in Dept. Matagalpa	EAGE	Train students in the use of this methodology to apply it in soil studies in the communities.
El Rama, South Atlantic Region	FADCANIC	Train project personnel in the use of LISQ to apply it in development activities.

a. For acronyms and abbreviations used, see page 190.

Table 24. Action plans for follow up in Africa[a].

Location	Institutions involved	Proposed objectives/results	Expected impact
Muhesa, Tanga, Tanzania	District Agriculture Development Office	• Introduce the tool to the community • Organize a monitoring committee • Train farmers and school children in the use of the tool • Apply the LISQ methodology	• 450 households, 2250 people, 600 women, and 300 school children will be influenced by the activities.
Mwanza Bukoba, Lake Zone, Tanzania	LZARDI	• Facilitate farmers with easy soil testing tools • Integrate indigenous SQIs for soil quality assessment by farmers, trainers, and researchers • Develop resource management interventions based on identified soil constraints at different land use scales	• 15 MARAFIP ISFM component villages • 12 KAEMP demonstration sites • 10 water sanitation women groups Mwanza and Misungwi districts • Five agricultural youth organizations
Mwanza, Tanzania	Agricultural R&T Institute, Ikiriguru. KAEMP MARAFIP	• Better understanding of soils by farmers for proper management decisions and land use planning • Clear picture of the importance of tools by researchers, trainers, and extension staff towards improvement of advisory role in integrated soil fertility management approaches • Guide professionals and non-professionals on the impact of selected management interventions and their implications for future planning and sustainability of the land resource	• Five villages of three districts in Mara region • 3000 farmers will be trained. • 10 demonstration sites in each region will participate. • 70 students at Ukiriguru Training Institute trained in the use of the tool • 70% of all groups are women.
Arusha and Moshi, Tanzania.	MATI Tengeru MATI Mlingano KATC	• Farmers and trainees will identify common constraints to soil quality in the area. • Training institutes will understand local indicators in the area for training purposes. • To train certificate and diploma students/farmers' groups and extension agents (especially women who are major implementers in agricultural production) on proper identification and management of soils as indispensable resource to sustain productivity. These in turn will disseminate knowledge to other farmers and professionals. A specific result is to increase awareness on the use of LISQs and incorporate their use in agricultural practice.	• Integrated use of LISQ and TISQ indicators in decision making about soils • People trained: 30 male and 30 female extension agents, 20 male and 40 female farmers, and 35 male and 25 female students. • Training institutes will receive training material for soil management, providing a base for management strategies around the institute area.

Continued.

Table 24. Action plans for follow up in Africa[a]. (Continued)

Location	Institutions involved	Proposed objectives/results	Expected impact
Hai District, Moshi, Tanzania	ITECO	• Setting demonstration areas in Masama division (Hai District), Mwembe, and Usangi (Mwanga District) Wards, where results will be practically interpreted and applied for future expansion to other areas • Train 200 farmers on identification and classification of soil quality • Train and support 15 selected water user groups • Increase farmers awareness through wide application of strategies	• Capacity building promoted and gender integration in all development activities assured in ITECO working area • Self-reliant development of irrigation improvement activities consolidated and expanded • About 150 000 poor strata rural population benefited
Lushoto, Tanzania	District Council DALDO SECAP	• Control soil erosion to contribute to fertility improvement and vegetative growth • Reduction of salt levels in valley bottoms • Production increase • Introduce the application of the SQI tool and identify good SQIs • Farmers will increase their knowledge of soil management.	• "Many farmers will be affected, especially women who mostly cultivate in steep slopes of West Usambara mountains."
Homa Bay, Rashuonyo and Suna Districts, Nyanza Province, western Kenya	CARE Kenya, Task Project	• Improve knowledge and skills of extensionists and researchers in LISQ and TISQ integration and application • Enhanced farmer knowledge and practices on NRM for improved livelihoods	• Research and extension workers trained: 42 women and 26 men • Adaptive research farmers: 50 women and 58 men • Group resource persons: 120 women and 96 men and 1600 farmers
Nairobi, Kenya	KIOF KARI	• Application of the tool will influence decision making processes in changing soil fertility management at farm level. • Correlation of technical and indigenous knowledge will result in improved soil management practices. • The participatory methodology will ensure women's participation in soil fertility management practices.	• 40 small-scale resource-poor farmers will benefit from this activity.

Continued.

Table 24. Action plans for follow up in Africa[a]. (Continued)

Location	Institutions involved	Proposed objectives/results	Expected impact
Usonga, Karapul, Bujumba, Township, South Alego	CARE, Jamaa Wazima Project	• Targeted households will adopt new improved productivity enhancing soil management techniques. • Improved capacity to use LISQs to identify soil constraints, determine and apply relevant management strategies • Improve ability of extension workers to participatorily identify and prioritize LISQ, and integrate them with TISQ	• Six community extension workers and four collaborators (GoK staff), three women's groups and one youth group, and four farmer groups totaling 160 men and women
Awassa, Ethiopia	Awassa Research Center	• To explore farmers' indigenous knowledge • To integrate local and technical knowledge • To establish strategies for NRM • To deliver training to experts	• Farmers: 20 women and 30 men • 10-20 experts
Iganga District, Uganda	Dept. of Agriculture, Iganga District Africa 2000 Network CIAT-Kawanda	• Empower extension staff in participatory soil management practices • Improve knowledge and skills among farmers, especially women, to choose appropriate management techniques • Encourage farmers to put into practice soil management techniques and other technologies with positive impact to crop yields	• 54 Extension staff (20% women) • Five communities to work mostly with women's groups • 250 farmers to participate directly (60% women)

a. For acronyms and abbreviations used, see page190.

Contributors: H Barreto (consultant); M Trejo, M Ayarza, O Mejia; A Iturbe (consultant)

3.3. Strengthen small-scale producers, managers, and local, regional, and national organizations through participatory investigative methods

3.3.1. Scaling out from the reference site

Justification

Often, research and development projects in agriculture and NRM have very little impact in relation to its arrival and diffusion to the farmers, reduction of poverty, sustainability of the development process, or influence on policies. Thus, the researchers and those involved in development face the constant challenge of maximizing impact and advancing the development process. In the present situation of reduced financing to support research and agricultural development, interest is growing in "enlarging the scale" (Gonsalves, 2001)[10]. Larry Harrington

[10] Gonsalves, J. 2001. Escalar: Lo que hemos aprendido en los últimos talleres. LEISA Revista de Agroecología. Experiencias para crecer. Vol. 17, No. 3.

and his colleagues (2001)[11] warned that if little attention is paid to the increasing of scale we "will have failed in our purpose of contributing to the alleviation of poverty, to improving food security, and to the protection of the environment". This situation allows us to evaluate the focus of scaling out to determine its effectiveness, and identify principles and important lessons to improve our general understanding of the out-scaling process.

Objective

Utilizing the work methods and products developed at reference-site level (development of profitable technologies, systems of sustainable production through multi-institutional contribution, using the participative design focus and PM&E that include responsibilities shared at all decision levels) to enter into alliances with different actors (local, national and regional) allowing us to reach more people with these benefits in less time, and a better way.

Materials and Methods

In the CIAT reference sites in Central America (San Dionisio and Matagalpa in Nicaragua, and Yorito, Yoro in Honduras), diverse CIAT projects are present, such as C&W, Forages, Participatory Research, Agro-enterprises, Soils, Beans, and Rice, among others. Since 1999, a process of identifying research priorities and implementing alternatives has gone on in these reference sites, based on three principles:

(1) Participative focus (design, planning, decision taking, monitoring and evaluation of the research projects) integrating all interest groups in the process;
(2) Multi-institutional alliances; and
(3) A network of experiment sites that cover the range from research to development.

Starting from this technological and methodological offer of CIAT's, during the last 2 years visits to the reference sites with donors, GOs, NGOs, and universities have increased. As a strategy, the following scheme has been utilized (Figure 11) that comprises four phases:

(1) Approach partners with national or regional coverage, where supply and demand of the institutions are identified at internal level and at the level of the clients they serve.
(2) Visits to the reference sites to get to know experiences at technological and methodological levels.
(3) Partners identify products that they can introduce, apply, or investigate in other regions.
(4) Elaborate a plan of institutional work that permits learning alliances, the collaboration scheme includes on CIAT's part: germplasm, methodologies, training, accompaniment, and training.

Through these steps we expect not only to train participating NGO personnel, but also to enter upon a process that allows us to apply what is learned, to monitor and follow up these experiences, to learn mutually from concrete work, and to measure the impact to determine that what we did really works and contributes finally to the improvement of the quality of life of the

[11] Harrington, L. and collaborators. 2000. Delivering the goods: Generalizing and propagating NRM research results through "scaling out". LEISA Revista de Agroecología, Vol. 17, No. 3.

people. Under this plan, NGOs would be able to have facilitators, to count on CIAT's support in the application of what is learned, to participate in the collective learning, and to have access to improved practices improved on the theme of interest previously selected.

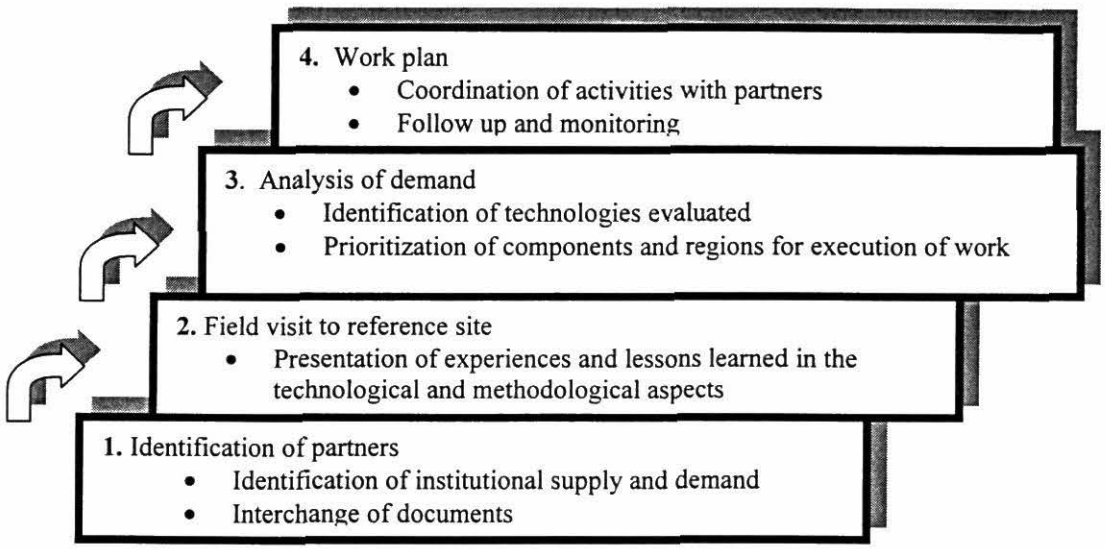


Figure 11. Summary of the methodology used at CIAT reference sites.

Results

During 2001-2002, visits have been made to the reference site with different partners, including:

- Donors: Norwegian Agency for Cooperation for Development (NORAD), United Nation's Children's Fund (UNICEF), Swedish International Development Agency (SIDA), and Swiss Development Cooperation (SDC)
- Government institutions: MAGFOR, INTA, MARENA, and Programa Socioambiental Forestal (POSAF)
- NGOs: Fondo de Desarrollo Agropecuario (FONDEAGRO), Programa de Agricultura Sostenible en las Laderas de Centro América (PASOLAC), and Instituto Interamericano de Cooperación para la Agricultura (IICA)
- Universities: Universidad Nacional Agraria (UNA), Universidad Nacional Autónoma de Nicaragua (UNAN)-Matagalpa
- International agencies: Agua y Tierra Campesina (ATICA, Bolivia), Inter-cooperación, CIAT-HAP (Haiti), Development Alternative Inc. (DAI, Bolivia) and
- Groups of producers: with interest in fodders, CIALs, UCOSD

Table 25 presents a summary of the scaling out process initiated through different associates in Nicaragua during 2002. The main themes identified by partners are: germplasm, silvopastoral systems, market options, SOL strategy, CIALs, focus on watersheds, methodologies of collective action and training.

Figure 12 shows the increase of scale presented by "scaling out" from the San Dionisio, Matagalpa reference site to other regions of the country such as the departments of Jinotega, Matagalpa, Boaco, Chontales, Managua, Estelí, Nueva Segovia, León, and Chinandega.

Table 25. Process of scaling out with different partners in Nicaragua, 2002.[a]

Partner	CIAT projects involved	Theme	Site	Duration and state
CARE	Agro-enterprises	Market options	Matagalpa, Estelí	1 year. In process
	C&W	Integral management of watershed, SOL focus	Sub-watershed Río Pueblo Nuevo (Estelí)	5 years Concept Note
	Forages	Germplasm Silvopastoral systems Training	City of Darío	3 years Concept Note
FONDEAGRO	Forages	Forage grasses, legumes, and trees	Paiwas Río Blanco Ubu Norte	2 years In process
POSAF	C&W, Forages, IPRA	Establishment of SOL sites Training	Sub-watersheds: Dipilto and Jicaro, Estelí, Molino Norte, Jiguina, Río Grande, Cuenca Sur, and S. Francisco Libre	2 years Proposal
NORAD	C&W	Areas not protected by the MBC	Central America	5 years Proposal
UNAN-Matagalpa	Forages	Germplasm and training (three theses)	Matagalpa	1 year In process
INTA	C&W, IPRA, Forages, Agro-enterprises	Watersheds focus Improvement of soils CIALs, forages, Monitoring and follow up	Matagalpa-Jinotega Estelí-Madriz-NS Léon-Chinandega Boaco-Chontales Masaya-Carazo	In preparation
PRODEGA	Forages	Germplasm and training	Boaco-Chontales	3 years Concept Note
UNICEF[b]	C&W	Training in support tools for decision taking in NRM	Juigalpa Matagalpa Estelí	2 months Finalized
ATICA	C&W	SOL focus Market options	Bolivia	Initiating
CIAT-HAP	C&W	SOL focus PES	Haiti	3 years In process

a. For acronyms and abbreviations used, see page 190.
b. Training and plans of action.

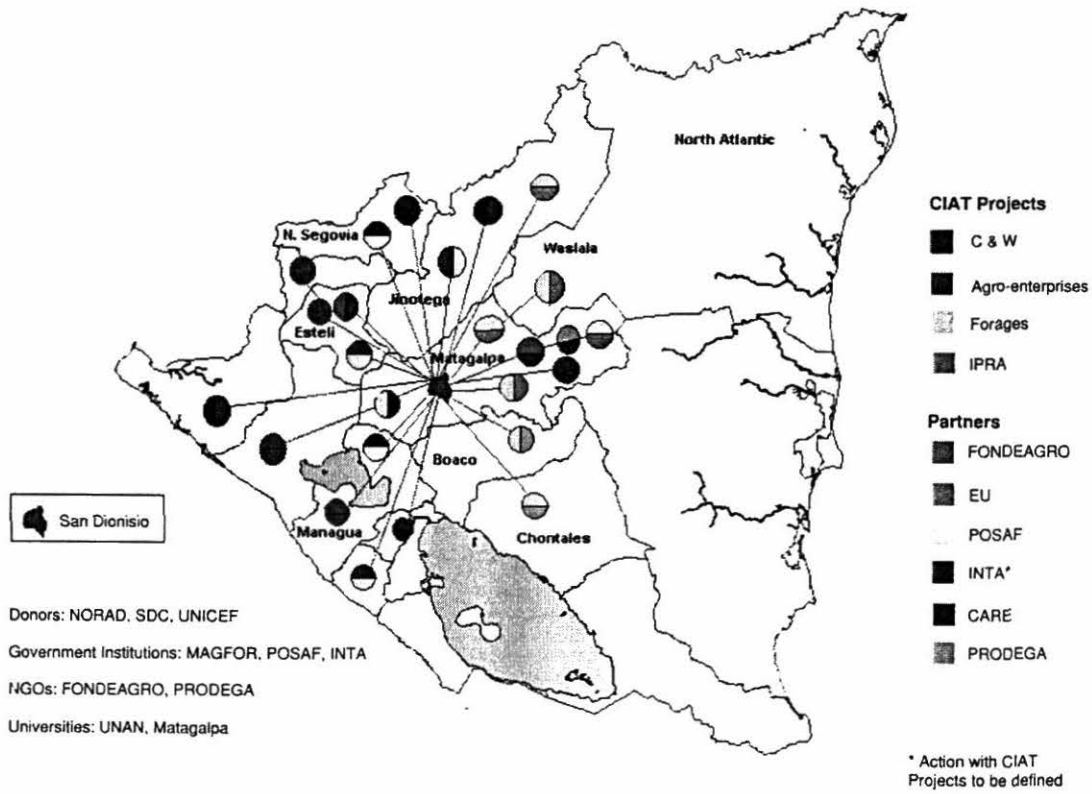


Figure 12. Scaling out from the reference site, Nicaragua.

Conclusions

Mainly partners that do not have strong presence and field of action in the region of San Dionisio have visited the reference sites. We therefore should reinforce alliances with institutions within the reference site. The SOL (reference site) concept has become a valid instrument to initiate a process of approach to non-traditional partners/ donors through visits and demonstration of the products developed and offered by CIAT.

In terms of "going to scale", alliances will facilitate CIAT personnel with scenarios in which the methodologies are implemented, adapted, and improved; where impact is measured, and more importantly, the learning of our methodological instruments is in the hands of development partners. This justifies before traditional donors to research that funds invested in the research bear fruit.

Usually, new associates seek finished and ready products; this means that our results are available in attractive and simple form. Basic research would be feasible with difficulty within these alliances, not impossible, but more difficult. This can affect CIAT's agenda. Equilibrium must be sought among the different donors, and development alliances should be used more for application and to show impact. Partners have their own research demands; we should discover which of these fit the CIAT agenda. We need to initiate a process of systematization and

documentation of this process to continue improving the process of interaction with other associates.

Contributors: J Beltrán; A Schmidt (PE-2)
Collaborators: PP Orozco, C Davies

3.3.2. Training courses in farmer participatory research methods, Thailand and Vietnam

Rationale

Since we have a target to benefit at least 8000 farming households by the end of the cassava project in 2003, we need to expand to additional sites every year. In 2002, the project was operating in about 60 sites in Vietnam, Thailand, and China. To be able to work in so many sites, it is necessary to train and convince officials at the national, provincial, district, and subdistrict level, as well as village leaders and key farmers, about the importance of the participatory approach and the use of participatory methodologies. Another purpose of the training courses is to get to know each other as friends and colleagues, and to motivate people to actively participate in the project. Thus, the list of people collaborating in the project at all levels keeps growing, allowing the project to expand with a minimum of additional funding.

Methods and Results

In Thailand, a 5-day training course was held for 30 government officials from the Land Development Dept (LDD), the Department of Agriculture (DOA), the Department of Agricultural Extension (DOAE), and the TTDI. The course was prepared upon request of the Deputy Director General of the LDD, who, after visiting one of the FPR pilot sites, was convinced that the participatory approach is very effective in achieving adoption of new technologies, including soil conservation practices. Participants of the course learned and then practiced in the field, several FPR methodologies, such as rapid rural appraisal (RRA), participatory rural appraisal (PRA), farm budgeting, participatory planning, implementation of FPR trials, and evaluation of the tested technologies. Most participants went home with the motivation and desire to collaborate in the project and to try out the participatory approach.

In Vietnam, two FPR training courses were held for local extensionists and key farmers, one in Van Yen district of Yen Bai province in north Vietnam, and one in Hue city in central Vietnam. These courses were intended to teach both extensionists and farmers about FPR methodologies as well as cassava production technologies. By being together for 1 week in the same course, people get to know each other, so that in the future they can work together as local "FPR teams" to teach others in the community how to conduct FPR trials, and how to adopt new technologies.

In addition, four leading collaborators in the project, three from Thailand and one from Vietnam, participated in a 3-week FPR course in Los Baños, Philippines, organized by the CIP- Users' Perspectives with Agricultural Research and Development (UPWARD) Program. This very intensive course was helpful in refreshing their previous knowledge about FPR and in teaching additional methods and techniques.

Contributor: R Howeler

3.3.3. Training in participatory research and extension methods, Asia

Background

The FLSP will contribute to increasing capacity in participatory research approaches and technical skills in forage and livestock management of 36 Lao Subject Matter Specialists (SMS) and Farming Systems Extension Workers (FSEW). These trained staff will work with and assist farmers in developing and disseminating improved livestock technologies. Through these people the project will help foster a system of participatory extension using forage and livestock technologies as a model.

Materials and Methods

In February, and again in May/June, Village Planning Meetings were held in each of the 18 villages where the project started working in 2001, and from these, estimates of the expansion of forage use in the existing target villages were gained (see Table 26).

Table 26. Changes in the number of farmers and forage areas planted in existing target villages, Laos.

District and village	2001		2002					Total area
	No. of farmers	Area (ha)	No of farmers who: Will expand their area	Will maintain their area	Are new	Total	New area (ha)	
PEK								
Ta	8	0.74	8	0	6	14	0.75	1.49
Phonekham	36	0.45	16	15	1	32	0.47	0.92
Dong	7	0.08	1	6	0	7	0.08	0.16
Xang	12	0.64	6	3	6	15	5.58	6.22
Subtotal	63	1.91	31	24	13	68	6.88	8.79
Nonghet								
Houay Khiling	8	0.25	7	0	2	9	0.76	1.01
Nonghetai	8	0.14	6	0	5	11	0.82	0.96
Paklak	8	0.13	4	4	3	11	0.80	0.93
Khanganien	14	0.28	6	8	5	19	2.91	3.19
Subtotal	38	0.80	23	12	15	50	5.29	6.09
Xieng Ngeun								
Kieu Chaluang	23	1.45	9	14	0	23	0.41	1.86
Kieu Talun Noi	7	0.02	1	6	2	9	0.12	0.14
Kieu Talun Nyai	16	0.09	4	12	3	19	0.28	0.37
Phonesaad	7	0.19	4	3	4	11	0.31	0.50
Subtotal	53	1.75	18	35	9	62	1.12	2.87
Luang Phabang								
Long Lao 2	26	0.46	9	17	7	33	0.52	0.98
Nong Tawk	9	0.15	7	2	4	13	0.35	0.50
Kok Wan	13	0.06	5	0	11	16	0.36	0.42
Bor Hae	16	0.17	5	11	5	21	0.13	0.30
Houay Leuk	16	0.10	5	11	4	20	0.36	0.46
Densavang	18	0.10	6	0	3	9	0.36	0.46
Subtotal	98	1.04	37	41	34	112	2.08	3.02
Total	252	5.50	109	112	71	292	15.37	20.77

Results

The following changes in key indicators from 2001 can be noted:

Numbers of farmers

In all but four villages, the numbers of farmers growing forages increased. Even in two of the villages where their numbers decreased, new farmers were still planning to grow forages this year. The overall increase in the number of farmers is modest (15%), rising from 252 to 292.

Thirty-two farmers dropped out. They were reported to be those who (a) originally had no livestock and so had planted forages with false expectations (their inclusion last year was due to inexperienced staff who were keen to enlist a large number of farmers and were not careful in their selection), and (b) farmers whose animals died during 2001 because of disease or other reasons.

There are 71 new farmers planning to grow forages this year in the target villages from 2001. This represents an increase of almost 30% on the number originally growing in 2001, and is a very significant increase, especially because we normally would not expect such an increase until the Focus-Group farmers had started to experience significant impacts. The increase in the number of farmers could well have been greater than this. The numbers of farmers planning to plant in May had dropped considerably from the numbers estimated at the end of 2001. Little contact had been made with them since then. When the early rains began at the end of May and staff had still not contacted them or provided seed, farmers planted this land to other crops rather than let it go to weeds. Despite this problem, there are still farmers who had already planted their land (often to sesame, or an opportunistic crop, or maize), and when contacted in May/June were ready to replant these areas to forages, indicating that they considered them a higher priority.

Area of forages

The area of forages was expected to increase from about 5.5 ha to 20.9 ha, almost fourfold. Subsequently, in most villages, the forage areas planted did not reach these targets. There could be many reasons for this, but the two most likely causes are (1) farmers nominated areas for planting with forages, but subsequently planted them with other crops when the rains started and forage seed had not yet arrived; and (2) some farmers expected that forages could be planted in March whereas the planting season for forage seed is June. The exact areas planted are being monitored at the time of writing this report.

What is perhaps more indicative of farmer acceptance of forages is that the area per farmer is now about 700 m^2, compared to just 200 m^2 last year. In many cases, the farmers who already grew forages last year, and are expanding, are planning to grow 1000 to 2000 m^2 of forages. This scale of planning for forages is significant, not only in its size, but also in the commitment of time and family labor to plant it. At this scale, forages are becoming a real factor in planning in the household economy.

Types of forages

From the early participatory research with six forage varieties in 2001, farmers have begun to make some selection of the types of forages they want to expand. *Panicum maximum* "Simuang" and *Stylosanthes guianensis* "Stylo 184" are the forages most consistently required across

villages in both provinces. *Paspalum atratum* "Terenos" has begun to drop out of the picture in Xieng Khouang, while *Brachiaria decumbens* "Basilisk" has suffered a similar fate in Luang Phabang. Even so, many of the villages in Luang Phabang are still requesting a wide range of forages, perhaps because many of them did not do this directly in 2001. In Nonghet, there has been significant interest in *Calliandra calothyrsus* "Besakih". The project must document the reasons for these differences in preferences towards the end of this second wet season.

The figures and discussion described above represent early outputs of the project, whereas our main goal is to provide all the enabling factors required for farmers to achieve substantial impacts. Such impacts are starting to occur. Several recent cases have emerged where farmers are changing the focus of their farming systems because of the potential they see from the forages. An example comes from the family of Sia Thua Chan, in Hoauy Khiling village, Nonghet. This family has traditionally grown maize for sale, but yields have been declining in recent years. After 1 year of evaluating forages in small plots, they selected three varieties that looked promising (*Stylosanthes guianensis* "Stylo 184", *Andropogon gayanus*, and *Panicum maximum* "Simuang") using seed and cuttings. They bought barbed wire to protect the area from wandering animals and plan to build a barn near the plots to save labor in cutting and carrying the feed. It will also mean that returning manure to the forages will be relatively easy. They plan to reduce the amount of effort they put into unproductive cropping systems and increase their focus on livestock production.

A similar example comes from the family of Thit Chan in Pik Nyai village, Luang Phabang that currently raises six pigs and has a small plot of *Stylosanthes* (300 m^2). The family also has a plot of sesame, which only earns them 200 000 kip per year (about US$20). Based on their experiences with the *Stylosanthes*, they estimate that if they replace the sesame with it, the returns from that plot will increase to 700 000 to 800 000 kip per year (about US$70 to 80). On the strength of this experience, plus new varieties of sweet potato, which they are now evaluating, this family wants to expand its pig numbers and reduce its emphasis on low-yielding crops.

In both cases reported above, the farmers have recognized that an alternative to expending a lot of labor on growing low-yielding staple crops is to raise livestock, and buy rice or maize. During this year, the FLSP needs to focus strongly on quantifying the extent and significance of emerging impacts such as these so that we can help farmers in a similar decision process, for example, "if I sell *x* pigs per year I can take *y* hectares of shifting cultivation out of production and this means I can save *z* amount of labor, some of which I put back into my livestock system".

Contributors: P Kerridge, R Lefroy, P Horne (FLSP Project)

3.4. Support, through incorporating processes of participative investigation, local organizations oriented to agricultural research

Participative research is ongoing at SOL sites. See also work with CIALs, DICTA, and SERTEDESO (under Activities 1.3 and 1.5). In October 2001, training was given to IPCA and CLODEST in Honduras on PM&E.

3.4.1. Cassava Development Villages formed in Thailand

Introduction

In Thailand, the government has supported the formation of "Cassava Development Villages" in 11 of the 24 pilot sites of the Nippon Foundation Project, with the objective of empowering the local community to make their own decisions about the protection of natural resources and the development of new crops or new practices that will improve their livelihoods.

Rationale and Methods

As a result of FPR erosion control trials conducted in a neighboring village, farmers in Sappongphoot village of Nakhon Ratchasima decided in 1997 to organize themselves into a "Soil Conservation Group", in order to obtain vetiver grass planting material and to help each other set out contour lines and plant nearly 100 km of vetiver grass hedgerows in cassava fields in their village. This approach was so successful that in 2001 the Thai government allocated about US$10 000 for each of 11 FPR pilot sites to set up similar community-based self-help groups, called "Cassava Development Villages". To be eligible for government support, each group needed to have at least 30 members, to elect five officers among themselves, and to write the by-laws of the organization, detailing the rights and responsibilities of officers and members, frequency of meetings and membership fees. Once established, each group received from the government about 2½ bags of fertilizers for each member, sufficient for fertilizing 0.8 ha of cassava. Each member received these fertilizers free of charge, as well as planting material of vetiver grass, and new cassava varieties or other selected crop or animal species. Each member has to repay at time of harvest the cost of the received fertilizer plus a small interest to the group, which can then use the money as a revolving fund, from which members can borrow in case of personal emergencies or for purchase of production inputs.

Results

After nearly 2 years, most of these Cassava Development Villages are operating very successfully. After the first year's harvest, most farmers were able to return the money of the "borrowed" fertilizers, and were thus able to "borrow" more fertilizers for the next crop. The timely availability of fertilizers at a reasonable price was considered as a very important reason for farmers to join this group. The resulting increased yields obtained, together with a relatively good price for cassava roots this year, have considerably improved farmers income from cassava. In addition, working together, farmers have markedly expanded the vetiver grass hedgerows to control erosion in their fields (see Table 13, Activity 1.3.5.); they are also continuing to experiment with application of organic manures and the planting of green manures. At one site, farmers used their revolving fund to buy four head of cattle, which were allocated to four

members. The original farmers keep the offspring of these cows, while the mother cows are then allocated to other members. The village herd has now increased to about eight head. It is a practical way of diversifying from cassava production into other enterprises that can supplement the household income. Enabling and empowering the community to do so is of primary importance.

Contributor: R Howeler

3.5. Promote and support inter-institutional processes and plans for sustainable rural development

3.5.1 Facilitate the execution of action plans of the MIS Consortium

Introduction and Overview

The MIS Consortium was created at a workshop in Honduras, 11-12 August 1999, to focus efforts in the hillsides of Central America, a recognized hotspot for poverty and environmental degradation. Seven NARS from Honduras, six from Nicaragua, and four advanced research organizations (AROs) participated at the launching of the consortium. The same institutions met again in January 2000 to review progress and develop the consortium's work program and logframe. Since then, the group has met twice to develop proposals around the themes of the consortium.

Objective

To develop, adapt, and disseminate improved options for the sustainable management of fragile soils in the Central American region.

Rationale

Hillsides comprise over 87% of the cultivated land in Honduras and 40% in Nicaragua, where ecological vulnerability to erosion, nutrient depletion, and other degrading processes are high. In addition, it is estimated that the population of these areas will double in 35 years and that there are already 63 million hectares of degraded land in the region. Thus, there is an urgent need to stabilize the environment and increase productivity in order to meet burgeoning demands.

Results

We give here brief highlights of progress, using the outputs of the Soil Water and Nutrient Management (SWNM) Program logframe.

Output 1. Decision support tools for improved SWNM developed and evaluated in different agro-ecological zones:

- Nutrient constraints were identified using the nutrient strip methodology.
- Trained partners in Central America and Africa developed action plans for the use of the soil quality indicators guide.

- A spatially linked soil database was developed for Honduras in order to assist decision makers in identifying resource problems and target solutions.

Output 2. Improved technologies for increased production based on efficient use of water and nutrients adapted and applied by land users:
- Reference sites were characterized to assess the impact of traditional and improved practices.

Output 3. Impacts of improved practices on production, the environment and socioeconomic conditions assessed:
- The profitability of soil conservation practices in Honduras was documented.
- The MSEC decision support system to evaluate the economic impact of soil conservation was tested at field level in Nicaragua.

Output 4. An improved information and communication exchange framework established and materials produced for stakeholders:
- Partners visited the reference sites

Output 5. Stakeholders' capacity for better SWNM enhanced:
- One MIS partner trained by MSEC on the use of the PCARES model to simulate soil losses at the watershed level.

Output 6. Efficient program management, communication, monitoring and evaluation:
- Two members of the Executive Committee of MIS attended the SWNM steering committee meeting and the Integrated Natural Resource Management (INRM) meeting of the CGIAR in Cali, Colombia.
- MIS members developed 11 joint proposals at the last planning meeting in Estelí, Nicaragua.

Contributor: M Ayarza

Output 4. Decision makers supported

4.1. Identify, at different levels, decision makers related with project tasks and diagnose their needs

See under 5.2.1. Workshops and meetings.

4.2. Support decision taking at different levels using the information, and methodological tools generated by the project

Nicaragua. CIAT-Nicaragua given recognition by MAGFOR for its technical and economic support in the elaboration of the Rural Atlas of Nicaragua awarded in August 2002. See under Activity 2.3.2.

Honduras. Validation was made of the Guide on Small Seed Enterprise Development (SEED). This year, the C&W provided support for the work of Guillermo Giraldo in Honduras. Fourteen participants attended a workshop in which the Guide was submitted for evaluation and adjustment. Participants made many good suggestions that were incorporated into the text. This material will be used in its final version in Haiti, during the training events that are part of the C&W strategy for that country, as previously described. Capacity development is again the core of this activity. G Giraldo has accompanied small seed enterprise promoters in Honduras in a facilitating process that brings to these promoters new tools and new strategies for the establishment and management of small seed enterprises.

CIAT Headquarters. New versions of the Guides were proposed and are underway. A few CIAT Board Members (C. Girard, G. Pantin, and J. Jones) in their report on a visit to Honduras indicated that *"the various information technology tools, such as atlases and decision support tools, provide one good mechanism for significant, tangible deliverables from the project, and these have strategic importance...."* This year, the SDC requested the C&W to present a proposal to disseminate the decision support tools. A proposal was formulated and approved to adapt five of the former Guides to software designed by the UBC. This new product will be in the hands of several large Honduran and Nicaraguan NGOs and universities that are interested in using the tools, and training their personnel in the use of the methodologies thereby presented. This is again a capacity development tool that will help institutions better fulfill their respective missions in regard to NRM.

An expert from UBC (Dr Sandra Brown) has given training to the Project in the use of the software. A content analysis is being made with several of the original authors of the Guides so that the material fits the technical requirements of the ToolBook program.

4.3. Strengthen capacity for management and use of information, tools, and methods (train, diffuse, and follow up the process)

4.3.1. Appointment to the Red de Organismos de Cuenca (RENOC) Executive Committee

This year, the C&W was appointed by RENOC to their Executive Committee. This is made up from eight institutions: POSAF-MARENA, UNA- Facultad de Recursos Naturales (FARENA), INTA, Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)- Fortalecimiento de la capacidad local en manejo de cuencas y prevención de desastres natures (FOCUENCAS), Catholic Relief Service (CRS), MARENA, and Centro para la Investigación en Recursos Acuáticos (CIRA)- UNAN.

4.3.2. Workshops

Bolivia. A planning workshop and visit was carried out at the end of 2001 with seven Bolivian GOs and NGOs. During visits to institutions and their work scenarios, it was possible to understand the areas and topics of collaboration among national institutions and the role of CGIAR centers in capacity development.

The workshop dedicated time to collectively formulate a synthesis of collaboration areas that could become an input for the preparation of a proposal for inter-institutional cooperation. The final synthesis comprised (a) demands of participating institutions' clients regarding agricultural production and NRM, (b) other demands from clients that did not fall within that area (i.e., institutional capacity development), and (c) demands in terms of institutional strengthening needs for which "we" require support from other institutions. Once demands were expressed, participants dedicated time to identify technologies and methodologies they could offer to their colleagues to respond to the expressed needs. Finally, participants gave their ideas regarding the methods and strategies to follow to make inter-institutional cooperation a reality.

Honduras. The newly appointed Minister of Agriculture answered a call from the C&W to discuss areas and topics for future collaboration with CIAT. He was very much open to providing support to initiatives that CIAT could arrange with the Programa Nacional de Desarrollo Sostenible (PRONADERS) or any other NRM program. A letter from D Pachico on behalf of CIAT was presented to the Minister. After the meeting, a report on the possible areas of collaboration and mechanisms to carry inter-institutional cooperation was elaborated and presented to interested parties in CIAT.

Haiti. A planning workshop was prepared and coordinated. It counted on the participation of CIAT's project leaders working in the HAP Project, local professional staff appointed to work in the HAP Project, and representatives of DAI. This workshop was a true collaborative multi-stakeholder event that provided a series of results for the improvement of the HAP Project.

The C&W, as well as the other CIAT and CIMMYT participants, was able to identify the expected results. The C&W team, working with workshop participants, proposed to obtain the following outputs:

(1) Institutional capacity developed for adaptive on-farm trials, and the establishment of SOLs with local partners;
(2) Local capacity enhanced through training and technical assistance activities;
(3) Strengthening local farmers' organizations in their operational capacity;
(4) Agricultural innovations implemented and appropriated by local organizations;
(5) SOL established with operational capability to run trials, evaluations, and to disseminate knowledge and respond to other information demands; and
(6) Small artisanal seed enterprises established.

An important result of this workshop was the preparation of an integrated chronogram, which shows all activities of all CIAT partners, that is useful in the coordination of simultaneous activities. Activities have been carried out as planned. In Part 3, more space is dedicated to the Haitian scenario.

Mexico. A workshop was held on the use of the Logical Framework. The C&W considered important the participation of one of its members in this facilitation process, requested by the Director General of Mexican Forest, Agriculture, and Livestock Research Institute (INIFAP, the Spanish acronym). Besides helping the researchers of 14 national agricultural research centers to use the Logframe, the visit would be an opportunity to link with INIFAP with regard to NRM

initiatives. A result of this visit was the preparation of an itinerant workshop for the visit of INIFAP researchers to Honduras and Nicaragua.

The workshop accomplished its objectives. Many of the participants reported a successful dissemination of the proposed methodology. The Project formulated a proposal for a visit and workshop to Honduras and Nicaragua, which was submitted to INIFAP with the previous revision by the Central America Coordinator and the Liaison Officer in Nicaragua. Months later, INIFAP announced a visit of its directors to Honduras to observe the research and development activities taking place in Yorito. This visit will be an opportunity to further develop relationships with one of the strongest NARs in Latin America, for scaling our research and development strategies.

Nicaragua. Three workshops were given for the Empresa Nicaragüense de Acueductos y Alcantarillados (ENACAL), the Nicaraguan water authority in charge of planning and supervising the aqueducts and swish systems in the country. The CIAT-Nicaragua office made an agreement with UNICEF to prepare 40 of ENACAL's staff in the use of four guides, which were considered to be useful in enhancing the work being done in the country. Capacity development in this case has a good argument. The four tools on which training was delivered were (a) Poverty Profiles, (b) Participatory Mapping, (c) Stakeholder Analysis, and (d) Organizational Processes. After a previous revision of all decision support instruments, ENACAL's officials elaborated the following needs assessment: *"the organizational processes tool will help us in the promotion and organization of Water Committees, which are now weak; the participatory mapping tool will help our stakeholders understand the status in which water and other natural resources are and to define action towards their conservation and rational use; the stakeholder analysis will help us and the communities identify and understand sources of conflict in the use of natural resources and the poverty profiles will help us adjust the tariffs according to the different groups that constitute our communities..."*

UNICEF has enthusiastically promised economic support to some of the eight Action Plans that were prepared as a result of the training received by the participants who come from 15 different institutions that work in Juigalpa, Matagalpa, and Estelí, three of the localities with greater water delivery problems in the country. It is also worth noting that the three workshops were delivered with the participation of the Nicaraguan trainers' team.

Asia. Since November 2001 (last reporting), the FLSP has provided substantial ongoing training support for project staff. This has included formal training events (Table 27) and continuous on-the-job learning opportunities linked with farm visits, field days, and regular project meetings.

Table 27. Formal training events organized for Forages and Livestock Systems Project (FLSP) staff, 2001-02.

Training event	Timing	Location[a]	No. of participants
Monitoring and evaluation and animal health issues in Lao PDR	13-14 Nov 2001	FLSP Office, Luang Phabang	27
Focus-group and village feedback	11-14 Dec 2001	FLSP Office, Luang Phabang	16
Extension administration	11-14 Jan 2002	FLSP Office, Luang Phabang	12
Participatory diagnosis	15-21 Feb 2002	FLSP Office, Xieng Khouang	13
	26 Feb-03 Mar 2002	FLSP Office, Luang Phabang	14
Participatory approaches	4-22 Mar 2002	IRRI Los Baños, Philippines	1
Forage technologies, animal health strategies, gender and equity issues, and environmental impact training	1-6 Apr 2002	Livestock Research Centre, Nam Suang	39
Lucerne management and utilization in smallholder farming systems	21 Apr-6 May 2002	SARDI, Adelaide, South Australia	1
Database design	20-28 May 2002	CIAT office, Vientiane	3
Extension administration	04 June 2002	FLSP Office, Luang Phabang	12
Cassava agronomy and management	Aug 2002	Rayong Research Station, Thailand	1
Animal health and forage management	29 Aug-4 Sept 2002	FLSP Office, Xieng Khouang	26

a. IRRI = International Rice Research Institute, Philippines; SARDI = South Australian Research and Development Institute.

4.4. Provide technical support for decision taking

4.4.1. Technical support given in Colombia and Africa

Colombia

The staff of the Corporación Colombiano de Investigación Agropecuaria (CORPOICA) "Project Guaitara" in Nariño received technical support from C&W for the application of several instruments that would provide inputs to the project to arrest degradation of soils in seven municipalities of this state. Trainers trained by the Project provided support. CORPOICA requested continuous support from the C&W, but we did not have the necessary resources to respond to this request.

Africa

Building on this year's visit of the Directors of National Agricultural Research Centers (Malawi, Uganda) to CIAT, and in collaboration with Ugandan, Malawian, and Mozambican agricultural research and development institutions, CIAT called on a group of partners and donors to carry out a needs' assessment exercise geared to identify common grounds for collaborative work. A draft concept note was previously discussed with several African National Agricultural Research Organizations (NAROs) under the name of "*Investment in Rural Innovation and Enterprise Development to Build New Livelihood Opportunities*" (Kirkby et al., 2001)[12]. This concept note

[12] Kirkby, R. and others. 2001. Investment in rural innovation and enterprise development to build new livelihood opportunities for the poor in competitive, high-value, ecological agriculture. Draft proposal. CIAT, Cali, CO.

showed the need for a needs' assessment that would give direction to a *program* geared to build national capacities to improve land management, productivity, and income for poor farming communities by bringing together many elements at the level of farmers as decision makers.

As a result of this activity, the rural innovation proposal was sharpened for its presentation to United States Agency for International Development (USAID) officials.

Leading this activity helped CIAT staff to become acquainted with the plans, programs, projects, and organizational structure of the partnering NAROs and extension organisms, to better focus CIAT's collaboration. It was also possible to define areas of convergence between CIAT's research agenda and the agendas of NAROs and extension organisms. Inputs were also provided for the design of a collaborative project between CIAT and African institutions. The present activities carried out in the areas of agro-enterprises, participatory research, and soils capitalized on the information derived from these workshops.

4.4.2. Data supplied to farmers for decision taking in Vietnam and Thailand 104/45

Rationale

Farmers make decisions about the choice of crops or animals and the type of production practices to be employed mainly on the basis of their income generating capacity. To make the right decisions, it is extremely important to supply farmers with correct data on gross income, production costs, and net income for each new practice, combination of practices, or cropping system. According to the latest estimates, in all FPR pilot sites combined in Vietnam, various new cassava production technologies have been adapted by 4812 farm households, covering an area of 1411 ha, and resulting in increases in income of US$274,400 in 2002.

Materials and Methods

At time of harvest of the FPR trials in a particular village or area, both participating and non-participating farmers, including from neighboring communities, are invited for a field day. Cassava plants from the center of each plot are harvested and weighed early in the morning so that the visiting farmers can see the piles of harvested roots as well as the calculated yield of cassava and intercrops or the weight of eroded sediments displayed on signs in each treatment. Farmers copy this information on previously handed-out forms and note their own observations or evaluation of each treatment. Afterwards, usually after a joint lunch in the village, the average data of each type of trial are presented to the meeting, including the most accurate values for gross income (using current prices of crops), production costs, and net income. Finally, the assembled farmers vote by raising their hands to indicate their preferences for each treatment.

Results

Tables 4, 8, and 9 of Activity 1.3.4., Tables 11 and 12 of Activity 1.3.5., and Table 28 show examples of calculations of gross and net income, while Tables 8 and 9 of Activity 1.3.4. also indicate the farmers' preferences. Once farmers start adopting certain varieties or production practices on larger areas of their fields, data on the performance of each variety or practice are

again collected for each farmer. Table 28 shows the results of the performance and dissemination of some of these technologies in six FPR pilot sites in Pho Yen district of Thai Nguyen province in north Vietnam. It shows that 273 farmers are now planting new varieties in 8.12 ha, providing an additional income of about 18 million dong. Similarly, in three of the six communes, 73 farmers are now intercropping cassava with peanut in 5.54 ha, which produces an additional income of about 20.4 million dong compared with monocropping. Using similar calculations for all technologies adopted by farmers in all sites in Vietnam, the total additional income from the adoption of new cassava technologies was estimated at 4116 million dong or US$274,400 (Table 35 of Activity 5.5.3.). Almost 5000 farmers had adopted one or more technology components in about 1411 ha. Thus, while the total area in Vietnam is relatively small, many households are benefiting from the new technologies. In Thailand, on the other hand, some of the new technologies have been adopted in only four sites in 1573 ha, but this has benefited probably less than 300 farmers in those four sites. No numbers are available for all sites in Thailand, but Table 29 indicates that at least 865 farmers have adopted the planting of vetiver grass hedgerows on their cassava fields, while it is very likely they also adopted new varieties and improved fertilization practices.

Table 28. Extent of the dissemination of new cassava varieties and intercropping with peanut in six communes of Pho Yen district, Thai Nguyen province, Vietnam in 2001-02, and their effect on gross and net income.

Varieties	No. of farmers	Area (ha)	Yield (t ha^{-1})		Gross income	Production costs ('000 t ha^{-1})	Net income	Increase in net income (mil. dong)
			Cassava	Peanut				
New varieties[a]:								
KM 60	3	0.11	25.92	-	12 960	3864	9 096	
KM 94	9	0.08	23.89	-	11 945	3864	8 081	
KM 95-3	118	3.74	27.98	-	13 990	3864	10 126	
KM 98-7	143	4.19	31.22	-	15 610	3864	11 746	
Vinh Phu (local)	154	8.54	22.82	-	11 410	3864	7 546	
Total new varieties	273	8.12	27.25		13 626	3864	9 762	17.994
Intercropping with peanut[b]:								
Cassava monoculture	111	4.38	21.46	-	10 730	3864	6 866	
C+peanut	73	5.54	24.44	0.70	15 720	5164	10 556	20.443

a. Average of six communes.
b. Average of three communes.

During one PM&E exercise, farmers in Thaa Chiwit Mai in Chachoengsao province were asked whether the project had improved their incomes and their standard of living. Most replied that it had. Although this village is not particularly rich, all farmers do have motorcycles and color TV, while about 50% have washing machines and mobile phones. It is most likely that the project has contributed to a significant improvement in their living standards over the past 4 years.

Table 29. Location of farmer participatory research (FPR) pilot sites in Thailand in 2002, and the adoption of vetiver grass for erosion control in those sites.

FPR pilot sites[a]				Adoption of erosion control practices			
Province	District	Subdistrict	Village	No. of farmers	Cassava area with vetiver (ha)	Vetiver (no. of plants)	Vetiver hedgerows (km)
Nakhon Ratchasima	Daan Khun Thot	Baan Kaw	Khut Dook	53	49.4	130,000	15.0
	Thephaarak	Bueng Prue	3 and 6	26	34.2	80,000	11.0
	Soeng Saang	Noon Sombuun	Sapphong Phoot	62	132.5	80,000	20.0
		Sratakhian	Sratakhian	0	4.8	20,000	2.0
	Khonburi	Tabaekbaan	Nong Phak Rai*	27	24.0	50,000	5.0
Prachinburi	Naadii	Kaeng Dinso	Aang Thong Khao Khaat	34	27.2	60,000	4.5
Kalasin	Mueang	Phuu Po	Noon Sawan	61	49.0	85,500	8.6
		Khamin	Khamplaafaa				
	Nongkungsri	Nong Bua	Khamsri	67	110.4	111,600	11.2
	Sahatsakhan	Noonburi	Noon Sawaat	63	59.2	86,170	8.6
		Noon Namkliang	Huay Suea Ten Paa Kluay	47	40.6	128,330	12.8
	Naamon	Naamon	Noon Thiang*	50	24.0	16,000	1.6
	Don Chaan	Dong Phayung	Noon Kokchik*	50	24.0	16,000	1.6
	Huay Phueng	Nikhom	Huay Faa*	50	24.0	16,000	1.6
Chachoengsao	Sanaam Chaikhet	Thung Phrayaa	Thaa Chiwit Mai	32	10.4	50,000	2.0
	Thaa Takiab	Khlong Takraw	Nong Yai	42	27.2	100,000	5.3
Kamphaengphet	Khanuwaralakburii	Bo Tham	Siiyaek TonThoo	42	27.2	68,000	3.0
Chaiyapuum	Thep Sathit	Naayaang Klak	Khook Anu	42	27.2	68,000	4.0
Kaanchanaburi	Law Khwan	Thung Krabam	Nong Kae	42	27.2	80,000	3.0
Srakaew	Wang Sombuun	Wang Sombuun	Baan Khlong Ruam	75	220.8	90,000	9.0
Total: 8	17	20	24	>865	943.3	1,335,600	129.8

a. *, initiated in 2002.

Contributor: R Howeler

Output 5. Efficient, participatory project management

5.1. Foster the active participation of partners in the planning of project activities in the region

This is an ongoing activity and is manifest in the many meetings with partners for joint planning of activities (see under 5.2.1. below).

5.2. Actively and permanently coordinate the reference sites, projects, and individuals working in the region

5.2.1. Workshops and meetings

During the year, workshops and meetings were held for exchange of information, planning, and training purposes. Table 30 shows those that took place in Honduras and Table 31 in Nicaragua.

Table 30. Workshops and meetings organized by CIAT from September 2001 to August 2002, Honduras[a].

Event	Organizers	Date	Participating institutions	No. of participants		Results
				Producers	Technicians	
Three field tours of trials LIM-1, Luquigue, Mina Honda, Guaco	L Brizuela, G Palma, M Pineda	31 Aug 2001 6 Sept 2001 7 Sept 2001	None	28	2	Opinions of producers on the trial treatment and list of terminology used
Coordination of PRM and Head of National Maize Program	L Brizuela, M Palma	Sept 2001	DICTA, PRM	-	3	Coordination
Three Technical Committee Meetings of the Network of SOL sites	L Brizuela	27 Sept 2001	IPCA, SERTEDESO	-	8	Work plan elaborated and coordinated, and joint activities planned
Workshop of presentation of results at technician level	L Brizuela, G Palma	29-30 Mar 2001	IPCA-EAP, SERTEDESO, Institutes of San Juan de Sula, José Antonio Ochoa, San Pedro, PDA-Yoro, PDA-Jocón, ESA consultants, FUNDER, PRR, Biodiversa, IPCA-Zamorano	13	27	Presentation of results of trials established in Spring and second season, 2001
Sweet potato tasting in the Luquigüe community	G Palma, M Pineda, H Cruz	13 March 2002	None	20	3	The variety Cetis 78-32B chosen
Workshop of presentation of results in forages and Meeting of Technical Committee in Costa Rica	M Peters P Argel	1 April 2002	SERTEDESO, MAG, INTA	-	15	An evaluation was made of the project activities 2001-2002
Soils Fair	M Trejo, L Brizuela, G Palma	8 June 2002	Institutes of San Pedro and José Antonio Ochoa	45	8	Producers, students, and technicians familiarized with indicators of soil quality
Workshop to complete and elaborate proposals of the MBC	MC Roa	15 July 2002	CARE, CATIE, CIPAV	-	18	Second draft of proposal completed
Tour of reference site with professors of UCN, UNR	M Trejo, L Brizuela	3, 4 Aug 2002	None	-	5	Interchange of information

a. For acronyms and abbreviations used, see page 190.

Table 31. Workshops and meetings organized by CIAT from September 2001 to August 2002, Nicaragua[a].

Event	Organizers	Date	Participating institutions	No. of participants	Results
Field day to evaluate maize varieties	PROMESA, CIAT	28 Sept 2001	PROMESA, PRODESSA, ADDAC, CIALs	90	• Evaluation and selection by producers of nine maize varieties in the SOL
Training workshop in Honduras on participative monitoring and evaluation	CIAT	1-5 Oct 2001	IPCA, CLODEST	20	• Training in participative monitoring and evaluation
Workshop on methodological instruments for NRM – Diploma UNN Jinotega	UNN	9 Feb 2002	UNN	23	• Training of diploma students in methodological instruments for NRM
Workshop of presentation of SOL results	CIAT and partners	20 Feb 2002	INTA, ADDAC, PCAC, CIALs, ACV	23	• Present research results of the SOL-2001
Workshop of scenarios with ETHZ	ETHZ, CIAT, UNA	12-15 Feb 2002	UNA, INTA, ADDAC, Swiss Embassy	10	• Learning of methodology for development of scenarios in rural areas • Proposals of development scenarios for San Dionisio in 5 years
Annual MIS meeting	MIS, CIAT	19-22 Feb 2002	UNA, SERTEDESO, FAO-Lempira Sur, ESNACIFOR, INTA	30	• Presentation of work done in 2001 • Approval of proposals for 2002
Annual PCCMCA meeting	IDIAF	14-20 Mar 2002	Country reps from Cuba, Puerto Rico, Mexico, Guatemala, Dominican Rep., Honduras, Nicaragua, Costa Rica, Panama, Haiti, CATIE, PODAR	200	• Focus of the meeting on themes of agricultural technology for competitivity in agro-food chain • Prize for best work in natural resources to "Mapping, analysis, and monitoring of NRM" tool • Recognition of the work "SOL – an alternative concept for germplasm flow in crops, with emphasis on participative selection and evaluation"
Partenariado Meeting	SDC	15 Mar 2002	AGUASAN, MIP-Zamorano, C&W	4	• Definition of themes for work on partenariado: (a) criteria for selecting partners, (b) quality of relations with partners, (c) lessons learned • Strengths and weaknesses of the partenariado in SDC

Continued.

Table 31. Workshops and meetings organized by CIAT from September 2001 to August 2002, Nicaragua[a]. (Continued.)

Event	Organizers	Date	Participating institutions	No. of participants	Results
Workshop to organize the National Network of Hydrographic Watersheds	UNA, INTA, POSAF-MARENA, CIAT, CATIE-FOCUENCAS, CRS	21 Mar 2002	16 institutions working with focus on watersheds	36 technicians and professionals	• Consensus on the Network objectives • Definition of priority actions for 2002 and the LTP to 2006
Meeting of the Committee for Municipal Development	Mayor's Office	3 Apr 2002	Mayor's Office, C&W, ODESAR, PCAC, local organizations	30	• Forming of the CDM, where it will participate as member of the Campos Verdes Association • An integral operative plan elaborated for the municipality; CIAT will support this measure • Socialization of information
Soils Fair	UNA, CIAT	6 Apr 2002	UNA, UNAN, producers	130	• Share training with producers on aspects of soil and presentation of results of trials of limiting nutrients
Planning Workshop of research activities of SOL 2002	CIAT and partners	25 Apr 2002	INTA, ADDAC, PCAC, CIALs, ACV	20	• Plan research activities for 2002
Presentation of PES	PROMESSA	21 May 2002	INTA, PROMESA, MAGFOR	12	• Presentation of the PES experience in Honduras • Revision of the law on certification of seed and authorized seed. Suitable seed will be eliminated.
Meeting on strategic alliance CIAT-INTA	INTA	24 May 2002	2	12	• Definition of some lines for future meeting between partners of CGIAR and INTA • Elaboration of a model of collaboration between INTA-CGIAR and other partners • Identification of strengths, weaknesses, and some recommendations for future meeting
Training workshop on methodological instruments for NRM (Juigalpa, Matagalpa, Estelí)	UNICEF-ENACAL, CIAT	June 2002	Technicians of ENACAL	45	• Elaboration of action plans for ENACAL technicians to be incorporated in 2003 • UNICEF interest in financing work on indicators of water quality • 45 technicians trained in INRM

Continued.

Table 31. Workshops and meetings organized by CIAT from September 2001 to August 2002, Nicaragua[a]. (Continued.)

Event	Organizers	Date	Participating institutions	No. of participants	Results
PASOLAC evaluation workshop	PASOLAC	13 June 2002	PASOLAC organizations	30	• Knowledge of work done during the year by PASOLAC organizations
Course-Workshop of socioeconomic evaluation of environmental services	National university of Costa Rica and Rafael Landívar University of Guatemala	17-21 June 2002	Institutions and organizations of Central America	28	• Knowledge and practice of the methodologies of evaluating environmental services • Interchange of experiences and expert knowledge for research consultancies • Wide documentation on the theme
Workshop of partial research results in San Dionisio of representatives of ETHZ (San Dionisio and Managua)	ETHZ	16-17 July 2002	UNA San Dionisio, local organizations and institutions	Managua 15 San Dionisio 40	• Maps of infrastructure and soil use for seven communities of San Dionisio that make up the study. These were given to the local communities and organizations, including the Mayor's Office.
Presentation of summary of methods of economic evaluation of environmental services	MIS-CIAT	26 July 2002	UNA, PASOLAC, Network of watersheds	15	• Knowledge of methodologies and discussion of scenarios for application
Presentation forum and MIS discussion	MIS, CIAT, UNA	12 Aug 2002	National institutions and organizations, donor agencies	45	• Presentation of 2001 results • Strategy for financing MIS projects
Socialization of Rural Atlas of Nicaragua	MAGFOR, INEC, INETER, MARENA, CIAT	29 Aug 2002	Cooperation agencies, GOs, NGOs	130	• Official presentation of Rural Atlas of Nicaragua • Distribution of 120 CD-ROMs

a. For acronyms and abbreviations used, see page 190.

5.3. Maintain an efficient information system of the project with its partners

5.3.1. Workshops and Meetings attended

Table 32 shows the workshops and meetings attended during the year in Honduras as participants.

Table 32. Workshops and meetings attended as participants from September 2001 to August 2002, Honduras.

Workshop/ meeting	Place	Participating institutions	Purpose	Results	CIAT staff attending
Meeting (1) with the coordination of Project Land o Lake in Ceiba	La Ceiba	-	Initiate contact to establish an agreement between CIAT and Land o Lake	Contact made	H Cruz
Workshop (1) for the management and utilization of the NUMAS Program	Tegucigalpa	CIAT, CURLA, FHIA, SERTEDESO, UNA-Nicaragua	Familiarization with the management of the NUMAS Program	Draft of proposal for program validation	L Brizuela
Training (1) on monitoring and evaluation	Yorito	IPCA	To give information to the Youth CIALs	70%	Technicians, seven adult facilitators and practitioners
CLODEST Assembly (1)	Yorito	IICA/ Holland-Hillsides	Present strategic plan of the Network of SOL sites	Activities of the Network of SOL sites presented to the Operative Plan of CLODEST	L Brizuela
Meetings (4) of Board of Directors of CLODEST and REDOLYS	Yorito	None	Participate in the meeting of the Board of Directors to strengthen decision taking of both organizations	Work plans of the Network and CLODEST, and drafts of proposals were elaborated.	L Brizuela G Palma

a. For acronyms and abbreviations used, see page 190.

5.3.2. New Web site of Nippon Foundation Project

A new Web site was developed and opened to make information about the project widely accessible. The Web site can be accessed at www.ciat.cgiar.org/asia_cassava/index.htm

5.4. Strengthen joint work with other projects and organizations

5.4.1. Efficient Program management, communication, monitoring, and evaluation of MIS Consortium

Two MIS planning meetings were conducted in the period 2001-2002. They were carried out to review the progress of the consortium and elaborate operational plans. Table 33 shows the outcome of the last planning meeting in Estelí Nicaragua. Consortium members approved several collaborative proposals that were prepared. Results will be reported in 2003. Additional information about these meetings can be accessed through the Web page of the consortium.

Table 33. Proposals developed during the Program Planning Meeting of the Manejo Integrado de los Suelos de Centro América (MIS) Consortium in Estelí, Nicaragua[a].

Outputs	Proposal	Person responsible	Funding requested[a] (US$)
Output 1: Information about practices and policies for SWNM collected and available to stakeholders	Systematization of information and development of databases	A Schmidt (CIAT)	9 000
	Economic evaluation of soil erosion	ME Baltodano (CIAT) B Mendoza (UNA)	4 500
Output 2: Improved practices for sustainable management of SWNM	Development of a methodology for local soil classification	M Trejo (CIAT) I Rodriguez (UNA)	2 500
	Testing and calibration of indicators of soil degradation	J Herrick (USDA) E Amezquita (CIAT)	6 700
	Characterization of soil improvement under the Quesungual agroforestry system	L Welchez (PROLESUR) E Barrios (CIAT)	9 000
	Participatory evaluation of water quality	S San Martin (SERTEDESO)	6 500
	Validation of the NuMass expert system	J Smith (NCSU) M Ayarza (CIAT)	Funds from CRSP consortium
	Evaluation of the hydrologic performance of three watersheds in Honduras and Nicaragua	S Rivera (ESNACIFOR) L Caballero (EAP-Zamorano) M Somarriba (UNA)	15 000
Output 3: Improved practices disseminated	Visits to the Quezungual agroforestry system in Lempira	S San Martin (SERTEDESO) L Rodriguez (UNA)	1 500

a. For acronyms and abbreviations used, see page 190.

Two members of the Executive Committee participated in the SWNM meeting at CIAT in Colombia in 2001. They presented to other consortiums the MIS approaches for SWNM and participated in the discussion of the future of the SWNM Program.

As a part of the strategy for exchange of information among MIS partners, the consortium supported the visits of MIS members to the reference sites in the two countries. Thirty-five representatives from 10 institutions of MIS in Honduras visited the reference sites in Yorito, Lempira, and Calan during 2001. They were particularly interested in the SOL approach developed by CIAT in Yorito, the performance of the Quesungual agroforestry system in the Lempira site, and the sustainable forest management systems at the Calan site. They made plans for future visits with farmers.

5.5. Establish a participative system of monitoring and evaluation of the project to monitor its performance and feed back to planning

See also under Part Two for refocusing of the project and the new logframe.

5.5.1 Fully implement the FLSP Project's monitoring and evaluation strategy

The FLSP is implementing a practical framework for M&E to quantify both outputs and impacts, and to provide feedback into the development and extension process.

Materials and Methods

The M&E strategy of the FLSP was developed from 5 years' experience in trying to come up with an M&E process that was simple, that would capture innovative and unusual outcomes in the field, and that could be conducted by nonspecialists. The strategy, which has been documented elsewhere, is based on:

- Capturing outputs in the field through an annual adoption tree survey of all participating farmers;
- Monitoring the changes in these outputs through a bilingual database;
- Capturing and quantifying impacts in the field through a combination of informal observations, focus group meetings, and household case studies; and
- Comparing impacts at the end of the project with outputs from a baseline survey conducted in 2002.

This strategy is now fully functional within the project. In April 2002, a baseline survey was conducted using a "case-study" approach with 42 households in project villages. The objectives of the baseline study were to:

- Provide "baseline" information on individual household livelihoods based on a stratified sample. These households will provide examples of the diversity in livelihoods in villages engaged with the FLSP.
- Provide "baseline" data on labor requirements for managing and feeding animals, and productivity of important livestock types.
- Build the capacity of project staff to carry out interviews with individual households and analyze the results. These skills will be needed for future impact assessment.
- Improve the understanding of extension and project staff of the context of farm and livelihood systems in project villages.

- Explore the opportunities for using some of the interviewed households for case studies documenting the impact of project interventions.

Within districts, two villages were selected for the baseline study using the following criteria:

- Uptake of technologies offered by the FLSP has high potential, and
- That the selected villages cover the range of farming systems, ethnic groups, market access, and wealth status of all villages engaged with the FLSP.

Within villages, the selection of households was based on the guidelines that they needed to:

- Represent the range of livelihood systems and wealth of households participating in the FLSP; and
- Include households with good potential for uptake of the range of technologies offered by the FLSP, while not yet receiving substantial benefits from the technologies. Some of these households may be used for longitudinal case studies assessing impact of project interventions from initial testing to integration of technologies.

Results

Differences in farming and livelihood systems (and major problems encountered) between villages were much greater than the differences between households within villages. There were some indications that this may also be true for "knowledge" on issues such as animal health and management. Respondents in some villages seemed to have a good understanding of how diseases were transmitted, while respondents in other villages were very unclear about this issue.

A major difference between "poor" and "better-off" households seemed to be access to land resources, with poor households having smaller fields further away from the village. In several cases, poor households had less labor at their disposal. They also had fewer animals (often no large animals), which are a clear indication of cash reserves. Often, poorer households seemed to be young couples having recently started their own family, people who migrated to the village relatively recently, or single-parent households.

Although many Hmong farmers (particularly the men) spoke good conversational Lao, we quickly discovered that using Lao disadvantaged the second respondent (often the women) in the interview. Using Hmong as the interview language overcame this problem. In many cases, women sat a little further away from the group than did their husbands, showing that the man should be the main respondent. This was particularly noticeable in ethnic Hmong households. Participatory tools such as mapping and matrix weighting helped to overcome their reluctance to participate. Other effective ways of including women more strongly in the interview included (i) addressing some questions directly to the woman, and (ii) giving each of the two respondents half of the counters to be used in any weighting so both had to contribute equally to the weightings.

The results of the survey are currently being tabulated and analyzed.

5.5.2 Outcomes of a technical review of the FLSP Project

In August 2002, the Australian Agency for International Development (AusAID) sent one of its technical advisers to:

- Assess FLSP progress to date in relation to achievement or likely achievement of project objectives, in particular examining implementation issues, such as the lack of technical support for livestock disease problems and the problems achieving target staff numbers at province level.
- Identify problems and issues that either presently impact on FLSP implementation or are likely to do so in the future, and suggest cost-effective strategies to alleviate any negative impacts.
- Make recommendations as appropriate to enhance the quality of FLSP implementation in a manner that does not lead to significant project cost increases.

Dr Scoullar concluded, in summary, that:

- The innovations are appropriate. Agricultural productivity is increasing. Planting forages close to homes, thereby also increasing substantially the productivity of labor, reduces environmental pressure on the uplands.
- The program is farmer-led.
- The project is institutionalizing a participatory, facilitative extension strategy consistent with a farmer-led program, whilst ensuring and increasing the technical competence of staff.
- A sense of Lao ownership of the program is promoted at all levels.
- Food security is increasing.

To continue this process and to accelerate adoption, the project needs to:

- Increase outreach to rural women;
- Expand the extension strategy concept to an enlarged community-based group approach with selected farmers having a training role;
- Within this framework, increase the capacities of extension staff in on-farm analysis of options within smallholder farming systems;
- Give priority to the issue of nutrient recycling; and
- Implement the proposed strategy of disease minimization to meet farmers' needs for improved animal health.

He also added, that "having CIAT implement the project is better than a company because they have access to a wide range of technology. A company has only a narrow range of technologies to call on. CIAT has accessed extra-budgetary funding and technical assistance that have benefited the project's program."

5.5.3. Participatory monitoring and evaluation of the Nippon Foundation Project, Thailand and Vietnam

In order to assess the progress made so far and to evaluate the impact of the project up to this point, a PM&E exercise was conducted in four principal pilot sites in Thailand. In each village, about 30-40 farmers participated in brainstorming, using cards, or in evaluating certain technologies, using seeds of *Canavalia* to indicate their preferences. They also conducted a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis and a time-line to show changes over time in the adoption of new technologies. Table 13 of Activity 1.3.5. shows results, while Table 34 summarizes the current adoption of various technology components in these four sites in Thailand, and Table 35 in all sites in Vietnam.

Table 34. Extent of adoption[a] of various cassava technology components in four pilot sites in Thailand, 2002, as a result of the Nippon Foundation Project.

Technology component	Baan Khlong Ruam Sra Kaew		Thaa Chiwit Mai Chachoengsao		Sapphongphoot Nakhon Ratchasima		Huay Suea Ten Kalasin	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Varieties	480	100	469	100	396	100	228	100
Chemical fertilizers	480	100	469	100	364	92	180	79
Vetiver grass hedgerows	139	29	94	20	218	55	89	39
Green manures	72	15	0	0	0	0	114	50
Intercropping	0	0	0	0	0	0	0	0

a. Estimated by farmers in each site during participatory monitoring and evaluation in August 2002.

Table 35. Adoption of new technologies and the estimated increase in gross income of farmers in the farmer participatory research (FPR) pilot sites in Vietnam, 2002, as a result of the Nippon Foundation Project.

Technology component	No. of households	Area (ha)	Increase in income (million dong)
New varieties	2717	1244	3650.07
Intercropping	689	42	142.80
Erosion control	222	99	118.16
Balanced fertilization	157	26	57.42
Root and leaf silage for pig feeding	1027	-	147.54
Total	4812	1411	4115.99 (US$ 274,400)

5.6. Establish an efficient and participatory administrative system within the project

5.6.1. Identify new opportunities of financing the project activities, prepare research proposals, and carry out follow up to these initiatives: Nicaraguan activities

The objectives are to keep donor agencies informed of the project's activities and products, and Identify new financing opportunities for the project.

Potential donors were identified and approached for the project activities in the region. Table 36 summarizes the activities and results of follow up made to several agencies of cooperation.

Contributor: J Beltrán

Table 36. Plan of follow up to donors in Nicaragua (for acronyms and abbreviations, see page 190).

Institution	Contact persons	Date	Activity	Results
SIDA (Sweden)	Bjorn Frostell, representative for the environmental sector, Swedish Embassy	March 2002	Identify opportunities for CIAT	• Review, with the new representative, Cecilia Scharp, the new conceptual framework of C&W and the collaboration of SLU, SIDA, and IFS.
IFAD	Ladislao Rubio, Representative for Central America	May 2002	Identify opportunities for CIAT	• Contacts were initiated by E-mail from Rome
POSAF	Georgina Orozco, Mauricio Rodriguez	May 2002	Identify opportunities for CIAT	• Visits to the POSAF priority watersheds by CIAT-Nicaragua personnel • Elaboration of a project for up scaling in the POSAF regions
SDC	Jurg Benz, Regional Coordinator Liliana Ortega, Coordinator, Agricultural Program	June 2002	Meeting	• Approval of scaling up/out of existing materials/tools. Method of diffusion via tools book. • Explore institutional support of PRONADERS (Honduras) for methodological tools
DANIDA	Hans Henrik Saas, main technical advisor	June 2002	Visit with the CIAT Director General	• *Identify advances* made by the DANIDA-financed consultancy to the agricultural technology project for the general strategy on seeds
CIDA	Augusto Garcia Barea, CFLI Coordinator	June 2002	Identify opportunities for CIAT	• CIDA has a fund for local initiatives (possibility for Campos Verdes, CIALs). • CIDA has a bilateral program with the state for 2001-2006 (fight against poverty). • The new office director, Enrique Madreño, acquaintance of J Voss, arrives end of July.
DFID	Georgia Taylor, Representative for Central America	June 2002	Identify opportunities for CIAT	• Invited to present ideas to do with development processes and that may be of national interest • Visit San Dionisio and presented some processes on growth that favors the poor
NORAD	Alf Friiso, Second Secretary to Royal Embassy of Norway	August 2002	Delivery of draft of MBC proposal	• Delivery to and approval by Alf Friiso of the proposal to Evelyn Hoen • Delivery of proposal to Per Kristian Roer • Meeting with the new NORAD personnel, to give details of the proposal made by CARE, CATIE, CIPAV, and UBC
CARE	Felix Jimenez	February 2002	Identify opportunities for CIAT	• Elaborate a proposal for Agro-enterprises and begin execution • Elaborate proposals for forages, Seeds of Hope, and integrated management of watersheds

5.6.2 Identify new opportunities of financing the project activities, prepare research proposals, and carry out follow up to these initiatives: Honduras activities

Objective

To scale up CIAT's products and expertise through joint proposals with partners in the region.

Materials and Methods

One of the tasks for the regional coordination in Central America is the identification of funding opportunities to scale up CIAT research based on demands from partners in the region, and similarly, to develop strategic alliances with AROs to incorporate their knowledge into our work in the region. During the present year, several proposals were developed with different partners at different scales of action.

Four national and two regional proposals were developed for Honduras in collaboration with NARS, NGOs, and AROs.

Results

Cooperation with NARS and Development Agencies in Honduras
During last year, the CATIE-CIAT consortium assisted PRONADERS on the design of a US$80 million project to rehabilitate the watersheds most affected by Hurricane Mitch. Now, the project is ready to start. Along with PRONADERS, we have identified the main areas for CIAT's potential contribution in the project's implementation. These are to strengthen local capacity for NRM, develop sustainable production prototypes, and design local information centers. The work plan will be developed before the end of the year and resources assigned to CIAT accordingly.

More recently, the Secretary of Agriculture requested CIAT's help in developing a collaborative proposal to improve pasture systems in Honduras. P Argel (PE-5), G Giraldo and M Ayarza (PE-3), and C Burgos from DICTA developed the proposal. The Minister of Agriculture has already submitted the document to USDA for financial support (US$2 million).

Two other new initiatives of collaboration with the Ministry of Agriculture are underway: One is in the area of information systems and the other on cassava systems. Within the first initiative, CIAT will collaborate with the Infoagro Project to make available agricultural information to users. The second initiative is related to the development of a program to use cassava pellets for the poultry industry. This initiative will start with a visit from the CLAYUCA team to evaluate the technical and economical feasibility of this project.

One of the important spillovers left by the Seeds of Hope Project was the increasing interest among funding agencies about the benefits of improved seed to reduce poverty and improve the food security of small-scale farmers in hillsides. As a result of this, the European Economic Community (EEC) during the last 2 years funded a collaborative project between CIAT and FAO to strengthen the capacity of eight NGOs in Honduras to produce seed of improved varieties of

bean and maize for local markets. Because of the good results obtained during 2002-2003, this donor agency decided to approve two additional phases: One to help participating institutions to develop PES, and the other to improve commercialization channels for new products. CIAT has been invited to participate in the elaboration of the two initiatives. The total budget requested to support collaborative work between CIAT, FAO, MOVIMONDO (an NGO for international cooperation and solidarity), and six local NGOs is 1.4 million Euros.

Development of regional proposals

CIAT has been working actively with CATIE and CARE International in the preparation of two proposals:

(1) Multi-stakeholder participatory development of sustainable land use alternatives for degraded pasture lands in Central America, and
(2) Conservation, rehabilitation, and production in communities located in the non-protected areas of the Mesoamerican Biological Corridor (MBC).

The first proposal aims at the participatory evaluation and selection of improved pasture options to intensify animal production and validate improved land use systems to reverse pasture degradation problems. The work will be conducted in pilot areas in Honduras, Guatemala, and Nicaragua. CIAT will contribute with improve pasture germplasm and participatory methodologies to identify best options according to farmers' needs. In addition, the Tropical Soils Biology and Fertility Program (TSBF)-Latin America will contribute to the development of soil indicators to assess soil improvement. The proposal was submitted to NORAD for funding (US$5.76 million for 5 years). An official answer is expected before the end of the present year.

The proposal on the biological corridor has just been prepared with the participation of CATIE, CARE, and the Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuária (CIPAV). A draft of the proposal has been sent to NORAD and the Regional Coordination for the Mesoamerican Biological corridor. The process will continue with consultations with these two institutions in October and the elaboration of the final proposal for NORAD.

Cooperation with AROs

A joint collaboration started this year between the MIS Consortium and the Soil Science Department of North Carolina State University in order to validate the NuMass expert system. This system generates N, P, and lime recommendations for several crops. A planning workshop was carried out recently to identify main collaborative activities with universities and NGOs from the region. Several proposals were developed for funding through the Collaborative Research Support Project (CRSP).

Similarly, C&W is planning to start a collaborative project with Montana State University to validate the usefulness of trade-off analysis for hillside ecosystems in Honduras. This approach has been validated with success in Peru and Ecuador. The work will be conducted at the CIAT reference site in Honduras (Tascalapa watershed in Yorito). Activities will also be funded through the CRSP Project.

Cooperation with Challenge Programs

New efforts are in progress to connect the project research agenda with the Challenge Program on Water. Along with the International Water Management Institute (IWMI) and other partners in Africa and Asia, we are selecting "hot spot" areas where land degradation problems have been reversed. The objective of this effort is to identify the main driving forces that favored the change. Several case studies will be carried out for this purpose, and we expect that the Quesungual agroforestry system can be included in this study. CIAT and FAO are working together to characterize the environmental services provided by this system during the present year. The Comprehensive Assessment Program of IWMI will provide funds for the case study.

The project has also participated in developing the conceptual framework for the new Challenge Program on Water. As a result of its participation, CIAT was appointed to serve as the convening center for the working group on watershed management. The Ulua Basin in Honduras was proposed as the benchmark site for collaboration activities to be supported by this Program. The final decision will be taken next December. If our site is accepted, fresh funds will be available to C&W and partners in the region to tackle water problems in the proposed basin.

Conclusions

Overall, perspectives are good for funding up-scaling activities of the project in the region. If they are successful, it will be possible to achieve greater impact of the technologies developed by CIAT.

Contributors: M Ayarza; G Giraldo (consultant for C&W); P Argel (consultant for IP-5); C Burgos (DICTA); J Beer and M Ibrahim (CATIE); N Mills (CARE); J Smith (North Carolina State University); J Antle (Michigan State University, MSU)

5.7. Establish a system of efficient administration

Finances for the C&W have been well managed and are up to date. Part Two (Internal Organizational Aspects) gives more details of proposed changes in the system of administration, including the multi-tasking of administration staff for greater efficiency

PART TWO: THE NEW CONCEPTUAL FRAMEWORK

Justification

Introduction

Water is the unifying theme between communities and watersheds, people and land, and management and resources. Water is rapidly emerging as the critical resource that restricts development. Virtually no place on earth has optimum conditions that satisfy all desired uses and users. Because of its dynamic nature, water has to be managed differently than other resources, and watersheds are the most appropriate landscape unit in which to study the use and management of water. We examined the reasons why watersheds and the communities living within them constitute our unit of analysis and a basis for decision making. We highlight the importance of research on community management of watershed resources as a way to provide alternative solutions to the problems that are threatening the viability of an adequate water supply for human consumption and agriculture. Increasing demand, pollution, water shortages, inefficient use, inequitable access, and climate change are concerns for the future. Water stress and pollution are of great significance for the rural poor and their livelihoods. Land use in the uplands affects water near its source, and impacts upon communities and land uses downstream. Highland-lowland water conflicts are becoming common where the sustainability of lowland economies is dependent on upland water, and upland farmers are marginalized socially and economically. There is an urgent need to create greater awareness of water supplies and their uses, and of the ecological, social, and economic significance of water resources. Communities and watersheds are the key to understanding water supply and quality, and to resolving conflicts over water use allocation.

Watersheds are defined as areas of land bounded by topographic features that drain water to a shared destination such as lakes, streams, estuaries, and oceans. They capture precipitation, filter and store water, and determine its release. The inherent conditions (chemical, physical, and biological) and the human uses and management within a watershed determine the water quality and water flow conditions that are essential to the survival of the biota and the human race (Schreier et al., 2001)[13]. Watersheds are units of interaction between stakeholders where all land use activities have some impact on water, sediments, and biota. Watersheds as units of analysis facilitate the understanding of processes and interrelationships between components, which can be used as indicators of ecosystem health for a given set of land use activities.

Watersheds act as an integration tool for land-water interactions, natural processes at varying scales, and cumulative effects. Despite watersheds being biophysical units, social interactions occurring within and outside their boundaries can be analyzed and understood, and socioeconomic alternatives can be proposed to take advantage of the opportunities that their natural resources and biophysical characteristics offer. The differences between upper (hillside) and lower (valley) components of watersheds and their inhabitants (poor farmers in the upper parts and large-scale agricultural and urban water users in the valleys) represent a challenge in

[13] Schreier, H.; Brown, S.; Shrestha, P.B.; Merz, J. 2001. Jhikhu Khola watershed, Nepal. [CD-ROM] Institute for Resources and Environment, University of British Columbia, Vancouver, CA, USA. 1 CD.

terms of trade-off analysis and institutional participation for collective management of watershed resources. From the perspective of NRM, watersheds are advantageous over political units, in that political boundaries often divide watersheds, making priority management difficult.

Watershed Challenges

Upland watersheds and their stakeholders face problems and challenges that are unique and are determined by environmental conditions and social characteristics. Population pressure in many mountainous areas is growing and the growth rate is expected to increase in the next few decades (Templeton and Scherr, 1997)[14]. This trend implies that water and food requirements will increase, and therefore increase the pressure on watershed resources to provide them for urban and rural settlements.

Upper watersheds, like most mountainous areas, are characterized by ecological fragility, diversity, and high geomorphic energy; economically they are poorly accessible because of their slope, altitude, terrain, and natural hazards. Consequently, they suffer from political and economic marginality, giving their inhabitants little or no voice in regional or national affairs, and making access to external markets often available only on unequal and unfavorable terms. Population pressure in these areas can therefore lead to social and environmental degradation, because there is *little* room for livelihood improvement. Upper watersheds are net exporters of natural resources such as water, sediments, and environmental services (i.e., the improvement or maintenance of ecological characteristics that results from soil and water conserving land uses [Pattanayak and Kramer, 2001][15]). Hence they are inextricably linked to agricultural lands and cities in the valleys below. The management of upper watershed resources has a direct effect on living standards and food production downstream, making it necessary to integrate the diverse needs of upper and lower watershed stakeholders in analysis, trade-off negotiation, and decision making.

In addition to facing the purely environmental challenges posed by population pressure on fragile ecosystems, we need to work with local communities and institutions to produce viable alternatives that are beneficial for all stakeholders, and we need options that are applicable at different scales. Watersheds from 10-100 km^2 are best for management as causal relationships between land use and ecosystem health are difficult to determine in large river basins, and very small watersheds are inefficient management units. Resource surveys at 1:5 000 to 1:25 000 scale are necessary to collect sufficiently detailed information to determine land-water interactions, to link management to resources, and to inform decision making. Micro-watershed studies (1-10 km^2) can be effective to evaluate specific issues, to compare between micro-watersheds, and to scale out to similar sites in the larger watershed.

[14] Templeton, S.; Scherr, S. 1997. Population pressure and the microeconomy of land management in hills and mountains of developing countries. EPTD Discussion Paper No. 26. International Food Policy Research Institute, Washington, US.

[15] Pattanayak, S.; Kramer, R. 2001. Worth of watersheds: A producer surplus approach for valuing drought mitigation in Eastern Indonesia. Environ Develop Econ 6:123-146.

Research Opportunities

Community-based watershed management (CBWM), which addresses local natural resource priorities, requires sound scientific data, tools, and techniques to inform the watershed management process. An understanding of land-water interactions and how upstream land uses affect downstream areas is fundamental to sound watershed management. Hillside watershed environments are not viewed as "food baskets", but in terms of environmental niches, environmental services, and sustainable livelihoods. We use "sustainable livelihoods" to mean capabilities, assets (including both material and social resources), and activities required for a means of living that can recover from stresses and shocks, while not undermining the natural resource base (Scoones, 1998)[16]. Partnerships and stakeholder involvement in designing and implementing alternative solutions to environmental and socioeconomic challenges are vital to developing effective programs. Four unique aspects found in watersheds represent opportunities for research and development, and will frame the communities and watersheds research agenda.

1. Land-water interactions: Improved watershed management based on knowledge of land-water interactions. Human activities have a direct influence on the quality and quantity of surface water, ground water, and other natural resources in the watersheds. Quantifying the linkages between production systems, nutrient management, land use change, and water are a precursor to improving environmental management.

2. Highland-lowland interactions: Water resources are generated in upland watersheds, the "water towers" of the world. Improper management results in supply and pollution problems to both upper watershed environments and downstream users. Wealthier farmers in well-endowed valleys anticipate sufficient water quality and quantity for increased productivity, while poorer upland farmers often have limited economic opportunities. Highland – lowland interactions and trade-off analysis are key to conflict resolution and equitable resource allocation of water.

3. Environmental services: Provision of environmental services including water, biodiversity, and recreation. The innumerable microclimatic niches found in the tight ecosystems related to the variations in altitude, soils, and climatic conditions present an opportunity for both diversification of agriculture and preservation of natural ecosystems. To improve livelihoods and diversify agriculture for additional income in upper watersheds, good water supply and quality must be maintained. Appropriate forested buffer zones along water streams are essential. Existing natural and biodiverse tropical mountain forests in upper watersheds can fulfill this role while producing additional benefits from environmental and recreational services.

4. Community-based watershed management: Strengthened organizations. The complex interactions between upper watershed farmers, urban settlements, and lowland activities, established through the flow of natural resources and environmental services, demand the empowerment of local communities. Community participation at different scales through farmers' organizations, and their interaction with governmental and nongovernmental institutions requires the integration of diverse stakeholders and the strengthening of institutional capacity.

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[16] Scoones, I. 1998. Sustainable rural livelihoods: A framework for analysis. IDS Working Paper No. 72. Institute for Development Studies, GB.

The C&W seeks to cover research that offers alternative solutions to these environmental and socioeconomic challenges. To do this, we adopt complementary approaches (Schreier et al., 1997)[17]:

- Temporal – to assess resource status and dynamics in time;
- Spatial – to obtain georeferenced biophysical and socioeconomic information transferable to GIS;
- Interdisciplinary – to focus on problems or research questions as opposed to scientific disciplines (Figure 13); and
- Scale-nested – to consider ecosystem hierarchy (Izac and Sanchez, 2001)[18] from plot to watersheds reflecting the varying processes operating at different scales.

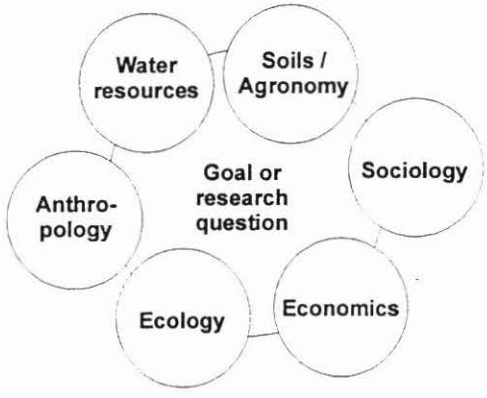

Figure 13. Interdisciplinary approach to community-based watershed management.

The project works on action research for development. We identify and actively participate in multi-stakeholder development processes, and relevant researchable issues within NRM. We examine upland and lowland watershed interactions, and concentrate on research relevant to the rural poor. It is commonly accepted that people living in hillside watersheds in developing countries have poor livelihoods. Although they possess a wealth of historical local knowledge, they have limited opportunities to express that knowledge, to link with external knowledge, and to enhance their capacity to manage their own resources in a sustainable manner.

Strategies

For effective implementation, the Project relies on a number of strategies aiming to make optimum use of scarce resources and take advantage of modern technological advances. Youth projects, GIS, modeling, capacity building, and strategic alliances are crosscutting with the four main research opportunities (land-water, highland-lowland, environmental services, and CBWM). Networks and multi-media platforms will be used to disseminate research information and to scale out regionally through watershed comparisons.

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[17] Schreier, H.; Hall, K.; Brown, S.; Tamagi, W. 1997. Integrated watershed management. [CD-ROM] Institute for Resources and Environment, University of British Columbia, Vancouver, CA. USA. 1 CD.

[18] Izac, A.M.; Sánchez, P. 2001. Towards a natural resource management paradigm for international agriculture: The example of agroforestry research. Agric Syst 69:5-25.

Age and social groups for participatory research: The project believes in the important role of youth in NRM. Youth are avid to learn, and desire to become useful and successful members of their communities. Participation in rural projects early in their education can help young people to build a future that does not rely on migrating to the cities. The adult population in poor rural settings is focused on the struggle to produce enough food for survival, and their time availability and wish to take risks in new endeavors are limited. Alternatively, the oldest members of communities who are no longer physically strong can provide a support network to youths, given their experience, desire to guarantee the future of their descendants, and that they are not part of the generational conflict that often exists between parents and their children.

Women and other marginalized groups are also key in social development, and we need to focus on their issues and the solutions they can directly offer. Participatory development without an explicit equity focus is often exclusionary. Examining variability and actively seeking to include marginalized stakeholders and inequity issues are critical. The project is already involved in projects with youth, women, and the rural poor.

Strategic alliances: Alliances are important to mutually capitalize between participating institutions in aspects such as expertise, increased interdisciplinarity, and capacity building. At present, we are working as part of strategic alliances with expert partners (see under Part 3, Strategic Alliances).

Geographic information systems: GIS are an essential component of the Project and are needed throughout our research framework in order to represent problems and activities in a geographic context. A temporal and spatial perspective, with local participation throughout the implementation of research activities, permits the assimilation and use of GIS by local communities and other stakeholders.

Models for dynamic trends and options: Open and simple models to simulate rates and trends, and to help identify options and opportunities for prevention and rehabilitation, are a time- and resource-saving mechanism. Models can be used and transferred to diverse stakeholders, provided their involvement occurs from the onset of the decision to use modeling for any given initiative.

Networks and multimedia platforms: Existing networks using simple multimedia platforms, such as the "Himalayan-Andean" initiative led by Hans Schreier and his team from the University of British Columbia in Canada, are well advanced in the exchange and extrapolation of results between watersheds in the Himalayas and the Andes. The common interest between their team and our group, that at present includes ongoing, shared projects, is to expand this initiative to a global one. To implement this further, a flexible and open exchange of information is a requisite. Diverse stakeholders need to comply with minimum datasets and indicators in order to have an organized system for easy consultation and a simple one from which to build. Stakeholders with similar interests can widen their knowledge without significant additional efforts and in return can benefit with information from other parts of the world. Additionally, we consider that all our research products have been supported with public funds and therefore they are of free public use.

Capacity building: Building social capital needs to be fully engaged into the interdisciplinary approach and to accompany the research for development process from its onset. Capacity building needs to be ongoing, responsive to local needs, useful to local participants and function with local, regional, and national organizations.

Best bets: To guarantee both short- and long-term sustainable impact, the Project engages in best bets where there are also clear funding opportunities. Amongst these best bets are those related to NRM solutions that could imply extra income generation, such as the production of high-value crops.

The Framework

We believe that our best research options to produce useful and generalizable outputs for communities and watersheds are those related to land-water interactions, highland-lowland interactions, environmental services, and CBWM. To develop alternative options to manage watershed resources through these four research topics, we need to establish a research framework for the context in which these options are being developed and where they will be used, in order to increase the chances of producing research results that are relevant and replicable. Figure 14 represents our research framework.

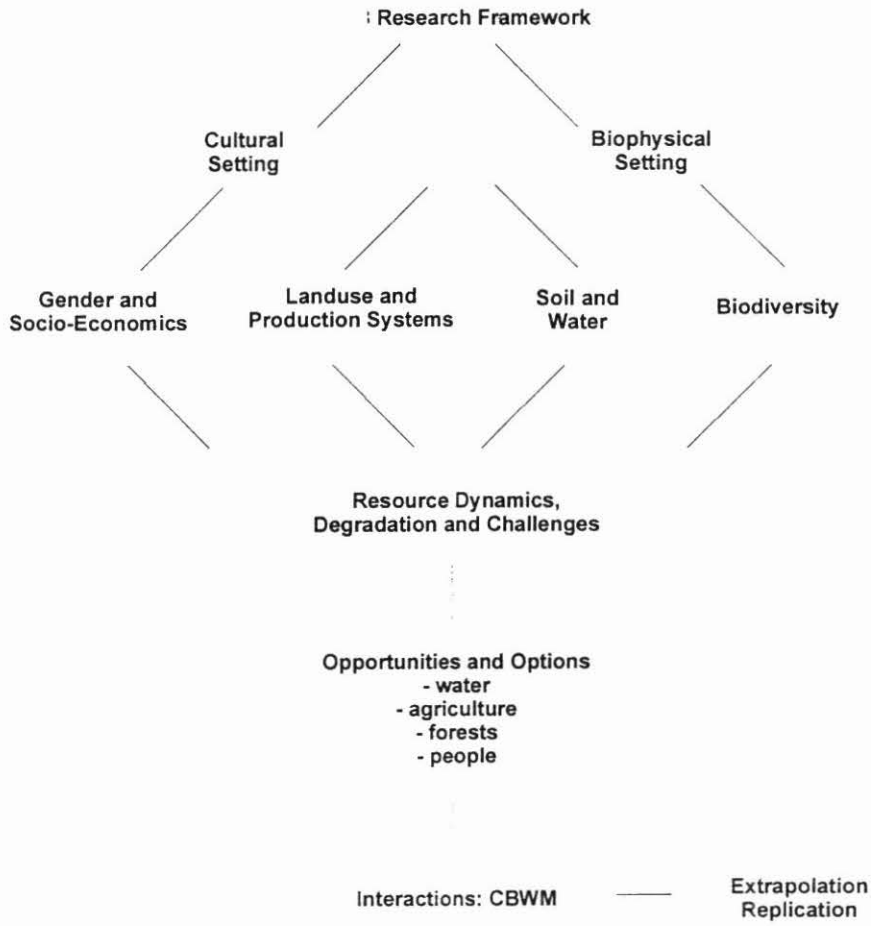

Figure 14. The Communities and Watersheds Project's research framework.

Alternative watershed management options need to consider the factors that influence their applicability. Cultural factors related to land ownership, gender, ethnicity, religion, local knowledge, or family structure can influence NRM and the replication of research results. Biophysical characteristics such as topography, climate, soil types, and geology are essential to understanding biophysical constraints, and potential management options. Research aiming at providing alternative solutions to watershed problems needs to be based on fundamental biophysical, social, and economic information. If conducted in a participatory fashion, baseline surveys can become an empowering methodology to create awareness of social and environmental conditions for communities.

A primary component of the diagnosis includes the current status of socioeconomic conditions, production activities, and environmental resources. With the use of socioeconomic surveys we can analyze population dynamics, land tenure structure, productive assets ownership, poverty indices, roles of social groups, production systems, the state of soils, water, and forests, local knowledge, and the ways in which people use and protect their resources. This diagnostic research component analyzes the current status of conditions that can be improved by interventions resulting from research activities.

The cultural and biophysical settings, and the current status of resources, can help us determine patterns or trends in the use of natural resources or in their responses to management decisions. Land-water interactions, highland-lowland interactions, inequities in resource allocation, and trade-off analyses are major components of assessing interactions. The dynamics of forests, soil fertility and erosion, water quality and quantity, and their relation to human health, poverty, and social capital reveal the interconnectedness of environmental and socioeconomic trends, which in turn help us address priority problems that pose higher risk for rural communities.

Research results linking socioeconomic factors, resource management, and biophysical resource trends provide the starting point to search for opportunities to mitigate the present consequences of socioeconomic and environmental stress, prevent deterioration or further degradation of current conditions, and rehabilitate resources with changes in practices. Prevention is considered more cost effective and has led us to a focus on age and social groups that can play a key role in targeting issues that are expected to become serious in the future, but that at present are being neglected. Youth, women, and elders are groups sensitive to the preservation of resources for the next generation. Exploring watershed resource management options for soils, forests, and water, and socioeconomic options to increase chances of generating rural income through high-value crops, are alternatives that have to be tested on a long-term basis with target population groups having a long-term vision. We consider options and opportunities for preventing the deterioration of natural resources and for their rehabilitation as based on: (1) water resource management; (2) diversification of agriculture and conservation management to stabilize soils, retain nutrients, maintain organic matter, and conserve soil moisture; (3) sustainable use of mountain forest resources; and (4) people's learning and organizational processes.

The interrelationships between socioeconomic factors, resource management, and resource dynamics force scientists to adopt a holistic view to be able to understand the linkages between them. An important hypothesis is that research results that are obtained with this approach are valid because linkages between causes and effects have been considered and solutions are

offered integrally. For this reason, participatory research and development of alternatives based on our four research fields are part of an integrated watershed management approach (Figure 15). Socioeconomic factors directly impact the management of natural resources, which in turn impacts resource dynamics and degradation.

The principle of understanding the complex interactions between communities and watersheds (people and natural resources) is also valuable in the extrapolation and replication of successful options. Involving people in the solutions and in the capacity-building strategy for replication from the start of the research activities ensures the design of viable options that stakeholders are willing to try in their farms and organizations.

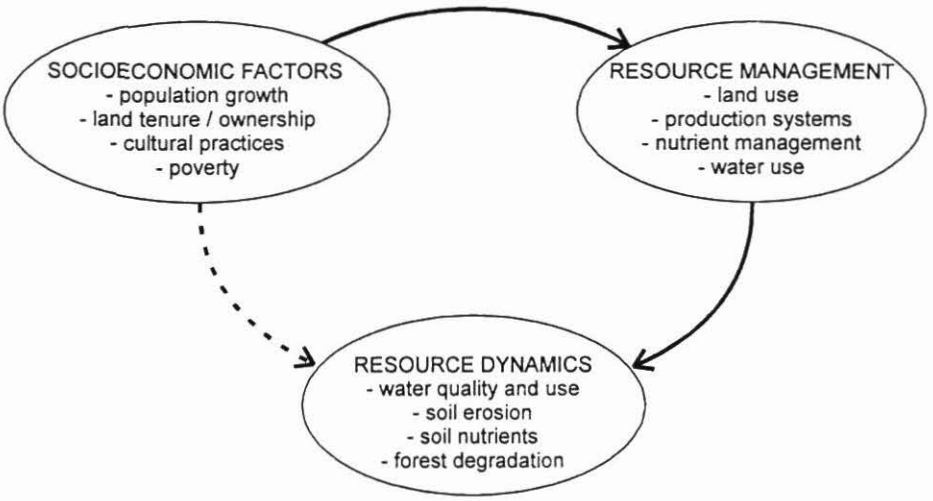

Figure 15. Interrelationships between socioeconomics, resource management, and natural resources.

Impact and Outputs

The desired impact is to obtain well-managed watersheds with sustainable activities that improve welfare and generate income for poor communities. The outputs consist of a multiple-options portfolio rather than single solutions. To achieve this goal, a scale-nested approach is adopted (Figure 16). The hierarchy from site to micro-watershed and watershed reflects varying processes operating at different scales. Out-scaling regionally and global comparisons are achieved through comparisons of watersheds and success stories.

Site specific: Fields, farms, households, and water sources.
Survey and monitoring data from specific sites such as fields, farms, households, or water sources provide the foundation of the research program. Site-specific quantitative data are required to assess variability and inequity, and can be extrapolated to similar sites. By collecting the relevant biophysical and socioeconomic data simultaneously, data collection is streamlined and integration is enhanced. A GIS-based approach to data collection is used to facilitate spatial analysis and extrapolation. While GIS are common in biophysical research, spatial analysis at the site level for socioeconomic information is rare. Site-specific data can then be extrapolated to the

micro-watershed or watershed level using standard modeling techniques. Site-level data are critical to assessing inequity and developing sound CBWM. Our focus is on improving NRM and socioeconomic conditions for the rural poor, and site level data allow us to target impacts.

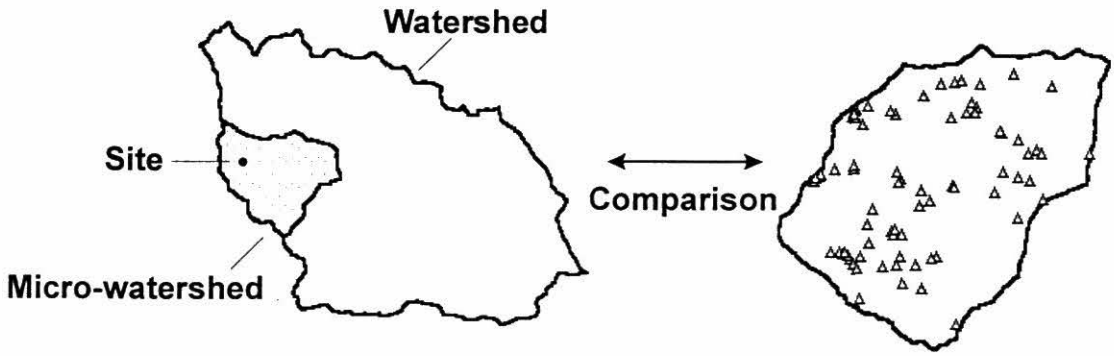

Figure 16. Scale-nested approach.

Watershed level: By looking at the various biophysical and socioeconomic components within watersheds in an integrated manner, we can achieve impact at the community and landscape levels. The impact on communities and watersheds consists of informed communities engaged in activities that go beyond family units into CBWM initiatives that have an effect on commonly shared natural resources. Land-water and highland-lowland interactions with a focus on environmental services provide the knowledge base for those community initiatives. At the watershed level, we follow interdisciplinary and problem-focused approaches that produce research outputs with general applicability to other watersheds, while producing concrete solutions in the areas of study. The different disciplines do not concentrate solely in their specific areas, but provide their expertise to complement the solution to commonly agreed problems, and produce knowledge (Figure 14).

Regional level: By looking at commonalities and differences between hot-spot[19] watersheds at the regional level, we aim to influence policies for NRM and poverty alleviation.

At the regional level, problems of significance are identified in a participatory manner, with regional stakeholders; and, following a scale-nested approach, they can be tackled initially at hot-spot watersheds within the region. This can help overcome the difficulties found in regions such as Central America where there are many governments, contrasting agendas, non-integrated institutions, etc. Elements of Web-based networking with regional partners and parallel capacity building along the research for development process are essential to the implementation of solutions to problems found in hot-spot watersheds into the regional setting. Following a common research framework with a minimum indicator set facilitates this regional out-scaling.

[19] Hot spots are defined as critical niches that cover a relatively small part of a landscape, but account for a large proportion of the impacts of the land degradation process under investigation. Hot spots can be identified using a holistic systems approach that integrates scientific perceptions.

Global level: By comparing between regions we can share lessons learnt in the different regions, using existing networks. In general, the project contributes globally to risk reduction in aspects such as drought, erosion, land degradation, economic adversity, water shortages, and migration.

At the global level, comparisons between watersheds, regions, and continental approaches through existing and new Web-based networks and multimedia platforms allow for a south-south exchange as well as exchange between CIAT's work in the different continents. Comparisons across continents in turn generate researchable issues by participating stakeholders that can have global applicability.

The New LogFrame
Project PE-3: Communities and Watersheds

Project Description (for acronyms and abbreviations used, see page 190)

Goal: To foster community based watershed management (CBWM) to address local natural resource priorities and contribute to improved environmental management, equitable resource allocation, and enhanced livelihood and food security.

Outputs:
1. Improved watershed management: land-water interactions
2. More equitable highland-lowland resource allocation
3. Provision of environmental services: water, biodiversity, and recreation
4. Strengthened organizations: community and institutional capacity building
5. Efficient use of project resources through participatory project management

Gains: Farmers and local organizations adopt technologies, tools, and methodologies developed with CIAT and its partners at research watersheds. Results are sustainable, production systems profitable, land use improved, and natural resources preserved at the watershed level. Partner organizations apply technologies, tools, and methodologies developed by or with the project for their planning and activities at local, national, and regional levels. Decision makers at various levels have information, tools, and methodologies provided by the project to support their planning, monitoring, and decisions.

Milestones:

2003 Establish monitoring networks and indicators for individual research sites / watersheds. Document land-water interactions, highland-lowland interactions, resource allocation inequity, and community priorities. Initiate capacity building programs at the local level. Promote the adoption of already proven approaches and technologies.

2004 Continuation of monitoring networks. Capacity building, strengthening local organizations, and training programs. Develop new technologies and approaches. Community-based adoption of proven methods and technologies. Improved local management using CIAT's research results.

2005 Continuation of monitoring networks. Community-based adaptive management with proven methods and technologies. Ongoing capacity building. Decision support providing information, tools, and methods at various levels (local, national, regional). Training programs. Improved watershed management using CIAT's research results. Scaling out.

Users: Farming families, youth, and rural communities of tropical watersheds. Project sites profit from increased community action aimed at improving watershed management. Educational institutions directly through youth involvement and student participation, and indirectly through access to research materials. National and international development organizations involved in priority setting and investments in development.

Collaborators:
SDC, CIMMYT, CATIE, CIP, IPCA, IWMI, IICA, PASOLAC, CARE, CIPAV, CVC, universities of Georgia, Florida, Guelph, British Columbia (Canada), Javeriana (Cali, Colombia), Nacional Agraria (Nicaragua), and CURLA (Honduras); DICTA, INTA, CONDESAN, ACERG, Herederos del Planeta, CIPASLA, Campos Verdes, CLOs, CIALs, Hillsides Agricultural Program, Haiti (HAP); District, Provincial and National partner staff in Laos; DOA, Bangkok, DOAE, Bangkok, TTDI, Huay Bong, Nakhon Ratchasima, Land Development, Dept, Bangkok and Kasetsart University, Bangkok in Thailand, Thai Nguyen University, Thai Nguyen, Vietnanm, National Institute of Soils and Fertilizers, Hanoi, Hue University of Agriculture and Foresty, Hue Hung Loc Agriculture, Research Center, IAS, Dong Nai Thu Duc University of Agriculture and Forestry, HCM in Vietnam and Chinese Academy Tropical Agric. Sciences, Hainan , China Guangxi Subtrop. Crops Res. Inst., Nanning Guangxi, China Central Institute for Food Crops, Bogor, Indonesia.

CGIAR System Linkages: IWMI, CIP, CIMMYT and Water and Food, Mountain Development, and Urban Harvest CPs.

CIAT Project Linkages: Soils (PE-2), Land Use (PE-4), Agro-industries (SN-1), Participatory Methods (SN-3), Forages (IP-5), Impact Assessment (BP-1), Bean Improvement (IP-1), Cassava (IP-3), Rice (IP-4).

CIAT PE-3 Project LogFrame, 2003-2005

Project: **Communities and Watersheds**
Manager: **José Ignacio Sanz**

Narrative Summary[a]	Measurable Indicators	Means of Verification[a]	Important Assumptions
Goal To foster CBWM to address local natural resource priorities and contribute to improved environmental management, equitable allocation and enhanced livelihood and food security.	Water quality Biodiversity Conflict resolution mechanisms Income (monetary and/or in kind) Farmer adoption of technologies / methods	National and local statistics Local research	The environmental, social, economic, and political conditions are maintained on a macro level.
Purpose To strengthen local processes of watershed management and sustainable agricultural development in tropical regions based on the experiences of NRM at research sites.	User groups (# and types) Institutions with community involvement Local capacity building – training programs Youth involvement in NRM Community-based involvement in watershed management	Field verification Institutional reports.	Local partners continue project-related activities. Donors remain interested in the proposed project objectives and continue to provide support.
Output 1 Improved watershed management based on knowledge of land-water interactions. Farmers adopt approaches and technologies developed with CIAT and its partners to establish environmentally sound management and livelihood alternatives.	Land-water interactions: Water quality Land use change / intensification/ diversification Soil erosion Nutrient management Productivity	Local research Field verification Project reports Youth reports Local research groups' reports	Climate variability is normal.
Output 2 More equitable resource allocation based on highland-lowland interactions and trade-off analysis. Identify and monitor indicators of highland-lowland resource interactions. Promote community-based approaches for resolution of inequities.	Highland-lowland interactions: Erosion Water quality Water quantity (drinking and irrigation) Trade-off analysis: Water rights / concession Income distribution (highland-lowland) Livelihood opportunities Conflict resolution: User association participation Consortium functioning Policy and/or institutional changes	Local research Field verification Youth reports CIAL reports Consortia reports Monitoring reports.	Social stability

Continued.

CIAT PE-3 Project LogFrame, 2003-2005. (Continued)

Narrative Summary[a]	Measurable Indicators	Means of Verification[a]	Important Assumptions
Output 3 Valuation and analysis of environmental services including water, biodiversity, and recreation. Adoption of sustainable management practices by local farmers and user groups. Increased forest and agricultural biodiversity. Realizing the potential of recreational opportunities.	Water: Water quality Water quantity Biodiversity: Native vs. exotic species numbers (temporal and spatial) Agro-biodiversity (no. and type) Recreation: Types and no. of suppliers Eco-tourism	Field verification Local research CIAL reports Youth reports Institutional reports	Climate variability is normal.
Output 4 Strengthened organizations. Local and national organizations involved in sustainable agricultural development at various levels (site, national, regional) use the technical and methodological resources developed by the project in their decision making and other activities. Inter-institutional coordination is enhanced.	Training programs (no. and type) Youth group formation and activities User groups supported (no. and type) Digital information (no. and type) Decision support mechanisms Information dissemination (format and content)	Local research groups' reports Youth reports Training reports Institutional reports Dissemination materials and project reports	Social stability
Output 5 Efficient use of project resources through participatory project management. Internal and external partners directly participate in project management to ensure adequate and efficient use of the project's resources.	Approved projects designed with partners and donors Partners participate in fieldwork Data-sharing agreements Lessons learned by the project and its partners disseminated New projects adopt methods, techniques, and experiences generated by the project and its partners	Planning documents, proposals, and reports Dissemination materials and project reports Direct verification through networks and consortia Reports to donors Annual Reports	Institutional linkages maintained

a. For acronyms and abbreviations used, see page 190.

Research for Development Processes Underway: 2003 and Beyond

The Role of Participatory Research by Youth in Food Security and Natural Resource Management: Improving Education for Rural Development

Honduras

Funded by: Canadian International Development Agency (CIDA), Canada Linkage Fund

The purpose of this project is to contribute to the early involvement of rural youth in research leading to the discovery and/or adaptation of practices for better food availability and natural resource management.

Output 1: Diagnosis of the target area

With this output we want to present a brief description of the population involved in the project and its expectations about the research activities it will be conducting. Initially, the project considered organizing participatory research groups based on a participatory research methodology developed by CIAT called the CIAL. Changes were made to the original plan to make the project more sustainable in terms of the capacity to organize research activities among participants. It was planned that the research groups would be organized and that research on chosen topics would start immediately. However, the project committee decided to train facilitators that would learn the skills necessary to organize and conduct research after the project finishes. This has implied a program of capacity building and delaying the start of proper research on food security and NRM.

The reason for this change was that IPCA's experience has revealed that CIALs have more chance of remaining active and evolving into more effective organizations if their members have the capacity for self-organization. CIALs that are dependent on technical or professional assistance for establishing priorities, planning activities, and drawing conclusions are limited in their ability to drive their own development.

Two surveys were conducted to collect information about the facilitators and research group members. Facilitators are 35 youngsters (20 female and 15 male) between 12 and 26 years of age. Twelve of them live in Yorito, and the rest in surrounding villages. Of the group, 40% (14) live with both parents, 23% (8) live with their mothers, and 9% with other family members (no information for 10). Only five of the facilitators work, while 30 are students. Most (27) belong to one or more groups (sports, church, or others); most also help in their homes (4.8 hours in the case of females, and 1.6 hours in the case of males). In contrast, males help on the average 3.4 hours per week doing field work in agricultural activities and females help for 0.3 hours a week. Sixty percent of facilitators use wood for cooking in their households.

Output 2: At least five research groups established

The 35 young facilitators come from six communities of the municipality of Yorito: Jalapa, La Ladera, Luquigüe, La Sabana/el Destino, Wisilka, and Yorito. During the first 2 months of 2002 these young facilitators were trained in the first three steps of the CIAL methodology:

(1) The project: Participatory research by youth in food security and NRM.
The exercise: Mapping actual and future problems with food security and natural resources in the community.
(2) General principles of participatory research.
The exercise: Definitions, the participatory steps, and the CIAL methodology.
(3) Organizing CIALs
The exercise: Definition of responsibilities of CIAL members; analysis, discussion, and adjustment of commitments; definition of requirements to become member of a CIAL; and elections of CIAL members.

In the last week of February 2002, the young facilitators of each community invited other young people from their communities to participate in an introductory meeting. At the end of these meetings, CIALs were formed in six different communities: Yorito, Jalapa, La Ladera Wisilka/El Destino, La Sabana, and Luquigüe. In each CIAL, there are three to eight youth facilitators and two adult facilitators to assist them with the programming, organizing, and conducting of the meetings. From May onwards, only one of the two adult facilitators planned and assisted the meetings. The IPCA Project is preparing the adult facilitators, and supervising the process in each of the communities. The CIAL members decide when and where they meet. The young facilitators are in charge of organizing the meetings. They submit a list of needed materials to the Instituto San Pedro (ISP), and they organize lunch or snacks for the group.

Each CIAL(Table 37) has formed a board with a coordinator, a secretary, and a treasurer. In most CIALs, the board is formed by CIAL members who are trained as facilitators, and members who are not.

Table 37. Composition of each Comités de Investigación Agricola Local (CIAL) in each community.

Community	CIAL members		
	Men	Women	Total
Yorito	11	17	28
Jalapa	15	14	29
La Ladera	7	13	20
Wisilka/ El Destino	13	10	23
La Sabana	12	6	18
Luquigüe	13	12	25
Total	71	72	143

In the last week of April, each CIAL selected three research themes, taking into account the criteria of costs, risks, and expected benefits. They also indicated what training they would like to receive to strengthen their capacities (Table 38)

Table 38. Research themes chosen and training required for each Comités de Investigación Agricola Local (CIAL).

Community	Research themes	Training requirements
Yorito	1. Pollution of streets and rivers 2. Water wastage 3. Bushfires	• Natural resources • Sustainability and development • Gender equality • Audiovisual aids
Jalapa	1. Deforestation 2. Bushfires 3. Water pollution	• Computer training
La Ladera	1. Reforestation 2. Food security 3. Protection of the watershed	• Watershed management • Cultivating vegetables • Human relations • Protection of the environment
Wisilka/ El Destino	1. Deforestation 2. Water pollution 3. Low yield	• Computer training
Luquigüe	1. Natural resource management 2. Reforestation	• Computer training • Natural resources

The six CIALs formed have chosen a particular topic for their research and have written their research projects (Table 39).

Table 39. Summary of Comités de Investigación Agricola Local (CIAL) research projects and their cost.

CIAL name	Community	Topic	Research cost (US$)
Sueños Juveniles	Yorito	Water pollution	430
Por un Futuro Mejor	La Ladera	Evaluation of species for firewood	315
De Luquigüe	Luquigüe	Vegetable gardens	150
CIAL de Wisilka	Wisilka Jalapa La Sabana	Energy forest	180

Most groups chose topics related to NRM and their projects imply activities that will produce an impact in their communities. This result was anticipated by CIAT and IPCA, because it was expected that youngsters would be more willing to conduct research on natural resources rather than on germplasm, which adult CIALs usually evaluate.

The most important difficulty experienced in this project was the selection of a control group and the collection of information that will allow comparisons with the group of youngsters currently involved in the project. The reason for this difficulty was that we are not clear which would be the best control group in terms of socioeconomic conditions, and in terms of the influence that the project might produce even on youngsters not directly involved. Choosing a control group outside the project's area of influence would probably result in a control group with big differences in socioeconomic aspects. Yorito and its neighboring towns differ importantly from more distant areas in terms of income sources for farmers; additionally, Yorito has had important influence from several religious groups that have produced changes in social capital in Yorito

and its influence area. This could mean that comparing our group of participants with youngsters from distant towns would not allow isolating this project from other social factors that could also be affecting the rural youth behavior. On the other hand, choosing a control group from the same area of influence as the project could present a serious difficulty in terms of personal features that were preferred when choosing the participants. The children and teenagers involved in the project were chosen through a participatory process in which their leadership, charisma, and popularity were essential. Thus, clearly the most talented youngsters in the community form the current team. Comparing the project participants with people not involved in the project in the same areas could give the project merits that the leading characters of the children would gain by themselves with or without their participation in participatory research. However, this latter approach will probably be that chosen for the project because it often happens that the most advantaged people first take the opportunities that arise in their communities (e.g., the formation of CIALs promoted by CIAT and IPCA with the adult population in the Central American and Andean region). Additionally, an emphasis should be given to measuring changes in food security and NRM, which could be done by analyzing the activities that the participating youngsters will perform under their own initiative in these topics when the project activities have finished. This information could then be compared with their initial activities and those of other youngsters in their area, and in similar age groups, under their own initiative.

IPCA and CIAT are and will be providing the information and tools for participatory research using the CIAL as starter. However, the CIAL has been used most particularly for evaluation of germplasm at different locations in a watershed. Using this methodology for a younger population with quite a different array of interests is proving to be a challenging task. Changes will have to be made to make the methodology youth-compatible and flexible to include research topics ranging from food security to NRM.

Matching the sluggish communications technological options and the precarious computer knowledge of rural settings in Honduras with the wishes and advanced communications of developed countries and scientists proves to be a hard task. Despite all the possibilities that telecommunications offer to rural youth, the project needs to move forward at the pace that present infrastructure allows. Yorito has no Internet connection and providing it through telephone lines is not viable. We are exploring radio and satellite technologies, and next year will be considering using project capital funds for these tools. Only then can we think of teaching and using Web page development to rural teachers and youngsters for rural development.

Following the work plan, the project bought two computers that have been installed, one in CLODEST and the other in ISP. The computer at CLODEST is being used as part of the normal activities conducted by CLODEST (courses for computer literacy both for youngsters involved in the project and for farmers). The computer installed at ISP is being used for administrative activities of the schools, including the production of memos and materials for the project activities.

Output 3: Analysis of impact on food security and natural resource management

It is still early to anticipate any progress in food security and NRM because the youngsters have not yet begun research activities on these topics. However, the project is including the participation of youngsters that are not attending school. Intentionally, the selection of participants was made considering that equal opportunity should be given to youngsters that, because of poverty, do not have the chance to attend school. This has meant that they have the opportunity to acquire knowledge and create bonds with peers. We think this will have an impact on their chances to access information and to explore the possibilities available to them.

The involvement of UBC in this project, providing the methodology for evaluation and analysis of water quality through a 3-day workshop in April has produced immediate awareness of the water problems in the Yorito urban area among participants. The workshop combined the evaluation of water and pollution sources with computer training, which became an important source of motivation because youngsters were encouraged to present their activities using maps in Power Point, and their quantitative research results using Excel graphics.

The workshop included the following topics:

(1) Introduction to multi-media and the Internet. What can it do?
(2) Introduction to watershed management (multi-media presentation).
(3) Group work: Mapping all drinking water resources in the watershed.
(4) Field visit to conduct a case study in one community to make an inventory of all water supplies.
(5) Class project: Mapping all water resources using aerial photos, maps, and local knowledge (all water resources: springs, streams, groundwater, lakes, wetlands, etc.).
(6) How to protect drinking water and streams (flow and water quality). This includes how to make buffer zones and how to design the best vegetation and protection within the buffer zone (multi-media presentation).
(7) Another afternoon in the field conducting a case study survey on how to map and assess buffer zones along a stream.
(8) How to make a map of buffer zones and then decide on priority areas for reclamation.
(9) Presentation on how to rehabilitate streams and protect water sources (Multi-media presentation on case studies on how to make a buffer zone).
(10) How to put all the information into a multi-media document.

Thirty youngsters and several ISP teachers participated in this workshop.

For the groups doing research on other topics, such as reforestation for firewood and vegetable gardens, IPCA and CIAT are facilitating the involvement of organizations with particular expertise on these issues to support their research projects. Part of this support has included a visit to an energy forest by the groups involved in firewood research accompanied by IPCA.

Contributor: MC Roa
Collaborators: ISP, CLODEST, IPCA, University of Guelph, UBC

Colombia

Funded by: Kellogg Foundation

The project's objective is to increase the chances of rural youth' access to a high quality education that fosters their personal development and improves their natural and physical environment through learning processes based on participatory research. The project will also stimulate the formation of leaders, and will provide managerial skills and tools for the formation and consolidation of rural youth organizations.

Output 1: Development of leadership skills and research abilities

This output has been considered a requirement for the formation of research groups, particularly because the two local partners Asociación de Centros Educativos del Cañon del Río Garrapatas (ACERG) and HPB differ importantly in communication and analysis skills because of the latter's exposure to research through their participation as co-researchers in CIPAV research projects in the region. The methodology to be used for this output will consist of:

- Game workshops to share skills and construct base lines for participants
- Rural forums (on the research themes)
- Competitions

To stimulate participants to think about possible research topics related to their environment and local strengths, a brainstorming session took place. Youngsters mentioned the following research areas and possible issues or topics for research:

Area 1: Alternative forms of farming production
- Sustainable home gardens
- Alternative feed for animals
- Buffer zones (that protect and produce)
- Sylvopastoral production (trees in pasture)
- Making use of genetic resources (e.g., *bore*, a plant species used to feed fish and pigs)
- New forage plants
- Utilization, protection, and recuperation
- Alternatives to farm systems taking advantage of forest resources

Area 2: Natural resources
- Flora, fauna (documentation on native flora and fauna)
- Identification of promising species
- Work with biological corridors, connectivity among protected areas
- Biodiversity inventories
- Fog banks (as method for obtaining water)
- Tree phenology
- Planning of micro-watersheds
- Water decontamination
- Non-timber resources of the forest and their use

Area 3: Food security

- Production alternatives utilizing germplasm
- Inventory of native seeds
- Inventory of flora resources for food security
- Product transformation for commercialization, utilizing native resources (plantain)

Area 4: Agro-enterprise

- Production of concentrates, protein banks - Molino
- Starch production from *bore*
- Artisan crafts using the center of the *Arboloco* (soft wood)
- Nurseries (native species)
- Packaging
- Fruit
- Selective use of the forest, transformation

Area 5: Loan of environmental services

- Pollinization service
- Offer of educational services (exchange with schools, universities)
- Agro-tourism (environmental education)
- Teaching advise
- Characterization and reservation of farms, management plans
- Advice on setting up agro-industries
- Alternatives for generating energy through hydroelectric means

To facilitate integration and share results among the diverse research groups, they will be organized in pairs. That is to say, each ACERG research group will have a group "partner" working on the same research theme in the HPB group. Although the research theme is the same, the research focus can be different. For example, if an HPB group developed its research on the extraction of starch from the *bore* (high protein content), its group "partner" in ACERG can work on the theme of use of the *bore* (also good for protecting ponds and wetlands) for water source protection. In this way, the groups share the results of their work, and the research is complemented.

The research groups will be formed in two stages. In Stage 1 (9 months to 1 year) ACERG will form 10 groups located in 10 different villages selected by the ACERG managers according to criteria such as geographical proximity that facilitate support visits. Each of the 10 research groups will be supported by one of the four HPB members with greater experience in research processes (Julián Giraldo, Lina Andrea Giraldo, Eudali Giraldo, and Adriana and/or Diana Giraldo). A secondary school student or a graduate of Juan Salvador Gaviota College, the only ACERG secondary school, will coordinate each group.

In Stage 2, in accordance with the degree of success reached in the first stage, other groups will be formed in other villages of the 32 that make up ACERG.

The HPB at present has 50 members. Four research groups will be formed with a coordinator, six young co-investigators, three child co-investigators, and a counterpart from the ACERG groups.

Output 2: Bonding between youth groups and research, education, and development organizations

The project will seek pre-graduate or Masters' students that are interested in the same themes selected by the research groups so that they accompany the processes and form part of the groups. For this purpose, we need to establish agreements with universities or to strengthen existing ones between ACERG, CIPAV, and CIAT with universities that have related areas. The project will create capabilities among the participants that could be shared with rural and urban schools. Through the creation of alliances with other education centers, youngsters will be able to exchange skills and knowledge with similar groups of urban schools with limited access to direct natural resource education.

Output 3: Establishment of self-financing mechanisms

Both ACERG and HPB will have immediate access to resources to form a micro-enterprise that allows them to begin to generate income. The first activity should be a workshop for the market opportunity identification. This workshop will be coordinated by CIAT and CIPAV. ACERG already has extensive experience in the rural formation of agro-enterprises, since it has promoted the creation of a brooms business and one of meat products. Also, ACERG has opened an Artisanal and Agro-ecological Store for its products in El Dovio. The HPB will be able to join with the store taking in the products that are made in its agro-enterprise. Since this project began on the 1st of June 2002, activities have primarily concentrated on planning the project's execution.

Contributor: MC Roa
Collaborators: CIPAV, ACERG, HPB

Case Studies of Natural Resource Management

As part of our alliance with UBC, we collected information about two organizations that are involved in NRM; HPB, one of our partners in the Colombian youth project, and ASOBOLO. The information about these organizations is being put together in Toolbook (See under Activity 3.1.1. in Part 1 of this report). The UBC will use these case studies for its teaching courses on environmental sciences, and ASOBOLO and HPB will benefit from having all their history, collected data, research results, and impact information in a platform that can be sent to donors and partners, and used for presentations. The program used allows adding new information and progress of the organizations' work. ASOBOLO was chosen for this case study because it is a prospective CIAT partner for research projects on gender and NRM, environmental services, lowland highland trade-off analysis, institutional analysis for watershed management, and biophysical land-water interactions. HPB is a current CIAT partner in the youth project in Colombia and this case study is a result of an effort to reconstruct the organization's history and collect data that have never been structured. It has been a useful exercise for the group in the frame of the youth project. It has created awareness of the scope of their work, their impact, their involvement in NRM activities, and it has become a tool that stimulates the use of presentation and communication skills among members. It will be used to encourage other youth groups involved in NRM to develop similar skills.

PART THREE: STRATEGIC ISSUES

Institutional Capacity Development: A New Emphasis

The Previous Experience

In the recent past, the C&W made important efforts in the dissemination of research results. Researchers working with the project dedicated time to synthesize their research findings (technologies and methodologies) in such a way that they could be shared with large numbers of professionals who, in turn, would make these results available for local development groups in watersheds, municipalities, and other types of institutional or field settings. The process of training trainers and training potential applicants of the research products has been a large effort, compensated by the positive response of professionals and applicants in several institutions of Honduras, Nicaragua, and Colombia. To date, more than 400 staff members of nearly 40 institutions have received training in the use of these research tools. A current demand for training in their use is being fulfilled with the participation of trainers in each country. The follow-up process and impact evaluation of this process could not be done because of economic restrictions, which started in 2001.

The New Emphasis

Capacity is defined as the ability of individuals and organizations to perform their functions effectively, efficiently, and in a sustainable manner (UNDP, 1985)[20]. Capacity is also a set of attributes, capabilities, and resources of an organization that enables it to undertake its mission.

The terms "capacity building" and "capacity development" are often used synonymously. Capacity development reflects the developmental nature of this process. Morgan (1997)[21] defines capacity development as the process by which individuals, groups, organizations, and institutions strengthen their ability to carry out their functions and achieve desired results over time. Capacity development can be seen as the process of improving the ability of organizations and systems to perform their assigned tasks. Such capacity development involves strengthening the capabilities of individuals and organizations, and in the establishment of linkages among them.

Linked to the concept of capacity development is that of facilitation. This concept implies the provision of assistance and support to organizational processes by external and internal agents. Facilitation may involve stimulating, motivating, guiding, and providing technical or political support to the implementation of organizational processes.

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[20] UNDP (United Nations Development Programme). 1998. Capacity assessment and development in a systems and strategic management context. Management Development and Governance Division, Technical Advisory Paper No. 3. UNDP, New York, NY, USA.

[21] Morgan, P. 1997. The design and use of capacity development indicators. Paper prepared for the Political and Social Policies Division, Policy Branch, Canadian International Development Agency (CIDA), Quebec, CA.

A second important concept linked to capacity development is that of "organizational learning". Brown (1998)[22] defines it as "an organization's capacity for accumulating knowledge from its own experiences, disseminating that knowledge to members throughout the organization (and not to a single individual or group within it) reflecting on it and using it as a basis on which to build planning and programming activities, to adapt and cope with change". Organizational learning is more than the collection of data and the preparation of reports. It is a process of collective reflection on experience, and requires the inculcation of positive attitudes towards learning and the development of analytical and cognitive capabilities at the institutional level. Dale (1994)[23] defines a learning organization as "one that facilitates the learning of all its members and continuously transforms itself".

The new C&W conceptual framework includes organizational strengthening as one of the expected outputs. It states that "the community participation at different scales through farmers organizations, and their interaction with governmental and nongovernmental institutions requires the integration of diverse stakeholders and the strengthening of institutional capacity."

Three Paths for Research Findings

Research results take a variety of forms. Some are specific sets of information that can be used to make political, strategic, and programmatic decisions. Some are technologies designed to manage particular problems within the realm of a commodity. Some are methodologies that facilitate change processes. Some results take the form of instruments or tools that improve the efficiency or efficacy of development processes.

Research results are valuable when change occurs after their application in the places they are needed. Therefore, the responsibility of researchers goes beyond reporting results. It also covers the creation and maintenance of linkages with "intermediaries of information" that are located at different levels of the development ladder.

Research results follow at least three different paths. Two of them point in the direction of their incorporation to the development flow, and one points in the direction of oblivion. Once they are generated, researchers document their findings in journals, in meetings, on the Web or by many other means of communication. It is expected, and usually happens, that publications take information to the scholars in the same area of expertise and often reaches those in charge of applying the findings.

Some research products, as is the case of many thesis and dissertation papers, for many different reasons do not reach the operational levels at which they can be applied. Valuable information rests today in files and on shelves because it was not lucky enough to find its way to dissemination and use.

Research results can also be managed to purposely reach those who need this information. Transforming technical and scientific knowledge into user-friendly products is a task in which

[22] Brown, D. 1998. Evaluating institutional sustainability in development programmes: Beyond dollars and cents. J Int Dev 10:55-69.

[23] Dale, M. 1994. Learning organizations. *In:* Mabey, C.; Iles, P. Managing learning. Routledge, London, GB.

researchers can participate, if there is in place an institutional capacity development mechanism designed to achieve this purpose.

The C&W has had an opportunity to work with researchers in transforming scientific information into training tools. It has also managed to reach large audiences of final users through the development of national training teams. The process is not a complex one. Once a researcher has validated her/his research findings, she/he is provided with a methodology to present the technology, methodology, or tool in a didactic way. The resulting guide or manual goes through a validation process with potential users of the scientific information. Adjustments are made before the guide is published and passed on into the hands of those in charge of dissemination. Experience shows that technical and professional staffs of large NGOs are most likely to take the material, and incorporate it into their current activities and projects.

This year, the C&W, with the valuable support of the UBC has undertaken the task of transforming the Guides on decision support instruments into a multi-media format, called "The Tool-Book". The CDs that will be prepared will reach NGO and governmental audiences in early 2003 in Nicaragua and Honduras. It is also expected that this new product will be available through the Web to large audiences at no cost. In this way, we hope to ensure that research results move into the hands of those who need them, in a variety of forms.

Methods and Approaches: The Bolivian Model

Strategic planning requires analysis of the external context. Any research for development action must be illuminated by a clear knowledge of the institutional, geophysical, and socioeconomic environment where an intervention is planned as well as the trends that are taking place in any of those component variables. It is in the contextual analysis where institutions can identify the threats to face and opportunities of which to take advantage in accomplishing their mission.

The new Bolivian agricultural technology development system (SIBTA, its Spanish acronym) is a development strategy that has mechanisms in place for exploring the agricultural demands of local communities and organized producers, that in turn flow to the so-called Foundations (Fundaciones) for analysis and prioritization. Foundations open bids for private providers of technological services to respond to such demand. These providers formulate projects, which are in turn evaluated by external panels of experts. If approved, projects are financed by the Foundation, and SIBTA's central offices do the project monitoring, evaluation, and auditing. There are two types of projects: (1) production chain led projects, to respond to the needs of actors in a prioritized commodity production chain; and (2) projects that cut across different commodities and issues (e.g., watershed management).

The "Bolivian Model" is the name given to an event conducted by the C&W with CIAT's and Bolivian partners. The model comprises a series of visits to institutions and farmers along with planned exercises carried out with participants from seven GOs and NGOs, and five CIAT projects. The aim was to analyze the Bolivian rural development context and organize for immediate action. This effort is now called a "model" because its strategic sequence of steps shows itself a valid process to undertake similar explorations of the context in countries where CIAT has worked, or countries in which CIAT is expecting to operate.

The first step in the process was the exploration of opportunities for research that the Director General of CIAT and the C&W Leader made with donors. A first approximation to institutional needs and opportunities for CIAT to respond to them was made (2001). At the same time, key partners to accompany the process were identified. Among them, ATICA, an NGO supported by the Swiss, played an important role in convening other partners to the planning table. This was the basis for two different activities that followed. One, an exploration of the supply that Bolivian private institutions and government organizations offer in terms of technologies, methodologies, and tools, and an analysis of demands formulated both by the participating institutions in terms of their own capacity development needs as well as demands being formulated by their stakeholders and clients. A side analysis was also made regarding the methods and approaches to follow if the group decided to organize itself for work together in the Bolivian scenario.

As the process progressed, the C&W team facilitated the organization of information and ensured consensus building. A series of information-gathering instruments were developed that were used in open discussions. There was also a need to elaborate definitions regarding different issues that related to the process in which the group was engaged (information, discussion, and consensus). Information also covered institutional profiles, which can be later used to further examine the "installed capacity" of partners. Part of this process was conducted via E-mail and part of it was done in Cochabamba, Bolivia.

A matrix showing prioritized supply and demand was a product brought to a planning workshop in which participants were able to synthesize what they could do together within a capacity development framework. Group members analyzed and prioritized over 80 demand items and more than 40 supply items, dealing with the work done with nearly 20 institutions in Bolivia. In this workshop, the active participation of Bolivian institutions and other regional partners (CIP and the Consorcio para el Desarrollo Sostenible de la Ecorregión Andina [CONDESAN]) was ensured. Following the analysis of three major work areas for the group, an Interinstitutional Consortium for Bolivian Rural Development was organized. Participants in the last workshop appointed a coordinator and a technical committee, and designed a strategy to make the consortium known in the Bolivian agricultural community. (A power point presentation on the goal, purpose, expected products, and organization of the Consortium is now available for consultation. This document is also a narrative summary of a platform of projects from which to draw proposals for donors).

The C&W is now exploring ways to further develop linkages between the Consortium and many other Bolivian potential partners, in search of ways to project development and implementation. In this regard, a proposal was prepared for the Fundación Valles to present to USAID–Bolivia. A second preconcept note was shared with USAID–Washington to put the Consortium into action.

The results of this process, developed over 1 year, are pending. Nevertheless, some important issues have been accounted for in terms of a contextual analysis and the future role of CIAT's participation with Bolivian partners. First, Bolivian partnering institutions look upon the Center as a "member" of the Consortium and not as an "outside provider" of research services. Along these lines, the Consortium is led by a Bolivian NGO (Programa Manejo Integral de Cuencas [PROMIC]) of high repute and strongly linked with both the donor community and government

authorities. Second, the knowledge gained by CIAT's staff through their participation in this process contributes to better prepare CIAT's projects to work together with Bolivian partners. The three topics of concern for the Consortium (1) integrated watershed management, (2) production systems, and (3) rural enterprises, are now clearly depicted for CIAT's projects to plan for research and development interventions. Third, the C&W has an important knowledge of the geographic areas, institutions, and partners with whom its recently developed theoretical framework can be applied.

In terms of capacity development, several contributions stand out: (1) a planning strategy was provided to participating institutions for a multi-stakeholder analysis of the context in terms of supply and demand; (2) a facilitation process in which CIAT presents itself as one of the team members, not an outside leader; and (3) the creation of a Consortium as a mechanism to channel multiple initiatives from its members, based on current national agricultural demands.

Methods and Approaches: The Haitian Scenario

Under a USAID grant to Haiti and a subcontract signed with DAI, within the HAP, four CIAT projects (Cassava, Forages, Beans, and C&W) are developing parallel activities in two priority areas. The C&W is working on the implementation of an agenda that takes care of adaptation and adoption processes, once the commodities release their germplasm. These processes have to do with on-farm experimentation and analysis within the established production systems. The successful implementation of this agenda requires in-country collaboration, and a steady flow of germplasm, information, training, and facilitation that ensures adoption impacts.

The project counts on a native field coordinator who, with the support of the Central America team, is now working on a baseline study of the sites where the project works, the identification of partners with whom to promote adaptation and adoption, and the partnering of farmers who will do the final adoption of germplasm. Planting, monitoring, and evaluating the performance of germplasm in the production systems will follow this planning stage.

Parallel to this effort, is the work being done towards the establishment of small seed enterprises. Haiti does not have such a system; on the contrary, large seed producers supply seeds. The experience gained in Central America in the Post-Mitch period, and the subsequent job done with small seed producers in Honduras and Nicaragua, have provided the experience to establish a small seed production system in Haiti. An initial analysis of the two areas of concern to the project complemented by the basic information obtained in the baseline study has been done. This year, a course on small seed enterprise development will be delivered for small-scale producers committed to this initiative.

Besides the implementation of its own agenda, the C&W has played a facilitation role with CIAT's partners and local professional staff. A major effort was made at the outset of activities in Haiti to organize a work plan in which all planned activities proposed by each project team would be in the same Gantt chart. At a workshop held in Port-au-Prince, all project coordinators were led to use the same planning format that would make all activities correspond in terms of trial planting periods, evaluation and selection, harvesting activities, training, and visits. To date, this instrument has been useful for the planning and evaluation meetings.

A New Strategic Vision for Central America

Exploring the research agenda with stakeholders, involving them in the research process, and validating research results with them has proved to be a successful strategy to ensure adoption. The search for relevance gave way to the organization of consultative groups with the participation of farmers, community organizations, extension workers, national researchers, and donors with whom the research agenda could be checked vis-à-vis the problems and needs of the poor.

The promulgation of the new Framework for the C&W calls for the formulation of a new operational strategy in all of the places where the Project operates or intends to work. Experiences gained in Bolivia and Haiti have inspired the Project team to conduct similar exercises in Central American countries. A variety of stakeholders must be brought together to synchronize both research and development activities with them. Stakeholders must also be organized around common interests and provide facilitation to planning, monitoring, and evaluation processes in which they become involved.

This means that, in the near future, a contextual analysis of countries in which we operate will need to be performed. This process should take short periods of time working with stakeholders to share strengths around research and development opportunities. A broad and flexible organization that may take diverse forms, depending on the scenario, should lead stakeholders into a collaborative venue in which they all can contribute to different components according to their institutional strengths.

A Strategic Approach to Ecuador: Collaboration with SANREM-CRSP

This year, the C&W has re-established links of communication with the University of Georgia's (UGA's) Sustainable Agriculture and Natural Resource Management (SANREM)-CRSP project. Collaboration UGA dates from 1998, when the Hillsides Project conducted joint activities with this institution. The purpose was the design of a multiple-stakeholder analysis methodology that planning offices could apply at the national level. This methodology was tested and evaluated in three workshops in Honduras and Nicaragua between 1998 and 2000. A draft publication of the methodology was presented to donors in the final stage of this initiative (2001). After this final evaluation, the flow of communication has been weak.

New preliminary contacts with R Rhoades, UGA's SANREM-CRSP Project Director, have been conducive to the celebration of a workshop in Ecuador. Two topics have been considered to be included in this event. One is the application of an "envisioning methodology", which is a strategic planning tool and scenario-building approach. The application of the methodology should provide information regarding the "visions" that participants hold about the future. This type of information is useful in the planning stage of project design. The Project expects that this will be a good opportunity to meet with potential partners and collaborators. The C&W also needs to get to know the institutional actors with whom strategic planning and team building can be carried out as the Project finds the resources to involve Ecuador in the C&W research and development initiatives.

Asia and Africa Ahead

Africa: This year, a series of planning workshops were conducted in Africa; they provided inputs for the formulation of a proposal to USAID. The lobbying of this initiative is in the hands of the Africa Coordinator, R Kirkby.

The C&W conducted two different meetings with East African agricultural leaders and professionals. In these meetings, CIAT research results were presented to the audiences to evaluate them and check their applicability in different research and development activities. As a result of these meetings, the methodology for the evaluation of market opportunities and the methodology to use LISQs are now being applied in several East African countries. In collaboration with TSBF, four action plans applying the methodology of LISQ are underway. Follow-up of this activity is in the hands of R Delve.

Asia: The focus of the FLSP during the next 3 years will be to consolidate, quantify, and then expand impacts of CIAT technologies on smallholder livestock farmers in the upper watersheds of Laos. The strengths of this program for the conceptual framework of C&W are within the following two strategic research areas:

(2) Diversification of agriculture and conservation management to stabilize soils, retain nutrients, maintain organic matter, and conserve soil moisture; and
(4) People's learning processes.

In practical terms, the impacts of the FLSP on strategic research area (2) will come from increasing work on integration of project technologies in ways that better manage vulnerable resources on steep lands, that is:

- Establishing and evaluating forage grass and tree hedgerows in cropping areas prone to sheet erosion;
- Establishing blocks of tree legumes to demonstrate their ability to control weeds and improve soil fertility, as well as providing animal feed;
- Using forage grasses to stabilize gullies in areas where they are threatening to destroy cropland;
- Using forage legumes to demonstrate the benefits of ground cover in areas where farmers have started to plant upland crops (such as pineapple) following rice or Job's tears;
- Establishing forage legumes with maize as a way of introducing a legume into the subsequent fallow (providing feed for animals and fertility inputs into the cropping system);
- Establishing forage grasses as a "catch crop" in areas where manure is being lost to the system; and
- Improving livestock production systems to the point where farmers are able to reduce their emphasis on shifting cultivation in steep lands.

The impacts of the FLSP on strategic research area (4) will come from continuing the work in participatory research and extension processes for which CIAT in Asia is gaining a reputation as a leader. This may be enhanced in future by the production of a book of experiences we have had on developing participatory extension processes.

Apart from field implementation issues, CIAT faces several broader challenges in this process:

- By definition, the FLSP is a "development" project funded by a donor agency not sympathetic to research needs. Some of the issues described above (such as nutrient management and weed control) require significant research inputs. These will have to be provided under other projects (such as the nutrient management project being proposed for ACIAR funding).
- National research organizations in Laos are seriously short of staff capable of conducting a focused research program on improved resource management in the uplands. CIAT's program in Asia will have to devote significant resources to training counterpart staff in research methodologies.

As CIAT in Asia expands its stable of special projects, we need to ensure that we share the complementary expertise of the internationally recruited staff between the various projects. This will provide, for example, resource economics inputs to the FLSP and training support in participatory methodologies from the FLSP to other CIAT projects.

FLSP Plans for 2002 - 2003

The major priority for the FLSP in 2002 - 2003 is to focus on consolidating impacts in the field. To achieve this, the major activities will be:

- Providing all the training, mentoring, and resources necessary to ensure information exchange, between farmers within villages, between villages, and between extension workers and farmers;
- Providing all the training, mentoring, and resources necessary to ensure genuine impacts are generated from existing project technologies, not just increases in area planted;
- Building the confidence of field teams to work with focus groups in the field rather than individual farmers;
- Commencing work with special interest women's groups;
- Providing all the training, mentoring, and resources necessary to document case studies of impacts not just outputs;
- Expansion to new farmers and villages only where there is real momentum;
- Supporting district teams with the training, mentoring, and resources they need to be able to organize cross visits and field days;
- Developing a broad range of extension materials for cross visits and field days;
- Commencing field trials with new animal health technical options; and
- Publishing an extension book on participatory approaches in five regional languages.

Integrated upland agricultural development using participatory approaches in China, Lao PDR, and Vietnam

This proposal, submitted to the International Fund for Agricultural Development (IFAD) for funding, has been accepted. The project proposes to work alongside five IFAD loan projects in the P.R. China, Lao PDR, and Vietnam. Focus sites will be selected within these project areas so that they can be used for training staff in IFAD projects and in dissemination activities.

The overall goal is to improve sustainable livelihoods (SL) of resource-poor farmers in the steep upland areas through technical and institutional innovations. The project will work within the context of the conceptual SL framework proposed by Chambers (1987)[24]. The expected outputs are:

(1) Appropriate technology interventions that improve livelihoods of the rural poor;
(2) Strengthened community leadership and organizational capacity;
(3) Increased capacity at different government levels to implement participatory technology development;
(4) More effective approaches to evaluate, improve and disseminate appropriate technologies that integrate local and new knowledge; and
(5) Improved communication linkages between IFAD and other organizations working on integrated agricultural development.

CIAT and CIP have crop, forage, and integrated pest management systems that have been shown to increase productivity and income and reduce risk. They have also developed approaches to introducing participatory methodologies to researchers and development workers, developing small agro-enterprises with local communities, and introducing monitoring and evaluation to development projects. These participatory approaches directly address the issues of gender and ethnicity in development. Additionally, we have good relationships with national GOs and other international centers that work in the region. The project will be able to draw on resources from these groups where there is the demand for their products and expertise.

Research and development will largely be conducted through national GOs at the provincial and district levels, but the project will also operate through national partners in Lao PDR, P.R. China, and Vietnam to ensure flow-on effects to other areas. Partners have been identified at provincial and national levels. CIAT will be the executing agency; however, the project will be a partnership between CIAT and CIP together with IFAD and the organizations participating at each site.

The total cost of the project is a US$ 2.2 million over 4 years, of which IFAD will contribute US$1.48 million. About 50% of funds will be used directly for support and capacity building of national organizations and rural communities. The remainder will be used in project coordination, for input from CIAT and CIP researchers, and national and international consultants.

Internal Organizational Aspects

The management of the C&W has applied strategies and methods geared to the implementation of two administrative roles: (1) getting the most out of individual capabilities, and (2) specializing human resources. The Project Leader, taking into consideration the analysis of personal and professional profiles, has exercised these two roles. This is how a person with roles in one area, such as accounting, is now successfully collaborating in the Youth Project in the North of Valle del Cauca. Likewise, another Project member with computer design roles has

[24] Chambers, R. 1987. Sustainable livelihoods, environment and development: putting poor rural people first. IDS Discussion Paper 240, Institute for Development Studies (IDS), Brighton, GB.

committed herself to work for that same project. A newcomer, Dr Sandra Brown from UBC, is now filling the important role of leading integrated watershed management in the theoretical and practical realms. Another newcomer, Dr Mario Piedra, holding a joint appointment with CIAT and CATIE in the economic area is dedicating his research efforts to Honduras and Nicaragua, a region he best knows as an economist.

One of the most important challenges the C&W group faced this year was the preparation of a conceptual framework for the project. New visions regarding our mission, new realities, and accumulated experiences, called for a new position paper regarding the communities and watersheds theme. Several documents were prepared with evident difficulties in grasping the whole and its parts. The exercise provided those who attempted an interpretation a good opportunity to examine their ideas about the project. Later, the participation of UBC staff in the analysis of the project, gave way to a document that is now the frame of reference for C&W. The conceptual framework was later translated into Spanish so that all CIAT collaborators in Honduras and Nicaragua could review it and make suggestions for adjustment.

During the period in which recent economic adjustment had to be made, C&W actively participated in discussions and in the elaboration of documents to submit to the Management Team.

These achievements are in tune with the proposed output regarding the sound management of the Project.

Team Building within CIAT

Activities carried out in Bolivia and in Haiti, and those in preparation of the Mesoamerican Biological Corridor (MBC) Project, have been major opportunities to strengthen multidisciplinary linkages with other CIAT projects. One could say that the C&W has larger and more longstanding interactions with other CIAT projects. In Haiti, the Project works with Cassava, Forages, Beans, and Maize (CIMMYT); the Haiti group meets regularly with the two coordinators (administrative and C&W) to plan the course of action in a development project that has different characteristics compared with research projects. In Bolivia, the Project has partners in Rural Agro-enterprises, Forages, Land Use, and Participatory Research. The MBC Project has also established collaborative linkages with many other CIAT projects.

Strategic Alliances

This year the C&W in developing strategies has made important efforts conducive to strategic alliances. Strategies include personal interchange, study of institutions (their roles, major activities, and missions), and visits to the sites where institutions work. Another strategy is the joint formulation and signature of technical cooperation agreements with GOs and NGOs. In Bolivia, for example, two visits were made during this year that helped in gaining knowledge about potential partners. An inter-institutional workshop, previously reported, gave way to the creation of the Inter-institutional Consortium. Project staff visited the Ministry of Agriculture, Bolivian donors, and the planning, monitoring, and evaluation section of SIBTA. To strengthen the relationships with the agricultural sector of this country, a cooperation agreement was signed

with the Ministry of Agriculture. Signature of the agreement calls for a planning meeting with the new Ministry to plan coordinated actions.

In a different area of interest, an agreement has been signed with UBC. This agreement is not only the basis for interchange of staff, but also opens doors, among other options, for the design of a training program in watershed management that can be jointly led by UBC and CIAT.

In section IV of the C&W Conceptual Framework, a list of strategic alliances is presented. At present, 11 alliances have been made with institutions throughout the world.

CATIE

As early as January 2002, CIAT and CATIE established a shared project to work on the social effects that alternative NRM strategies or decisions have in watersheds and on the multiple stakeholders involved in decision making. The strategy followed was to establish two joint positions between economists from both institutions. By April 2002, Mario Piedra joined CIAT's staff and was stationed in Turrialba. Eliecer Vargas was selected as CATIE's counterpart. The initial idea was for Eliecer to work on the Trade-Off Analysis (TOA) Project. However, a successful arrangement between CIAT and John Antle to carry out TOA has not been finally achieved. Eliecer commitment to CIAT's C&W Project is 25% of his time.

The reported actions are part of a series of activities carried out by Mario Piedra while working exclusively for CATIE. However, most of them are in full agreement with his terms of reference and represent an effort to shift his work towards the new conceptual framework of C&W. Finally, both institutions are already drafting a proposal that internalizes CATIE's experience in watersheds, economics, and forestry with CIAT's experience in watersheds to implement a forestry-based project in San Dionisio, as well as other student-conducted research projects for 2003.

Teaching/training activities

(1) Taught 50% of the Econometrics course at CATIE. It emphasized the use of probabilistic models for economic valuation of environmental/natural resource issues. April – June, 2002.
(2) Lecture on the *Econometrics Issues for Estimating Consumer's Welfare with Linear Models Departing from Travel Cost Data* at CATIE's training course on Environmental Economics and Valuation of Goods and Environmental Services .23/09 –04/10/02.
(3) Lecture on *The Importance of Shifting from Financial to Economics Analysis while drafting Forestry and Environmental Projects* at CATIE's training course on Identification, Formulation and Financial/Economic Evaluation of Forestry and Environmental Projects. 07-18/10/02.

Research activities through MSc theses directed by Mario Piedra

With Jeannete Gutierrez and Eliecer Vargas: "Economic valuation of potable water use from the Molino Norte and San Francisco watersheds in Matagalpa." The original objective was to

assess of the economic value of potable water, with emphasis on urban domestic consumption, for Matagalpa dwellers. More specifically the project originally aimed to:

- Estimate water supply provided by Molino Norte and San Francisco watersheds plus potential water consumption by Matagapla City dwellers;
- Estimate domestic water end-users' willingness-to-pay to support a farmer- oriented incentive program to protect the upper watersheds of Molino Norte and San Francisco; and
- Using focal groups, explore the possibility of implementing this farmer-oriented incentive program in the upper watersheds.

So far, all fieldwork in Matagalpa, Nicaragua, has been completed and the student is working on data analysis and modeling at CATIE. A final thesis report is expected by December 2002.

With Patricia Talavera and Glen Galloway: "Valuation of products and services provided by the Toncontin communal forest in Honduras." The original objective was to identify diversified-management strategies plus commercial activities that may generate greater income to forest dwellers profiting directly from goods and services available at the Toncontin communal forest. More specifically the project originally aimed to:

- Identify and select those goods with current and potential commercial value available in the forest;
- Estimate the direct economic use for each selected good;
- Simulate, at the community level, alternative income flow scenarios related to a diversified forest management;
- Evaluate tourist tastes and preferences for the different diversified management scenarios proposed; and
- Evaluate institutions and legal framework for implementing a "payment for environmental services" for water protection to the dwellers of the communal forest.

Fieldwork in Honduras has been completed and the student is working on data analysis and modeling at CATIE. A final thesis report is expected by December 2002.

With Felicia Granados and Eliecer Vargas: "Eco-efficiency analysis of rice farms at the Arenal-Tempisque Irrigation water district in Guanacaste, Costa Rica." The original objective was to assess eco-efficiency indexes of rice-producing farms at the Arenal-Tempisque Irrigation water district. More specifically, the project originally aimed to:

- Characterize different technological packages used in irrigated rice production;
- Define and account the cost structure per hectare during one production cycle; and
- Define and calculate eco-efficiency indexes for a sample of rice farms.

Fieldwork in Guanacaste is near completion. The student is working on data analysis, GIS software, and calculating indexes at CATIE. A final thesis report is expected by December 2002.

Research activities through MSc theses on which Mario Piedra is a key collaborator

With Karla Sanchez and Francisco Jiménez: "Methodology for identifying priority areas for payment for environmental services on water protection in the Sarapiqui River watershed, Costa Rica." The original objective was to develop a methodology to identify priority areas within the Sarapiqui river basin (area 1901 km^2) to efficiently allocate financial resources to water protection through payments for the environmental service. More specifically, the project aimed to:

- Identify and characterize the main direct users and beneficiaries (current and potential) of water resources within the basin;
- Establish criteria allowing identification of key areas for water protection; and
- Propose a payments for the environmental service compensation mechanism to land owners from water users.

Fieldwork in Costa Rica is near completion. The student is working on data analysis using software. A final thesis report is expected by December 2002.

With Raquel Chirinos and Bommat Ramacrishna: "Developing a methodology for developing and managing a compensation mechanism for water protection in rural micro-watersheds in Honduras." The general objective was to contribute to developing a sustainable and participatory management scheme (mainly for water resources) of rural micro-watersheds in the Catacamas Municipality in Olancho Department. More specifically, the project aimed to:

- Characterize biophysically, socioeconomically, and institutionally the Quebrada Seca watershed using primary and secondary information;
- Assess a potential compensation mechanism for agricultural producers for water production;
- Assess water users' willingness to pay for the program and the socioeconomic factors that might influence it; and
- Propose the essential elements for designing sustainable water management strategies to enhance local municipality capacity for water management.

Fieldwork was completed involving water users, agricultural producers, and institutions engaged in management and protection of the Quebrada Seca micro-watershed resources (1.5 km from Catamas City).

With Fabiola Tabora and Francisco Jimenez: "Development of an environmental fund scheme for management and conservation of natural resources in a micro-watershed in Honduras." The general objective is to design an environmental fund scheme for management and conservation of natural resources in La Soledad micro-watershed, located in Los Angeles Municipality, at 23 km from Tegucigalpa, Honduras. More specifically, the project aimed to:

- Characterize biophysically and socioeconomically La Soledad Micro watershed using primary and secondary information;
- Assess potential sites and activities for tourism and eco-tourism within the river basin;

- Assess visitors' and local merchants' willingness to pay for scenic beauty under "an improved infrastructure scenario" for eco-tourism;
- Assess eco-tourism's profitability with this scheme; and
- Design a municipal environmental fund scheme for payments for the environmental service to forest owners.

Research activities at PhD level in the Cerbastan Project

The Cerbastan Project is a multi-stakeholder approach for the sustainable development of reforestation technologies for dry rangelands in Guanacaste, Costa Rica. In its initial phase, three institutions collaborated in this project: Hacienda La Pacífica, CATIE, and the Asociación para la Vida y la Naturaleza (AVINA). Starting April 2001, CATIE's authorities kept the the Scientific Committee coordination in Mario Piedra's hands. Principal staff of La Pacífica, CATIE, CIAT, and representatives of local landowners make up this committee. The project focuses on successful reforestation of degraded dry rangelands with native timber species and integrates research projects at MSc and PhD levels. CATIE-based staff supervises field research. The initial phase lasts from 2001 to 2004.

With Juan Carlos Flores and Dietmar Stoian: "Exploring the potential of sound management of forest cover to counter the loss of tropical dry forest on cattle farms in Guanacaste, Costa Rica." Together with cattle farmers of Guanacaste, we study how the cultural, economic, social, political, biophysical, and institutional factors determine land use trends in the dry tropics of Costa Rica, and identify economically viable options to increase forest cover

With Ottoniel Monterroso: "Evaluation of economic, social, political, and institutional framework for reforestation of cattle farms in the Pacific dry forest of Costa Rica." Research determines the economic and social returns of pure reforestation and silvopastoral systems in order to propose political instruments for the promotion of sustainable production systems. A database will be obtained from primary and secondary sources, on which models will be developed and tested.

University of British Columbia (UBC)

Our relationship with UBC started as a result of previous collaboration between Hans Schreier and JI Sanz while the later was in IDRC in a secondment agreement in 1996-1998. Since then, we have been working together towards establishing a relationship around the theme of integrated watershed management. The alliance was consolidated last year with a joint participation in the "The Role of Participatory Research by Youth in NRM" being funded by the Canadian International Development Agency (CIDA).

This year, this alliance was further advanced by the joint appointment of Dr Sandra Brown, a Resource Management Specialist who will spend half her time at CIAT and half at UBC. She is helping us to strengthen our research on themes that link biophysical research with the social aspects of the development process.

As part of this alliance we have also started to benefit from students from UBC who will support our research. This year, the first student, Amy Fournier, is joining our team in Yorito, Honduras,

and will be with us from next November until April 2003, working on aspects of water and youth.

Bolivia

A planning workshop and visit was carried out at the end of 2001 with seven Bolivian governmental and nongovernmental institutions. During visits to institutions and their work scenarios, it was possible to understand the areas and topics of collaboration among national institutions and the role of CGIAR centers in capacity development.

The workshop dedicated time to collectively formulate a synthesis of collaboration areas that could become an input for the preparation of a proposal for inter-institutional cooperation. The final synthesis comprised (a) demands of participating institutions' clients regarding agricultural production and NRM, (b) other demands from clients that did not fall within this area, and (c) demands in terms of institutional strengthening needs, for which "we" require support from other institutions. Once demands were expressed, participants dedicated time to identify technologies and methodologies they could offer to their colleagues to respond to the expressed needs. Finally, participants expressed their ideas regarding the methods and strategies to follow to make inter-institutional cooperation a reality.

Other important forging of links in Bolivia led to the creation of the Bolivian Consortium and the Project Platform, previously described in this report.

Haiti

The C&W Project, as well as the other CIAT and CIMMYT participants in a workshop carried out in February 4-8, was able to identify a set of expected results:

(1) Institutional capacity developed for adaptive on-farm trials, and the establishment of SOLs with local partners,
(2) Local capacity enhanced through training and technical assistance activities,
(3) Strengthening local farmers' organizations in their operational capacity,
(4) Agricultural innovations implemented and appropriated by local organizations,
(5) SOL established with operational capability to run trials, evaluations, and to disseminate knowledge and respond to other information demands, and
(6) Small artisanal seed enterprises established.

Besides the implementation of its own agenda, the C&W Project has played a facilitation role with CIAT's partners and local professional staff. A major effort was made at the outset of activities in Haiti to organize a work plan in which all planned activities proposed by each project team would be in the same Gantt chart. At the workshop, all project coordinators were led to use the same planning format that would make all activities correspond in terms of trial planting periods, evaluation and selection, harvesting activities, training and visitation. Up to date, this instrument has been useful in planning and evaluation meetings.

Appendix I shows all CIAT- HAP activities in one single chronogram.

The Search for Funding

Accomplishments

In March this year, a proposal submitted to the Kellogg Foundation on "The role of participatory research by youth in NRM" was approved for the Garrapatas watershed in El Dovio, northern part of Valle del Cauca, Colombia, for a period of 3 years.

In June of this year, the SDC approved our proposal to carry out the dissemination of the decision support tools developed during our last project with them. Five of these tools will be packaged into multimedia software called "Toolbook" in collaboration with UBC.

Recently, the joint CIAT-CIP project proposal "Integrated upland agricultural development using participatory approaches in China, Lao PDR, and Vietnam was approved by IFAD under the Technical Assistance Grant (TAG) Program. This project proposes to work alongside five IFAD loan projects in the P.R. China, Lao PDR, and Vietnam. Focus sites will be selected within these project areas so that they can be used for training staff in IFAD projects, and in dissemination activities. The overall goal is to improve sustainable livelihoods of resource-poor farmers in the steep upland areas through technical and institutional innovations. The project will work within the context of the conceptual SL framework proposed by Chambers (1987)[25]. The expected outputs are:

- Appropriate technology interventions that improve livelihoods of the rural poor;
- Strengthened community leadership and organizational capacity;
- Increased capacity at different government levels to implement participatory technology development;
- More effective approaches to evaluate, improve, and disseminate appropriate technologies that integrate local and new knowledge; and
- Improved communication linkages between IFAD and other organizations working on integrated agricultural development.

Projects in the Pipeline

The C&W team is preparing various other proposals that we describe briefly here. We are also working with donors as partners to assure that our proposals fit as part of their own interests.

FSLP in Asia

As CSF is perhaps the most devastating disease problem of livestock in the uplands, we are developing a collaborative research project with CSIRO-AHL focusing on disease management in village pigs. If the application for funding from ACIAR is successful, the project is expected to start in January 2003. It will work alongside FLSP for 3 years to:

- Develop, evaluate, and implement a simple, rapid diagnostic test for CSF;
- Evaluate the efficacy of a new virus-vectored CSF vaccine in experimental studies;

[25] Chambers, R. 1987. Sustainable livelihoods, environment and development: putting poor rural people first. IDS Discussion Paper 240, Institute for Development Studies (IDS), Brighton, GB.

- Establish a system to apply the virus-vectored CSF vaccine in Lao villages;
- Measure the social and economic impact of the virus-vectored vaccine in the village pig production system;
- Continue studies on the epidemiology of foot and mouth disease and CSF in Lao PDR; and
- Communicate the results of the project nationally and internationally.

At the same time, we will commence work on improved housing and management of village livestock to minimize the impact of disease outbreaks.

Develop a research project proposal to look at nutrient cycling

Thomas Oberthür, Rod Lefroy, and Peter Horne have been developing a proposal for submission to ACIAR. Thomas Oberthür came to Laos in June 2002, and traveled with Peter Horne and Rod Lefroy to four potential sites in the north of Laos, where the FLSP is also active. The proposal is now well advanced and ACIAR have expressed interest in considering it for funding. It will examine the dynamics of nutrient management and farmers' decision-making processes in resource allocation as they move away from shifting cultivation into more permanent forms of agriculture in the uplands.

Mesoamerican Biological Corridor (MBC)

Our proposal consists of providing support to ongoing efforts by contributing to the MBC's sustainable development with the analysis of geographic information on population, agriculture, and environment. We seek to contribute also in the design of alternatives for water protection, rehabilitation of degraded areas, and biological corridors at the local level. The aim is to take these alternatives to the most vulnerable points within the non-protected areas of the MBC.

CIAT (C&W Project) and its partners are proposing a project to contribute to the creation of human and institutional capacity at the local, national, and regional levels, to use GIS, communication technologies, and methodologies for the analysis of natural resources. These capacities would be directed to the preservation and recuperation of water resources and biodiversity in the non-protected areas of the MBC.

In June 2000, Joachim Voss and José I. Sanz visited NORAD who suggested presenting a concept note for a project in the Central American region, with the support of governments and the regional strategy of the Comisión Centro Americano de Ambiente y Desarrollo (CCAD). The focus should be on water and deforestation, and it should include a monitoring system of progress made at a local and regional scale.In September 2000, a preliminary project was designed with the participation of various CIAT projects. The focus was complementary to the work of CCAD and the National Aeronautics and Space Administration (NASA).In November 2000, we visited Lorenzo Cardenal, Principal Technical Advisor of the MBC with headquarters in Managua. That same month we visited NORAD. We ascertained that regional funds were available, but not in 2001. We thus sought alliance with CATIE that is already working with Norway. The focus was on problems at different scales. We undertook to write a pre-concept note to present to headquarters. The permanence of NORAD in the region is dependent on election results. There are problems of corruption and governance. There was discussion within

NORAD on the relative importance of Latin America as opposed to problems in Asia and Africa.The Proposal Support Fund of CIAT approved US$7000 in March 2001 to develop the project with partners in the region. A visit was made to NORAD in June where there was a movement towards a regional emphasis for the project. NORAD voiced an interest in visiting CIAT. The status of the embassy is dependent on the election results. The new ambassador was appointed in October 2001 when elections took place in Nicaragua.
In March 2002, CIAT (Glenn Hyman) attended the meeting on initiatives of environmental information for the MBC in Guatemala. This was followed in May by contact with strategic partners to establish alliances (CATIE, CARE, CIPAV, and UBC).
A second meeting with Lorenzo Cardenal and Rado Barzev took place in June and approval was given of the steps taken to date. Important recommendations were made. A meeting also took place with NORAD where interest in the proposal was maintained. The final date given for delivery of the proposal was the end of July.

Strengthening rural undergraduate education

The purpose of this project is to contribute to the development of a model of rural undergraduate education based on research, the use of GIS, and multi-media information technologies that can be used for NRM, the development of entrepreneurial skills, and enhanced income-generating capacities.

The role of participatory research by youth in NRM for Nicaragua

The goal of this project is to educate Nicaraguan youth on how to manage, protect, and conserve water resources using scientific and participatory techniques, and initiate local monitoring, prevention, and rehabilitation programs.

Women and land tenure

Land ownership structures in Colombia lack the needed elements to drive sustainable development in rural areas. Several past land reform efforts failed to produce more efficient mechanisms of land ownership that could have increased land productivity, corrected inequalities and market distortions, and strengthened institutions and democracy. With this project, we propose to search for an alternative strategy for acquiring and managing land among a group of 20 women located in an area currently suffering from the armed conflict. Using participatory research, acting collectively, and using scientific tools and methods to evaluate the effect of a land ownership change in their families and community, we expect to generate the local capacity for producing positive changes in the land ownership structure. The approach developed may then be applied to other similar agrarian communities in Colombia.

Strengthening an ASOBOLO rural education program (submitted to Re-Source)

The goal of the project is to develop environmental education programs for youth, focused on water and its relation to local sustainability in social, economic, and ecological aspects. The project will work at the local community level, initially with 2-3 pilot schools, and focus activities at pilot sites (micro-watershed scale) within the Rio Bolo watershed. The methods,

field based activities, analytical tools, and educational materials developed with the pilot youth groups will be designed to be flexible and transferable. Youth-to-youth exchange programs will be initiated to scale out to other schools in the watershed and other watersheds in Valle del Cauca.

Integrated watershed management in peri-urban Cali

Strengthen the contribution of peri-urban agriculture to food security and the eradication of poverty, through efficient and sustainable use of natural resources of the peri-urban watersheds of Cali supported by the participation of the vulnerable young population.

Publications

Book and Journal

Beltrán, J.A.; Tijerino D. 2002. Fortaleciendo los procesos organizativos a nivel local: La Asociación "Campos Verdes" una estrategia que facilita el desarrollo del Municipio de San Dionisio, Matagalpa, Nicaragua. LEISA Agroecol J. (Submitted)

Beltrán, J.A.; Zeledón, J.C.; Morales, J.; Espinoza, N. 2002. Participatory mapping, analysis and monitoring of natural resources in the Calico River micro-watershed, in San Dionisio, Matagalpa, Nicaragua. PLA-Notes. (Submitted)

Decaëns, T.; Lavelle, P.; Jiménez, Jaén, J.J.; Escobar, G.; Rippstein, G.; Schneidmadl, J.; Sanz, J,I.; Hoyos, P.; Thomas, R. 2001. Impact of land management on soil macrofauna in the Eastern plains of Colombia. *In:* Nature's plow: Soil macroinvertebrate communities in the neotropical savannas of Colombia. CIAT, Cali, CO. p. 19-41. (CIAT Publ no. 324)

Horne, P.M.; Stür, W.W. 2002. Developing agricultural solutions with smallholder farmers – participatory approaches for getting it right the first time. ACIAR Monograph Series. Australian Center for International Agricultural Research, AU. 120 p. (In press)

Howeler, R.H. 2002. Cassava mineral nutrition and fertilization. *In*: Hillocks, R.J.; Thresh, M.J.; Bellotti, A.C. (eds.). Cassava: Biology, production and utilization. CAB International, Wallingford, GB. p. 115-147.

Luitjen, J.C.; Knapp, E.B.; Sanz, J.I. 2002. A role for GIS-based simulation in empowering local stakeholders in water resources negotiations in developing countries: Case studies for two rural hillside watersheds in Honduras and Colombia. Water Policy (Submitted)

Stür, W.W; Horne, P.M. 2002. Developing forage technologies with smallholder farmers – how to grow, manage and use forages. ACIAR Monograph 88. Australian Center for International Agricultural Research, AU. 96 p. (Available in English, Chinese, Indonesian, Lao, Thai, and Vietnamese)

Stür, W.W.; Horne, P.M.; Gabunada, F.A.; Phengsavanh, P.; Kerridge, P.C. 2002. Forage options for smallholder crop-animal systems in Southeast Asia – working with farmers to find solutions. Agric Syst 71:75 -98.

Suyamto; Howeler, R.H. 2002. Cultural practices for soil erosion control in cassava-based cropping systems in Indonesia. *In*: Barker, D.H.; Watson, A.; Sombatpanit, S. (eds.). Ground and water bioengineering for the Asia-Pacific region. Intern Erosion Control Assoc. (In press)

Workshop and Conference Papers

Ayarza, M. 2002. Priorización de temas y actividades de investigación en el sitio SOL-Luquigüe, Memoria del taller "Planificación participativa por objetivos" desarrollado en Yorito, Yoro, Honduras, 7-8 Mayo 1999. CIAT-Communities and Watersheds Project, Yorito, HO. (Internal document)

Beltrán, J.A.; Zeledón, J.C.; Morales, J. 2002. Mapeo, análisis y monitoreo participativo de los recursos naturales. Estudio de caso: Subcuenca del río Calico, San Dionisio, Matagalpa, Nicaragua. Paper presented at the XLVIII Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de cultivos y animales (PCCMCA), 15-19 Apr 2002, Santo Domingo. CIAT- Communities and Watersheds Project, Yorito, HO. (Internal document)

Brizuela, L. 2002. Memoria del Comité Técnico de la Red de Sitios Sol, Yorito, Yoro, 2 de Mayo del 2002. CIAT- Communities and Watersheds Project, HO.

Dakouo, D.; Trouche, G.; Bâ, Malick; Zongo Adama. 2002. Perspectives de lutte contre la cécidomyidé du sorgho, *Stenodiplosis sorghicola*, une contrainte majeure à la production du sorgho dans les zones Centre Ouest et Est du Burkina Faso. *In:* Procs of the "Forum de la recherche scientifique et de l'innovation technologique", April 2002, Ouagadougou, BF. (In press)

Hocdé, H.; Lançon, J.; Trouche, G. 2002 (eds.). 2002. La sélection participative: Impliquer les utilisateurs en amélioration des plantes. Procs of a workshop held in Montpellier, 5-6 May, Montpellier, FR. 148 p. Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) Working Document on line www.cirad.fr.

Horne, P.M. 2002. Farmer-initiated forage management for stabilization of shifting cultivation systems. *In*: Cairns, M.F. (ed.). Indigenous strategies for intensification of shifting cultivation in the Asia-Pacific region. Procs of a regional workshop held in Bogor, Indonesia, June 23–27 1997. International Centre for Research in Agroforestry (ICRAF), Chiang Mai, TH. p. 54.

Howeler, R.H. 2002a. Cassava in Asia: Research and development to increase its potential use in food, feed and industry – A Thai example. Paper presented at the cassava workshop organized by the Department of Agriculture, Thailand, 16 Jan 2002. (In press)

Howeler, R.H. 2002b. Evaluation of cassava and bean germplasm in East Timor. Paper presented at the international conference "Agriculture: New directions for a new nation", 1-3 Oct 2002, Dili, East Timor. (In press)

Howeler, R.H. 2002c. Nutrient inputs and losses in cassava-based cropping systems – Examples from Vietnam and Thailand. *In*: Procs international workshop on "Nutrient balances for sustainable agricultural production and natural resource management in Southeast Asia", 20-22 Feb 2001, Bangkok, Thailand. (In press)

Howeler, R.H. 2002d. The use of a participatory approach in the development and dissemination of more sustainable cassava production practices. *In*: Nakatani, M.; Komaki, K. (eds.). Potential of root crops for food and industrial resources. Procs 12th Symp Intern Soc Trop Root Crops, 11-16 Sept 2000, Tsukubu, Japan. p. 42-51.

Howeler, R.H.; Oates, C.G.; Allem, A.C. 2002. An assessment of the impact of cassava production and processing on the environment and biodiversity. *In*: Nakatani, M.; Komaki, K. (eds.). Potential of root crops for food and industrial resources. Procs 12th Symp Intern Trop Root Crops, 11-16 Sept 2000, Tsukubu, Japan. p. 52-55.

Howeler, R.H.; Watana Watananonta; Tran Ngoc Ngoan. 2002. Improving the sustainability of cassava-based cropping systems in Asia: A farmer participatory approach to technology development and dissemination. Paper presented at the 17th World Congress of Soil Science, 14-21 Aug 2002, Bangkok, Thailand. 1 CD-ROM.

Howeler, R.H.; Tongglum, A.; Jantawat, S.; Utomo, W.H. 2002. The use of forages for soil fertility maintenance and erosion control in cassava in Asia. *In*: Stür, W.W. (ed.). Procs of 3rd Regional Meeting of the Forages for Smallholder Project (FSP), 23-26 Mar 1998, Samarinda, East Kalimantan, Indonesia. CIAT, Cali, CO. p. 196-211. (Working Doc no. 188)

Orozco, P.P.; Brizuela, L.; Schmidt, A.; Beltrán, J.A. 2002. SOL - un concepto alternativo para el mejoramiento participativo de cultivos. Paper presented at the XLVIII Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de cultivos y animales (PCCMCA), 15-19 Apr 2002, Santo Domingo, DO.

Saravia, J. 2002. Problemática de los actuales sistemas de producción, Memoria del taller de planificación participativa por objetivos, Yorito, Mayo 1999. CIAT- Communities and Watersheds Project, Yorito, HO. (Internal document)

vom Brocke, K.; Trouche, G.; Barro, C. 2002. Evaluation of data from participatory selection in segregating material of sorghum in two villages in Burkina Faso. Paper presented at the Workshop of Quality of Science in Participatory Plant Breeding, 30 Sept- 4 Oct, Rome, IT.

vom Brocke, K.; Trouche, G.; Vaksmann, M.; Bazile, D. 2002. Préservation de l'agrobiodiversité du sorgho au Mali et au Burkina – amélioration de la productivité et maintien de la biodiversité. *In:* Procs of the workshop on "La conservation et valorisation des ressources génétiques des mils", 28-29 May 2002, Niamey, NE. (In press)

Watananonta, W.; Vongkasem, W.; Klakhaeng, K.; Howeler, R.H. 2002. A farmer participatory approach for the development and dissemination of sustainable cassava production practices in Thailand. *In*: Procs of the national seminar on "Agricultural systems for the sustainable management of resources and the development of community organizations", 15-17 Nov 2000, Bangkok, Thailand. p. 135-150. (In Thai)

Technical Reports and Others

Beaulieu, N.; De Wispeleare, G.; Alvarez, M.; Jaramillo, J.; Leclerc, G.; Rubiano, Y.; Fajardo, A.; Muñoz, O.; Peñuela, N. 2002. Using remote sensing to monitor environmental dynamics in support to local planning efforts. CIAT-Land Use Project, Cali, CO. (Poster)

Bosco, J.; Beltrán, J.A.; Zapata, V. (eds.). 2002. Curso taller sobre instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales y la protección de fuentes de agua con ENACAL-DAR 1- Juigalpa. CIAT- United Nation's Children's Fund (UNICEF)-ENACAL (Empresa Nicaragüense de Acueductos y Alcantarillados). CIAT-Communities and Watersheds Project, Publ no. 13, Nicaragua, Managua, NI.

Bosco, J.; Beltrán, J.A.; Zapata, V. (eds.). 2002. Curso taller sobre instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales y la protección de fuentes de agua con ENACAL-DAR 5- Juigalpa. CIAT- United Nation's Children's Fund (UNICEF)-ENACAL (Empresa Nicaragüense de Acueductos y Alcantarillados). CIAT-Communities and Watersheds Project, Publ no. 12, Managua, NI.

Bosco, J.; Beltrán, J.A.; Zapata, V. (eds.). 2002. Curso taller sobre instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales y la protección de fuentes de agua con ENACAL-DAR 6- Juigalpa. CIAT- United Nation's Children's Fund (UNICEF)-ENACAL (Empresa Nicaragüense de Acueductos y Alcantarillados). CIAT-Communities and Watersheds Project, Publ no. 12, Managua, NI.

Davies, C.; Beltrán, J.A.; Bosco, J. (eds.). 2002. Resultados de los ensayos de investigación año 2001, realizados por los Comités de Investigación Agrícola Local (CIALes) en San Dionisio, Matagalpa. CIAT – Communities and Watersheds Project, Publ no. 10, Managua, NI.

Horne, P.M; Braun, A.; Caldwell, J.; Ito, O. 2002. Improving adoption of agricultural technologies: How participatory research can complement conventional research approaches. A CD-ROM of training resources from a training workshop at Japan International Research Center for Agricultural Science (JIRCAS), 4–8 March 2002, Tsukuba, Japan. CIAT-Laos, LA.

Ministerio Agropecuario – Dirección General de Estrategias Territoriales – MAGFOR – INEC – CIAT – INETER – MARENA (Ministerio Agropecuario y Fore - Instituto Nacional de Estadisticas y Censos – CIAT - Instituto Nacional de Estudios Territoriales - Ministerio de Ambiente y Recursos Naturales). 2002. Atlas Rural de Nicaragua. CIAT, Managua, NI. 1 CD-ROM.

Orozco, P.P.; Bosco, J.; Beltrán, J.A.; (eds.). 2002. Resultados de ensayos de investigación año 2001 en los sitios Supermercado de Opciones para Laderas (SOL) en San Dionisio, Matagalpa. CIAT- Instituto Nacional de Tecnología Agropecuaria (INTA). CIAT-Tsukuba, Japan, Publ no. 11, Managua, NI.

Probst, K.; Brizuela L. 2001. Sistema de monitoreo y evaluación de la Red de Sitios Sol, Yorito, Yoro. CIAT-Communities and Watersheds Project, Yorito, HO. 6 p.

Ratnadass, A.; Trouche, G.; Chantereau, J.; Dakouo, D.; Ag Hamada, M; Fliedel, G.; Luce C. 2002. Selection of a sorghum line CIRAD 441 combining productivity and resistance to midge and head-bugs. Intern Sorghum Millet Newsl Vol. 42. (In press)

Roa, MC. 2001. The role of youth groups in natural resources management research: Improving education for rural development. CIAT- Communities and Watersheds Project, Cali, CO. 15 p. (Internal document)

Sanz, JI.; Ziegler, RS.; Sarkarung, S.; Molina, DL.; Rivera, M. 2002. Improved rice-pastures systems for native savanna and degraded pastures in acid soils of Latin America. CIAT, Cali, CO. 22 p. (In press)

Zapata, V. 2002. Estrategias para la formulación de propuestas de investigación y desarrollo. Taller de diseño de proyectos utilizando el marco lógico. CIAT- Communities and Watersheds Project, Cali, CO. 12 p. (Internal document)

Donors

Canadian International Development Agency (CIDA)
Danish International Development Agency (DANIDA)
Ecoregional Fund to Support Methodological Initiatives
International Development Research Centre (IDRC)
International Fund for Agricultural Development, (IFAD)
International Service for National Agricultural Research (ISNAR)
Kellogg Foundation
Royal Danish Ministry of Foreign Affairs, Department for Development Research
Swiss Agency for Development and Cooperation (SDC)
United States Agency for International Development (USAID)

Collaborators

Within CIAT:

Soils (PE-2), Land Use (PE-4), Agro-industries (SN-1), Participatory Methods (SN-3), Forages (IP-5), Impact Assessment (BP-1), Bean Improvement (IP-1), Rice (IP-4) Projects.

Outside CIAT:

Honduras:

Centro Universitario Regional del Litoral Atlántico (CURLA)
Comité Interinstitucional para el Desarrollo de Sulaco (CIDES), Yoro
Comité Local para el Desarrollo Sostenible de la Cuenca del río Tascalapa (CLODEST), Yorito, Yoro
Comité de Microempresas y Comercialización del CIDES de Sulaco, Yoro
Comités de Investigación Agrícola Local (CIALs), Yorito, Yoro
Consorcio para el Manejo Integrado de Suelos Frágiles en Centro América (MIS)
Escuela Agrícola Panamericana El Zamorano (EAP-Zamorano)
Escuela Nacional de Ciencias Forestales (ESNACIFOR)
German Agency for Technical Cooperation (GTZ)
Instituto Interamericano de Cooperación para la Agricultura (IICA)
Instituto San Pedro (ISP), Yorito, Yoro
International Water Management Institute (IWMI)
Programa de Agricultura Sostenible en las Laderas de Centro América (PASOLAC)
Programa Nacional de Desarrollo Sostenible / Proyecto (MARENA)
Proyecto de Investigación Participativa para Centro América (IPCA), Yorito, Yoro
Proyecto FAO-Lempira Sur
Secretaría de Agricultura y Ganadería / Servicio Nacional de Sanidad Agropecuaria (SAG/SENASA)
Secretaría de Agricultura y Ganadería/ Dirección de Investigación de Ciencias y Tecnología Agrícola (SAG/DICTA)
Servicios Técnicos para el Desarrollo Sostenible (SERTEDESO), Yorito, Yoro

Nicaragua:

Alcaldía de Masaya
Alcaldía del Municipio de San Dionisio, Matagalpa
Asociación para la Diversificación y Desarrollo Agrícola Comunal, Matagalpa (ADDAC)
Campos Verdes Association, San Dionisio, Matagalpa
CARE-Nicaragua
Centro y Promoción de Desarrollo Local (CEPRODEL)
Comités de Investigación Agrícola Local (CIALs), San Dionisio, Matagalpa

Delegaciones Regionales de Acueductos Rurales, adscritos a la Empresa Nicaragüense de Acueductos y Alcantarillados (ENACAL-DAR)
Eidgenossische Technische Hochschule-Zentrum (ETHZ, Swiss Federal Institute of Technology), Zurich
Instituto Nacional de Tecnología Agropecuaria (INTA)
Instituto Técnico Forestal (INTECFOR)
Mesoamerican Biological Corridor (MBC)
Ministerio Agropecuario y Forestal (MAGFOR)
Programa para la Agricultura Sostenible en Laderas de América Central (PASOLAC)
Programa Socioambiental y Desarrollo Forestal (POSAF-MARENA)
Proyecto Campesino a Campesino (PCAP), San Dionisio, Nicaragua.
Proyecto de Desarrollo de San Dionisio (PRODESSA), Nicaragua
United Nations Children's Fund (UNICEF)

Costa Rica:
Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)

Haití:
Hillsides Agricultural Program, (HAP)

Colombia:
Asociación de Centros Educativos del Cañón del Río Garrapatas (ACERG)
Centre for Research on Sustainable Agricultural Production Systems (CIPAV)
Consorcio para el Desarrollo Sostenible de los Andes (CONDESAN)
Consorcio Interinstitucional para una Agricultura Sostenible en Laderas (CIPASLA)
Corporación Autónoma del Valle del Cauca (CVC)
Herederos del Planeta, Juventud Vida y Naturaleza de Bellavista

Bolivia:
Fundación Promoción e Investigación de Productos Andinos (PROINPA)
Intercooperation Andes
Programa Manejo Integral de Cuencas (PROMIC)
Universidad Autónoma Gabriel René Moreno-Instituto de Investigaciones Agrícolas (UAGRM IIA) "El Vallecito"

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Provincial partner staff
District partner staff

Thailand:
Department of Agriculture DOA, Bangkok
Department of Agricultural Extension (DOAE), Bangkok
Land Development Dept., Bangkok
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Appendix I

CIAT - HAP
ORGANIZATION OF ACTIVITIES - CHRONOGRAM
Integrated Version

(03.2002)

This table shows all CIAT- HAP activities in one single chronogram. Activities carried out by different projects (Bean, Cassava, Forages, and Hillsides) are inserted in each set of categories (1 to 9). Columns 2 and 3 indicate the months of the year (1, 2, 3, 4, etc.), and the year (2002-2005) when activities will take place.

ACTIVITIES	Months	Year
1.1 Preliminary activities to be carried out at CIAT headquarters		
• ***Review of previous work and achievements***		
♣ *Cassava*	1-6	2002
❖ *Maize: Review from previous trials from Haiti.*	2-3	2002
• ***Organizing facilities***		
♣ *Cassava*	6	2002
• ***Conducting germplasm preliminary trials***		
➢ *Forages*	1-12	2002
• ***Requesting germplasm from other institutions***		
♣ *Cassava*	6	2002 2003
• ***Requesting protocols from other institutions***		
♣ *Cassava*	3	2002
• ***Selecting materials***		
♣ *Cassava*	3	2002 2003
❖ *Maize: Selection of superior materials OPV's*	2-3	2002
➢ *Forages*	1-12	2002
❑ *Beans – Selection of small- seeded lines in drought and low fertility nurseries.*	4-12 4-12 4-12	2002 2003 2004
• ***Reproducing germplasm***		
♣ *Cassava*	3-12	2002
❖ *Maize: Request seeds from CIMMYT of selected cultivars*		
➢ *Forages*	1-12	2002
• ***Seed multiplication***		
➢ *Forages*	1-12	2002
❑ *Beans – Red and black small-seeded lines*	3-5 9-12 9-12	2002 2003 2004
❑ *Beans – Drought- tolerant lines*	6-8 6-8	2002 2003
1.2 Preliminary activities to be carried out in Haiti		
• ***Institutional needs assessment***		
♣ *Cassava*	1-6	2002

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
1.2 Preliminary activities to be carried out in Haiti		
• ***Farmers' needs assessment***		
♣ *Cassava*	1-12	2002 2003 2004
o *Hillsides: Participatory needs assessment of production systems*	3-4	2002
• ***Farmers' organizations and local leadership identified***		
♣ *Cassava*	3-9	2002
o *Identification of farmers' groups interested in participatory evaluation and selection of germplasm*	5	2002
• ***Identification of key farmers for field work***		
♣ *Cassava*	3-9	2002
❖ Maize: Contact farmers for trials testing -Haiti Cycle A	2-3	2002
• ***Identification of multi-purpose R&D sites for all activities***		
♣ *Cassava*	3-6	2002
o *Hillsides: identification of potential SOL sites*	7-8	2002
• ***Collecting local germplasm***		
♣ *Cassava*	1-12	2002 2003 2004
➢ *Forages*	2,3	2002
o *Hillsides: Team induction on needs assessment*	2-3	2002
• ***Organizing CIAT Haitian team***		
♣ *Cassava*	3-10	2002
2.1 Establishment germplasm on-farm (plot) trials		
• ***Seed availability***		
♣ *Cassava*	1-12	2002 2003 2004
❖ *Maize: Seed increase of entries not available from CIMMYT - Cali.*	3-7	2002
➢ *Forages*	3	2002
• ***Definition of experimental protocols***		
♣ *Cassava*	3	2002
➢ *Forages*	2	2002
• ***Seed multiplication***		
♣ *Cassava*	1-12	2002
➢ *Forages*	1-12	2002
❖ *Maize: Seed increase of entries included in trials, Cali.*	8-12 1	2002 2003
❖ *Maize: Seed increase of best entries from validation plots in Haiti, Cycle A*	3-7	2003
❖ *Maize: Seed production of best entries from validation plots Cycle 2002-B*	3	2003
❖ *Maize: Seed production of best entries from validation plots, Haiti, Cycle 2003-A*		
❖ *Commercial seed production of selected entries from validation plots from Cycles A and B available for promotion*	8	2003

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
2.1 Establishment germplasm on-farm (plot) trials		
• ***Preparation of plots***		
♣ *Cassava*	4	2002 2003 2004
➢ *Forages*	2,3	2002
• ***Planting trials***		
♣ *Cassava*	4	2003 2004
❖ *Maize: Trial testing of selected entries available from CIMMYT seed. Haiti - Cycle A*	3-7	2002
❖ *Maize: Trials analysis and selection of best entries.*	3-7	2002
❖ *Maize: trials testing of entries not included in Haiti-Cycle A evaluated in Haiti Cycle B*	8-12 1	2002 2003
❖ *Trials analysis and selection of best entries*	8-12 1	2002 2003
➢ *Forages*	3,4	2002
❑ *Beans – Observation trial of red-mottled bush types, 1 sites, N & S*	3-8 3-8 3-8	2002 2003 2004
❑ *Beans – Preliminary yield trial, 1 site, N & S, red mottled*	9-12 9-12 9-12	2002 2003 2004
❑ *Beans – On-farm validation trial, red mottled*	3-12 3-12	2003 2004
❑ *Beans – Observation trial of climbing beans, 1 site, N & S*	3-8	2002
❑ *Beans – Preliminary yield trial, 1 site, climbers*	9-12	2002
❑ *Beans – On-farm validation trial, climbers*	3-12 3-12	2003 2004
❑ *Beans – Observation trial of red & black lines, 1 site, N & S*	7-12 7-12 7-12	2002 2003 2004
❑ *Beans– Preliminary yield trial, 1 site, reds & blacks*	3-12 3-12	2003 2004
Beans - Validations trial, reds, blacks, yellows, &/or creams - 5 in north	1-3, 3-12 3-12 3-12	2002 2003 2004
Beans - Validations trial, reds, blacks, yellows, &/or creams - 5 in south	3-5, 9-12 3-12 3-12	2002 2003 2004
❑ *Beans – Observation of drought tolerant lines, 1 site,*	12 1-3, 12 1-3	2002 2003 2004
❑ *Beans – Preliminary yield trial, drought tolerant lines, 1 site, N & S*	4-12 4-12	2003 2004
❑ *Beans – Validation trial, drought tolerant*	4-12	2004
• ***Harvesting***		
♣ *Cassava*	12 1	2002 2003
➢ *Forages*	6,12	2002

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
2.2 Participatory establishment of on-farm (plot) germplasm trials		
• ***Seed availability***		
♣ *Cassava*	1-4	2004
➢ *Forages*	3	2002
• ***Definition of experimental protocols***		
♣ *Cassava*	3	2004
➢ *Forages*	2	2002
• ***Identification of farmers to participate in trials***		
♣ *Cassava*	3-6	2004
➢ *Forages*	2,3	2002
• ***Induction of farmers to participate in trials***		
♣ *Cassava*	4,7	2004
➢ *Forages*	2,3	2002
○ *Hillsides: Establishment of germplasm farmer-field trials*	7-8	2002
○ *Hillsides: Establishment of systems trials on farmers' fields*	8	2003
• ***Preparation of plots***		
♣ *Cassava*	4	2004
➢ *Forages*	2,3	2002
• ***Planting trials***		
♣ *Cassava*	4	2004
➢ *Forages*	3,4	2002
○ *Hillsides: establishment of systems trials (SOL)*	3-4	2002
• ***Harvesting***		
♣ *Cassava*	12-1	2004
➢ *Forages*	6,12	2002
3.1 Evaluation and selection of promising germplasm		
• ***On-farm evaluation of materials***		
➢ *Cassava*	2-12	2003 2004
➢ *Forages*	6,12	2002
❖ *Maize: Validation of plots/strip plots of varieties identified in cycle A, in farmers' fields*	8-12 1	2002 2003
• ***Promising materials selected***		
♣ *Cassava*	2	2003 2004
➢ *Forages*	11	2002
❖ Maize: Release of superior varieties identified from validation plots conducted in Haiti-Cycle A	4	2003
❖ Maize: Release of superior varieties identified from validation plots conducted in Haiti Cycle B	8	2003
○ *Participatory evaluation and selection of systems trials*	7-8	2003
• ***Adjustment of protocols***		
♣ *Cassava*	3	2002 2003 2004
3.2 Participatory evaluation and selection of promising germplasm		
• ***Participatory on-farm evaluation of materials***		
♣ *Cassava*	2-12	2003 2004

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
3.2 Participatory evaluation and selection of promising germplasm		
• ***Promising materials selected***		
♣ Cassava	2	2004
o *Participatory monitoring and evaluation of systems trials*	12	2003
o *Selection of promising materials for seed multiplication and delivery*	1-2	2004
• ***Adjustment of protocols***		
♣ *Cassava*	3	2002 2003 2004
3.3 Monitoring and evaluation for different purposes		
• ***Visits to fields and processing plants***		
♣ *Cassava*		
• ***Preliminary visits for the establishment of trials***		
♣ *Cassava*	1-12	2002 2003 2004
o *Hillsides: selection of farmers interested in system trials*	9	2002
• ***Monitoring and evaluation of germplasm trials***		
♣ *Cassava*	3	2003 2004
o *Hillsides: Monitoring and evaluating multi-location germplasm trials*	7-8	2002
o *Participatory evaluation and selection of promising materials for systems trials*	10-11	2001
• ***Monitoring and evaluation of other trials (i.e. erosion control)***		
♣ *Cassava*	6-11	2003 2004
❑ *Beans – Trip by M Blair*	5 10 5	2002 2003 2004
❑ *Beans – Trip by S Beebe*	8 10 5	2002 2003 2004
• ***Technical visits to provide consultancy***		
➢ *Forages*	5,11	2002
• ***Monitoring and evaluation visits***		
➢ *Forages*	5,11	2002
3.4 Impact evaluation		
• ***Evaluation protocol***		
♣ *Cassava*	1-2	2002 2003 2004
• ***Evaluation process***		
♣ *Cassava*	3	2003 2004
❖ Maize: Validation of plots/strip plots of varieties identified in Cycle B, in farmers' fields	3-7	2003
o Final impact evaluation of germplasm and systems work	3	2004
4.1 On farm (plot) diagnosis and development of methods to face:		
• ***Soil erosion***		
➢ *Forages*	6,11	2002

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
4.1 On farm (plot) diagnosis and development of methods to face:		
• ***Soil degradation***		
➢ *Forages*	6,11	2002
• ***Biotic and abiotic stresses***		
♣ *Cassava*	1-12	2002 2003 2004
• ***Root rot***		
♣ *Cassava*	1-12	2002 2003 2004
❑ *Beans – Bean lines evaluated for root rot severity in modified cultivation systems*	3-12 3-12	2003 2004
• ***Drought***		
➢ *Forages*	6,11	2002
❑ *Beans – Bean lines evaluated for drought effects in modified cultivation systems*	3-12 3-12	2003 2004
• ***Diseases***		
♣ *Cassava*	1-12	2002 2003 2004
➢ *Forages*	6,11	2002
• ***Weeds***		
♣ *Cassava*	1-12	2002 2003 2004
• ***Processing problems***		
♣ *Cassava*	1-12	2002 2003 2004
♣ *Cassava*	1-12	2002 2003 2004
5.1 Germplasm multiplication and distribution		
• ***Multiplication of promising clones***		
♣ *Cassava*	1-12	2003 2004
• ***Identifying seed multiplication plots***		
♣ *Cassava*	2	2003 2004
➢ *Forages*	4,8	2002
• ***Planting seed multiplication plots***		
♣ *Cassava*	4	2003 2004
➢ *Forages*	8	2002
• ***Planting seed validation plots***		
♣ *Cassava*	4	2003 2004

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
5.1 Germplasm multiplication and distribution		
• ***Promotion and release of varieties***		
♣ *Cassava*	9-12	2004 2005
❖ Maize: Release of superior varieties identified from validation plots conducted in Haiti-Cycle A	4	2003
❖ Maize: Release of superior varieties identified from validation plots conducted in Haiti Cycle B	8	2003
6.1 Training Technicians		
• ***Training to carry out needs assessments***		
o *Hillsides: Haitian team induction on needs assessment*	3-4	2002
• ***Training for the management of on-farm trials***		
♣ *Cassava*	5	2002 2003 2004
o *Hillsides: Training technicians and farmers for systems trials work*	1-2	2003
o *Hillsides: Training technicians on participatory germplasm evaluation and selection*	6	2002
➢ *Forages*	6,11	2002
• ***Training of trainers for transfer of technology***		
♣ *Cassava*	6	2002 2003
• ***To report results***		
♣ *Cassava*	6	2002 2003
• ***To participate in on-farm trials***		
➢ *Forages*	3,4	2002
• ***For germplasm selection and evaluation***		
❖ *Maize: Training in artisanal seed production, variety maintenance, storage, etc.*	8-12 1	2002 2003
o *Hillsides: Training on germplasm selection and evaluation*	6	2002
➢ *Forages*	6,11	2002
• ***To establish system trials***		
♣ *Cassava*	4	2003 2004
• ***To monitor and evaluate systems trials***		
♣ *Cassava*	9	2003 2004
• ***To establish CIALs***		
♣ *Cassava*	6	2003 2004
• ***For local organization purposes***		
o *Training selected seed producers for small seed enterprise development*	1-2	2003
o *Training seed producers in managerial skills*	1-2	2003

Continued.

CIAT – HAP Organization of Activities – Chronogram. (Continued)

ACTIVITIES	Months	Year
7.1 Establishment, management and monitoring of trials in diverse production systems. - Hillsides		
o *Identification of sites for systems trials*	1-2	2003
o *Administrative arrangements for trial sites use*	1-2	2003
o *Participatory establishment of systems trials (SOL)*	3-4	2003
o *Participatory evaluation of systems trials*	7-8	2003
o *Participatory selection of promising intercrops*	1-2	2004
8.1 Development of seed delivery systems - Hillsides		
o *Identification of sites for the establishment of seed systems*	4-5	2002
o *Identification and selection of farmers interested in small seed enterprises*	4-5	2002
o *Identification of farmers interested in multiplication of vegetative materials*	4-5	2002
o *Participatory establishment of pilot (demonstration) enterprise for seed production*	6-12	2002
o *Establishment of a vegetative seed multiplication site*	6-12	2002
o *Establishment of small seed enterprises.*	2-12	2003
o *Provide technical support for seed processing infrastructure*	2-8	2003
o *Participatory monitoring and evaluation of small seed enterprise performance*	1-2	2004
o *Seed commercialization and vegetative material distribution*	3-12	2004
o *Final impact evaluation of seed enterprise performance and vegetative material distribution*	1-2	2005
9.1 Progress and final reports		
• ***Trimester progress reports as requested by DAI***		
♣ *Cassava Beans Maize, Forages, Hillsides*	3, 6, 9, 12	2002-2004

Appendix II : Work in Asia led by Peter Kerridge

Use of Participatory Approaches in Ensuring Sustainable Livelihoods for Poor Communities in the Steep Uplands of Central Vietnam

Le Van An[26], Hoang Thi Sen[1], Nguyen Xuan Hong[1], Hoang Huu Hoa[1], Le Quang Bao[1], Nguyen Thi Cach[1], Nguyen Thi My Van,[1] and Peter Kerridge[27]

Abstract

The paper describes experiences in using participatory approaches to improve food security and facilitate involvement of the rural community in natural resource management (NRM)[28]. The research was carried out in Hong Ha, A'Luoi district, Thua Thien Hue Province, Vietnam, from 1998-2000. The government was compelling farmers to abandon shifting cultivation and engage in permanent agriculture, however, they did not allocate sufficient land for producing food for subsistence needs.

Characterization was carried out in 1998 through a formal survey of 60 households and a participatory diagnosis that showed the main problems were food insecurity, sickness, low education, and inability to generate cash income; many households only having rice for 4-6 months. Food insecurity was associated with low soil fertility, pests and diseases, restricted access to land, and lack of agricultural inputs. Women highlighted problems of food insecurity, sickness and poor family planning.

Various interventions were introduced through interest groups in 1998. The most successful was increasing irrigated rice yields through improved varieties and fertilization, while improving pig and fish production increased cash income. The project facilitated allocation of land from a failed sugar scheme to the commune, who allocated it to the poorest households with the capacity to work the land. Rights of access to and use of non-agricultural land was clarified through stakeholder meetings.

Involving the community in planning and decision-making gave them the confidence to negotiate with the project and government officials. Women now have more involvement in public activities. Researchers gained a much better understanding of working with farmers through interdisciplinary teams. There are still challenges in reaching the poorest households, introducing co-management of forest resources, and extending the process more widely to other communes.

1. Introduction

Mountainous areas cover more than 70% of the area of Vietnam and provide livelihoods for one-third of the population. Many government programs have been carried out to improve the management of these mountainous resources and the livelihoods of the communities, but there have been problems during implementation, including issues of land rights, forest tree tenure, and alternative management systems.

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[26] Hue University of Agriculture and Forestry, Hue city, Thua Thien-Hue, Vietnam
[27] CIAT Regional Office for Asia, Vientiane, Lao PDR
[28] Initiators of the work were Ignacio Sanz John Graham, Peter Kerridge, and Le Van An.

Hong Ha commune, the research area, is in an important watershed in Thua Thien Hue province, and is typical of the highland area in the Central region of Vietnam. There is diversity in land use and culture, continuing poverty, and public concern about resource management. It is located in a mountainous area, west of Hue City. In 1998, the population was 1100 persons from five ethnic groups. The government was compelling farmers to abandon shifting cultivation and engage in permanent agriculture. In 1975, farmers were allocated 150 ha, including 13 ha of wetland rice, for agriculture, but this was not enough to produce food for their subsistence needs. The other portions of the 14 110 ha commune area were controlled by a Watershed Protection Board, Forestry Department, and State Forestry Enterprise.

Although the main idea of carrying out the research was to facilitate community involvement in NRM[29], it quickly became apparent that the main concern of the community was food security. Hence, early interventions were focused on improving food production and increasing household income. This paper describes the experience of the Upland Team[30] in characterizing the household and land resources and implementing interventions during the first phase, 1998-2000.

2. Methods

Participatory methods were used to define and analyze the problems facing the Hong Ha community, in evaluation and dissemination of various interventions, and in assessment of the progress. These were complemented by more formal methods of survey and assessment.

2.1 Definition and analysis of problems

Initially, contact was made through representative meetings called by the commune leadership that gave strong support to the project. Then the Upland Team worked directly with individual households and groups of households. While the leadership cooperated in ensuring that households from the five villages and different wealth groups[31] were represented at communal meetings, they influenced the initial selection of farmers who participated in the evaluations of new interventions.

Households were characterized in 1998 through structured interviews of 60 representative households. This provided information about the livelihood systems and served as a baseline for measuring changes with time, a follow-up survey being conducted in 2000. This was complemented by participatory diagnoses with men and women from the five villages and different wealth groups, using mapping, seasonal calendars, matrix scoring, and weighting tools. The role of gender in the household was studied using structured interviews of representative households and separate group discussions with men and women. A study was made of indigenous knowledge, in particular, as it related to shifting cultivation and use of non-timber forest products (NTFPs). Changes in forest management were assessed with information

[29] The International Development Research Centre (IDRC) Community-Based Natural Resource Management Program supported the project.

[30] A research team was formed from staff of the Departments of Agronomy, Animal Husbandry, Forestry, Social Sciences, and Economics in the University of Agriculture and Forestry and University of Hue.

[31] The village and commune leaders place households into categories of Better-off, Average, Poor, and Very Poor. These categories are related to the amount of land cultivated, and number of animals owned. The very poor are usually families with a household male head being absent or incapacitated, thus lacking labor for cultivation.

obtained from group discussions, household visits, field observations, and secondary data collection. This allowed classification of forests using local criteria, and identification of present and alternative methods for forest management. The information was compiled and the technical assessment presented at a commune meeting for checking accuracy and obtaining supplementary information.

2.2 Evaluation of interventions

The community was most interested in interventions that would improve food security and generate cash income. Interest groups of five to eight farmers were formed around a range of technical interventions, rice improvement, pig production (women's group), ponded fish production, home gardens (which included fruit trees, pineapple, pepper, and vegetables), cassava, maize, food legumes, and improved forages for cattle. Also, an interest group was formed on forest management, and a water line installed to one of the villages. Interest groups received training in management practices, and were provided with materials such as seed, fertilizer, fingerlings, and piglets to carry out production trials. Visits were made during the season to discuss progress and collect data. Field days were organized during and at the end of the season to demonstrate results to a wider group of farmers.

The commune leadership suggested the initial members of the interest groups whose interest was confirmed in meetings and individual visits. Other households subsequently joined the interest groups on a voluntary basis. There were limits to numbers in some cases (e.g., pig raising because of limited availability of new piglets, or fish production because of limited water supply for, and resources to, build fishponds). However, in other cases, there was a large increase in numbers of farmers evaluating new interventions (e.g., by the end of the second growing season, 75 households were evaluating new rice varieties).

2.3 Assessment of results

Progress was monitored on a regular basis at meetings of the interest groups. At the end of the first year, representatives from different wealth groups, both participants and non-participants, prioritized different interventions initiated in the first year. At the end of the project, an assessment was made of the extent to which the project had met its objectives. Two days were spent in the field carrying out individual and group interviews of households, followed by an assessment by the Upland Team members of the information obtained during these field visits[32].

3. Results

3.1 Characterization of natural resources

Hong Ha commune is mountainous, comprising 14 110[33] ha with only 300 ha having a slope <15%. The rainy season extends from September to January with an average rainfall of 2690 mm. Maximum temperatures of 38-40 °C can occur during May to July, while minimum temperatures can fall to 12 °C during December to February. Table AI shows land types.

[32] This exercise was facilitated by Dr Sam Fujisaka, CIAT agricultural anthropologist.
[33] Though the Land Office of A'Luoi District lists 18,950 ha in Hong Ha commune.

Table A1. Different land types in Hong Ha commune

Land type	Approx. area (ha)	Land use rights[a]
Natural forests with full canopies	7850	State, Community for extracting NTFPs
Natural forest regenerating	4560	State, Community for extracting NTFPs
Planted forests	710	State
Bush covered land "reserved" by community for shifting cultivation	1000	State, Community
Imperata grassland	4830	Uncertain, rights given as land developed
Agricultural land -home gardens, lowland rice, other crop land	150 (1998) 275 (2000)	Permanent land use right for Community

a. NTFP, non-timber forest products.

The use of the natural forests in a traditional manner by Hong Ha villagers (Table A2) shows the diversity of non-timber products that can be gathered without causing damage to the forest. However, all stakeholders lacked information and knowledge on forest management and use rights (Table A3).

Table A2. Role of non-timber forestry products in the livelihood of the Hong Ha Community.

Kind of forestry product	Frequency of use	Usage
Timber	Rarely	Building houses
Firewood	Frequently (everyday)	Daily cooking
Cane	Rarely	House devices
Palm leaves	Rarely (yearly)	Covering roofs
Bamboo sprouts	Rarely (yearly)	Home food
Wild taro	Sometimes (every three months)	Pig food
Medicinal plants	Rarely	Medical treatment
Honey	Rarely	Food, medical treatment, for sale
Wild animals	Usually (every month)	Food, for sale

The state allocates the "right of use" of land to organizations, households, and individuals who are called land users. Initially, all lands with forest cover were assigned to State Management Forestry Offices and Water Protection Boards. Land was often assigned on the basis of surface area and slope, without taking into account the state of the vegetation. Thus, in some cases, land used by communities for cropping was assigned as forestland. This applies to many areas used for shifting cultivation. On the other hand, large areas of so-called "waste land", often covered by *Imperata* grassland, were not assigned. Although the households knew they could appropriate this land for cultivation, the "land right of use" tenure remained uncertain in relation to crops grown, and so they questioned doing so because of the large amount of labor required. On the other hand, State Forestry Agencies expressed their "use of right" role by using them for reforestation. Through planting forest trees, these agencies have gradually re-established their management right over *Imperata* grassland. However, because the area planted annually is quite

small, in reality, many areas of *Imperata* grassland are still not under State management and could be available to the Community or for Co-management activities.

Table A3. Limits in the knowledge of stakeholders in forest management in Hong Ha.

The main stake-holders	Limiting information/knowledge
The Song Bo Watershed Management Forestry Department A'Luoi Forestry State Enterprise	- The principles of managing upper watershed forests. - Social-economic information of the local communities. - Information and knowledge on restoring forests using indigenous trees. - Information and knowledge of how agriculture and forestry can cooperate. - Knowledge of establishing and maintaining forests.
Hong Ha villagers	- Unclear about the administrative borders and the distribution of protected natural resources. - Unclear about land use classification used by the authorities - Lack of knowledge of forest management practices of the Government.

In contrast to land tenure, forest tree tenure in Hong Ha is diversified with more possibilities for community ownership. Tree tenure is governed by factors as such as species, tree size, parts of product extracted, and type of land use tenure. District, commune, and village administration allow households to use forest trees to ensure their minimum needs for timber and other forest products are met. Households have ownership of trees planted on land with permanent land-use rights for cultivation. Thus, although *Cinamomum* species were planted with funds provided by Program 327, ownership resides with the households. Farmers make the decisions on location, planting, density, and harvesting.

Planting timber species on land used for cropping can contribute to the security of the land-use rights. Thus, planting trees on land used for shifting cultivation ensures land-use rights are protected temporarily under the commune laws ensuring food security for households, even though "shifting cultivation" is actively discouraged by government policy. However, during the period of rapid expansion of the Government reforestation programs, the slash-and-burn areas were at risk during the fallow period, that is, without the presence of a crop or planted trees, and were resumed. Most of the reforestation in Pahy, Can Sam, and Pa Ring villages was carried out on the shifting cultivation fallows.

With respect to planted forests, the right to land use and management by households is only assured where there is complete coverage by forest trees. Following harvest, as in the case of the 8 ha in Con Tom village, land use rights reverted to the Commune People's Committee, which then assigned the land to others. However, according to the Commune leaders, those households that had planted trees were given back their land use and cultivation rights wherever this was possible.

This security with respect to land-use rights was also demonstrated when the Bo River Watershed Management Board expanded areas under their management by reforestation of areas of *Imperata* grasslands. Legally, the Board only has the right to manage the forest and vegetation cover without actually becoming the "land users". However, when the *Imperata* grasslands and

shifting cultivation areas under fallow were replanted with perennial trees with State funding, in order to develop and maintain protected forests, the role of management agencies was enhanced.

This improved knowledge of land and tree tenure will allow the community to negotiate with other stakeholders to acquire more assets than would be available from agricultural land alone.

3.2 Characterization of Households

Social structure: In 1998, the population of 1100 in 185 families was from four minority groups (Ka Tu –69%, Pa Coh – 20%, Ta Oi – 7%, Pa Hy – 3%) and a few households of Kinh and Van Kieu –1%. Many households contained 8 to 10 persons. It was estimated that there were only 300 able laborers, 200 being old or incapacitated, and the remainder children. The Chairman and Secretary of the People's Committee together with the village heads are responsible for administrative affairs, but the traditional system of "village elders" is still respected. The traditional system uses informal rules, customs, religion, and beliefs as a basis of self-management. The government system of officials at village and commune levels is linked to higher arms of government, administers government policy, and promotes political organizations such as Farmer Women and Youth associations, who can play a key role in village life. Men have authority over women. The community recognizes four wealth levels (Table A4). The moderate and better-off wealth groups have larger farm areas, (including irrigated rice and home gardens) and livestock/household than the poorer groups. Rice yields are similar between groups.

Table A4. Different wealth groups (%) in Hong Ha commune.

Wealth groups	1998	2002	Annual income (VND/person)[a]	Criteria
Better-off	19	29	>900,000	Have invested in capital for production, laborers, off-farm income, adequate food, savings Eat rice with cassava for 6 months, rest cassava
Moderate	37	45	600-850,000	Have enough cash for daily expenditure and stable life, but lack capital for investment and have some shortage of food Eat rice with cassava for 4 months, rest cassava
Poor	34	20	300-600,000	Lack capital for investment, insufficient cash for daily expenditure, a small area for crops with no clear production plan, and lack food for 4-6 months Eat rice with cassava 2-4 months, rest cassava/ banana
Very poor	10	5	<300,000	Lack labor, not willing to borrow capital, no production plans, many young children and lack adequate food for 7-9 months. Eat rice for 2 months, rest cassava and banana when available

a. 1US$=15,000 VND

Production activities. Villagers previously practiced slash-and-burn agriculture and extracted forest products. The government is encouraging sedentary agriculture based on upland crops, paddy rice, and livestock. The main production/income sources (in descending order) are cassava, rice, social/ off-farm income, bananas, NTFPs, livestock; with home gardens, and maize being important in some families.

Diagnosis of problems: A participatory diagnosis of the very poor and better-off people from the five villages disclosed that their main problems were lack of capital, sickness, lack of food, low education, and lack of labor. Lack of food was associated with low crop yields caused by low soil fertility and incidence of pests and diseases, restricted access to land previously available for shifting agriculture, damage from wild animals, lack of labor, and lack of agricultural inputs. The community also indicated that some of their problems were associated with lack of technical knowledge and poor communication. Women highlighted the problems of food insecurity, sickness, and poor family planning. The highest incidence of food scarcity, labor demand, and health problems occurs during preparation of land for cropping.

3.3 Gender analysis

Women contribute more time than men in all activities of agricultural production, but with activity equal in forest management. Poultry and pig raising are women's responsibility, while cattle fall under men's domain. Male farmers participated more than the female farmers in hunting and collecting rattan, while the women spent more time than men in gathering herbs and fuel wood. Men and women participated equally in off-farm occupations. While women contribute to decisions on crop and livestock production, men make most other decisions. Men have a higher educational level than women; land certificates were mostly in men's names; men participated much more than women in social activities, and had greater access to credit, information, and training. Thus, there is gender discrimination in accessing to resources and benefits. Women's first concern was improving food crop production, while that of men was generating cash.

3.4 Indigenous knowledge

Indigenous knowledge is very important in determining farming activities in slash-and-burn agriculture, even as to the days to plant certain crops. The moon is the symbol of plant and animal development, with different pairs of good and bad days. Hence, taking account of the phases of the moon helps to assure good harvests. Note is taken of changing patterns of weather, activities of wild life (e.g., where bees build their hives, worm activity, the color of frogs, and sounds of birds). Soil selection and land classification is based on the observation of the color, characteristics of the soil, and the vegetation. *Imperata* is a sign of degraded soil. Soils are classified according to texture, color and stoniness, and the terrain. Natural regeneration of soil fertility takes 7-10 years under forest. Crops and varieties are then selected according to their adaptation to different soils and terrain. Farmers follow a system of cropping that is optimum where no inputs are used and few products are sold to the market. Further, these ethnic communities follow practices that minimize soil erosion and enhance soil fertility, such as rotating crops, intercropping, mulching with crop residues and wild plants, minimal cultivation (with digging stick). They understand the need to leave trees in the steepest parts of the landscape, and occasionally will build stone and bush barriers along the contour to collect water. Care is taken so as not to burn forest or other people's lands by choosing the day and time of day for burning, with it often done collectively. The "owner" of the land sows the first rice seeds. During harvesting, farmers select the seed and varieties for next coming season, and dry and store it above the cooking area.

4. Interventions

Opportunities. As noted above, the most serious problem faced by the community was food insecurity. In discussions with the community, priority was given to interventions that would increase crop and livestock production and generate cash income:

- Rice varieties for yield (suggestion coming mainly from community [C] or project [P]) and disease resistance (C, P)
- Improved rice management (P)
- New cassava varieties and management practices (P)
- Introducing new varieties of maize and food legume crops (C, P)
- Green manure crops to bring *Imperata* grasslands into production (P)
- Improving home gardens by introducing more fruit, vegetables, and pepper (C, P)
- Improved pig breeds and management practices (C, P)
- Increasing fish production in ponds (C, P)
- Improved grasses and legumes for supplementing livestock (P)

In addition,

- A community group on forest management was formed (P)
- Water was brought by pipe to15 households in one village to overcome health problems (C, P).

Irrigated rice trials. Five farmers in the interest group compared the yield of four new varieties with the so-called IR38 in 1998. The new varieties TH30 and D116 gave higher yields (up to 4.1 t/ha) than the control variety, IR38, even in the absence of fertilizer (Figure A1). They are suitable for low fertility soils, but also respond strongly to fertilizer application, more so than KSB140 and VN_D95-19.

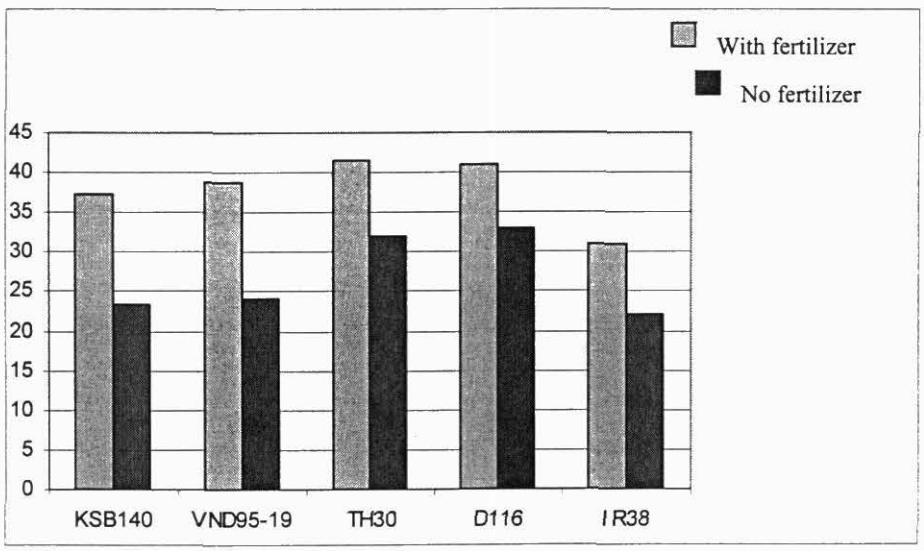

Figure A1. Comparison of variety and fertilizer on yield.

A commune field day was held to demonstrate the results, and subsequently 100 farmers were given 5 kg of TH30 for evaluation. Results were obtained from 75 farmers. TH30 produced higher yields than the local variety, IR38, in all villages. Ninety-five percent of households decided to use the new varieties.

Five households evaluated the use of fertilizer with the new variety, TH30 (fertilizer application was 200 kg livestock manure plus 8 kg urea, in two applications, for 500 m^2). Fertilizer increased rice yield from an average of 3.17 to 4.21 tons per ha.

By 2000, all farmers were using one or other of the new rice varieties, together with fertilizer application.

Upland rice: Five households tested KLN39-1 and CH5 with the traditional variety. Yields were 25.5, 17.5, and 18.5 quintals per ha, respectively. As the growing period of these new varieties is only 95 days, they can be harvested before the "flooding" time. Also, an earlier crop would allow for planting a second crop or a forage crop after the rice harvest.

Cassava: Little interest was shown in cassava in 1998, because farmers were looking for an alternative to cassava as the main food crop. However, some farmers agreed to evaluate new cassava varieties in 1999. More interest was taken in 2000, when they realized the value of cassava for fattening pigs. With fertilization, yields (t/ha) were: traditional variety, 17.2; Xanh Phu Tho (an alternative eating variety), 24.1; and KM98-1 (animal feed/starch), 34.3 t/ha. Farmers also evaluated rates of fertilizer, intercropping cassava with brown or black beans, and various crops and grasses for contour hedgerows. They have adopted a moderate rate of a fertilizer application (30:30:90 : NPK) that increases yield by 70%, and intercropping with beans. They are now ensiling cassava leaf meal for feeding to pigs.

Other crops: Improved maize varieties yielded 3.0-3.5 t per ha, with a glutinous variety yielding 2.8 t per ha. Black mung bean was widely adopted as an intercrop with maize and cassava.

NRM interventions: The one interest group formed around forest management was not an active group. Farmers showed little interest in using legumes to improve *Imperata* grassland, probably because there was no convincing demonstration of improved productivity. It is understandable that the community did not want to be in involved in the general issue of resource management when they were more concerned about producing sufficient food. Government programs of reforestation of shifting cultivation and *Imperata* grasslands to protect the watershed were looked on as sources for off-farm income rather than as conservation activities. However, during the 3 years, the community became more aware of their rights to land and tree use. They were able to negotiate with district officials for the recovery of 8 ha of forested flat land and allocation of land that had been set aside for sugar production. They are now aware that they may engage in rehabilitation programs on *Imperata* grassland, but lack the capital resources needed for investment. Also, the Forestry Service and Water Protection Board are now acting less as policemen, and more open to some community ownership or management of forestland.

5. Outcomes and Impacts

Socioeconomic changes. Results from the follow-up survey of the 60 representative households give some measure of overall changes. Land available for wetland rice production and fishponds among the poor substantially increased (Table A5). However, the apparent large increase in land in upland rice production is probably an artifact that can be attributed to the farmers revealing the real areas planted to shifting cultivation after they developed confidence in project members and became aware of their land use rights. Correspondingly, there was a large percentage increase in net income of the poor from rice, food crops, and home gardens (Table A6), and movement of households from lower to higher wealth groups. Increases in income occurred from outputs in the agriculture sector, with a large decrease from the forestry sector. This is a bit disconcerting because the forestry sector offers the best opportunities for income generation in the long-term.

Table A5. Changes in land use (m^2) for different enterprises among the wealth groups.

Wealth groups	Wetland rice			Upland rice			Crops			Fishponds		
	1998	2000	Change (%)	1998	2000	Change (%)	1998	2000	Change	1998	2000	Change (%)
1. Better-off	750	910	21	200	870	318	980	1430	46	130	260	92
2. Average	710	860	21	440	1260	184	710	2230	214	190	300	56
3. Poor	330	760	128	440	1020	135	420	1530	268	80	230	183
4. *Very poor*	*180*	*150*	-17	*100*	*500*	*400*	*130*	*650*	*408*	*120*	*0*	-

Table A6. Changes in net income ('000VND).

Wealth group		Rice	Food crops	Home gardens	No. households in wealth groups
Better-off	1998	960	1530	460	35
	2000	1280	2020	550	55
	Change	33%	32%	20%	
Moderate	1998	690	1090	260	68
	2000	1170	1850	370	84
	Change	71%	70%	46%	
Poor	1998	370	370	90	62
	2000	840	1520	200	38
	Change	126%	140%	113%	
Very poor	1998	210	390	60	18
	2000	215	400	50	10
	Change	2%	3%	-15%	

Other specific outcomes were:

Food security: Shortage of food was reduced from 3.5 to 1.4 months per year[34].

Crop production: Farmers have adopted new irrigated rice varieties, maize and bean varieties, and incorporated vegetables in the home garden for consumption. Maize is an alternative crop for food, and is grown as a reserve crop between the two seasons for irrigated rice. Beans are

[34] Based on the need for 15 kg/rice equivalent/person/month for the uplands.

grown as intercrops. High-yielding cassava varieties are being grown for livestock feeding. Crop management has improved, with farmers using fertilizer and manure for rice and other crops in permanent cropping areas.

Gender: The project met practical needs of both men and women. Installing a water pipe in Arom village reduced the water supplying activities of women and children from 2.5 to 1 hours per day, in addition to the water being used for home gardens and fishponds. This result prompted the government to install similar systems in the other villages. New methods of planting rice reduced labor input by women, while pig raising increased their labor input, but with the compensation that they now had a new income source to spend. Men benefited most from raising fish. There is still a gender gap in accessing technical training and obtaining benefits from all project activities.

Natural resource management: It was learnt that commune institutions can play an important role in effectively managing and ensuring equal benefits of the natural resources to the local community. However, it will be necessary to merge community involvement with State administration requirements to create a more synergistic management system. It is imperative to integrate issues of land use rights issues in projects that are involved in rural development and resource management. Tree ownership rights, on any scale, can help secure land use rights. Likewise, it is important to integrate gender issues in planning and implementing projects on NRM research and development.

Facilitation: The project acted as a bridge or facilitator for the different organizations with an interest in NRM, such as the Departments of settlement, agriculture, forestry, culture, health and community development organizations, helping them solve problems together. The advantage of third-party facilitation between stakeholders deserves to be more widely recognized by government organizations.

6. Lessons learned

There were many lessons learned in applying participatory approaches to reducing poverty and improving resource management. Some of these were:

- There is a need to exercise care in selecting farmers for evaluation if results are to be shared equitably. Households from different wealth groups need to be included in interest groups, whose membership should be kept open to all households, splitting into new groups if membership becomes too large.
- Men and women have different perceptions of problems and different needs. Women have less opportunity to attend training sessions than men because of their role in looking after the house and children, and this needs to be taken into account in designing training for them. Establishing interest groups aimed at helping them increase cash income and improve their self-confidence can improve the position of women.
- Farmer-to-farmer visitation, within and between communes, is an efficient way of spreading ideas.
- Information from different wealth groups and men and women can be obtained, analyzed, and confirmed more rapidly using participatory diagnosis than formal surveys, although the

latter are more objective in assessing impact. However, surveys should be short with interviewers using a conversational approach.

- Focus groups are efficient for monitoring progress and discerning needs.
- There is a need to be aware of and respect farmers' schedules when interacting with them, because their time is as valuable to them as is that of the researchers.
- In most areas, participatory methods can be complemented by non-participatory methods, for example, in resource mapping and interpretation.
- Stakeholder analysis needs to be carried out prior to collective action. As users of a resource have different interests and resources, their form of participation is likely to be different. Sometimes, differences are difficult to reconcile. Thus, it is necessary to identify the roles, resources, and interests of each user before planning and promoting cooperative activities. Initial priority is best given in those areas where there is a common interest.
- State authorities learned that there could be harmonious cooperation between the State and the Community in managing the forest and land resources based around government decrees, provided that local rights were taken into account.

In conclusion, it is difficult to attribute the proportion of change caused by the activities of the project itself as there were a lot of concurrent government investment in improving roads, supplying electricity and improving communications during the 3 years. Nevertheless, the project was recognized as a bridge between the many organizations operating in the area and the community.

Appendix III

ANNUAL REPORT PROJECT PE – 3
COMMUNITIES AND WATERSHEDS – AFRICA

Tilahun Amede

(10. 2002)

1. Modeling Cropping Systems to Improve Human Nutrition in Ethiopian Mountainous Highlands

Rationale

The food situation in sub-Saharan Africa is continuing to deteriorate as a result of environmental calamities (drought, occasional flooding etc..), decline in soil fertility, increasing pests and diseases, land scarcity and poor market access, coupled with discouraging policy environments, which caused a recurring food shortage. Food shortage is predominantly taken as a function of quantity. Governmental & non-governmental institutions, donors and aid organizations have rarely treated food shortage as a function of non-balanced nutrition (quality). This research was designed to reveal whether the current farming system of the uppermost Ethiopian highlands (Ginchi) furnish balanced human nutrition, both in terms of quality and quantity. The Ginchi highlands enjoy a mixed farming system with barley as the most dominant crop. Although livestock is an integral part of the system, animal products are rarely consumed at the household level as they are used as scarce source of cash. Analyzing households' production of nutrients could be valuable in guiding intensification of those systems in which markets are less important than securing subsistence. The model could offer a better household nutrition by readjusting crop combinations, increasing the land area allocated to crops rich in requisite nutrients by decreasing the land area of another component, or suggesting dietary supplements that could be accessible within or around the vicinity.

Methods

Ginchi is one of the benchmark sites of AHI, where integrated ecoregional research in INRM is conducted in collaboration with national partners and IARCs. It is 80 kms west of Addis Ababa, representing Ethiopian mountainous highlands (3000 m asl), with an average farm size of 3.0 ha, and an average family size of 6. The watershed is dominated by barley-fallow-barely, and crop diversity is restricted by low mean temperature. For the analysis, farm size /household, household family composition by age and sex, crop land allocation, household food allocation/ distribution, crop yield on farm was collected. Secondary data was also collected on average crop yield in the district, nutritional composition of each produce before and after processing, and other relevant data was assembled. An optimization model was employed to analyze the scenario of nutrition and cropland allocation.

Results

In the Ginchi farming system, farmers leave about 45% of their land fallow for two major reasons. Firstly, the soil fertility status of the soil in that location is so low that it couldn't support a continual cropping, and hence fallowing at least for one year is a precondition to grow crops. Secondly, the system is a mixed farming system whereby the livestock is equally important likes that of the crop sector. As there is limited pasture land to keep the animals during the cropping season farmers are obliged to leave part of their land fallow for grazing. The largest proportion of land is allocated for barley followed by wheat and potato. The amount of land allocated for legumes and vegetables is relatively small. As presented (Table 1), the system furnishes a considerable amount of energy, protein, zinc and iron per consumption unit, much higher than the recommended rate. The energy supply is by about 27 % higher than the recommended rate. The system also offers about 20x more zinc that it is required. However, the production system was also in a severe nutrient deficit in terms calcium and vitamines. Vitamine A is one of the most deficit nutrients in the system.

Table 1. Human nutrition in Ginchi systems: Comparison of nutrients that the current system furnishes per consumption unit to the amount of nutrients recommended for a balanced nutrition.

Source	Recommended Allowance (Cu/day)	Current Allowance (Cu/day)	Differences
Energy	2000	2550	549.24
Protein	37.53	48.127	10.597
Vit A	10	2.336	**-7.664**
Zinc	15	320.07	305.07
Iron	7.61	33.614	26.004
Calcium	528	211.24	**-316.76**
Niacin	15.2	19.656	4.456
Thiamine	0.92	1.423	0.603
Ascorbic ac	25.42	0.024	**-25.396**

Collaborators

Holeta Research Centre, Ann Stroud, B. Mackyntre(WB), Dorit Kaluski (Ministry of health, Israel)

2. Pathways for Integration of Legume Cover Crops: After Effects, Tradeoffs and Decision guides

Rationale

The current farming system of East African highlands is predominantly exploitive, overmining nutrients from certain corners of the farm mainly through continuos cropping and nutrient movement. Replenishment of nutrients through application of mineral fertilisers became

unaffordable for small-scale farmers. One strategy could be systematic integration of N-fixing legume cover crops into the farming system. Organic inputs from legumes could increase crop yield through improved nutrient supply/availability and/or improved soil-water holding capacity. Moreover, legumes offer other benefits such as providing cover to reduce soil erosion, maintenance & improvement of soil physical properties, increasing soil organic matter, cation exchange capacity, microbial activity, reduction of soil temperature and weed suppression. There are several studies in Africa that showed positive effects of Legume Cover Crops (LCCs) on subsequent crops. However, the success rate of LCCs in improving crop yield varied across locations/agro-ecologies/soil types is not well established. Despite the positive effects of legumes on the productivity of the following crop achieving effective adoption of LCCs and forage legumes in sub-Saharan Africa has been also low. Farmers prefer food legumes to legume cover crops in that the opportunity cost is so high to allocate part of the resources to LCC. Therefore, there is a need to test the adaptability and after effect of legumes and develop an effective guideline that targets different legume types to different niches of different agro-ecologies and socio-economic conditions.

Methods

The research was conducted in southern Ethiopian highlands (2000 masl, 1300 mm rainfall, bimodal, on a slightly acidic nitisol area). As presented in the CIAT- Annual report, 2001, the area is known for very high population pressure, small land holdings (< 0.3 ha of farm land for a family of 7) and very intensive cropping. The outfield is the most depleted. LCCs were introduced to the system through a farmers field school approach, and then the seeds of legumes of choice were distributed to the interested farmers. An on-farm evaluation of the effects of LCCs was also conducted in 2001 and 2002 growing seasons. Five legumes namely vetch, canavalia, tephrosia, crotalaria and mucuna were planted in three replicated plots, with a plot size of $12m^2$. vetch and crotalaria were broadcasted while the others were planted in rows direct following recommended spacing and seed rates. The crops received phosphorus at a rate of 30 kg/ha P_2O_5 at planting. After four months of vegetative growth, the green biomass of the legumes was weighed and incorporated directly to the soil. Maize (var A511) was planted about one month after incorporation on all plots. Three additional nitrogen treatments were included namely, 0 N, 30 N and 60 N per hectare to draw a nitrogen equivalent curve.

In another participatory experiments, after farmers monitored the introduced legumes in 1999/2000, 26 farmers from four villages selected species of their choice LCC and tested them in their farms together with a food legume, Pea. During the growing seasons of 2000 and 2001, we monitored which farmer selected what, how did they manage the LCCs in comparison to the food legume and for what purpose the legumes were used. Biomass production of the various legumes under farmers' management was also recorded. Besides structured questionnaire and formal survey, an informal repeated on-field discussion using transect walks were used to identify the socio-economic factors that dictated farmers to choose one or the other option and to prioritise the most important criteria of decision making using pair wise analysis matrix. More over, farmers invited non-participating neighbouring farmers for discussion; hence the decision made is expected to represent the community. Based on these series of research work a draft decision guide was developed.

Results

Productivity of LCCs

The research was conducted in a midfield, where variability in slope and soil fertility among plots was not apparent. There was enough rainfall for establishment and vegetative growth for most of the growing period. In the three months growing period, the herbaceous legumes varied in biomass productivity significantly. Crotalaria and vetch were fast growing and also early maturing than the others. On the other hand, tephrosia was growing relatively slow at the initial stage of growth, which is reflected in the biomass accumulation. Accordingly, the biomass yield of crotalaria was significantly higher than the other legumes, while the biomass of tephrosia was much lower than all the others (Fig.1). A similar experimental result was also obtained in the previous seasons on farm trials.

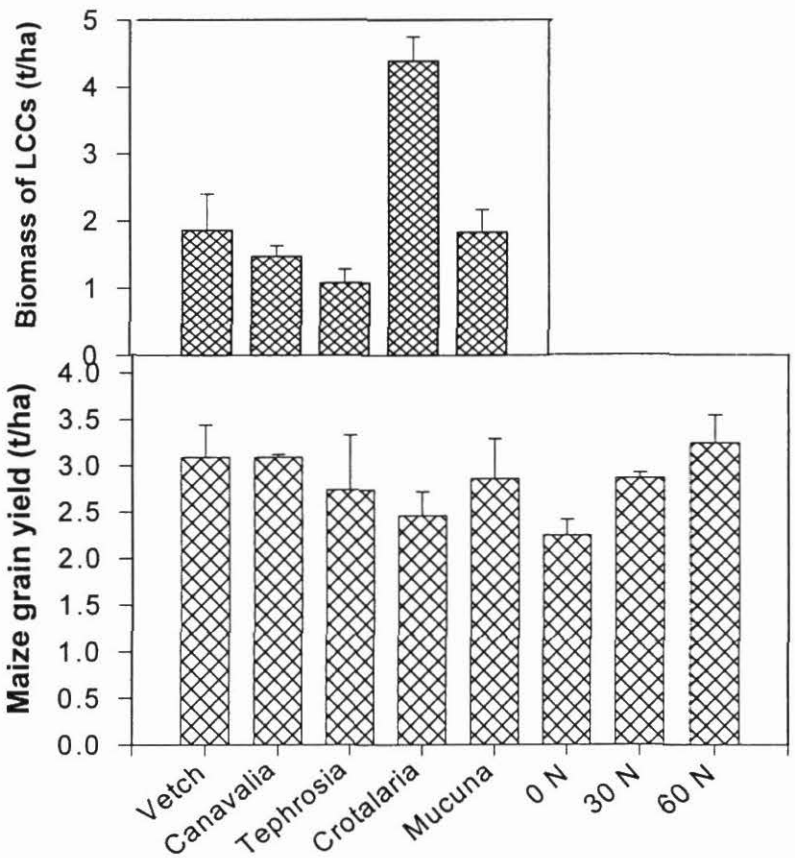

Figure 1. Biomass yield of legume cover crops and their corresponding effect on the following maize crop in southern Ethiopia.

After effect of LCCs on maize yield

Fig. 1 shows the after-effect of various LCCs in comparison to different of nitrogen fertilizers. The result showed that maize grown after legumes produced significantly higher grain yield than the check (maize grown with out nitrogen fertiliser) and gave a maize yield at least equivalent to 30 kg of N/ha regardless of the legume species.
The yield obtained from the plots of vetch, canavalia and mucuna was almost similar, while the yield obtained from crotalaria and tephrosia plots was significantly lower than that of the other species. Although the biomass of crotalaria incorporated to the soil was much higher than the others, the effect was not evident on maize yield. This could be explained by the fact that crotalaria had very high lignin content than the others at the time of harvesting and incorporation, which possibly affected the processes of decomposition and nutrient release.

By considering the type of produce the farmers grow in the neighbouring field of equal size, which was sweet potato, and calculating the costs and benefits of the LCCs and neighbouring field, we found out that the opportunity cost of growing LCCs was much higher than anticipated. The maize yield gain obtained after growing LCCs in a short season should be more than two folds for the farmer to consider growing LCCs as potentially profitable interventions.

The Decision Guide

The decision tree was developed based on the following background information from the site augmented by a quantitative data on the agronomic performance and soils characteristics.

1. Farmers preferred food legumes over non-food legumes regardless of soil fertility status of their farm.
2. The above ground biomass of grain legumes (grain & stover) is exported to the homestead for feed and food while the below ground biomass of grain legumes is small to effect soil fertility.
3. The probability of the manure to be returned to the same plot is less as farmers prefer to apply manure to the perennial crops (Enset & Coffee) growing in the home stead.
4. The tested legumes may fix nitrogen to fulfil their partial demand (we have observed nodules in all although we did not quantify N-fixation), but in conditions where the biomass is exported, like vetch for feed, most of the nutrient stock would be exported. Therefore, we did not expect significant effect on soil fertility.
5. LCCs produced much higher biomass when planted as relay crops in the middle of the growing season than when planted at the end of the growing season as short-term fallows due to possible effects of end-of season drought.
6. The homestead field is much more fertile than the outfield; hence those legumes sensitive to water and nutrients will do better in the homestead than in the outfield.

The guide is developed based on the data obtained from farmers and communities and after a pair wise matrix analysis was done to prioritise the decision criteria, and also by taking into account the market effects. The most important criteria at the lowest level is the presence or absence of livestock in the household followed by who manages the farm, market access, the size of the land holding and the land quality. The factor that dictates the decision at the highest level

was land productivity, which was governed mainly by soil fertility status. Growing food legumes was the priority of every farmer regardless of wealth (land size, land quality & number of livestock). Farmers with livestock integrated feed crops regardless of land size, land productivity and market access to products.

However, the size and quality of land allocated for growing feed legumes depended on market access to livestock products (milk, butter and meat). Those farmers with good market access are expected to invest part of their income on external inputs, i.e. inorganic fertilisers. Hence farmers of this category did not allocate much land for growing LCCs, but applied inorganic fertilisers. In the homestead field, there was no land allocated for LCCs in the system, not only because farmers gave priority to food legumes, but it also became very expensive for farmers to allocate the fertile plot of the farm for growing LCCs. The most clear spatial niche for growing LCCs is the most out field, especially in poor farmers' field with exhausted land and limited market-driven farm products. Because the land of most poor house holds was on the verge of being out of production due to the iniquitous nature of land management practices through years long share cropping arrangements.

Collaborators

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3. Towards Addressing Land Degradation in Ethiopian Highlands: Opportunities and Challenges

Rationale

Land resource degradation is one of the major threats to food security and natural resource base in Ethiopia. Hundreds of years of exploitve traditional land use, aggravated by high human and livestock population density have led to the extraction of the natural capital, which caused the farming of uncultivable sloppy lands and overexploitation of slowly renewable resources. The outcome is that half of the highlands are eroded, of which 15% are so seriously degraded that it will be difficult to reverse them to be agriculturally productive in the near future.

In the mountainous highlands, there is a direct link between land-based resources and rural livelihoods. Decline in soil fertility as a result of land degradation decreases crop/livestock productivity and hence household income. Depleted soils commonly reduce payoffs to agricultural investments, as they rarely respond to external inputs, such as mineral fertilizers, and hence reduce the efficiency and return of fertilizer use. Degraded soils have also very poor water holding capacity partly because of low soil organic matter content that in turn reduce the fertilizer use efficiency. The objective of this paper is to comprehend the land degradation paradigm in Ethiopian Highlands and suggest an outline that could be used by farmers, researchers and policy makers to reverse the alarming trend of degradation of the resource base.

Methods

While TSBF-CIAT/AHI has been working closely with the Ethiopian Agricultural Research Organisation (EARO) and the Buro of Agriculture, and conducting participatory research in two benchmark sites of the Ethiopian highlands on INRM issues, it became apparent that land degradation is the most fundamental threat for the Ethiopian Agriculture. Based on the systems intensification work that we have been conducting in the two sites, augmented by secondary data on relevant themes, the following approach was suggested to address land degradation in the country.

Results

Root Causes of Land Degradation in the mountainous highlands

The major environmental factor that caused significant soil and nutrient loss in the mountainous highlands of Ethiopia is water erosion. For instance, the amount of soil loss due to water erosion was about 230 t/ha/year under cultivated plots in Andit tid, Northern Ethiopia. It is partly true for most of part of Sub Saharan Africa, whereby the major agents of land degradation are water erosion, wind erosion, chemical degradation and others that affected soil loss by 47, 36, 12 and 3.5 %, respectively.

The contribution of different management factors towards land degradation in Africa is estimated to be 49%, 24%, 14%, 13% and 2% for overgrazing, agricultural activities, deforestation, overexploitation and industrial activities. The livestock sector is a very important component of the system both as an economic buffer in times of crop failure and economic crisis and as a supportive enterprise for crop production. There is a considerable concern, however, that the number of animal holdings per household is much higher than the carrying capacity of the land. Another influential factor that aggravated land degradation in the Ethiopian highlands is deforestation. The forest cover went down from 40% at the beginning of this century to less than 3% at present. Deforestation accelerated land degradation in many ways. Firstly deforested land is easily susceptible to erosion, both wind and water, and hence causes a considerable nutrient movement. Secondly the amount of litter that could have contributed for maintaining the nutrient balance is considerably reduced. Thirdly deforestation in the highlands caused lack of fuel wood, and as a result farmers used manure and crop residue as cooking fuel, which otherwise could have been used for soil fertility replenishment. Wood products could be also a very important cash crop, like that of Eculaptus trees in East African Highlands.

Overmining soil nutrients is also an important factor that contributed most for soil fertility decline in the region. For example, barley is the single dominant crop in the mountainous highlands of Ethiopia. The system has very low crop diversity with legume component of less than 3%. The system receives external inputs very rarely with a fertilizer rate of less than 5 kg/ha, and the practice of applying this limited amount of mineral fertilizer is a recent practice.

Another cause of land degradation is lack of early awareness of the managing community about soil erosion and soil fertility decline. When farmers were asked to describe their indicators of soil erosion they stated gully/rill formation, exposed underground rocks, landslides, wash away of

crops, shallowing of soils and siltation of the soil. These are soil traits that appear in a much later stage of soil degradation, after the soil organic matter and nutrients of the soil are removed. If farmers respond to soil erosion at this stage, the probability of reversing the fertility status to its earlier value would be difficult. Similarly farmers indicators of soil fertility decline include stunted crops, yellowing of crops, weed infestation, and change of soil color to red or Grey, traits that again appear at the later phase of soil fertility decline.

Integrated Soil Fertility Management options

Traditionally, the major nutrient management strategy promoted by governmental and non-governmental organizations was mainly application of mineral fertilizers, which became unaffordable and non-economical to subsistence farmers. An integrated nutrient management technology became essential due to its multiple benefits: as nutrient saving, such as in controlling erosion and recycling of crop residues, manure and other biomass, or nutrient adding, such as applying mineral fertilizers and importing feed stuffs for livestock. The traditional field operation in Ethiopian highlands, which could be characterized by multiple tillage, cereal-dominated cropping and very few perennial components in the system, is very erosive for soils and nutrients.

As land degradation is a complex phenomena affected by many external and internal factors, it demands a multidisciplinary & integrated approach to address the social, biophysical and policy dimensions as suggested below.

1. Community-based soil and water conservation measures

It is fundamental to minimize the movement of soil and nutrients through application of system compatible soil conservation measures. When a cropland covered by crops or grasslands is compared to a frequently hacked farmland in Areka, run-off was reduced by about 90 and 100 % and soil loss by 68% respectively. Hence soil nutrient loss and runoff could be minimized through increasing the frequency of crop cover, especially by those crops with mulching habits and higher leaf area index to minimize the rainfall effects. Results from soil and water conservation project (SCRP) showed that perennial crops like banana and fruit trees or annuals with mulching and runner habits, like sweet potato, could reduce erosion effects significantly.

Following the 1984/85 drought, there was a huge campaign in Ethiopian highlands on constructing terraces in sloppy lands for soil and water conservation purposes, using the food for work scheme of the world food programme. However, the approach was top down and did not participate the local community in decision making processes. The consequence was that farmers failed to maintain the terraces and in some case farmers have destroyed the terraces. When farmers were asked to list the reasons for rejecting soil and water conservation technologies they listed five major driving forces namely, high labour cost, it decreases farm size, it is inconvenient during farm operations especially for a U-turn of oxen plough, and multiplication of rats in the stone bunds. By considering those farmers criteria and by adopting participatory planning and implementation approaches the African Highlands Initiative program have facilitated adoption

and dissemination of soil conservation technologies at Areka, Southern Ethiopia. The major driving force for the adoption of the technology was its integration with high value crops (e.g. bananas, hops) and fast growing drought resistant feeds (e.g. Elephant grass, pigeon pea) grown on the soil bunds. How ever, the sustainable integration of soil & water conservation technologies depended heavily on the effectiveness of local by-laws to limit free grazing and movement of animals during the dry spells. Hence there may be a need to reconsider the local policy so as to facilitate the integration of natural resource management technologies to local communities.

2. Employing Integrated Nutrient Management

Re-building the organic matter of the soil and the nutrient stock in a short period of time requires an intensive systems approach, by combining compatible system components. These include the possible combination of judicious use of mineral fertilizers, improved integration of crops and livestock, improved organic residue management through composting and application of farmyard manure, deliberate crop rotations, short term fallowing, cereal-legume intercropping and integration of green manures. Because of the inconsistent and very low use of mineral fertilizers, most of the internal N cycling in small holder systems results from mineralization of organic residues. Such process may contribute most of the N for the annual crops until the labile soil organic fraction (N-capital) are depleted .

One potential source of organic fertilizer in the mountainous highlands is farmyard manure. There is a large concentration of livestock that could produce a considerable amount of manure to be used for soil fertility replenishment. However, there is a strong trade-off for manure use between soil fertility and its use as a cooking fuel. Recent survey in the upper central highlands showed that more than 80% of the manure is used as a source of fuel. Only those farmers with access to fuel wood could apply manure for soil fertility replenishment. The quality of most manures is also very low as it was composed not only of pure dung but also a mixture of dung and crop residues from the stall. Wet season manure has a higher nutrient content than dry season manure, and pit manure has a better quality than pilled manure. Besides the quality, the quantity of manure produced on-farm is limited to satisfy the demand side. To produce sufficient manure for sustainable production of 1-3 tonnes/ha of maize it requires about 10-40 ha of dry season grazing land and 3 to 10 of wet season pasture land, which is beyond the accessibility of Ethiopian farmers due to land shortage.

Another potential organic source is crop residue. However, there is strong tradeoff for use of crop residue between soil fertility, animal feed and cooking fuel. In the upper Ethiopian highlands crop residues are used as a major source for dry season feed and supplementary feed for the wet season. Hence little is remaining as a crop aftermath to be returned to the soil. Although legumes are known to add nitrogen & improve soil fertility, the frequency of legumes in the crop sequence in the upper highlands is less than 10%, which implies that the probability of growing legume on the same land is once in ten years. The most reliable option to replenish soil fertility is, therefore, promoting integration of multipurpose legumes into the farming systems. Those high quality legumes tested in the Ethiopian highlands include tephrosia, mucuna, crotalaria, canavalia, and vetch. However, despite a significant after-effect of LCCs on the preceding maize yield (up to 500% yield gain over the local management) farmers were

reluctant to adopt them because of trade-off effects for food, feed and soil fertility purposes. In an attempt to understand factors affecting integration of soil improving legumes in to the farming systems of southern Ethiopia, the most important socio-economic criteria affecting the decision of farmers were land productivity, farm size, land ownership, access to market and need for livestock feed. By considering the decision-making criteria of farmers combined with quantitative data on the resource flows, it was possible to integrate the technology to about 10% of the partner farmers in southern Ethiopia.

3. Systems Approach to INRM

Sustainable natural resource management in the region demands an investment in and improvement of the natural capital, human capital and social capital. Given the complexity of the problem of land degradation, and its link to social, economical and policy dimensions, it requires a comprehensive approach that combines local and scientific knowledge through community participation, capacity building of the local actors through farmers participatory research and enhanced farmer innovation. This approach requires the full involvement of stakeholder at different levels to facilitate and integrate social, biophysical and policy components towards an improved natural resource management and sustainable livelihoods. Watershed management as a unit of planning and change imposes the need for increased attention to issues of resource conservation and collective action by the community. The issues of land degradation may include afforestation of hillsides, water rehabilitation and/or harvesting and soil stabilization, soil fertility amendment through organic and mineral fertilizers and increasing vegetation cover by systematic use of the existing land and water resources. This could be achieved by working closely with communities and policy implementers in identifying and implementing possible solutions to address land degradation and other common landscape problems, like grazing land improvement, gully stabilization and by monitoring and documenting the processes for wider dissemination and coverage.

Some of the watershed conservation related solutions should be tried and implemented on specific test locations using farmers' own contribution and the INRM team's technical supervision. However, a wider application of these solutions to larger areas may require attracting additional funding investments from the district, donors or other NGOs in the area. The local village communities may also effect changes in the norms and rules governing the use of natural resources in their vicinity. Traditional rules and local by-laws (e.g. written and unwritten and called "afarsata" or awatcheyache) regarding the use and sharing of resources exist in most villages and these need to be identified and studied with a view to effect reform or renew their emphasis in the community. Integration of Agroforestry technologies in the farming systems of the Ethiopian highlands failed because of absence of national and/or local policies /by-laws that prohibit free grazing and movement of animals in the dry season. Experiences from the 1980s campaign of 'Green Campaign' in Ethiopia also showed that it is almost impossible to address the issue of land degradation without the full involvement and commitment of the local community. The local by-laws in resource arrangement and use should be facilitated and supported, as the rules and regulations at the local level could be implemented effectively through elders and respected members of the community with tolerance and respect. There may be a church and/or witchcraft dimensions to these, and there may be changes over time that might help to understand why people are doing what they are doing. In addition, the influence of

national and regional policies on local resource management should be understood. These will form an important subject of community wide discussion and deliberation.

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Budget Project PE – 3 Communities and Watersheds - Africa

PROJECT PE3: Communities and Watersheds - Africa

Source	*Amount (US$)*	*Proportion (%)*
Unrestricted core	-	0%
Core substitution	-	
Carry over from 2001	-	0%
Subtotal	**-**	
Special projects	117,173	100%
Total	**117,173**	**100%**

List of Acronyms and Abbreviations Used

Acronyms

ACERG	Asociación de Centros Educativos del Cañon del Río Garrapatas, Colombia
ACIAR	Australian Center for International Agricultural Research
ACV	Asociación Campos Verdes, Nicaragua
ADDAC	Asociación para la Diversificación y Desarrollo Agrícola Comunal, Matagalpa, Nicaragua
AGUASAN	Programa agua y saneamiento en America Central, of SDC
AHL	Animal Health Laboratory of CSIRO
AHMUPROH	Asociación de Hombres y Mujeres Progresistas de Honduras
ANAR	Asociación Nacional de Arroceros, Nicaragua
ASDI	Agencia Sueca de Cooperación para el Desarrollo
ASOBOLO	Asociación de Usuarios del Río Bolo, Colombia
ATICA	Agua y Tierra Campesina, Bolivia
AusAID	Australian Agency for International Development
AVINA	Asociación para la Vida y la Naturaleza, Costa Rica
BMC	Biological Mesoamerican Corridor
CACTRIL	Cooperativa Agrícola Cafetalera Triniteca, Ltda., Honduras
C&W	Communities and Watersheds Project, formerly Hillsides Project
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica
CCAD	Comisión Centro Americano de Ambiente y Desarrollo, Guatemala
CCD	Comisión Cristiana de Desarrollo, Honduras
CDM	Comité de Desarrollo Municipal, Nicaragua
CDR	Center for Development Research, Denmark
CENTA	Centro Nacional de Tecnificación Agrícola, El Salvador
CFLI	Canada Fund for Local Initiatives
CGIAR	Consultative Group on International Agricultural Research
CIALs	Comités de Investigación Agricola Local
CIDA	Canadian International Development Agency
CIDES	Comité Interinstitucional para el Desarrollo de Sulaco, Honduras
CIDICCO	Centro Internacional de Información sobre Cultivos de Cobertura, Honduras
CIEETS	Centro Intereclesial de Estudios Teológicos y Sociales, Nicaragua
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
CIP	Centro Internacional de la Papa, Peru
CIPASLA	Consorcio Interinstitucional para una Agricultura Sostenible en Laderas, Colombia
CIPAV	Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuária, Colombia
CIRA	Centro para la Investigación en Recursos Acuáticos, Nicaragua
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement, France
CIRAD-CA	CIRAD- cultures annuals, France

CLAYUCA	Consorcio Latinoamericano y del Caribe para la Investigación y el Desarrollo de la Yuca
CLODEST	Comité Local para el Desarrollo Sostenible de la Cuenca del río Tascalapa, Honduras
CLOs	Comités Locales
CNEARC	Centre national d'études agronomiques des regions chaudes, France
CNIA	Centro Nacional de Investigación Agropecuario, Nicaragua
CODESA	Consultores para el Desarrollo Sostenible, Honduras
COHDEFOR	Corporación Hondureña de Desarrollo Forestal
COHORSIL	Cooperativa Horticultores Siguatepeque Ltda, Honduras
CONDESAN	Consorcio para el Desarrollo Sostenible de la Ecorregión Andina
CORPOICA	Corporación Colombiana de Investigación Agropecuaria
COSAVY	Consultores de Servicios Agropecuarios del Valle de Yoro, Honduras
COVA	Comprobación de Variedades
CPs	Challenge Programs
CRS	Catholic Relief Service, Honduras
CRSP	Collaborative Research Support Project of USAID
CSF	Classical Swine Fever
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia
CURLA	Centro Universitario Regional del Litoral Atlántico, Honduras
CURM	Centro Universitario Regional de Matagalpa, Nicaragua
CVC	Corporación autónoma regional del Valle del Cauca, Colombia
DAI	Development Alternative Inc.
DALDO	District Agriculture and Livestock Development Officer, Tanzania
DANIDA	Danish International Development Agency
DAR	Delegaciones Regionales de Acueductos Rurales, ENACAL, Nicaragua
DFID	Department for International Development, UK
DGIS	Directoraat Generaal voor Internationale Samenwerking, (*Dutch Ministry for Development Cooperation*), Neths
DICTA	Dirección de Investigación de Ciencias y Tecnología Agrícola, Honduras
DIPAC	Diversification of the Agro-forestry Community Project of CARE
DOA	Department of Agriculture, Thailand
DOAE	Department of Agricultural Extension, Thailand
EAGE	Escuela de Agrícultura de Estelí, Nicaragua
EAP-Zamorano	Escuela Agrícola Panamerican-Zamorano, Honduras
ECAR	Ensayo Centroamericano de Apaptacion y Rendimiento
EEC	European Economic Community
ENA	Escuela Nacional Agricola de Olancho, Honduras
ENACAL	Empresa Nicaragüense de Acueductos y Alcantarillados, Nicaragua
ENAR	Ensayo Nacional de Adaptación y Rendimiento
ESNACIFOR	Escuela Nacional de Ciencias Forestales, Honduras
ETHZ	Eidgenössische Technische Hochschule-Zentrum (*Swiss Federal Institute of Technology*), Zurich
FADCANIC	Fondo de Desarrollo para la Costa Atlántica de Nicaragua
FAO	Food and Agriculture Organization of United Nations, Italy

FARENA	Facultad de Recursos Naturales, UNA, Nicaragua
FC	Fowl Cholera
FEPROH	Fomento Evnagélico para el Progreso de Honduras
FHIA	Fondo Hondureño de Investigación Agropecuária
FHIS	Fondo Hondureño de Inversion Social
FLAR	Fund for Latin America and the Caribbean Irrigated Rice
FLSP	Forages for Smallholders Project
FOCUENCAS	Fortalecimiento de la capacidad local en manejo de cuencas y prevención de desastres natures, CATIE project
FONDEAGRO	Fondo de Desarrollo Agropecuario, Nicaragua
FSEW	Farming Systems Extension Worker
FLSP	Forages and Livestock Systems Project
FSP	Forages for Smallholders Project
FUNDER	Fundación Nacional de Desarrollo Rural, Honduras
GoK	Government of Kenya GTZ Deutsche Gesellschaft für Techische Zusammenarbeit (*German Agency for Technical Cooperation*)
GTZ	German Agency for Technical Cooperation
HAP	Hillsides Agricultural Program in Haiti
HPB	Herederos del Planeta Juventud, Vida y Naturaleza de Bellavista, Colombia
HS	Hemorrhagic Septicemia
ICRAF	International Centre for Research in Agroforestry, Kenya
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
IDIAF	Instituto Dominicano de Investigaciones Agropecuarias y Forestales
IDRC	International Development Research Centre, Canada
IDS	Institute for Development Studies, UK
IFAD	International Fund for Agricultural Development, Italy
IFPRI	International Food Policy Research Institute, USA
IFS	International Foundation for Science, Sweden
IIA	Instituto de Investigaciones Agrícolas, Bolivia
IICA	Instituto Interamericano de Cooperación para la Agricultura
IITA	International Institute for Tropical Agriculture, Uganda
INEC	Instituto Nacional de Estadisticas y Censos, Nicaragua
INERA	Institut national pour l'étude et la recherche agronomique, Democratic Republic of Congo
INETER	Instituto Nacional de Estudios Territoriales, Nicaragua
INFOP	Instituto Nacional de Formación Profesional, Honduras
INIFAP	Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias, México
INRA	Institut national de recherche agronomique, France
INRM	Integrated Natural Resource Management workshop
INTA	Instituto Nacional de Tecnología Agropecuaria, Nicaragua
INTECFOR	Instituto Técnico Forestal, Nicaragua
INTSORMIL	International Sorghum and Millet Program, USA
IPCA	Investigación Participativa para Centro América project

IPRA	Investigación Participativa en Agricultura/*Participatory Research in Agriculture* of CIAT
IRD	Institut de recherche pour le développement, France
IRRI	International Rice Research Institute, Philippines
ISP	Instituto San Pedro, Yorito, Honduras
ISRA	Institut Sénégalais de recherché agricole
ITECO	Irrigation Training and Economic Empowerment Organization
IWMI	International Water Management Institute
JIRCAS	Japan International Research Center for Agricultural Science
KAEMP	Kagera Agricultural and Environmental Management Project, Tanzania
KARI	Kenya Agricultural Research Institute
KATC	Kilimanjaro Agri. Training Center, Tanzania
KIOF	Kenya Institute of Organic Farming
LDD	Land Development Department, Thailand
LEISA	Low External Input Sustainable Agriculture
LZARDI	Lake Zone Agricultural Research and Development Institute, Tanzania
MAG	Ministerio de Agricultura y Ganadería, Honduras
MAGFOR	Ministerio Agropecuario y Forestal, Nicaragua
MARAFIP	Mara Region Farmers Initiative Program, Tanzania
MARENA	Ministerio de Ambiente y Recursos Naturales, Nicaragua
MATI	Ministry of Agriculture and Food Training Institute, Tanzania
MBC	Mesoamerican Biological Corridor Project
MIS	Manejo Integrado de los Suelos de Centro América consortium
MOVIMONDO	NGO for international cooperation and solidarity, Honduras
MSEC	Managing Soil Erosion Consortium
MSU	Michigan State University, USA
NARO	National Agricultural Research Organization
NASA	National Aeronautics and Space Administration, USA
NCSU	North Carolina State University, USA
NORAD	Norwegian Agency for Cooperation for Development
NUMAS	Nutrient Management Support System
ODESAR	Organización de Desarrollo Sostenible Agrícola, Nicaragua
PADF	Pan American Development Foundation of USDA
PASOLAC	Programa de Agricultura Sostenible en las Laderas de Centro América
PCAC	Programa Campesino a Campesino, Nicaragua
PCARES	Predicting Catchment Runoff and Soil Erosion for Sustainability model
PCCMCA	Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios, Guatemala
PDA	Proyecto de Desarrollo de Area, Yoro, Honduras
PES	Productores Empresarios de Semillas Artesanales
PIF	Programa Investigaciones en Frijol
PLA	Participatory Learning and Action
PODAR	Programa cooperativo de Desarrollo de la Agroindustria Rural de America Latina y el Caribe
POSAF	Programa Socioambiental Forestal, Nicaragua
PRECODEPA	Programa Cooperativa de Papa

PRIAG	Programa Regional de Reforzamiento a la Investigación Agronómica sobre los Granos en Centroamérica
PRGA	Systemwide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation of the CGIAR
PRM	Programa Regional de Maïz
PROCIG	Proyecto Centroamericano de Información Geográfica
PRODEGA	Proyecto de Desarrollo Rural Ganadero, Nicaragua
PRODESSA	Proyecto de Desarrollo de San Dionisio, Nicaragua
PROFRIJOL	Proyecto Regional de Frijol para Centro América, México y el Caribe
PROINPA	Fundación Promoción e Investigación de Productos Andinos, Bolivia
PROLESUR	Proyecto Lempira Sur, Honduras
PROMESA	Proyecto Mejoramiento de Semilla, Nicaragua
PROMIC	Programa Manejo Integral de Cuencas, Bolivia
PRONADERS	Programa Nacional de Desarrollo Sostenible
PRR	Programa de Reconstrucción Rural, Honduras
QPM	Quality Protein Maize Project
RAOS	Regional de Agricultura Organica de la Sierra, Honduras
RED COMAL	Red de Comercialización Comunitaria Alternativa, Honduras
REDOLYS	Red de Organizaciones Locales de Yorito y Sulaco, Honduras
RENOC	Red de Organismos de Cuenca, Nicaragua
RERURAL	Proyecto de Reactivación de la Economía Rural, Honduras
SAG	Secretaria de Agricultura y Ganadería, Honduras
SENESA	Servicio Nacional de Sanidad Agropecuaria, Honduras
SANREM	Sustainable Agriculture and Natural Resource Management, a CRSP project
SARDI	South Australian Research and Development Institute
SDC	Swiss Development Cooperation
SECAP	Soil Erosion Control and Agroforestry Project
SEED	Small Seed Enterprise Development
SERNA	Secretaria de Recursos Naturales y Ambiente, Honduras
SERTEDESO	Servicios Técnicos para el Desarrollo Sostenido, Honduras
SIBTA	Sistema Boliviano de Técnología Agropecuario
SIDA	Swedish International Development Agency
SIMPAH	Sistema de Información de Mercados de Productos Agrícolas de Honduras
SLU	Sveriges Lantbruks Universitet (Swedish University of Agricultural Science)
SMS	Subject Matter Specialist
SOH	Seeds of Hope Project
SOL	Supermercado de Opciones para Ladera (*Hillsides Options Supermarket)*
SQMS	Soil Quality Monitoring Systems
SWNM	Soil Water and Nutrient Management program
SWOT	Strengths, Weaknesses, Opportunities, and Threats analysis
TAG	Technical Assistance Grant
TOA	Trade-Off Analysis Project
TSBF	Tropical Soils Biology and Fertility Program, Kenya

TTDI	Thai Tapioca Development Institute
UAGRM	Universidad Autónoma Gabriel René Moreno, Bolivia
UBC	University of British Columbia, Canada
UCA	Universidad Centroamericana
UCN	Universidad Central de Nicaragua
UCOSD	Union de Campesinos Organizados de San Dionisio, Nicaragua
UGA	University of Georgia, USA
UNA	Universidad Nacional Agraria, Nicaragua
UNAN	Universidad Nacional Autónoma de Nicaragua
UNDP	United Nations Development Programme
UNICAFE	Union Nacional de Cafetaleros, Nicaragua
UNICAM	Universidad Campesina Estelí, Nicaragua
UNICEF	United Nation's Children's Fund
UNN	Universidad Nacional de Nicaragua
UPWARD	Users' Perspectives with Agricultural Research and Development, Manila, Philippines
USAID	United States Agency for International Development, WA
USDA	United States Department of Agriculture
VIDAC	Vivero de Adaptación Centro Americano de grano rojo

Abbreviations

AROs	advanced research organizations
CBO	community-based organization
CBWM	community-based watershed management
DEM	digital elevation model
FPR	farmer participatory research
FYM	farmyard manure
GIS	geographic information systems
GOs	government organizations
HC	home consumption
HI	harvest index
LISQ	local indicators of soil quality
M&E	monitoring and evaluation
NARS	national agricultural research systems
NGO	nongovernmental organization
NRM	natural resource management
NTFP	non-timber forest products
OPVs	open-pollinated varieties
PDs	participatory diagnoses
PM&E	participatory monitoring and evaluation
PPB	participatory plant breeding
PRA	participatory rural appraisal
PVS	participatory variety selection
R&D	research and development

R&T	research and training
RCBD	randomized complete block design
RRA	rapid rural appraisal
SL	sustainable livelihoods
SQI	soil quality indicator
TISQ	traditional indicator of soil quality