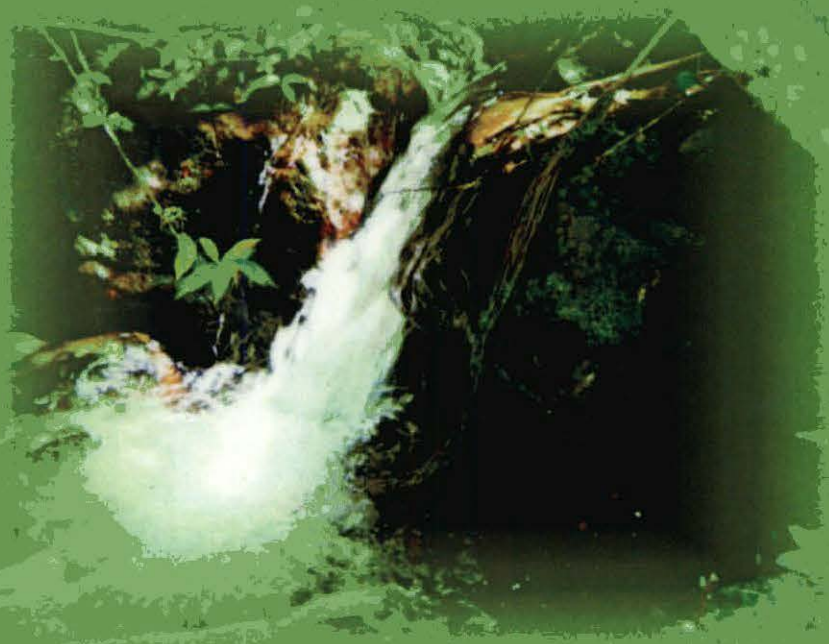
PROJECT PE- 3
Communities and Watersheds

ANNUAL REPORT

October 2003



CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

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CONTENTS

1. Research Framework

The ultimate goal of the Communities and Watersheds (C&W) Project is to safeguard water, food, and environmental health through research on land-water-community interactions. We utilize an integrated research framework (Figure 1) to organize and analyze interdisciplinary information, starting with the status and dynamics of the resource base, an evaluation of the interactions, determination and analysis of potential options, and finally replication of successful methods or approaches. While our focus is biophysical, we draw from the social sciences to better understand resource management, and utilize community-based methods to ensure local relevance to our research.

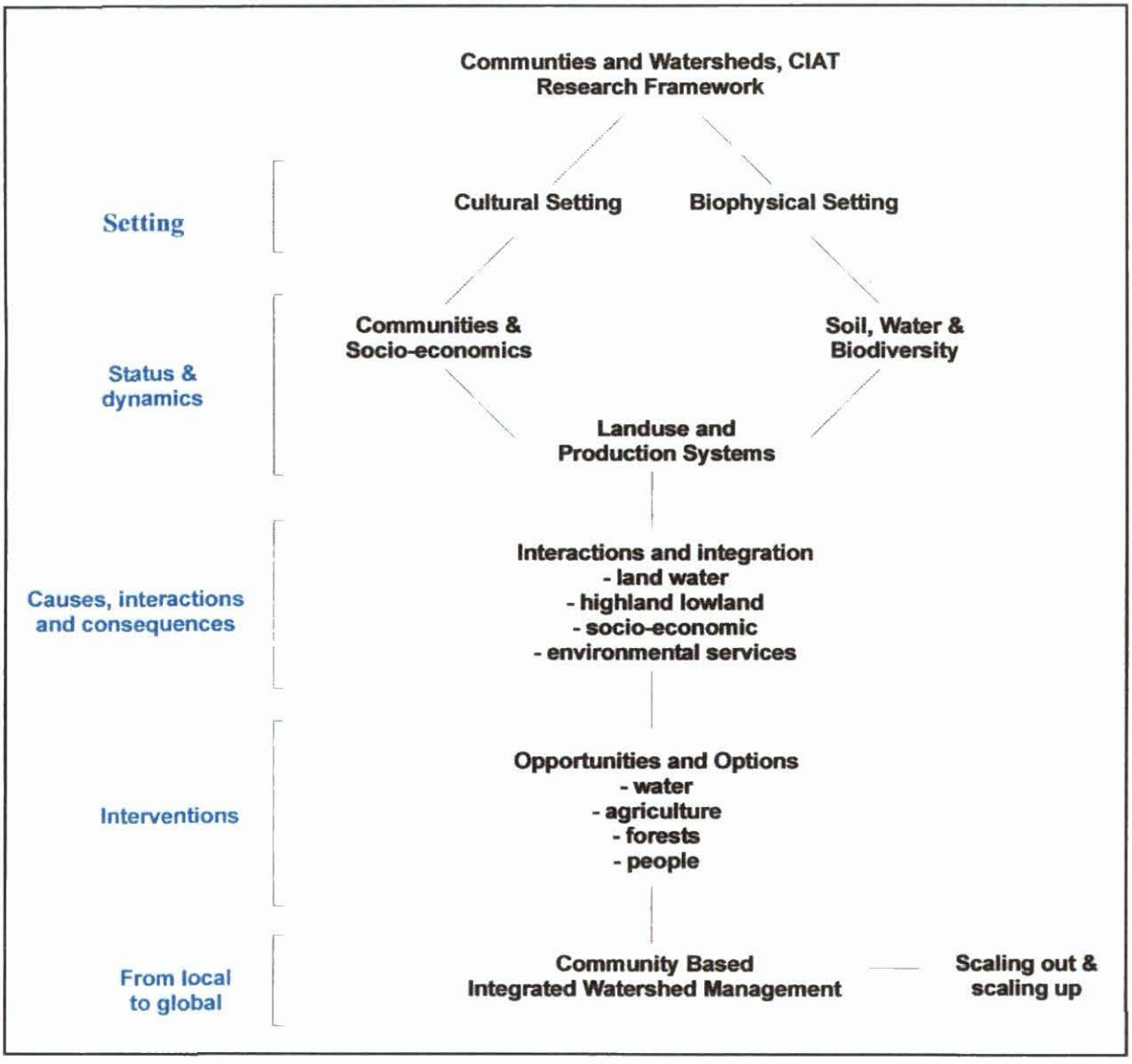

Figure 1. Communities and Watersheds' research framework.

The research program focuses on four components:

(1) Land-water interactions: How do land use and land management impact water quality, quantity, and distribution?
(2) Highland-lowland interactions: How do water quality, quantity, and distribution vary downstream, and what are the social and environmental consequences?
(3) Environmental services: How do we value environmental services considering varying social, environmental, and political perspectives?
(4) Community-based research for development: How do we integrate rural communities in research relevant to development issues?

Our primary clients are local organizations, local governments, and farmer groups. Research institutions, national governments, and nongovernmental organizations (NGOs) are secondary clients, and the final beneficiaries are the farmers and communities.

Our approach is interdisciplinary. We work in a scale-nested manner from farms to communities, microwatersheds, and finally watersheds (10,000 ha). We maintain an explicit focus on youth as leaders for tomorrow and long-term local partners. And to guarantee short- and long-term impact, we highlight best bets and success stories, in terms of methods, approaches, technologies, and activities.

Various tools and methods will be utilized, but core to the project's work are geographic information systems (GIS) mapping and modeling, case study watersheds for comparative analysis, and a minimum indicator set used in all watersheds. Indicators have been developed for each component of the research framework (Figure 1) and for farm, community, and watershed scales. Innovative technologies such as CD-ROM and Web sites are central to our information dissemination strategy.

Since the research framework is new to the team, we will initially concentrate on two pilot watersheds in each region (Central and South America). In the pilot watersheds, we will develop concrete research projects, baseline studies, hotspot analysis (environmental and socially sensitive area analysis), common indicators, monitoring, data collection and analysis, interactions, options and activities, and ultimately enhance team capacity for improved community-based watershed research.

1.1. Project Description and Logframe

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:

2004 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.

2005 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.

2006 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: CATIE, CIP, IPCA, IWMI, IICA, CIRAD, CIPAV, CVC; universities of Georgia, Florida, Guelph, British Columbia (Canada), Nacional Agraria (Nicaragua), Hue (Vietnam); INTA, CONDESAN, ACERG, Herederos del Planeta, ASOBOLO, CGIAB, GTZ, ICIMOD, Grupo Randi Randi, KIB, PARDYP, RNRR, Campos Verdes, CLOs, CIALs, Hillsides Agricultural Program, Haiti (HAP).

CGIAR System Linkages: IWMI, CIP, CIMMYT, ICRAF, ILRI, IRRI, and Water and Food CP.

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

CIAT PE-3 Project Logframe (2003-2006)[a]

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

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
Goal: To foster community based watershed management (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 natural resource management (NRM) at research sites.	User groups (number 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.

Continued.

CIAT PE-3 Project Logframe (continued).

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
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
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) Agrobiodiversity (number 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 (number and type) Youth group formation and activities User groups supported (number and type) Digital information (number 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

Continued.

CIAT PE-3 Project Logframe (continued).

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
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 64.

1.2. Alliances

Partnerships and strategic alliances allow us to build on our strengths and have a broader perspective. Our core alliances are with the Institute for Resources, Environment and Sustainability (IRES) at the University of British Columbia (UBC) in Canada, the Tropical Agriculture Research and Higher Education Centre (CATIE, the Spanish acronym) in Costa Rica, and the Center for the Investigation of Sustainable Agricultural Production Systems (CIPAV, the Spanish acronym) in Colombia. In addition, we link to various project alliances, such as the Consortium for the Sustainable Development of the Andean Region (CONDESAN, the Spanish acronym), the Nicaraguan Institute for Agricultural Technology (INTA, the Spanish acronym), and the Sustainable Agriculture and Natural Resource Management (SANREM) project of the Collaborative Research Support Project (CRSP) of the United States Agency for International Development (USAID).

1.3. Indicators

The C&W has developed a minimum indicator set for watershed analysis linked to our research framework (Figure 2). For each component of our framework (soil, water, land use, etc.) we have compiled indicators that will be monitored in each of our four pilot watershed sites. Our minimum indicator set includes both biophysical and socioeconomic indicators, such as water quality parameters, soil fertility, agrochemical inputs, landholdings, population density, and septic systems. Common indicators allow C&W to monitor change over time, and compare between pilot watersheds. Spatial patterns in indicators will be evaluated using GIS, and data will be integrated using indices (e.g., water quality index) to summarize complex information. We will also use a watershed profile (Figure 3) to display the scores for all indicators together because we feel this is a useful tool for integration and communication.

Indicators

Category: ☐ Soil ☑ Water / Climate ☐ Biodiversity

Indicator	Measurement	Scale / Data requirements		
		Farm	Community	Watershed
Infrastructure	**Irrigation canals (map, # km)** **Aquaduct (map, # km)** **Water distribution type (pipe, open**		X X X	
Water sources	**Source types (spring, river etc.)**			X
Irrigation - water use	**Irrigated area (% farm, % agr. land)** **Irrigation water source(s)** Water balance	X X		 X
Livestock - water use	**Livestock water source(s)** Requirements (L / day per farm)	X X		
Domestic - water use	**Domestic water source(s)** Consumption / use (L / house per day)	X X		

1 of 3 next

Cultural setting | Biophysical setting | Communities and socio-economics | Soil, water and biodiversity | Landuse and production | Interactions and options | Community management | Scaling

Figure 2. Minimum indicators used for comparative watershed assessment.

Common reference indicators allow the C&W team to compare conditions in one watershed with other watersheds, and will be one of our trademark activities. Our four pilot watersheds represent a range of issues, such as intensive agriculture, water scarcity, and alternative production

systems, and as such allow us to evaluate similarities and differences. Comparability between watersheds allows us to share information and exchange successful methods and techniques that are contributing towards improved food, water, and livelihood security.

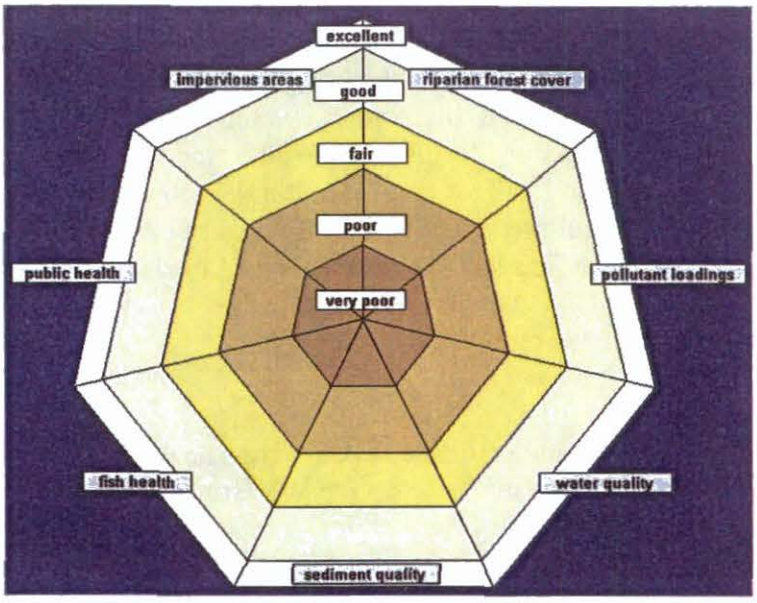

Figure 3. Watershed profile.

2. Pilot Watersheds

2.1. Mid-Garrapatas Watershed, Colombia

2.1.1. Baseline

The Youth in Natural Resource Management research project within the C&W research framework has been organized to facilitate the integration of results from biophysical and socioeconomic analysis at the watershed scale with the results that youth research groups are achieving at local scales.

The Colombia Youth research project has four expected outputs: (1) the development of leadership among the young population, (2) creating capacity for research through alliances, (3) making research and education sustainable through income-generating activities, and (4) providing a model for replication.

During the first year, project partners have concentrated on analyzing the current conditions that need to be improved according to the project objectives, setting up the basis for participatory research activities, and designing schemes for the sustainability of the project. There has been an important effort to communicate the project objectives to the communities involved. This has been necessary not only to gain support from parents for the youth activities, but also to show the neutral presence of partners in a conflict area.

The total number of children and youth attending the 38 Asociación de Centros Educativos del Cañon del Río Garrapatas (ACERG) schools is between 750 and 800. This number varies each year according to the families' ability to pay for school fees. After the first couple of workshops with participants from the 38 communities, we decided to reduce the scope of the project for the first year. We selected 13 communities, decided to concentrate our activities on these, and scale up to the other communities after completing the second year. The number of children and youth from these 13 communities is 277, of which 134 have participated in one or more activities.

The baseline on natural resource management (NRM) is being developed for the Los Sainos microwatershed, where the youngsters chose this topic as a priority research theme. With the participation of 15 youngsters (aged between 10 and 22), we have conducted 55 surveys covering the whole population of this microwatershed. In the following months, with the participation of young leaders, we will analyze the information generated, and will present results to the community. After this, a plan will be drawn to initiate research trials for improved watershed management.

At the scale of ACERG (38 schools located in an area of 380 km^2), general surveys will be conducted soon, as well as specific surveys in particular locations, depending on the research topic chosen by the group of youngsters in that location (Table 1).

Table 1. Distribution of topics chosen by youth groups.

Theme	Research topic	Location of group(s)	No. of members	Coordinating organization[a]
Food security	Maize, beans, rice	La Hondura	3 groups of 10 members	CIAT
	Beans	Alto Miranda	13	CIAT
	Vegetable gardens (bio-intensive)	Guatemala	6	CIAT
		La Peña	31	
		La Hondura	9	
		Puerto Nuevo	12	
Alternative animal production systems	Cattle	Bellavista	12	CIPAV
	Pigs	El Filo	19	CIPAV
		Marabeles	15	
	Chicken	Bitaco	4	CIPAV
	Fish	Balcanes Alto	9	CIPAV
		Balcanes Bajo	13	
Rural enterprises	Plantain use and commercialization	La Dorada	Not established	CIAT
		La Pradera		
	Bamboo management and transformation	La Peña, Bellavista	Not established	CIAT
Watershed management	Facilitating succession for rehabilitation of ecosystems	Bellavista	15	Herederos del Planeta

a. CIAT = Centro Internacional de Agricultura Tropical; CIPAV = Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuária.

2.1.2. Baseline geographic information

Through an alliance with the municipality of El Dovio and the participation of neighboring municipalities, a baseline map is being developed (Figure 4). The goal of this work is to generate, together with the municipality of El Dovio, the young rural population, and ACERG, an understanding of the existing information used for the Plan de Ordenamiento Territorial (POT), its potential use for decision making, and the development of additional information that can be useful both for the municipality and for the project partners.

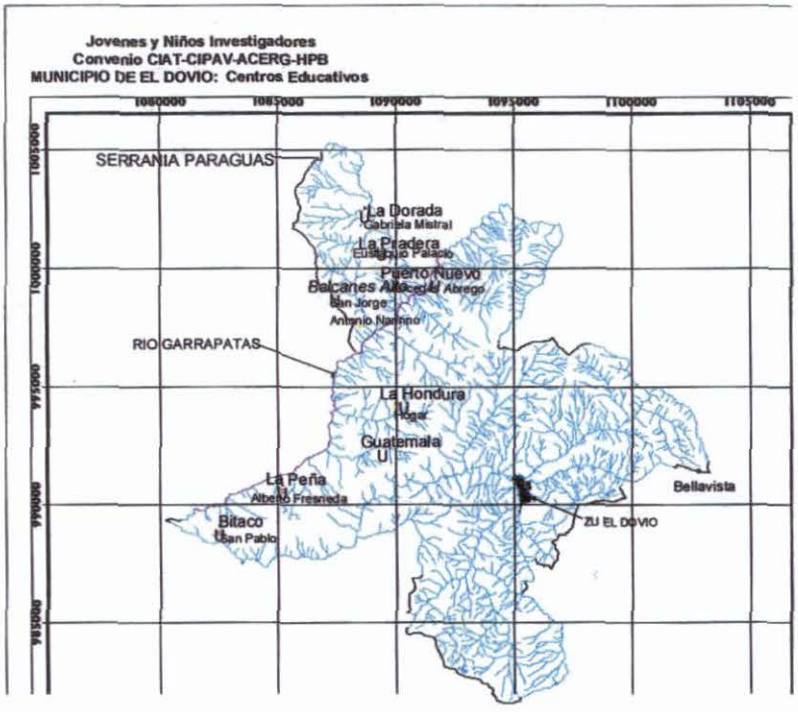

Figure 4. Baseline map under development for the municipality of El Dovio. (For acronyms and abbreviations used, see page 64.)

The main questions that can be answered, based on a geographic analysis, are:

- Where do we site the trials?
- How far distant are populated centers of consumers, for exchange, and/or commercialization of products?
- What is the area of each trial?
- What is the area of influence of each trial?
- Where and how big is the population: direct/indirect beneficiaries, population distribution by age, sex, schooling?

- How do we determine the strategic areas where trials should be sited, transfer appropriate technologies of less environmental impact, zones of protection, restoration, and ecological conservation?

2.1.3. Youth in environmental research

Youths in rural areas in Colombia find very limited opportunities to access high school, university-level education, or employment. However, youths are key actors in processes of development, and therefore are important long-term partners in research processes.

Their involvement in research activities in this project has included the prioritization of research topics according to their needs and long-term aspirations. During the first 6 months of the project, the participation of youngsters aged between 9 and 21 in several diagnosis workshops, led to the selection of research topics related to their food security, NRM in their communities, and the possibilities of using these resources for income generation.

Once the research topics were chosen, leading organizations (CIAT and CIPAV) began capacity-building processes so that these young researchers participate in research design, sampling, surveys, data compilation, analysis, and presentation of results to their communities. Fifteen youngsters have participated in the microwatershed diagnosis begun in the Los Sainos microwatershed. The process started with the participatory design of the surveys to be conducted in the microwatershed. Three of the more senior youngsters participated in several meetings where the surveys questions were written. One the oldest ones of the youngsters, together with his family, conducted the survey trial. The data collection using the surveys started with a survey made by the whole group (15 young co-researchers, two CIAT researchers, and one CIPAV researcher) on one of the youth's family. This served to show the group the way to introduce the survey to the farmer and the family, and to explain the objectives of the research process.

Since the microwatershed being studied is small (652 ha), most co-researchers knew the families, and were welcome to conduct the surveys despite the time involved (40 minutes on the average). Once all felt confident with the questions, we split into four groups, each led by a senior co-researcher, and started the data collection, including coordinates, photographs, and questions. The data collection process was extremely efficient (55 surveys in 7 days), and showed the development of skills in a group of rural youth. The process of data analysis, interpretation, and presentation of results to the community will be a participatory process also, and will involve the use of Excel and Power Point. Similar processes will occur in other areas where the youth groups chose particular research topics.

2.1.4. Options and actions

Food security. Communities with difficult road access particularly prioritized this topic. With the participation of the Participatory Research in Agriculture (IPRA) project, and the involvement of Autogestión, Desarrollo Y Sociedad (ADYS), we are starting research projects with several youth groups to analyze the different options for the production of food in small areas with limited resources such as land, soils, and water.

Major staple food diet components. In the area, these are maize (*Zea mays* L.), beans (*Phaseolus vulgaris* L.), and rice (*Oryza sativa* L.), and because of particular environmental characteristics (semi-permanent fog), most poor families import them from El Dovio. With the participation of several children in two locations (*veredas*), we are conducting adaptation trials aiming at the development of small enterprises for the commercialization of adapted seeds run by the young co-researchers. The main research questions to be answered by these groups are: What are the varieties most adaptable to the environmental conditions of the *veredas*? Can we contribute to improved food security through the promotion of adapted germplasm incorporated with other food security options, such as the bio-intensive vegetable gardens?

Bio-intensive vegetable gardens. The inhabitants of the *veredas* of La Peña, Guatemala, La Hondura, and Puerto Nuevo (northern Cauca valley) mostly have been dedicated to the cultivation of single crops, such as coffee (*Coffea* L.), which they used to market to later acquire vegetables and other food in El Dovio municipality market. Today, coffee does not exist, nor is there money to buy food. Thus the consumption of vegetables is minimal, and this leads to the poor nutrition of children of the area.

In March 2002, a group of officials from CIAT, CIPAV, and ACERG, as well as members of the community, participated in a training session on the Bio-intensive method of kitchen gardens that took place in Ecuador over 15 days. The training was supported by ADYS, a non-profit foundation of a World Humanitarian Network of 134 countries that watches over the food security of the less economically favored populations.

The Bio-intensive method is defined as: "Abundant life in small space by natural means". It is a living art of organic cultivation that helps us understand our place in the universe and our relation with the sun, moon, air, soil, animals, plants, insects, and worms. Agrochemicals, such as fertilizers, insecticides, or hybrid seeds, are not used. This method promises better crop yields, optimal use of water and space, and does not depend on external inputs. Furthermore, it calls upon community participation.

About 30 families, of the previously mentioned *veredas*, have begun the process with observation trials. This has included the active participation of children, youths, and adults of the area, who will answer important questions, such as:

- Does this method adapt to the particular conditions of each area?
- Does it improve the quality of diet and nutrition in children and young people?
- What is the economic impact of planting food?

The Bio-intensive method is a tool for introducing these communities to the concept and practice of bio-diversified kitchen gardens, in which the family does not have to move to the Market, but rather that it can supply itself with food from its own patio and can have a balanced diet, rich in nutrients, for all its members.

Alternative animal production systems. With the participation of CIPAV, we expect to develop animal production systems that require minimum amounts of inputs from outside the farm, and that can contribute to improved environmental management (monitoring water

quality). The main research question to be answered by these groups is: What are the components of a sustainable and profitable animal production system for the particular conditions of the four *veredas* and the particular animal system chosen?

Rural enterprises. The two remotest locations in the project area are *veredas* where farmers have extensive plantain (*Musa paradisiaca* L.) crops, and where commercialization has always been limited because of the difficulty in accessing markets, and the small added value to the plantain. Youngsters prioritized this topic, and research will focus on the development of alternatives for its use and commercialization.

At the same time, several locations in the watershed prioritized the use of natural resources for the production of handicrafts. After an analysis among project partners, we decided to concentrate on a resource with abundant stocks in the area, that would offer prospects for enterprise development, and that would require an adequate resource management for its sustainable use. These criteria led us to choose bamboo, and we are approaching a prospective partner for a joint action-research project.

Watershed management. After the diagnosis of the Los Sainos microwatershed, the analysis of data, the use of aerial photographs, and the presentation and discussion of results with the community, we expect to agree on topics and sites for the initiation of trials for options for ecological restoration of degraded lands, and for improved water quality and quantity. So far, the work at the Los Sainos microwatershed has allowed the identification of several critical factors and trends in the use of natural resources, the active involvement of young co-researchers in the diagnosis, and the detection of crucial farmers that could have a positive impact in the watershed.

2.2. Bolo Watershed, Colombia

2.2.1. Baseline

This 19,800 ha upper watershed has been identified as one with a potential for improved management because of several water-related issues. An example is highland–lowland interactions between poor upstream small-scale farmers and big downstream sugarcane plantations and mills. Another example is land-water interactions, such as land use change in recent years and its effect on water quality and quantity, the increasing demand for the resource from several urban areas, and the existence of a water users' association—Asociación de Usuarios del Río Bolo (ASOBOLO)—with a very positive record in terms of achievements at the community level, and that connects the voluntary contribution from downstream users to development processes and environmental protection upstream.

This watershed is also one of the 12 watersheds that flow into the Cauca River valley, where a similar number of users' associations work in like fashion, making an interesting case for scaling up results, particularly because of CIAT's alliance with the local environmental agency, the Corporación autónoma regional del Valle del Cauca (CVC) that deals with policy at this scale.

For these reasons, the Bolo watershed has been chosen as one of the Water and Food Challenge Program (WFCP) research sites. The research objectives for the watershed will focus on

establishing a community-based hydrological monitoring network, and developing a water balance model for improved water distribution and future management of the resource. The proposal also includes the analysis of alternative irrigation systems for efficient water use upstream.

2.2.2. Global Water Forum, Kyoto

Communities and Watersheds assisted ASOBOLO in entering the World Water Council, 3rd Water Forum water action contest, which sponsored grass-roots organizations to attend the Kyoto conference. ASOBOLO was selected as one of the top 150 organizations, and was the only Colombian NGO selected. At the Global Water Forum, ASOBOLO was recognized as one of the top 10 organizations globally.

This environmental NGO has worked since 1994 in the conservation of the Bolo River watershed, benefiting the 55,000 inhabitants of the municipality of Pradera, located in the department of Valle del Cauca. The work carried out with the local community has involved the establishment of community nurseries, propagation of threatened forest species, protection of strategic ecosystems, improvement of food security, support for environmental education, and organization of rural enterprises.

Figure 5 shows part of the poster content developed by C&W and ASOBOLO, and presented by ASOBOLO at the Global Water Forum in Kyoto. The poster shows the geographical position of ASOBOLO, gives some information about the organization, and explains a little of what it does, and how it would like to expand its work both with people and in the area covered.

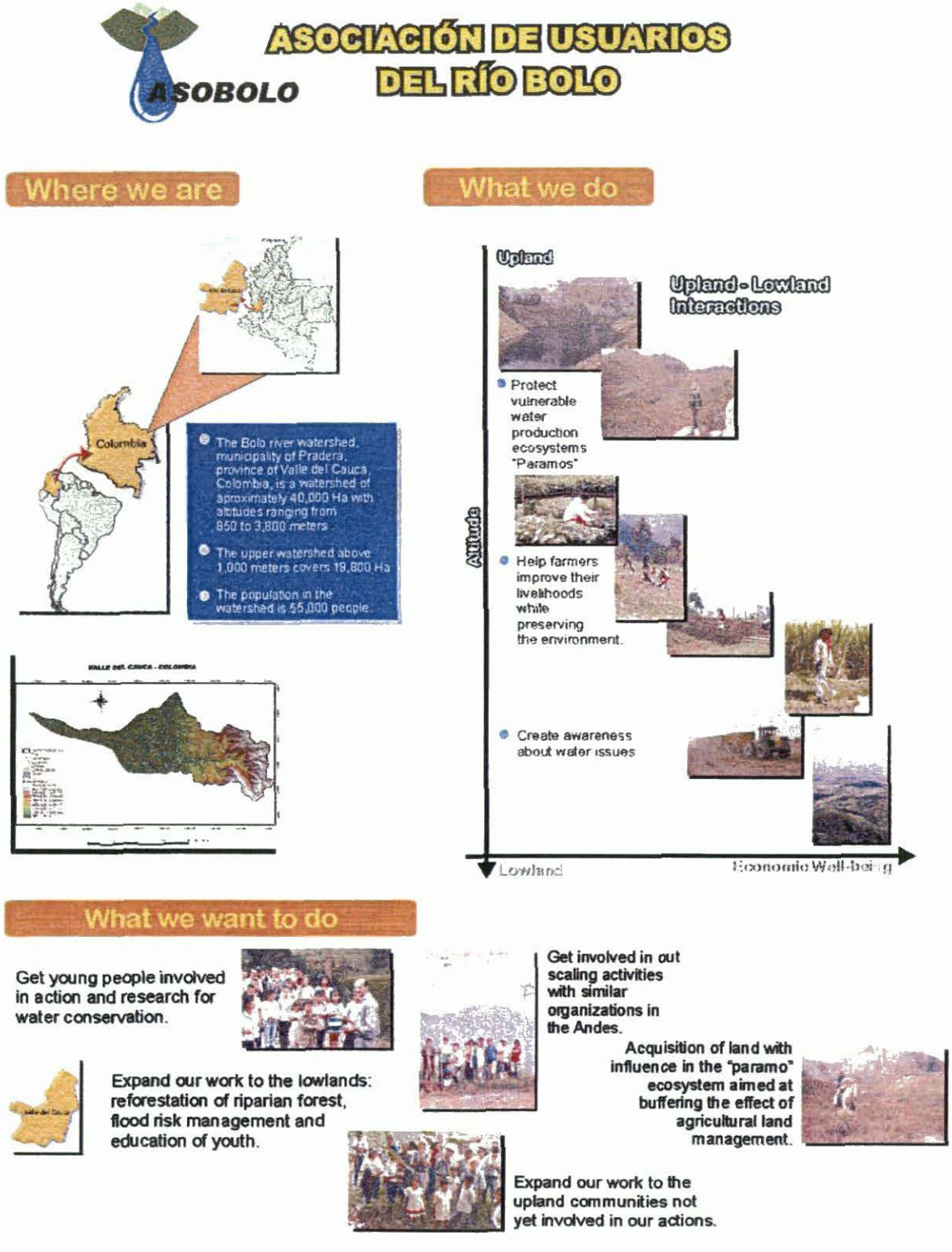

Figure 5. Part of the Asociación de Usuarios del Río Bolo (ASOBOLO) poster, presented at the Global Water Forum, 2002.

2.3. Tascalapa Watershed, Honduras

2.3.1. Baseline

The subwatershed contains the Tascalapa River, a tributary of the Sulaco River, which flows into the El Cajón hydroelectric dam, the most important in the country, generating 300 megawatts and representing 60% of national consumption. The Tascalapa River is a tributary also of the Ulúa River, one of the most important in the country.

The Tascalapa River area covers about 130 km^2. The area is located between the municipalities of Yorito and Sulaco in the department of Yoro, between latitude 14° 56' N and longitude 15° 10' N, and longitude 87° 10' W and 87° 23' W. It is a mountainous area with altitude between 470 m and 1700 m, with slopes greater than 30%, except in the very small flat areas of the intermontane valleys that have slopes of less than 15%. These characteristics greatly condition the production systems. The mean annual temperature is from 26 to 28 °C, and annual rainfall is 1295 mm, with a unimodal distribution with greater precipitation in the months of July and September, and less in March and April. The soil types predominating in the watershed are Entisols, Inceptisols in the higher areas, and Mollisols in the lower areas.

Data from the 1993 census indicate that this watershed is characterized by a strong smallholding sector, which coexists with a sector of medium and large farm exploitations; 83% of the farms of less than 10 ha take up 19% of the area. Sixty-three percent of rural families do not own land (they rent). Production systems of basic grains are common in the high areas with slopes greater than 30%, managed by small-scale farmers with a low level of technology. In the lower zones with slopes less than 15%, large-scale producers practice a more intensive agriculture of basic grains. Thus, the greater part of cattle farming is concentrated in the lower areas, is extensive, and 70% of producers practice a dual-purpose system.

Sources of information indicate that from 1993 the population grew by more than 2.9% per year, which suggests high growth, and a density of 100 inhabitants per km^2. Education levels are very low, at basic and secondary level.

Coffee is found mainly in the higher areas around 800 m. In the subwatershed, the latifoliate forest is under pressure, basically in the higher zone where land is cultivated to coffee, and in the middle zone, coniferous forest has suffered intervention. About 46% of forest coverage is under the infrastructure of agricultural cultivation, 20% is pine forest, and 3.3% latifoliate forest. During the dry season in the region, the traditional practice is to burn both agricultural land and pasture. This leaves the soils unprotected, so that when rain falls, high levels of erosion occur, and thus high levels of sedimentation in the rivers. Table 2 shows a condensed version of available data on biophysical, socioeconomic, and natural resource (water, soil, biodiversity) aspects, at different scales (farm, community, and watershed).

Table 2. Type of available information and existing gaps for the elaboration of a baseline focusing on the integrated management of watersheds at different scales, subwatershed of the Tascalapa River, Yorito, Yoro, Honduras.

Scale	Data available[a]		
	Biophysical	Natural resources/ production systems	Socioeconomic
Farm	-	- Soil fertility (N, P, K, Ph, %C) - Soil physical characteristics - *Use of water for irrigation, cattle, and domestic needs* - *Agrodiversity (crops/farm, variety by crop and by farm)* - Crop systems and agricultural calendar - Data on production and productivity of principal crops - Data on agricultural inputs (fertilizers, pesticides, etc.)	- *Land ownership (ha per owner), % irrigated/ total agriculture* - *Food produced on the farms* - *Migration (family members living in urban centers, seasonal work, and income from family remittances*
Community	-		- Census on education, no. of schools, students, years of study - Local groups (type of group, no. of participants, and level of participation according to type) - Population census, population density, rate of increase, and size of family, 2001 - Information on services: health, education, water, energy, 2001 - Protected areas/ conservation - Community management (no. of cooperatives, non-governmental organizations, local organizations)
Subwatershed	- Slope and elevation maps, 1:50,000 - Map of hydrographic network - Daily rainfall for the last 7 years - Geology map, 1:50,000 - Air photos, 1:10,000 (Luquigüe watershed)	- *Infrastructure (irrigation channels, aqueducts, and type of water distribution)* - Records of types of water source - Quantity and quality of water - Type of land use - Diagnostic on vegetative coverage, 2000 (Luquigüe watershed) - Soil and water assessment to evaluate three scenarios of land use in the Jalapa River watershed - Dissolved sediment - Summary of water balance (mm) in four cover types	- Census on ethnic groups, population, and spatial distribution - Community organizations of social and production type - Population census and population density, 2001 - Percentage of population by religious groups - Records on school level, number of educational centers

a. Use of italics indicates a gap in information due to non existence of data. Biophysical data are not required at farm and community levels according to indicators.

2.3.2. Geographic information systems

The subwatershed has available maps at a scale of 1:50,000—information that does not permit clear identification of environmentally and socially sensitive areas (ESSA). At present, information is being obtained at smaller scale that permits interpretation and analysis of these maps, and the identification with ESSA criteria. Maps have been obtained at 1:20,000 scale for potential and actual land use. Information is being sought from other projects acting in the subwatershed, such as the Programa de Administración de Areas Rurales (PAAR) and Servicios Técnicos para el Desarrollo Sostenido (SERTEDESO), among others.

2.3.3. The role of participatory research by youth in food security and natural resource management: Improving education for rural development

Education/occupation/activities. The project seems to be especially attractive to those youngsters who are studying. Of the members of the Local Agricultural Research Committees (CIALs, the Spanish acronym), 82% study as against 63% of the other interviewed youngsters. Females study longer than males, who spend more time helping their parents with work. The youngsters have received more years of education than their parents. Most working young men are employed in the agricultural sector; young women are generally working as housewives (without income).

Most of the CIAL members also belong to other youth groups, such as a football club or a church. Youngsters who are not a member of a CIAL participate less in other youth groups. Being more involved in agriculture and other activities in their communities, the mothers of the CIAL members seem to have a positive effect on the participation of the youngsters in the project.

Energy and water. Only the people in Yorito and La Sabana have access to electricity. Of the families interviewed, 83% use firewood for cooking. In 75% of the families, the youngsters are involved in collecting firewood. They spend an average of 2.6 hours a week on this. The quality of houses, access to electricity, and education level of the parents do not influence participation in the project.

The research groups (CIALs). In January 2003, three more youth groups were added to the project. To improve the participation of the College in the project, two groups were established within the College; and a group of youths in San Antonio formed their own CIAL, and have on their request been included in the project.

From August 2002 until August 2003, the six initial CIALs lost about 40% of their original members. The Luquigüe CIAL lost almost 70% of its original members, and the group from La Sabana almost 60%. The Yorito group, which had a slow start, only lost 15% of its original members. But, except for one, all groups gained more members than they lost: the number of members in the original six groups increased from 138 to 193. With the extra three groups, the project has 271 members—153 females and 118 males.

In August 2002, 35 young facilitators remained of the initial 50. Between August 2002 and August 2003, another eight left, less than the amount of other members who left the groups.

According to the data from the participatory monitoring and evaluation (PM&E), conducted by the Investigación Participativa en Centro America (IPCA) project during the months of May and June 2003, CIAL meetings have an average participation of about 63 women and 55 men. The groups have big differences: more than 90% attendance for one of the Instituto San Pedro (ISP) CIALs, and just over 40% for La Ladera and Jalapa (Table 3).

Table 3. Male (M) and female (F) membership of Local Agricultural Research Committees (CIALs, the Spanish acronym), August 2003.

CIAL name	Community	Members August 2003 (no.)			Members August 2002 (no.)		
		M	F	Total	M	F	Total
Los Pinares	Luquigüe	18	20	38	6	7	13
Por un Futuro Mejor	La Ladera	8	9	17	7	10	17
Sueños Juveniles	Yorito	22	20	42	14	26	40
Jóvenes Progresivos	Jalapa	12	14	26	11	8	19
Nuevo Despertar	La Sabana	19	10	29	14	10	24
Nuevo Horizonte	Wisilka	21	20	41	15	10	25
Total 6 initial groups		100	93	193	67	71	138
Unión y Esfuerzo	San Antonio	35	6	41			
Jóvenes Unidos	ISP (College)	12	6	18			
Jóvenes en Acción	ISP (College)	6	13	19			
Total		153	118	271			

Research activities and other activities conducted by the research groups (CIALs). One year after forming the CIALs, five of the six groups have started their research activities, but none of them has obtained final results as yet. The groups from Yorito and Wisilka have finished their first round of research, and are in the process of writing. The other groups will need more time, especially those working with trees. Some groups decided to change their research theme because of different problems, such as diseases or too much rainfall during their trial.

The new CIALs of the ISP have obtained more in 5 months than some of the other CIALs in more than 1 year! This could be because of the greater amount of time they have spent on the work, but is also because of the organization of the work and the research theme. Table 4 shows the CIAL activities and research themes in their communities.

Table 4. Activities and research themes of the Local Agricultural Research Committees (CIALs, the Spanish acronym).

Community	CIAL Activities	Research theme
Yorito	➢ Pollution of streets and rivers ➢ Reforestation for firewood ➢ Varieties of rice	➢ Management of garbage: Comparing different ways of treating the garbage of different sections of Yorito.
Jalapa	➢ Reforestation of the riverside with fruit trees ➢ A nursery with fruit trees	➢ Comparing different types of soil used for the plants in the nurseries
La Ladera	➢ Reforestation for firewood ➢ Food security: Vegetable gardens	➢ Comparing different types of trees for firewood.
Wisilka/El Destino	➢ Reforestation for firewood ➢ Fruit trees	➢ Comparing two varieties of cowpea
La Sabana	➢ Reforestation for firewood ➢ Reforestation of the watershed ➢ Food security: Rabbits	➢ Raising rabbits: The CIAL has not yet decided on the details - probably comparing different types of housing.
Luquigüe	➢ Reforestation with fruit trees ➢ Food security: Vegetable gardens	➢ Comparing the effect of the use of different bag sizes for the nursery plants
Jovenes en Acción[a]	➢ Cowpea, maize	➢ Comparing four varieties of chilies
Jovenes Unidos[a]	➢ Maize	➢ Comparing two varieties of "Guayaba", for organic manure
San Antonio	➢ Cowpea, maize	➢ Varieties of non-local trees

a. Of the Instituto San Pedro, Yorito, Honduras.

Training activities and other activities organized for the groups.

Training on:

- Establishing a nursery and about forest management, given by the Corporación Hondureña de Desarrollo Forestal (COHDEFOR)
- "Mapping", organized by CIAT
- "Conflict management", organized by ISP
- Computers—for a number of the CIAL members, organized by CIAT and Amy Fournier (UBC)
- Preparation of pizza and different kinds of cake within the communities, given by CIAT
- Water quality, given by Amy Fournier and the Escuela Nacional de Ciencias Forestales (ESNACIFOR)
- Jam and marmalades
- Establishment of a watershed, organized by UBC and CIAT
- The CIAL methodology, repeated by IPCA

Other activities for the CIAL members:

- Competition of different kinds of sports, organized by ISP
- Visit to a play about domestic violence in El Progresso
- Yorito Cleaning Day
- Football games between different CIALs

- Visit to "Curla" University, La Ceiba
- "Inter-CIAL" visits, organized by CIAT and the CIALs
- Participation in the regional and national meetings of IPCA
- Conducting interviews amongst the youngsters and adults in the different communities
- Parents meetings in each of the communities to inform them about the project
- Participating in a mapping in Yorito and La Sabana with PAAR

Participation of the different partners involved in the project. IPCA is still giving technical assistance to the research groups. The ISP received almost US$6000 from the "Fondo Canada Para Iniciativas Locales en Honduras" for the project. These funds stimulated the Institute into becoming more involved. It has appointed a room for the project where the computers are installed, and where we can work, give classes, have meetings, etc. This has changed many aspects: the youngsters work on the computers more often, and participate more in the preparation of activities (making posters or invitation etc.), or in general discussions about the project. This office has made the project more "visible" to the youngsters and the Institute.

Another action undertaken to involve the ISP has been the appointment of a new staff member who is working for CIAT, but has her office in the ISP. Since this person has a contract with CIAT, she is also representing CIAT in the project. The direct involvement of CIAT personnel has been improved this year: CIAT has been involved in a mapping exercise, water quality activities, training and technical support in reforestation, computer training, and in training, technical and material support in forages.

The UBC has organized a workshop on water quality, and has initiated the establishment of a small wasteland area in Yorito.

2.3.4. Options and actions

Influence of land use on the quality of water and determination of indicators. To analyze the disturbance suffered in the sources of natural water, potential water sources for supply to human settlements, the methods traditionally used have been physicochemical, but only give reliable data on the state of the water. The use of biological analysis, based on organisms, is being implemented strongly because it provides data of what occurred days and hours before taking the sample. It is accepted that biological analysis does not replace physicochemical data, but they overlap, and are complementary.

To help solve this problematic, the present study characterizes the quality of the waters of the river system of the Tascalapa River subwatershed (Honduras), by means of local knowledge, and analyses of physicochemical and biological parameters of water quality, in order to generate a baseline that supports decision taking for integrated management of this subwatershed.

The study was made in the upper and middle parts of the subwatershed, which is made up of three microwatersheds: Jalapa, Luquigüe, and Ojo de Agua watersheds (Figure 6). The main streams of water within the Tascalapa subwatershed are the Jalapa and Luquigüe Rivers. For this study, 12 monitoring stations were divided up between the three microwatersheds, and located at points with different grades of influence in land use.

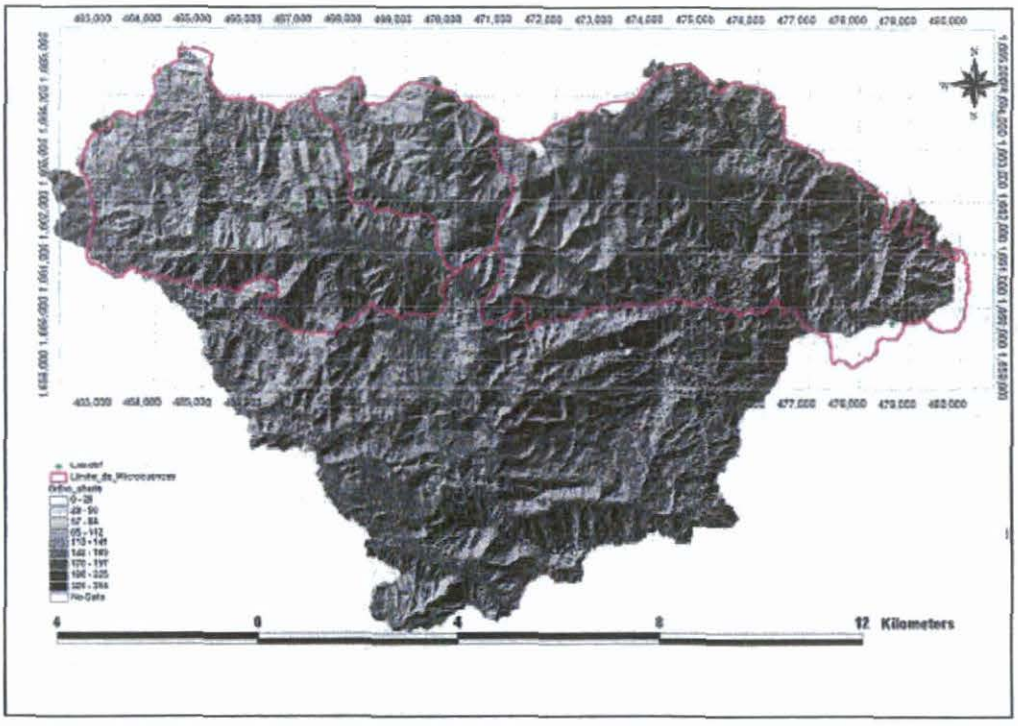

Figure 6. Tascalapa River subwatershed, middle and high areas; Jalapa, Ojo de Agua, and Luquigüe microwatersheds (from left to right).

Monthly sampling was carried out from February to July 2003, during the dry season and the start of the rainy season, to determine the state of management of the water resource and the alternate sources (rivers and gullies). At each station established in the streams of the microwatershed, three subsamples were collected, at random and on various opportunities, of all substrata representative of the water sources, using a hand net (25 cm x 40 cm), with an approximate volume of 0.5 L (Figure 7).

The water quality index proposed by the National Sanitary Foundation of the US will be used to determine the physicochemical quality of the microwatershed's water. With the values obtained, we will make graphics to analyze the behavior of the physicochemical variables with respect to the sample stations and time of sampling. In order to show the relationships between the biological indicators and the environmental variables (physicochemical) that could influence them, a Canonical Correspondence Analysis (CCA) will be applied.

Individual interviews were carried out with members of each of the communities in the watershed to identify, determine, and begin the validation of local water indicators. Then a participative workshop on local indicators of water quality was held to complement the information collected in the personal interviews. This workshop took place in the high and middle areas of the watershed. Finally, a general consensus was taken of the final list of indicators. Later, the local information generated will be compared with the technical information obtained during the monitoring of the water quality.

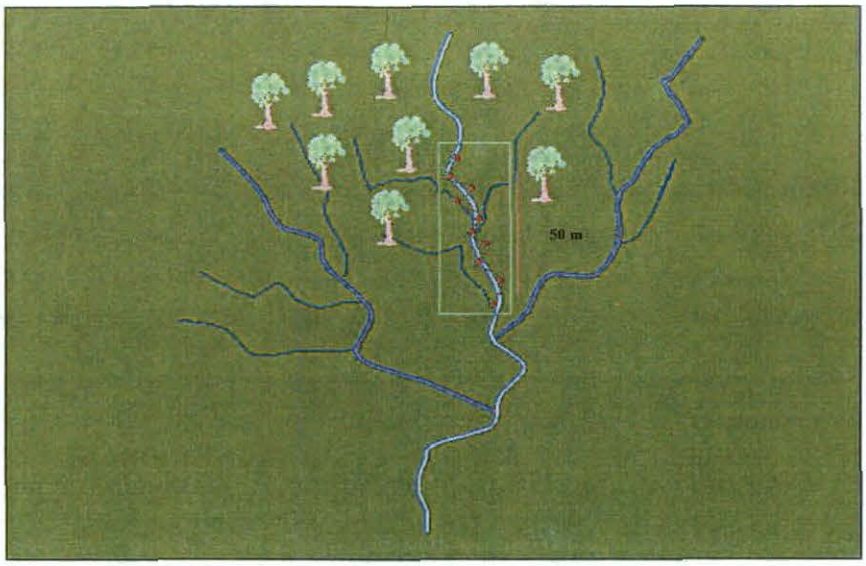

Figure 7. Samples taken at each of the sample stations.

2.3.5. Visits of partners to different activities in the Tascalapa watershed, 2003

Table 5 gives some detail of visits by partners from November 2002 to September 2003.

Table 5. Visits by participating institutions to the Tascalapa River watershed, 2003.

Date	Type of event	Participating institution[a]	No. of participants		Results[a]
			Producers	Technicians	
27 Nov 2002	Tour	IPCA	10	2	Selection of germplasm in SOL site
20 Feb 2003	Tour	IPCA	5	1	Two bean varieties selected
July 2003	Tour	ISP, San Pedro	35	6	Integral vision of the management of watersheds and production technologies
6 Jly 2003	Tour	UNAH	5	-	Interchange of experiences, elaboration of a joint proposal for the integrated management of watersheds
8 Jly 2003	Training	ISP-CIAL youths	18 students	3	Monitoring of water quality and basic knowledge on use and management of the water resource
22 Jly 2003	Tour	Vallecillo CIAL	16	2	Visit to the SOL and germplasm selection Engagement to diversify crops
24 Jly 2003	Tour	ISP	20	15	Identification and prioritization of local indicators of water quality
28 Jly 2003	Tour	PDA	23	2	Selection of IRAT 90
14 Aug 2003	Training	ISP, IPCA, COHDEFOR	20	10	Integrated management of watersheds and CIAT activities in the region
19 Aug 2003	Training	CIAL youths	85 students	8	Basic forestry concepts Basic concepts on installation and management of nurseries and reforestation Nurseries/ reforestation follow up
27 Aug 2003	Tour	SERTEDESO	25	4	Germplasm selection for crop diversification

a. For acronyms used, see page 64.

2.4. Cálico Watershed, Nicaragua

2.4.1. Baseline

The Cálico River watershed forms part of the Grande River watershed of Matagalpa, one of the main watersheds of the country, which drains into the Caribbean Sea. The watershed has a total area of 170 km^2, and is situated between latitude 12° 45' N and longitude 85° 51' W. Altitude varies between 400 and 1200 m, a factor that strongly affects temperature and rainfall and thus the distribution of crops. Annual average rainfall over the last 13 years was 1547 mm, and varied between 1000 and 2050 mm. Rainfall distribution is unimodal, with more rain in the months of September, and less in March. The soil types that predominate in the watershed are Entisols (86%), Inceptisols (5%), Alfisols (4%), and Vertisols (4%). Most of the soils have little depth, from 2-5 inches. According to producers, the soil does not yield well without fertilizers, and weeds are a problem.

This watershed is characterized by a strong smallholding sector, which coexists with a sector of medium and large farm exploitations. From 60% to 65% of the rural families do not own land (they rent). They produce basic grains, use few inputs, and occupy less than 6% of the total land. About 10% of producers have from 9 to 70 ha of land; they produce basic gains for consumption and coffee commercially. The main use of the land is natural or cultivated pasture. The same diagnostic indicates that the production systems are stratified according to altitude. Coffee is found mainly in the higher areas (700-800 m), and basic grains from 500-800 m. Average crop production is low: maize 1.8 t ha^{-1}, bean 0.8 t ha^{-1}, sorghum (*Sorghum bicolor* [L.] Moench) 2.4 t ha^{-1}, and coffee 0.27 t ha^{-1}. The diagnostic shows an increase in the costs of production, and a decrease in the prices of sale of basic grain. There is evidence of using trees for the production of firewood, fence posts and live barriers, and of home gardens.

Sources of information indicate that from 1995 to 1998 the population grew by more than 2000 inhabitants per year, which suggests high growth, and a density of 140 inhabitants per km^2. The average number of persons per dwelling is almost 6.5, which is slightly over the 6.4 in the population overall. Education levels are very low; the most educated person has an average of about 4 years of study. The index of illiteracy is 60%, and is similar to the national level. Health and birth problems are high. The diagnostic carried out by the Mayor's Office classified 15 communities and the urban area of San Dionisio within the strata of extreme, high, average, and low poverty.

The vegetation of the area is strongly intervened. About 80% of the land is put to pasture and agricultural crops; the remainder is covered by varied woody vegetation.

Water is scarce in the region and is a main limitation to development. Rainfall feeds subterranean and surface bodies of water. Most of the water for different uses comes from surface streams, which in recent years have decreased in volume because of generalized deforestation, compaction of soils, and strong droughts. Most of the urban and rural population is supplied from small rivers and springs. The volume of the main rivers diminishes progressively, and in April to May almost dry out. Their tributaries mostly dry up completely in the summer. Another critical problem is the water contamination. High sedimentation, sewage, human and domestic animal sediments, water residues from coffee production, and mining residues, among others,

contaminate most rivers. Run off is the most important source of water; it drains in great quantities during the rainy season, and is not utilized because of lack of infrastructure for its storage. Run off waters are a key element in the promotion of social and economic development.

This region has the highest social poverty of the country following the Atlantic Region, almost 85%, poverty that is concentrated in rural areas. The population suffers a permanent food crisis; consumption of maize and beans is basic. Milk, meat, eggs, and fruit are generally not consumed. Because of this food deficiency, levels of malnutrition, particularly in childhood, are very high, to which is added the high incidence of illnesses.

Table 6 gives a condensed version of the available quantitative data that are needed in biophysical, socioeconomic, and natural resource (water, soil, biodiversity) aspects at different scales (farm, community, watershed). Biophysical and socioeconomic data integration are related to minimum set indicators, that allow integration and the generation of scientific results representing solutions to problems, or research questions that can be replicated and used for comparative watershed studies.

Table 6. Type of available information and gaps identified in the elaboration of a baseline with focus on the integrated management of watersheds at different scales, Cálico River subwatershed, Matagalpa, Nicaragua.

Scale	Data available[a]		
	Biophysical	Natural resources/ production systems	Socioeconomic
Farm		- Soil fertility (N, P, K, Ph, %C) - Soil physical characteristics - Balance of nutrients on coffee farms with high and low use of inputs, 2001 - Analysis on nutrient flow, 2002 - Participative diagnostic of the state of natural resources in six microwatersheds, 1998, 1999 - Use of the woodland for one microwatershed - Production costs - Sowing practices - Composition of the production systems of 100 farms - Cattle farming - Practices with organic agriculture - *Use of water for irrigation, domestic use, and cattle* - *Quantity and quality of water* - *Behavior of systems and relation with management of natural resources* - *Levels and effect of erosion by land use type*	- Economic indicators, family income - Main problems - Economic analysis of soil conservation - Labor responsibility by type - Income from sales of agricultural products - *Analysis of farmer's economic system, patterns of decision taking* - *Records of food produced on farms* - *Records of migration (members of family living in urban centers, seasonal work, and income from family remittances)* - Records on the study of market options for products of the region

Continued.

Table 6. (Continued).

Scale	Data available[a]		
	Biophysical	Natural resources/ production systems	Socioeconomic
Community	- Participative maps of geographic location and state of natural resources	- Specific data on six communities of the subwatershed, 1999 - Forest species - Network of water distribution - Impact of different agricultural systems on natural resources in the community of Susuli, specifically soils and food security	- Community organizations - Identification of local deciders in landscape management in two communities, 1999 - Services: health, education, water, electricity (Mayor's Office census, 1998)
Subwatershed	- Orthophotos (1996) - Orthomosaic (1:40,000) 1996 - Digital elevation model (1998) - Watershed and microwatershed limits - Hydrographic network (1:50,000) - Rainfall, last 13 years - Monthly temperatures - Maps of soils, roads, humidity index, slopes, heights (1:5000), 1987 - Land use map (1:50,000), 1999 - Soil use for seven microwatersheds (1:15,000), 2002 - Agro-ecological zonification, 1992 - Digital atlas of Matagalpa (MAGFOR-CIAT) - Updated land use, 2000 - Effects of changes in land use in hydric conditions of San Dionisio (Masters Thesis, ETHZ) - Changes in agrarian structure in Nicaragua, case study: San Dionisio - Aerial photos at a scale of 1:25,000	- Main sections and analysis of options of diversification (1992) - Land use - Water source types - Native and introduced forest species - Typology of producers - Ethnobotanic study of forest species - *Water biodiversity* - *Changes in land use*	- Information on services: health, education, water, electricity (Mayor's Office, 1998) - Road infrastructure (1:50,000), 1987 - Presence of local groups (cooperatives, NGOs, groups *of interest*) and institutions - Analysis of goods, 1997 - Population and population density - Land ownership - Market options studies - Presence of organizations related to natural resource management - *Ethnic population* - *Migration*

a. Use of italics indicates a gap in information because of non existence of data. For acronyms used, see page 64.

2.4.2. Analysis of environmentally and socially sensitive area (ESSA) and use of GIS

The subwatershed has available maps at 1:50,000 scale, too large a scale to allow precise and efficient identification of ESSA. Maps of smaller scale are needed that allow, with the use of GIS, the delineation of hotspots by combining and ranking environmental and socioeconomic data. Activities of analysis and map interpretation at scales less than 1:5000 (GIS), and the identification of ESSA, will be done during 2004, with the project of strategic alliance between INTA, Universidad Nacional Agraria (UNA), and CARE-International, financed by the Foundation for Technological Development in Agriculture and Forestry (FUNICA, the Spanish acronym).

2.4.3. Options and actions

Improving water quality with the use of cover legumes. The C&W, Forages, and Soils projects have worked on various research themes in the Supermarket of Technology Options for Hillsides (SOL, the Spanish acronym), such as: (a) determination of nutrients, (b) nutrient flows and use of organic material, and (c) development of crop systems with the use of cover legumes and green manure. This research has provided valuable information that has allowed careful consideration with an interest group on soil management.

As a result, two local organizations (Cooperativa Sueños Realizados, and Campos Verdes) have associated with CIAT, obtaining financing from FUNICA to validate different options of traditional crop systems management with the insertion of cover legumes and green manure. This work is being done in Wibuse microwatershed, with 31 farmers of the 150 there. Four different systems of alternative management have been established, and a system of capturing sediment to determine the efficiency of each system in improving soil fertility, reducing erosion, and improving water quality.

2.4.4. Scaling out technologies selected by local organizations

In the Cálico River watershed, San Dionisio, Nicaragua, various local organizations, such as Campos Verdes, CIALs, Unión de Campesinos Organizados de San Dionisio (UCOSD), and the soil fertility interest group have begun to grow in scale (from plot to landscape), and are testing technologies in germplasm (beans, maize, rice, soya – Glycine max [L.] Merr, sweet potato – *Ipomoea batatas* [L.] Lam., and sorghum), green manures, soil fertility improvement, and conservation of water sources (Figure 8).

From these experiences, we can observe how the initial approach of the SOL, seeking to incorporate only demand-driven research activities, has resulted in answers to the real needs of rural communities. Additionally, support to local organizations focused on very specific issues, has facilitated the evaluation of concrete techniques developed in SOL sites, and their expansion to farmers' plots and farms within the same watershed.

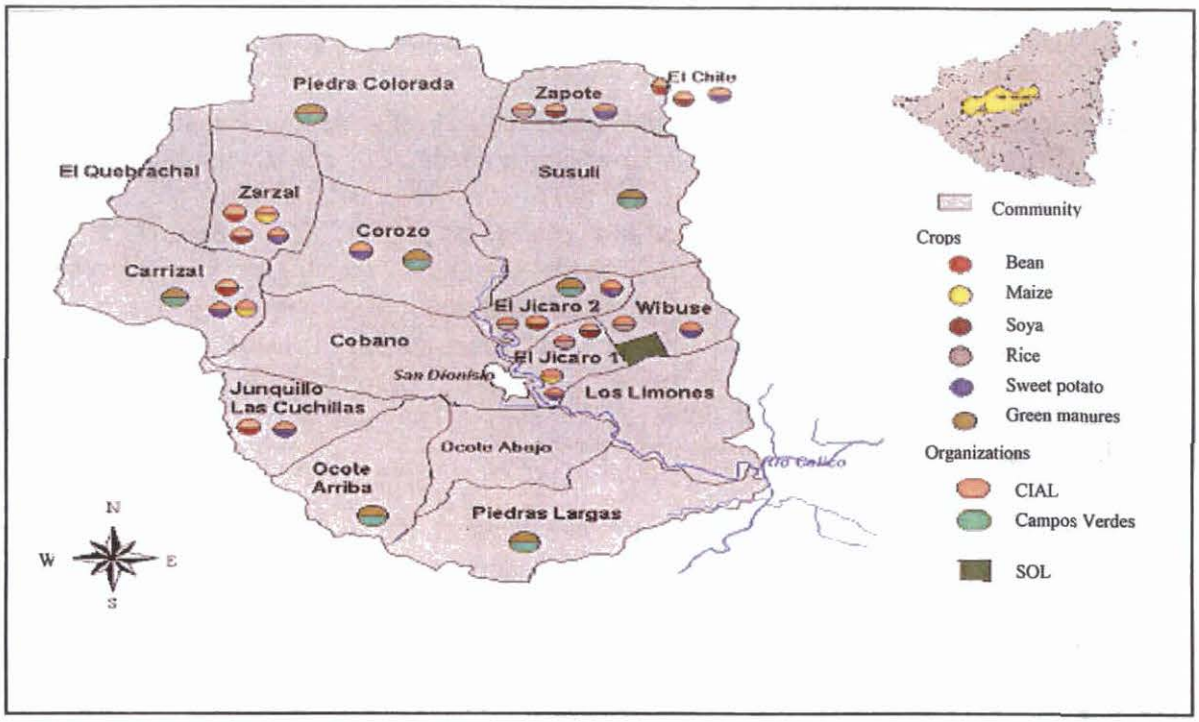

Figure 8. Technologies selected by local organizations from the Supermercado de Opciones para Ladera (SOL) site for evaluation in other microwatersheds of the Cálico River subwatershed, San Dionisio, Nicaragua. (CIAL = Comité de Investigación Agrícola Local).

2.4.5. Visit of partners to different activities in the Cálico watershed, 2003

In the Cálico watershed, 168 technicians and 176 producers were served, belonging to international and national institutions, NGOs, and local organizations. These visits correspond to field tours, participative evaluations of the evaluated technologies.

3. Other Projects / Collaborators

3.1. Haiti

C&W's contributions to the work in Haiti covered the areas of baseline preparation, production system management, and seed system development. In these areas, C&W deployed staff from Central America to provide support and training to the Haitian team. Experiences from Honduras and Nicaragua were adapted to fit the needs of Haitian rural communities. Activities included those outlined below.

3.1.1. PES (Small Seed Production Agro-enterprises)

In June 2002, during the first visit to Haiti and after visiting 14 community-based organizations (CBOs), eight in the north and six in the south, it was decided to concentrate on only seven of them:

- North: Koperativ Kapwan Lamo Dondon (KKKLD) in Gran Rivier, Cooperative Agricole Cafetière Gabard le Vaillant (CACGAVA) in DonDon, Ma Beauté, Abey, and Cooperative Petits Planteurs Haut Martineau (CPPHM) in Plaisence.
- Southeast: Asosyasyon Plante Kafechene (APK) in Jacmel, and Komite Presten Bonaksyon (KAPAB) in Marigot.

The reason for this was based on the quantity of Tío Canela bean seed available. Although 700 kg had been produced and were stored in the cold room of the Double Harvest Agency, only about 500 kg were considered usable as seed. The remainder would serve as grain because it did not have the necessary physical and physiological purity for use as seed. The CBOs, APK and KAPAB, as well as Tío Canela sowed Bruna bean seed, which has yielded better in the south; 120 kg of Bruna seed will be obtained.

Another important aspect was the establishment of stronger relations between the technicians of the CIAT- Haiti Agricultural Project (HAP) and the PanAmerican Development Foundation (PADF) directors and technicians, both in the north and south, who showed interest in the development of the project and the benefits farmers would accrue from it. For this reason, the directors undertook to give their technicians' operative support to the CIAT technicians, subject to the joint elaboration of a monthly chronogram of visits.

Another commitment was the course in Seed Technologies, in which not only farmers, extension workers, and CBO coordinators participate, but also PADF technicians who will support the project, as well as technicians of agencies collaborating in increasing the basic CIAT seed—Operation Double Harvest (ODH) in the north, and Vincent Foundation in the south. This course was programmed for the 13-26 October 2003. It was expected to strengthen inter-institutional relations.

In October 2002, CIAT-HAP initiated production of artisanal seed and its commercialization through the CBOs of the southeast and north of Haiti in response to the demand of a group of organizations and small-scale rural producers located in communities with high poverty index.

Table 7 shows a massive production scheme planned to be carried out during November-December 2003. Following this plan, PES could produce and distribute over 1.8 tons of seed by the end of May 2004. A similar situation is expected for other commodities, such as maize, forages, and cassava (*Manihot esculenta* Crantz).

The first maize and bean training course for technicians, extension workers, and farmers from NGOs and CBOs took place on the 14-25 October 2002. A course was given in the north of Cap-Haitien and another in the southeast, in Jacmel. Forty-six participants attended from 13 CBOs and two NGOs (Table 8).

Table 7. Estimated production of bean seed for 2002 to 2004 carried out by Small Seed Agro-enterprises.

Variety	Zone	Planting		Harvesting	
		Date	ha	Date	kg
Tío Canela	North and Southeast	Nov-Dec 2002		Feb 2003	6.4
		Mar-Aug 2003		May-Dec 2003	85.0
		Dec.03-Mar 2004	8.0	Feb-May 2004	1120.0
Brunca	South	Feb-Mar 2003		May-June 2003	3.2
		August 2003		Nov-Dec 2003	42.4
		Feb-Mar 2004	4.0	May-June 2004	565.0
Total				1822	

Table 8. Attendance at the first maize and bean training course, Haiti, October 2002.

Department	CBO/NGO[a]	Community	Participants (no.)
North – Cap Haitien	MABUTE, Uplacha, CPPHM, Abey, Ven San Oye, Kakgava, KKKLD, KADG, CJBC, San Vincent	Plaisance, Dondon, Grand Rivier, Port-au-Prince	21
Southeast – Jacmel	APK, KAPAB, OREL, APLAKAB, ODH	Cap-Rouge, Macary, Roche-Blanche, Larevoir	25
Total	15	8	46

a. For acronyms and abbreviations used, see page 64.

In a previous visit made on 29th of June, together with the CIAT-HAP technicians, a plan was elaborated of the course's instructional objectives and the main themes to be expounded. These were agricultural management and improved varieties of beans and maize, and postharvest management of beans and maize. Field tours were also programmed to plots of bean and maize production in farmers' lots.

Talks on improved varieties and agricultural management were given by the field technicians of CIAT-HAP and the Haitian lecturers expert on these themes. During this training, CIAT both facilitated and moderated the event. On the Thursday afternoon and Friday morning, in both localities, the knowledge imparted was complemented by a field tour to the seed production lots.

In the area of seed technologies, at the start of the day a group "dynamics" took place that allowed farmers to carry out a practical exercise to reinforce the theoretical knowledge. This allowed more participation by producers and motivated them to interchange experiences.

In the southeast region of Jacmel, the Regional Coordinator of PADF, Ingeniero Rico Nicolás, accompanied us both in talks and in the field tour, as well as offering logistical support to the course.

Of the participants, 62% qualified the overall course performance as very good. The sections most appreciated were: course content, support material used, instructor-participant relations, and the quality of the training center. Those with lower scores were quality of lodgings, and quality of meals and snacks. The contribution of producers' experiences during the course was excellent, although less so by Jacmel than by Cap Haitien participants. In the evaluation of technical content of the course, expositors were scored highly.

In the area related to visits to production plots of bean seed, in the north (Cap Haitien), plots of Tío Canela are well developed and healthy; rain has been plentiful, contrasting with the strong droughts in the southeast (Jacmel) that are affecting plots sown to BAT 304.

To date, the selection of areas for establishing seed production plots have been made based on primary information, but this is causing some problem because farmers, in their eagerness to participate in the project, give incorrect information. To assure a better selection of seed production zones it is highly important that CIAT-Headquarters supports the GIS elaboration of georeferenced maps that identify zones and seasons with best rainfall distribution and best agroclimatic conditions to establish plots. These maps should be elaborated as soon as possible so that technicians and farmers can validate them for the Dec-Jan/Feb sowing.

To conserve seed quality until sowing times, the CBOs must have metallic silos for storage of seed produced by farmers.

On the administrative side, management of a reasonable amount of funding in hand is very necessary because administrative transactions are slow, and when inputs can be obtained, the payment arrives too late or the time for using them has passed.

In March 2003, after visiting some CBOs and analyzing problems that have limited seed production, strong climatic and pathogenic elements were found to exercise pressure on the plots, which has caused a loss of 3.2 ha at one station. To find a solution to this problem, a meeting was held with the Regional Director of PADF in the southeast and it was found that of the 14 CBOs with which the PES began, only five can progress, having the best agroclimatic conditions without requiring irrigation, which is the ideal situation for seed production. The Director showed interest in collaborating with his technicians on this point, and in the massive distribution of seed to the CBOs they attend.

Including new improved germplasm within the production systems of farmers is something they are pleased to see, because they assume that improved varieties of beans, maize, cassava, and legume forages will offer them better results in terms of production and productivity.

However, the color of the seed/grain worries them a little, because although, from the point of view of food security, they can eat any type of bean, in market terms (i.e., selling the surplus) they say that the Brunca bean has a securer market than has Tío Canela, because the latter is a

new bean, small and red in color, and it will take some time to establish its market. This orients us towards the type of improved bean to produce.
It is important to state that these highly productive activities were suspended because of the abrupt cancellation of CIAT's contract with Development Alternative Inc. (DAI). Damage caused does not only refer to losses in the fields, in an environment particularly rich in production constraints, but also in the expectations of local technical personnel and CBOs.

3.1.2. Project development support

Continuous support was also provided to CIAT's researchers and Haitian field staff through planning and review meetings, progress report writing, and proposal preparation. This year the following activities were accomplished in support to the Haiti Project:

- Joint preparation of the "Progress Report and Working Plan for 2003" in collaboration with Guillermo Galvez, Haiti Project Coordinator, and Jean Osmy Chery and Garline Amboise, project agronomists (2003). This report shows the activities developed and planned by the CIAT-Headquarters team in the areas of (a) seed production and small seed enterprise development, (b) cassava, bean, forages, and maize (the latter, with the collaboration of the Centro Internacional de Mejoramiento de Maíz y Trigo [CIMMYT]), (c) production systems, and (d) a capacity development strategy for training local organizations and institutions in participatory research approaches. C&W support included the merging of individual work plans into an "integrated plan" that could provide coherence to the various specific activities carried out by different commodities.

- The Haiti Project, carried out under a contract with a private development firm (DAI) was halted as of May 30th, because of financial cuts made by USAID to our contractor. Soon after, intensive collaboration with Haiti's Project Coordinator and CIAT's commodity staff led to preparing alternative project options for (a) bridging ongoing activities while fresh funds were sought, (b) adapting the planned research and development activities to the new reality, (c) consulting with World Vision (WV) partners about opportunities to engage in a joint venture, and (d) preparing a new project that could draw WV funds provided by USAID through the Food Security and Humanitarian Assistance (FSHA) window.

Two projects were prepared after the contributions made by bean, forage, maize, cassava, C&W, and seed systems staff, as well as after the very proactive engagement of Levael Eugene, current Haiti project coordinator:

(1) "Enhancing food security and nutrition in Haiti: Improved germplasm development, community-based production systems, local seed-systems' development, and institutional building" (June 2003), for US$800,000.

(2) "Enhancing food security in Haiti: Grains and roots for better nutrition" (August 2003), for US$245,000.

After several contributions and budget cuts from WV staff, a merger of the two previous projects has been prepared and presented to WV for approval:

- "A new commitment to food security in Haiti: Grains and roots for better nutrition" (September 2003), for $US500,000

To sum up, these projects pursue the evaluation and selection of varieties adapted to Haitian conditions, providing Haitian communities with improved genetic materials along with scientific methodologies and rural development methods, such as local seed systems, that ensure the incorporation of innovations into the rural, agricultural bloodstream.

As a result of this resource mobilization campaign, the Economic Development Growth Office - Agency for International Development (AID) assigned one million gourdes (US$1 = 43 Haitian gourdes) to our project as bridging funds while agreements with WV are reached.

3.2. Water and Food Challenge Program

C&W, under the lead of JI Sanz and S Brown, submitted a concept note and subsequently full proposal to the CGIAR WFCP entitled "Scaling water use, quality and equitable water distribution issues in the Andes and Himalayas". Our concept note was highly ranked by the independent review panel, and our full proposal was submitted for funding totaling US$850,000 to start in January 2004 until December 2006.

The basic premises behind the project are:

(1) How can we develop watershed- or basin-level policies, programs, and projects to improve water use, quality, and equity in water distribution that are effective at the local level?
(2) Can we implement farm- or community-level projects that have an impact at the watershed scale?

This research builds on existing case study watershed projects across the Andes and Himalayas to evaluate successful approaches / methods to scale water use, quality, and water distribution issues from farm to community to watershed, and finally between watersheds.

3.2.1. Goal and objectives

The goal of this project is the improved capacity for the management of water at multiple scales. This requires efficient water use, conservation, reuse, quality, and equitable distribution for both food production and environmental services. The project will develop methods and concrete examples illustrating how water use, quality, and distribution operates and can be tackled at multiple scales within the context of integrated watershed management.

Specific objectives are to:

- Identify comparable indicators at different scales;
- Document methods, tools, applications, and success stories / best management practices in resolving issues;
- Contrast trade-offs between water use and environmental services; and
- Create capacity for local partners to network and share knowledge.

3.2.2. Partner organizations

The project will be implemented in eight watersheds, four in each mountain region (Andes / Himalaya) (Table 9). A National Agricultural Research and Extension System (NARES), NGO, or international project will lead the local level research activities in each watershed. CIAT will coordinate comparisons between watersheds, and the UBC will provide academic / methodological support.

Table 9. Participating organizations in the Communities and Watersheds project for the Water and Food Challenge Program[a].

Area	Contact investigators	NARES/NGO	International project/s	Other local partners	Donor links
Andes:					
El Angel, Ecuador	Mauricio Proano/ Susan Poats	Grupo Randi Randi	Manrecur	CONDESAN	IDRC
El Dovio, Colombia	Zoraida Calle / Ma. Cecilia Roa	CIPAV	-	Municipality of El Dovio	Kellogg
Bolo, Colombia	Amalia Morales / Ma. Cecilia Roa	ASOBOLO	-	-	-
Tiquipaya, Bolivia	Oso Andino	CGIAB	-	CONDESAN CIDERBO	SDC IDRC
Himalayas:					
Nan-e, Upper Mekong, China	Xu Jianchu	CIBK	-	Kunming Institute of Botany, Chinese Academy of Science	Ford IDRC
Middle Mekong, Vietnam	-	-	-	-	-
Jhikhu Khola, Nepal	Bhuban Shrestha / Hans Schreier	n.a.	PARDYP	ICIMOD	IDRC SDC
Lingmutey Chu, Bhutan	Sangay Duba / Hans Schreier	Bajo – RNRRC	-	IRRI	IDRC SDC

a. For acronyms and abbreviations used, see page 64. Details for Vietnam and international projects not yet decided. For all areas, CIAT is the CG center and the University of British Colombia serves as the Agricultural Research Institute.

3.2.3. Outputs and activities

The analytical framework (Figure 9) includes the integration of biophysical and socioeconomic data. For each watershed, primary and secondary data will be compiled for comparative indicators of watershed management. Gender and indigenous and other marginalized groups will specifically be assessed in the case studies (e.g., Bolivian water rights and female out-migration in China). For data integration, compilation, and exchange, GIS will be used. From this common base, each watershed research team will focus on an approach to scaling specific issues. Trade-off analysis, multi-stakeholder processes, scenario modeling, and GIS will be used to evaluate water conflicts and strategies. Case studies will be developed at farm, community, and watershed scales. Water use efficiency, ecological restoration, water balance, water rights, and water user

groups / consortia are some of the core research themes under investigation by NARES / NGO teams.

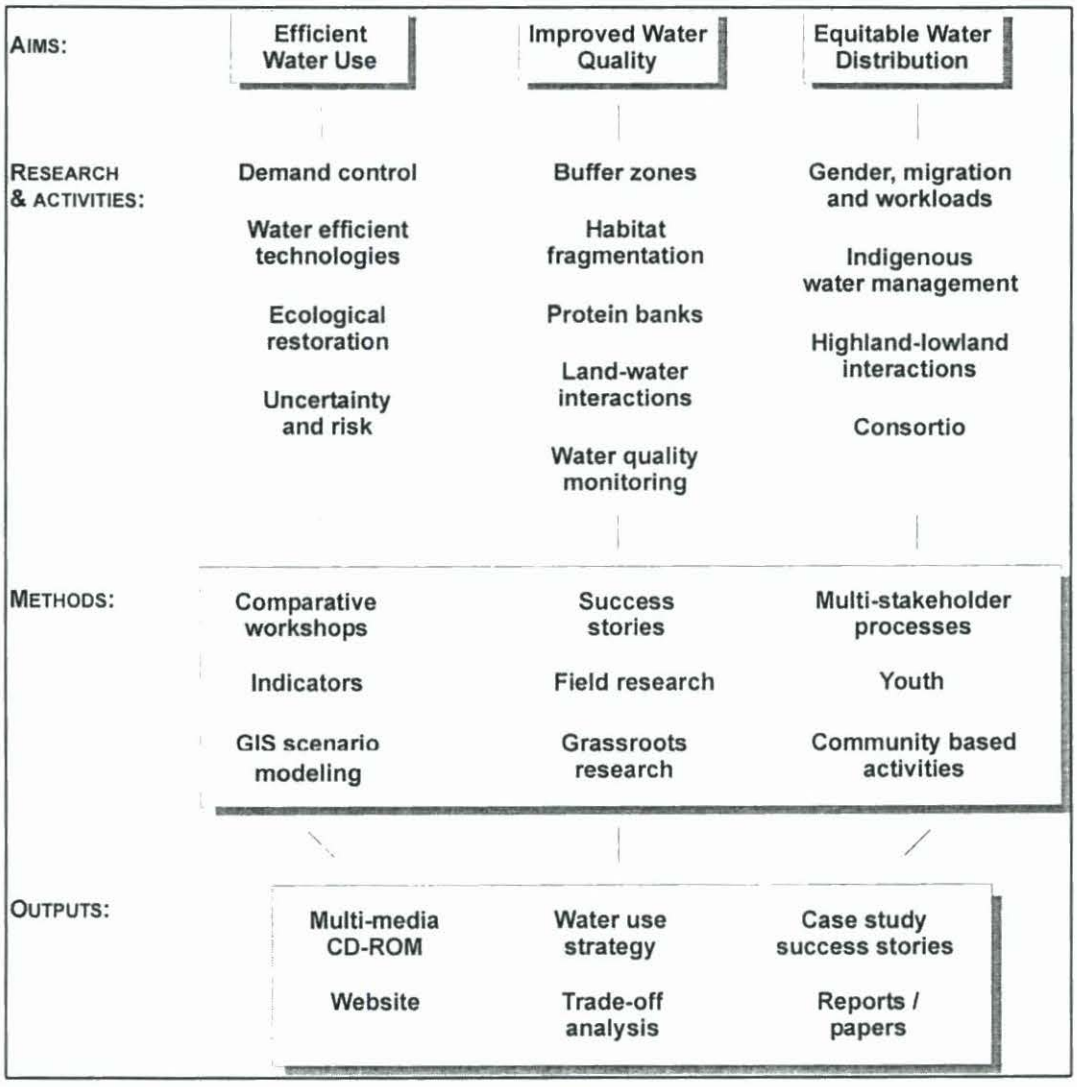

Figure 9. Analytical framework of project for Water and Food Challenge Program.

Annual workshops and inter-watershed exchanges will be used to coordinate activities, methods, analysis, and dissemination of results. Innovative information technologies, such as CD-ROM and linked Web-based databases, will be utilized for regional and cross-regional comparison. Local workshops, farmer-to-farmer exchange, and materials developed in local languages will be used to disseminate information within watersheds. Table 10 shows outputs and activities.

Table 10. Outputs and activities of the Communities and Watersheds project for the Water and Food Challenge Program.

Output		Activity[a]	
1	Capacity building / research and training	1.1	Community-based watershed research (NARES / NGO lead)
		1.2	Technical support training (led by UBC / CIAT)
		1.3	Student research
		1.4	Internal review
2	Indicators	2.1	Inception
		2.2	Selection of common indicators
		2.3	Compilation of essential baseline information in GIS
		2.4	Development of indicator databases for each watershed
3	Trade-off analysis	3.1	Regional workshop
		3.2	Evaluation between indicators at various scales
		3.3	Cause-effect relationships: land-water / highland-lowland interactions
		3.4	Scenario comparisons
4	Success stories	4.1	Wrap-up workshop
		4.2	Identification and documentation of best management practices by watershed teams
5	Water use strategy	5.1	Develop a water use and management strategy for each watershed with local stakeholders
6	Comparative Web sites and CD-ROM	6.1	Construct Web sites for each watershed
		6.2	CD-ROM
		6.3	Reports / papers
		6.4	Local workshops

a. For acronyms and abbreviations used, see page 64.

3.3. Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (CONDESAN)

Nacho Sanz continued to participate this year as a member of the Technical Committee of CONDESAN. This has meant continuous contact and exchange with the Board, Directors, and partners throughout the Andean region, and has provided a very useful space to position our C&W Project in the Andes.

This year, in mid June, Nacho was invited to Bolivia to participate as an observer in the 8th Meeting of the Governing Board of CONDESAN. During this meeting, Julio Berdegue was elected as President and Bernardo Rivera as Vice President of CONDESAN. Maximina Monasterio finished her period as Acting President. Hector Cisneros, Coordinator, and Elias Mujica, Vice Coordinator of CONDESAN, presented the Technical and Financial Reports for 2002. They presented an excellent and organized broad view of CONDESAN, particularly on what is being achieved and what is going to be achieved with the available resources.

Financially, the situation is very good for the next few years, and with high possibilities to improve even further. With the above situation, the Governing Board pointed out that there will be more visibility and closer observation from donors, and therefore there is the need to further emphasize CONDESAN's work on systematization of their experiences, integration of their thematic lines, transfer of results, and, in general, impact on livelihood improvements. It is a good historical moment for CONDESAN that makes it imperative to ally with them for work in the Andean region.

C&W has been working very closely with CONDESAN, particularly in relation to the Andes, as an associate site for the WFCP. The Project was involved heavily in the inclusion of the Andes and CONDESAN in the WFCP. A number of Andean watersheds were selected as pilot sites, C&W's watersheds amongst them, and were approved by the WFCP.

For information on the invited proposal from C&W to the WFCP, see section 3.2, above. A relevant example to illustrate C&W's collaboration with CONDESAN and partners could be the case of the selection of the pilot watershed in the Bolivian Andes. Initially, the Colomi watershed had been recommended as the Bolivian pilot site for the WFCP. Although the Ministry of Sustainable Development has declared the municipality of Colomi as "biodiverse", the CONDESAN group (including C&W and partners) visited and studied Colomi, and exchanged views to conclude that too many projects are present in the area, with very little apparent integration among them. Rainfall and soil conditions are also above average in terms of quality for the Bolivian Andes. C&W, CONDESAN, and partners agreed to change the site proposed for the Cochabamba watersheds of Taquina and/or Tiquipaya as reasonable and representative alternatives of the Bolivian Andes.

Ruben Dario Estrada continues as a shared CONDESAN-CIAT scientist, and his office and that of his support staff are based in C&W's offices, and are closely working together in aspects such as baselines for the Andean watersheds, and exchange of existing information for common watersheds.

Through this relationship with CONDESAN, contacts with donors also have been advanced:

- A preliminary Concept Note on "Options and actions for water and land quality, Quebrada Grande watershed, Colombia"was submitted to IDRC. We are in communication with IDRC about improvements to the Concept Note before moving onto a formal proposal.
- Alonso Moreno, Principal Advisor of German Technical Cooperation (GTZ), knowing of our Canadian International Development Agency (CIDA) and Rockefeller Foundation-funded youth projects, invited us to develop together an Andean Youth project on integrated watershed management for the pilot sites of CONDESAN. C&W provided existing information from our ongoing youth projects (one in a CONDESAN pilot site for the WFCP), and Alonso is drafting a preliminary proposal to agree upon with our C&W team, including Ruben Dario Estrada. Once agreed, Alonso will do the lobbying with GTZ in Germany.

C&W and CONDESAN conceptually share the approach of integrated watershed management. Specifically, the work carried out by Ruben D. Estrada fits thoroughly within Output 3 of the

Project's Logframe (environmental services). Equally, our work on this output fits within CONDESAN's thematic lines. Aware of this mutual fit, both CONDESAN and C&W share resources, exchange information, and work together within an efficient division of labor (e.g., baseline work, GIS), particularly where our pilot watersheds coincide.

3.4. Production and Commercialization of Improved and Diversified Artisanal Seed: New Developments after Seeds of Hope, Central America

3.4.1. Preservation of local varieties

Local varieties of basic grains, such as maize, beans, rice, and sorghum, are disappearing. They are important to the diet of hillside farmers and are characteristic of fragile ecosystems because they have a short vegetative cycle, need few inputs, and smallholders can use them for several generations. Seed is scarcer every day, and has been suffering a process of genetic degradation through crossing with hybrid seed from the private market without any control.

Also, in crops with vegetative material, such as cassava, sweet potato, chayote (cider potato, *Sechium edule* [Jacq.] Sw.), taro (*Colocasia esculenta*), and other species, the scarcity of propagators has led to home gardens, managed by the women, becoming more vulnerable and less productive each day. Consequently, family diet is gradually becoming poorer and unbalanced, and health more precarious.

To respond to these problems, the first trials in artisanal production of improved seed was begun in the south of Lempira, with the collaboration of the Food and Agriculture Organisation (FAO)-Proyecto Lempira Sur (PROLESUR) and the Seeds of Hope project, which CIAT carried out in Honduras after Hurricane Mitch.

From the FAO and CIAT experience was born what today is known as the "Project of production and commercialization of improved artisanal seed and diversified vegetative material", which has been financed by the European Commission – Office of Food Security of the European Union. Eight NGOs carried out the project in different regions of the country and the consortium FAO-CIAT-MOVIMONDO acted as consultants. FAO and CIAT gave training and assistance to the NGOs involved in the project development, and the NGO MOVIMONDO administered funds.

3.4.2. Beneficiaries

The beneficiaries of this project are small rural producers, either independent or organized in community groups, cooperatives, or associations. They have in common their level of poverty, and their location in ecologically and socially vulnerable areas. Another common aspect among them is their experience in the production of basic grains, their seriousness, commitment, land ownership, permanence in the region, and capacity to carry out activities in a collaborative manner with other farmers.

Five departments, 27 municipalities, 85 communities, and 409 farmers of basic grains and vegetative material took part in this project.

From the effort of 322 farmers, with the support of technicians, about 187 t of basic grains (bean, maize, rice, soya, sorghum, wheat [*Triticum sativum* Lam.], and barley [*Hordeum vulgare* L.]) were produced on 171 ha, of which 129 t was grain and 58 t was kept for seed. With the sale of these products, the farmers received about 555,506 Lempiras (14.41 L = US$1). This seed reached 818 farmers, through direct sale in the communities (368 farmers / 47 t), or through sale to institutions, such as the Red Cross and Euronaid (450 farmers / 11 t), that distributed it in 17 municipalities and 21 communities.

About 35 ha were sown to vegetative materials—cassava, plantain (*Musa paradisiacal* L.), taro, chayote, pineapple (*Ananas comosus* [L.] Merr.), pumpkin (*Cucúrbita máxima*), and sweet potato in 14 municipalities and 36 communities. Forty-one communities and 116 farmers benefited with the produce of this effort. Farmers received 23,165 Lempiras for the sale of this seed.

This result is due partly to the training given to technicians and farmers, partly to the introduction of improved germplasm, new agronomic management practices, irrigation, and fertilizers, but above all, to the enthusiasm and commitment of the technicians and farmers.

Parallel to these activities, and without being considered within the project framework, validation was made of new improved germplasm such as Amadeus and Carrizalito bean, from Zamorano, and four sweet potato cultivars from SOL research sites.

Also, and outside the project framework, at farmer and technician request, five recuperation processes of local or native varieties were begun, four of maize (Blanco de altura, Intibucano, Santa Marta, and Olote Rosado), and one of bean (Vaina Blanca). Monitoring and evaluation of plots was done in 12 tours with the purpose of giving support to technicians and farmers in aspects of agronomic and postharvest management, and of identifying and trying to solve administrative problems.

The main problem that put the project at risk was the management of funds by the European Economic Community; first funding arrived months late and second funding arrived 3 months after the end of the project. This difficulty was overcome thanks to the support given by MOVIMONDO, FAO, CIAT, and the NGOs, who resorted to their own resources to carry out operations. Another negative aspect was that the NGOs were not given appropriate participation in the elaboration of proposal goals, since there was no joint meeting where NGO directors could meet up with technicians and administrators. This meant that the project goals had to be re-planned because some NGOs did not have the capacity to fulfill them.

3.5. Sustainable Agriculture and Natural Resource Management (SANREM) – Andes

The C&W has pre-existing US university linkage fund money to work with Robert Rhoades, Ecological Anthropology, University of Georgia, on the SANREM – Andes project in Cotacachi, Ecuador. The C&W's involvement in SANREM is centered around supporting SANREM in data integration, using a modified version of our research framework, in the use of multi-media technology to present this integrated approach in an interactive and user-friendly manner, and in developing GIS-based land use change scenarios based on historic land use patterns.

SANREM – Andes involves work with four US research teams in three major universities (Table 11), and a series of Ecuadorian institutions /groups is involved. The main research themes led by US universities have been run parallel in the past with limited integration and little action-based outcomes. Robert Rhoades found the C&W research framework a useful tool for integrating the various SANREM – Andes components, and we have been working together to develop a modified framework specific to the SANREM project.

Table 11. Principal Sustainable Agriculture and Natural Resource Management (SANREM) project participants.

Theme	University / Center[a]	Contact(s)
US institutions:		
Community-based water quality monitoring	Uni. Auburn	Bryan Duncan, Sergio Ruiz
Soil fertility/erosion	Uni. Georgia	Bill Miller, Franz Zehetner
Ecological anthropology	Uni. Georgia	Robert Rhoades, Shiloh Moates
Social and institutional systems	Iowa State	Jan and Cornelia Flora
Ecuadorian institutions:		
Gender, institutions	Heifer	
Land use planning	Canton Cotacachi	
Indigenous community	UNORCAC	
Geographic information systems (GIS) mapping	Uni. Catolica, Quito	
Land use mapping	MAG, Quito	

a. UNORCAC = Unión de Organizaciones Campesinas Indígenas de Cotacachi; MAG = Ministerio de Agricultura y Ganadería.

In addition to the integrated framework, C&W has provided training to the SANREM team in both Ecuador and the United States on the use of Toolbook© multi-media authoring software. This software package will be used to develop a CD-ROM highlighting the project's activities, and integrating the project components using the research framework. Toolbook© is advantageous in that it is relatively easy to learn, and freely distributable to users without the need for software licensing. The final CD-ROM product will be user friendly and interactive, utilizing a navigation system for English and Spanish versions developed jointly between C&W and UBC.

3.6. Contributions to the Rural Innovation Institute (RII)

The C&W Project has deployed Vicente Zapata, to serve in his educational capacity, to new activities that are being carried out by IPRA in Bolivia. This contribution links with prior and current efforts to strengthen CIAT's presence in Bolivia (i.e., Interinstitutional Consortium and WFCP). An agreement has been reached with the RII with the understanding that this

contribution will help open new roads to CIAT's collaboration in Bolivia. V Zapata is also contributing to developing the first steps towards the establishment of an e-learning shop at CIAT in collaboration with the Library.

The following are activities in progress and products to be generated under this collaboration:

3.6.1. "Fomentando Cambios" (FoCam): A participatory monitoring and evaluation project

With the support of the Department for International Development (DFID), IPRA initiated activities in Bolivia in January 2003. The essence of this initiative is to contribute to the National Agricultural Technology System (SIBTA, the Spanish acronym) to establish PM&E systems within the current Agricultural Innovation Projects (PITAs, the Spanish acronym) and Strategic Innovation Projects (PIENs, the Spanish acronym), which are key mechanisms for agricultural development in this country.

Project induction. During the months of January and February, a series of activities were conducted in Santa Cruz, Cochabamba, and La Paz, to present FoCam to partners (government authorities, Agricultural Technology Development Foundations (FDTAs, the Spanish acronym), donors, universities, and sister projects such as "Innova" and "Ampliación" (DFID projects). A series of visits to key officers, and presentations made by partners and CIAT staff were the core of this induction activity.

Design of a capacity-development strategy. In order to establish PM&E systems within SIBTA, a capacity development strategy needs to be developed that not only dedicates efforts to training, but also takes a key role in process facilitation, accompaniment, external support, motivation, and self-assessment. The strategy, prepared by Zapata and Quirós, was shared and adjusted with the Bolivian team members, and is currently being applied and adjusted, as the project evolves.

PM&E training module. Based on previous CIAT and partners' experiences, a PM&E training module is being developed to train a national team of facilitators in the use of participatory methodologies (i.e., CIALs, Farmer Field Schools, and PM&E). This module—to be completed by the end of 2003—emerges from research experiences in Colombia, Honduras, and Nicaragua.

Training of facilitators. During the month of May, a first training course for facilitators was carried out at the Fundación para la Investigación y Promoción de Productos Andinos (PROINPA) headquarters. Thirty-one participants from 21 institutions and programs attended. The participants proposed a series of action plans to apply participatory methodologies.
By November 2003, a second training course on participatory methods will be carried out for research and extension service providers who are involved in PITAs or PIENS. This will be a second step in linking project development with community-based PM&E.

Participatory methodologies Diploma. Following an initiative from the FoCam team, an initial agreement has been reach between CIAT, PROINPA, and the Universidad Mayor de San

Simón, to conduct a joint Diploma Program for professionals who want to become specialists in participatory methods. The curriculum for Diploma candidates includes course attendance, action plan design, participation in training workshops, and writing a case study on the application of participatory methods.

Ex-ante analysis of action plans. In October this year, a visit to action plan sites will be conducted to analyze progress, and to provide additional support to incipient plans. A methodology to carry out action-plan monitoring visits will be evaluated and adjusted with the Bolivian team. In the future, team members will be in charge of monitoring and evaluation activities. Guidelines for reporting "case studies" for action plans will also be shared and adjusted with the Bolivian team to enable partners to report progress in the application of participatory methodologies.

Workshop on priority setting methodologies. One of FoCam's commitments is to carry out three workshops on methodologies for identifying and prioritizing demands, within the SIBTA framework. One of the processes that SIBTA needs to sharpen and disseminate is the mechanism through which demands are identified and prioritized by local groups (municipalities, organized farmer groups, etc.), and proposals made by research and extension services providers link to demands. This year, a workshop has been planned to provide a scenario for Bolivian partners and members of CIAT staff to share their views on priority setting experiences, methods, and problems.

The workshop will count on the participation of major CIAT partners, such as Agua y Tierra Campesina (ATICA), PROINPA, the Technical Development Division (DDT, the Spanish acronym) of the Ministry of Agriculture, as well as other stakeholders, such as the International Service for National Agricultural Research (ISNAR), the SIBTA PM&E Team (SIPSE, the Spanish acronym), and seven CIAT staff members. Participation is expected from the four Foundations, representatives of the demand sector, such as municipalities, technical assistance providers, and from universities and government officers involved in SIBTA.

3.6.2. Support to the e-learning initiative

Among the contributions made by C&W to other areas of CIAT, support to the e-learning initiative was provided. Three documents were prepared and shared with interested parties at CIAT, the Colombian National University in Palmira, and the Red de Instituciones Vinculadas a la Capacitación en Economía y Políticas Agrícolas en América Latina y el Caribe (REDCAPA):

- CIAT's e-learning standards: A proposal on design factors (V Zapata, 2003);
- Getting ready for distance education (V Zapata, 2003); and
- An estimate of human and financial resources to establish a distance education shop (V Zapata, 2003).

As a part of this contribution it has been agreed that a workshop on e-learning standards for the National University at Palmira and interested CIAT staff will be conducted in October to prepare materials, which are ready to be delivered through REDCAPA and other distance learning networks.

4. Workshops / Training

4.1. Toolbook

Multi-media CD-ROM design, authoring and production training workshops using Toolbook Instructor© software have been given in Ecuador (SANREM-Andes and Grupo Randi Randi, CONDESAN), in the US (University of Georgia and University of Auburn, SANREM partners) and internally within C&W. All training sessions utilize a series of templates developed at UBC that provide sample applications and programming scripts. The C&W has modified UBC's navigation system to include a language option (Spanish/English).

The workshop in Ecuador focused on two applications in resource management (SANREM and Randi Randi), and the use of multi-media software for presentation of project results in a user-friendly and interactive manner. The CD-ROM design focused on the "hyper link" capabilities to develop a product for multiple audiences using a non-linear tree structure. Both groups have adopted a modified version of C&W's research framework for data organization. Introductory authoring skills were stressed through hands-on examples working with each team's graphics, maps, and photographs.

The US-based workshop focused on applications of Toolbook© to SANREM project theme leaders (Uni. Georgia and Uni. Auburn), and advanced technical training in authoring and production.

Internal C&W Toolbook© training focused on design, layout, basic authoring, and CD-ROM production. The C&W team utilized multi-media software in the SDC Guia's project, led by V Zapata, and in the development of CDs (draft) for each of our four pilot watersheds (Quebrada Grande, Bolo, Cálico, and Tascalapa). Internal training will be ongoing as we incorporate our baseline studies, indicators, and research results for our long-term watershed research sites.

4.2. Integrated Watershed Management, Nicaragua

A 1-week workshop on integrated watershed management, led by C&W (Roa, Brown, and Beltran) was held in Matagalpa in March. The objective of the workshop was to support INTA professionals in their effort to adopt methods for improved watershed management. The short course focused on approaches, analysis, and monitoring tools, and covered a broad range of watershed management themes, including hydrology, water quality, aquatic biota, land use, institutions, policy, and community-based approaches. The application of GIS was highlighted along with ESSA.

Forty-five participants from the five INTA zones, INTA Central, and Universidad Nacional Autónoma de Nicaragua (UNAN), Matagalpa completed the intensive short course. Each regional team organized interactive/hands-on activities by utilizing their own data/information. Practical exercises were conducted on data availability (baseline), indicator selection, hot spot identification (ESSA), and developing a monitoring plan. The field excursion proved to be extremely valuable to ground team activities' focus on "real" issues, and to assess the extremity of problems when water is not managed in a biophysical context.

Based on discussions with Gustavo Cordova (Director of Extension) and key workshop participants, a concept note on water and food security was drafted as a follow-up activity between the CIAT Nicaragua–INTA team. Jorge Alonso Beltrán led the process of developing and submitting the full proposal to FUNICA for financing. The idea is to conduct two case studies in the Cálico (CIAT site) and San Rafael (INTA/CIDA sites) watersheds for establishing a baseline, common indicator set, identifying hot spots (ESSA methodology), and designing watershed monitoring and management strategy. This 1-year project was developed as a direct result of the success of the workshop, both technically and institutionally, through the enhanced CIAT-INTA linkage.

4.3. Geographic Information Systems (GIS)

In the interpretation of sociocultural and biophysical relationships in watersheds, GIS has been recognized as a basic tool that, through the capture, systemization, and analysis of data, contributes to the generation of information that permits better decision taking at different scales of spatial-temporal analysis. In this sense, for the Garrapatas watershed, GIS has been focused on two complementary areas—elaboration of the baseline, and training. Using GIS, knowledge was stored and shared with the dynamic participation of different social actors involved in the project in practical studies: property planning, elaboration of watershed three-dimensional models (*maquetas*), thematic support maps (complementary and adjustments) for participative territorial planning of the area. The following are involved in one or other process, according to the decision level of the territory: youth, children, researchers, producers, municipal technicians, and teachers of methodological processes for GIS training.

To achieve the linking of activities and a correct process of systemization and analysis, a strategy is proposed which links three components:

(1) Training – understood as the sharing of experiences and construction of shared knowledge;
(2) Elaboration and identification of a baseline; and
(3) Activities – commitments and responsibilities for improving the surroundings and quality of life of local actors, rational or sustainable management of resources to guarantee their access to future generations – based on the processing and analysis of data captured from the previous two components.

4.3.1. Training

As an introduction to the use of GIS in obtaining, systemizing, and analyzing geospatial data for users related with the project, an interchange was planned of GIS experiences in the processes of territorial planning at different scales (plot, watershed, territory, or region). This was also among the different actors (young people, researchers, students, ex-pupils and teachers of ACERG educational centers, representatives of El Dovio municipality, youth from Herederos del Planeta of Bellavista, local producers, and CIAT and CIPAV support technicians for field activities).

First experiences in GIS and participative planning were interchanged in the Juan Salvador Gaviota College, in Hondura *vereda*, El Dovio municipality.

Objective. The aim was to share conceptual and practical elements of the use of GIS for territorial planning through interchange and knowledge construction.

Methodology. The interchange of experiences took place in two sessions: reading and interpretation of maps, and different alternatives of geographic analysis with emphasis on the use of information tools. For the reading and interpretation of maps, the basic concepts of GIS, cartography, and mapping were presented, complemented with practice in identification and measuring using base maps of the zone from the Instituto Geográfico Agustín Codazzi (IGAC).

In the session on alternatives to represent and interpret the territory, a general presentation was given on the tools for the elaboration of maps—*maquetas*, participative mapping, digitizing and analysis of air photos, and digital mapping.

Practice was gained through the use of video beam, in simultaneous projection of the exercises on each microcomputer on which the groups were working, putting together the projects, adding themes, consultation, analysis, and generation of statistical reports.

Achievements. Actors from the Garrapatas River watershed gained in knowledge about the existence of tools for geographic analysis that allow them to make better decisions using supporting information.

Three committees were formed to give continuity to the process, with practical cases in property planning, elaboration of *maquetas* of the surrounding area, and the adjustment and updating of the scheme of territorial planning.

These committees are made up of children, young student researchers, ex-pupils of ACERG and other educational centers, teachers, local producers, and CIPAV and CIAT technicians, who work on various of the above themes according to requirements.

4.3.2. Baseline

In the participative elaboration of the baseline, tools were used to capture primary data, and revise secondary sources and inter-institutional alliances for data interchange. Among the institutions consulted were:

- CVC Management Unit of Watershed no. 18;
- Municipality of El Dovio – Municipal Planning Office and the Municipal Unit of Agricultural Technical Assistance (UMATA, the Spanish acronym);
- Corporación para el Desarrollo del Municipio de Versalles (CORPOVERSALLES); and
- Territorial plans of the municipalities of La Unión, Versalles, Roldanillo, and El Dovio.

The baseline structure was made following the model of integrated watershed management: identification, description, and characterization of the biophysical, sociocultural variables, and their interrelation (see Figure 4, under 2.1.2).

4.3.3. Short- and long-term expected results

- Permanent training of the project users, with emphasis on young users: offer conceptual and practical elements regarding the tools of territorial analysis with the purpose of contributing in its integral formation.
- Inter-institutional support to the processes of territorial planning: through the use of remote sensing images, complement, actualize, and interpret information on the territory.
- Define strategic areas for intervention: through geographic analysis, offer elements that can help select and prioritize zones for the even distribution of the investment of resources to improve the quality of life of local inhabitants linked with territorial entities.
- Structure a GIS for the educational centers that form ACERG.

4.4. Centro Agronómico Tropical de Investigación y Enseñanza (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 reported activities are part of a series carried out by Mario Piedra in accordance with the terms of reference of the agreement.

4.4.1. Courses at the graduate level

Ecological and socioeconomic considerations for a sustainable agricultural production and management of natural resources (Jan-Feb). The target group for this course is students from Masters programs in Ecological Agriculture, Watershed Management, Tropical Forests and Biodiversity, and Tropical Agroforestry. The purpose was to identify and explain basic concepts taken from ecological, social, and economic sciences relevant to the challenge of finding sustainable development strategies in tropical rural areas, reconciling socioeconomic development with the preservation of native biodiversity, its values, and functions. The evaluation for year 2003 is shown below.

Number of students	Course average	CATIE's average	Points above average
57	81.931	75.92	6.01

Rural economics. The target group for this course is students from Masters programs in Environmental Economics at CATIE. This is a classic course in Production Economics at the intermediate level, offered in Agricultural Economics and Natural Resources. The objective of the course is that students may be able to understand and conceptualize, from an economic perspective, production processes of goods and services (including the environment) of the tropical ecosystems. The evaluation for year 2003 is shown below.

Number of students	Course average	CATIE's average	Points above average
8	77.24	75.92	1.32

Quantitative methods for socioeconomists (March-April). The target group for this course is students from Masters programs in Environmental Economics at CATIE. This is a course presenting a set of quantitative tools for socioeconomic analysis at the graduate level. I covered linear and probabilistic models, and how to apply them to the production processes of goods and services (including the environment) of the tropical ecosystems. The evaluation for year 2003 is shown below.

Number of students	Course average	CATIE's average	Points above average
8	83.00	82.80	0.20

4.4.2. Training courses

A lecture was given 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 Sept to 4 Oct 2003.

A lecture was given 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, 7-18 Oct 2003.

4.4.3. Research activities through MSc theses supported by C&W

Ricardo Calles, Mario Piedra, and Ignacio Sanz, "Evaluating the hydrologic environmental service in the Upper Lempa Watershed to adjust water tariffs in the Metropolitan Area of San Salvador (MASS)". The main objective of this work is to be able to justify, from the ecological and economics standpoint, the environmental adjustment of water tariffs in the MASS to protect the upper watershed water sources.

More specifically the project originally aimed to:

- Quantify the Hydrologic Environmental Service produced by the Lempa Watershed, using a water budgeting procedure;
- Economically evaluate the hydrologic environmental service through a socioeconomic methodology; and
- Develop an environmentally adjusted water tariff by the Administración Nacional de Acueductos y Alcantarillados (ANDA), internalizing the environmental services provided.

So far, all fieldwork in El Salvador has been completed, and the student is working on data analysis and modeling at CATIE. A final thesis report is expected by December 2003.

4.4.4. Papers presented at International Scientific Conferences

Invited Paper at the United States Department of Agriculture (USDA)/CATIE-sponsored Henry Wallace II Inter-American Scientific Conference Series "Financing sustainable rural development in tropical America: Innovations for food, security, competitiveness and conservation", 19-21 March 2003. Paper entitled "Perspectivas sobre la valoración económica de la biodiversidad."

Invited Paper at the Deutscher Tropentag, 8-10 October 2003, University of Goëttingen, Germany. Paper entitled "Viewing multi-functionality in agriculture as a tool for development in the Latin American Tropics."

4.4.5. Papers accepted for publication in refereed journals related to thesis supported during 2002

Edith Méndez, Mario Piedra, Alan González, Jeffrey Jones and Gilberto Páez. "Análisis espacial del uso de la tierra en la cuenca del Río Turrialba, Costa Rica". Edited and accepted for publication in the first issue of Revista de Recursos Naturales y Ambiente, published by CATIE.

Abstract. By means of spatial analysis, the study attempted to identify the natural, physical, and socioeconomic factors that have influences on land use in the Turrialba River watershed. GIS was used to categorize soil use into six classes: forest, pasture, coffee, sugarcane, urban, and others. Two sources of information were used: aerial photographs and satellite images. The data were analyzed through logistical regressions of the type "Multinomial Logit", using LIMDEP econometric software. The results demonstrated that land use at the Turrialba River watershed depends on a combination of factors, such as: soil depth, soil type, life zone, size of farm, and distance as access cost. Based on the slope map, a coefficient of friction was included. The results demonstrated that the aerial photographs rendered an efficiency of 67% in the prediction of land use changes, and 61% in the satellite images. These results cannot be generalized because data were manipulated to group uses into six categories, for comparison. Additional studies should be carried out to validate the results.

Patricia Talavera, Glen Galloway, and Mario Piedra. "Diversificación del uso del bosque: Una propuesta para aumentar la rentabilidad de la actividad forestal en el bosque comunitario Toncontín, Honduras." Edited and accepted for publication in the first issue of Revista de Recursos Naturales y Ambiente, published by CATIE.

Abstract. Forest management financial profitability in Toncontín, Honduras, was evaluated and compared against a diversified management scenario that included three options: extraction of six non-wood forest products, ecotourism as a commercial activity, and a payment for water regulation. Returns obtained with the scenario proposed are 50% higher than present use. The forest inventory for non-wood forest products shows severe differences between primary and intervened forests, as in species quantity and abundance. *Brahea dulcis*, *Machaerium cirrhiferum*, *Smilax spinosa*, and orchids are the non-wood forest products with higher monetary returns. The evaluation of tourist activities shows a wide acceptance of a pattern that combines tourism and forest management. National and foreign tourists' preferences are

similar; the options best graded were infrastructure, tourist guides, and typical products and handicrafts. Opportunity cost method determined a value of US$27.4 per ha per year for water regulation, with cattle ranching as a second option for land use.

Karla Sanchez, Francisco Jimenez, and Mario Piedra. "Desarrollando una metodología de análisis multicriterio para la identificación de áreas prioritarias del manejo del recurso hídrico en la cuenca del Río Sarapiquí, Costa Rica." Edited and accepted for publication in the first issue of Revista de Recursos Naturales y Ambiente, published by CATIE.

Abstract. Processes that affect both water quality and availability were identified in the Sarapiquí River watershed. Priority areas for management of water resources in the watershed were identified by means of priority criteria in three scenarios, and a Multicriteria Analysis Methodology with GIS tools. The scenarios were: present quality of water (nine criteria), available water quantity (four criteria), and riverside vegetal cover restoration as a mitigation measure for water resource management (nine criteria). The priority model used in available water quantity management showed a predominance of areas catalogued as medium (65%) and low priority classes (33%). No areas were identified as very low or very high priority classes. High priority class represents 1.7% of the watershed area (3,500 ha). Comparisons between models for water quality management and the scenario of riverside vegetal cover restoration show that the areas corresponding to low priority class changed from 79% to 81% (2% more than the model without cover restoration). Medium priority class areas changed from about 20% to 19% of total watershed area.

Fabiola Tabora, Jorge Faustino, Francisco Jiménez, and Mario Piedra. "Desarrollo de un modelo de fondo ambiental para el manejo y conservación de los recursos de una microcuenca de Honduras." Edited and accepted for publication in the first issue of Revista de Recursos Naturales y Ambiente, published by CATIE.

Abstract. Ecotourism is considered one of the main financial sources for the creation of an environmental fund. The use of contingent valuation permitted us to estimate the willingness to pay (WTP) of national and foreign tourists, and so, to calculate the revenues of the activity. The results show that tourists have a positive WTP: 93% of national tourists are willing to pay US$0.07 for the conservation of the watershed natural resources, and 91% are willing to pay US$2 for an entrance ticket to a natural trail. But only 88% of the foreign tourists are willing to pay US$2 in the first situation, and 56% show a WTP of US$10 for the second alternative. The financial analysis shows that the potential income for the fund will be about US$105,207 during the first year, and US$128,550 at year seven. It is evident that this activity will provide the financial resources necessary for the creation of an environmental fund. The environmental services to be paid are: forest protection, reforestation, and the use of agroforestry systems. The payment proposed is: US$168.7 per ha per year for agroforestry systems, US$40.00 per ha per year for forest protection, and US$0.82 per planted tree per year. It is recommended that the fund be placed within the Municipal Government, administrated by a local environmental committee, and managed as a trusteeship.

4.4.6. Book chapters

Felipe Barito, Mario Piedra, and Gilberto Páez. "Modeling land use dynamics with remote sensing data: The case of intervened ecosystems in the central mountain range of Venezuela." Chapter on final edition and accepted for publication. Title of the book "Making development work: A new role for science". New Mexico University Press. Publication is expected before the middle of 2004. Grégoire Leclerc and Charles Hall are the editors.

Abstract. The objective of this book chapter is to address land use dynamics framed in the urban-rural interface using as a case study the central mountain range in Venezuela. Interest in understanding the dynamics of land use conversion in the urban-rural interface has been prompted by the rapid expansion of urban centers at the expense of agricultural and forested areas. During the past decade, most large cities in Latin America continued growing in places deemed unsuitable from an environmenal standpoint, increasing their vulnerability to natural disasters. The chapter uses spatial economics and a mathematical model of probabilities to assess the importance of spatial factors such as physical features of the landscape, distance to roads, and the location (inside/outside) of a park, among others, affecting land use conversion. Then, it incorporates a dynamic component through Markovian Transitional Probabilistic Matrices (TPMs) to assess land uses' persistence over time. Spatial data from 1958, 1973, 1983, and 1994, plus information from diverse themes, was used to model the time-spatial function on land use conversion. Main results suggest a clear tendency towards land use stability and ecosystem recovery in the middle to upper parts of the study area. Compared to 1958—baseline—the impact of human intervention on the upper, protected forested lands has been negligible, whereas it has been quite important on the lower lands of the watershed because of unorganized urbanization. All land use transitions—except to urban uses—were regulated by physical restrictions of the environment, and by factors of socioeconomic and regulatory character. The consistency in the sign of the effects attributed to the driving forces in shaping land use transitions supports Velkamp and Fresco's proposition of forecasting land use condition scenarios. However, inconsistency in the magnitude of the marginal effects suggests a differentiable influence of the driving forces over time.

5. Publications / Communications

5.1. Papers in Refereed Journals

Bestbier, R.; Brown, S.; Schreier, H. 2003. Innovative information technologies and mountain communitites. GeoJ. (Submitted)

Brown, S. 2003. Gender, poverty and natural resource management in Nepal: A farmers' perspective. GeoJ. (In Press)

Brown, S. 2003. Gender, workload and inequity in Himalayan watersheds. GeoJ. (Submitted)

Brown, S. 2003. Spatial analysis of socio-economic issues: Gender and GIS in Nepal. Mountain Res.Dev. (In Press)

Brown, S.; Kennedy, G. 2003. A case study of cash cropping in Nepal: Poverty alleviation or inequity. Agric. Hum. Values. (In Press)

Brown, S.; Schreier, H. 2003. Linking culture, economics and resources in Nepal. Agric. Syst. (Submitted)

Luijten, J.C.; Sanz, J.I.; Jones, J.W. 2003. A role for GIS - based simulation for empowering local stakeholders in water resources negotiations in developing countries: Case studies for two rural hillside watersheds in Honduras and Colombia. Water Policy 5: 213-236.

Schreier, H.; Bestbier, R.; Brown, S.; Quiroz, R. 2003. Himalayan-Andean watersheds: A comparative study using information technologies. GeoJ. (Submitted)

5.2. Chapters in Books

Barbier, B.; Hernandez, A.; Mejía, O.; Rivera, S. 2004. Trade-off between income and erosion in a small watershed. GIS and economic modelling in the Río Jalapa watershed, Honduras. *In*: Leclerc, G.; Hall, C. (eds.). Making development work: A new role for science. New Mexico University Press. (In press)

Barito, F.; Piedra, M.; Páez, G. 2004. Modeling land use dynamics with remote sensing data: The case of intervened ecosystems in the central mountain range of Venezuela. *In*: Leclerc, G.; Hall, C. (eds.). Making development work: A new role for science. New Mexico University Press. (In press)

Beltrán, J.A.; Orozco, P.P.; Zapata, V.; Sanz, J.I.; Roa, M.C.; Schmidt, A. 2004. Scaling out and scaling up: The importance of watershed management organizations. *In*: Pachico, D. (ed.). Scaling up and out: Achieving widespread impact through agricultural research. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. (In press)

Zandbergen, P.; Brown, S. Schreier, H. 2003. Watershed management education and training CD-ROMs. *In*: France, R. (ed.). Handbook of water sensitive planning and design. CRC/Lewis. (In Press)

Zapata, V.; Ashby, J.A. 2003. Dissemination and application of decision support tools (DSTs) for natural resource management. Chapter 2. *In*: INRM Case Studies. Technical Advisory Committee-Secretariat (TAC-SEC) / Consultative Group on International Agricultural Research (CGIAR). (In Press)

5.3. Workshop and Conference Papers / Presentations

Amede, T.; Amézquita, E.; Ashby, J.; Ayarza, M.; Barrios, E.; Bationo, A.; Beebe, S.; Bellotti, A.; Blair, M.; Delve, R.; Fujisaka, S.; Howeler, R.; Johnson, N.; Kaaria, S.; Kelemu, S.; Kerridge, P.; Kirkby, R.; Lascano, C.; Lefroy, R.; Mahuku, G.; Murwira, H.; Oberthür, T.; Pachico, D.; Peters, M.; Ramisch, J.; Rao, I.; Rondon, M.; Sanginga, P.; Swift, M.; Vanlauwe, B. 2003. Biological nitrogen fixation: A key input to integrated soil fertility management in the tropics. Position paper presented at the International Workshop on Biological Nitrogen Fixation for Increased Crop Productivity, Enhanced Human Health and Sustained Soil Fertility, 10-14 June 2002, Ecole nationale supérieure agronomique (ENSA)- Institut national de recherche agronomique (INRA), Montpellier, France. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, IN. (In press)

Barbier, B.; Hearn, R.; Gonzales, J.M.; Nelson, A.; Mejía, O. 2003. Trade-offs between economic efficiency and contamination by coffee processing. A bioeconomic model at the watershed level in Honduras. Paper presented at the International Association of Agricultural Economists (IAAE) conference, 10 Aug 2003, Durban, ZA.

Binder, C.R. (ed.). 2003. Memorias del Taller de Escenarios para la Región de San Dionisio, Nicaragua, 12 a 15 Febrero 2002, Matagalpa, Nicaragua. Swiss Federal Institute of Technology (ETHZ), Natural and Social Science Interface, Zurich. Centro Internacional de Agricultura Tropical (CIAT)- Universidad Nacional Agraria (UNA), Cali, CO. 41 p.

Brown, S. 2002. Gender and natural resource management in Nepal. Paper presented at the Gender and Development in Asia workshop, 15 March 2002, University of British Columbia, Canada. Sponsored by Intercultural Studies in Asia, Institute of Asian Research, and Centre for Research in Women's Studies and Gender Relations.

Piedra, M. 2003. Perspectivas sobre la valoración económica de la biodiversidad. Invited paper presented at the United States Department of Agriculture (USDA)- Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)- sponsored Henry Wallace II Inter-American Scientific Conference Series, Financing Sustainable Rural Development in Tropical America: Innovations for Food, Security, Competitiveness and Conservation, 19-21 March 2003. CATIE, CR.

Piedra, M. 2003. Viewing multi-functionality in agriculture as a tool for development in the Latin American tropics. Invited paper presented at the Deutscher Tropentag, 8-10 October 2003, University of Goettingen, DE.

5.4 Technical Reports and Others

Baltodano, M.E. 2003. Valoración socio-económica de la erosión y conservación de suelos. Reunión anual del Manejo Integrado de Suelos (MIS), Marzo del 2003, Copan, HN. 30 p.

Baltodano, M.E. 2003. Valoración socio-económica de la erosión y conservación de suelos. Curso Internacional Teórico Practico sobre Ciclaje de Nutrientes y Valoración Económica a Escala de Fincas. Indicadores económicos y ambientales. 12-14 de mayo del 2003, Bogotá, CO. 36 p.

Davies, C.; Franco, J. B.; Beltrán, J.A. (eds.). 2003. Taller de Seguimiento y Evaluación Participativa, para los Comités de Investigación Agrícola Local (CIALs) y la Asociación Campos Verdes, San Dionisio, Matagalpa. CIAT – Comunidades y Cuencas - Investigación Participativa (IPRA), Nicaragua. Centro Internacional de Agricultura Tropical (CIAT), Managua, NI. 34 p. (Publication no. 16)

Hernández, R.; López, F.; Rivera, S.; Barbier, B. 2002. Escenarios de simulación de la tierra del uso de la tierra en la cuenca del río Choluteca. Tatascan 14(1):13-29.

Jonsson, A.; Wall, E. 2002. Resource flow mapping as a tool for improving soil organic matter management in smallholder hillside farmers in Nicaragua. Swedish University of Agricultural Sciences, SE. 55 p. (Minor Field Studies no. 213)

Méndez, E.; Piedra, M.; González, A.; Jones, J.; Páez, G. 2003. Análisis espacial del uso de la tierra en la cuenca del Río Turrialba, Costa Rica. Revista de Recursos Naturales y Ambiente. (Accepted)

Orozco, P.P.; Franco, J.B.; Beltrán, J. A. (eds.). 2003. Memoria de la II Feria de Tecnología Productiva y Alimentos Alternativos - "Por una vida mas sana, produciendo y consumiendo lo nuestro, en armonía con la naturaleza". San Dionisio, Matagalpa. CIAT – Comunidades y Cuencas, Nicaragua. Centro Internacional de Agricultura Tropical (CIAT), Managua, NI. 29 p. (Publication no. 15)

Sanchez, K.; Jimenez, F.; Piedra, M. 2003. Desarrollando una metodología de análisis multicriterio para la identificación de áreas prioritarias del manejo del recurso hídrico en la cuenca del Río Sarapiquí, Costa Rica. Revista de Recursos Naturales y Ambiente. (Accepted)

Sanz, J.I.; Ziegler, R.S.; Sarkarung, S.; Molina, D.L.; Rivera, M. 2002. Improved rice-pastures systems for native savanna and degraded pastures in acid soils of Latin America. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. 22 p.

Schreier, H.; Brooks, D.; Brown, S.; Bestbier, R. 2002. Agricultural watershed management. Institute for Resources and Environment, UBC. CD-ROM textbook.

Schreier, H.; Brooks, D.; Brown, S.; Bestbier, R. 2002. Water in international development. Institute for Resources and Environment, UBC, and International Research Development Centre (IDRC), Ottawa. CD-ROM textbook.

Tabora, F.; Faustino, J.; Jiménez, F.; Piedra, M. 2003. Desarrollo de un modelo de fondo ambiental para el manejo y conservación de los recursos de una microcuenca de Honduras. Revista de Recursos Naturales y Ambiente. (Accepted)

Talavera, P.; Galloway, G.; Piedra, M. 2003. Diversificación del uso del bosque: Una propuesta para aumentar la rentabilidad de la actividad forestal en el bosque comunitario Toncontín, Honduras. Revista de Recursos Naturales y Ambiente. (Accepted)

Walter, S. 2002. Evaluation of two GIS-based models for landslide prediction for Cálico River watershed, San Dionisio, Nicaragua. Masters Thesis, University of Hohenheim, DE. 74 p.

Zapata, V. 2003. Fortalecimiento de capacidades institucionales para el seguimiento y la evaluación participativos en proyectos de desarrollo en el ambito del PRONADERS – Honduras. CIAT, Cali, CO. 10 p.

Zapata, V. 2003. Informe sobre la difusion del paquete de cinco instrumentos de decision en CD. Informe técnico presentado a COSUDE - Centro America. CIAT, Cali, CO. 55p.

Zapata, V.;Galvez, G.; Chery, J.; Osmy, G.A. 2003. Progress report and working plan for Haiti 2003. CIAT, Cali, CO. 24 p.

5.5. Book in Press – Making Development Work: A New Role for Science

The Project entitled "Methodologies for Integrating Data Across Geographic Scales in a Data-rich Environment: Examples from Honduras" (1 Jan 1997 – 31 Aug 2000) had as aim "to develop and document *principles and procedures* for building a scale-consistent database and for performing multiscale characterization of agro-ecosystems". It was funded by the Dutch trust fund for methodological support to ecoregional research.

At closure, the project had produced two main outputs: (1) published volumes of edited scale-consistent spatial databases, (2) principles, procedures, and methods for developing spatial databases for a wide range of stakeholders. It shaped the most complete and accurate set of ecoregional databases available for Honduras, i.e., the *Honduras Atlas*. It also provided tools to perform multiscale characterization of any region of Honduras at resolutions unavailable for any other country in Latin America, and an interactive computer-based tutorial clearly and concisely illustrates their use. More details can be found in:
http://gisweb.ciat.cgiar.org/cross_scale/project-description.htm

The final project synthesis and review workshop, held in San Jose, Costa Rica on 4-6 July 2000, served the purpose of strengthening existing collaborations and building new ones. Participants received with enthusiasm the idea of contributing to a book that would put ecoregional research

in the reach of a broader audience and in a development perspective. This convinced us to go forward to commit the project unspent funds for its production. Grégoire Leclerc, project coordinator (now with Centre de coopération internationale en recherche agronomique pour le développement [CIRAD]), and Charles Hall, Professor at the Environmental Science and Forestry Department (ESF)/ State University of New York (SUNY), assisted with the compilation, edition, and writing.

5.5.1. Book philosophy

The most important development models in recent times have been based on the concept of the supposed benefits that would flow from increasing trade more or less anywhere and everywhere. This concept has been taken to its logical extreme in contemporary neoclassical economics, which materialized in strategies adopted by the World Bank, the International Monetary Fund (IMF), and many other development aid donors. Meanwhile, the implications of the expansion of international trade on land use and environment (i.e., the ecoregion) in less developed countries (LDC) more generally remain as large, complex, and various as the changes in trade itself. One thing is clear, however, which is that as the international economy itself has expanded the use of resources, changes in land use have expanded more or less in proportion.

In parallel to the massive changes driven by mainstream economics, scientists are developing useful approaches to development that acknowledge the complexity of the interactions between societies and the environment. They are from the social sciences or from the natural sciences, and often work in multidisciplinary teams. Their influence on development is negligible compared to that of typical economics.

The purpose of the book is to show how current ecoregional science can vastly improve the way development is done. It starts by reviewing the main development paradigms; looks at a few LDCs and their development pathways; and then highlights scientific contributions, from many disciplines, on making development work better.

5.5.2. Status

The book project suffered from a slow start related to the availability of funds, and to the contribution of authors. By April 2003, 2 years after the start of this work, only 50% of the chapters initially promised had been received, and several authors had vanished. In the meantime, we had associated several new authors to either fill the gaps left or contribute to new topics that we wanted to emphasize (e.g., country case studies). Each chapter was heavily edited to ensure consistency throughout the book.

The book has now been accepted for publication by New Mexico University Press, which will commit substantial funds for the final edition and production. We expect the release mid 2004. The book structure, which may change slightly during the final edition process, is given below.

5.5.3 Book structure

Making Development Work: A New Role for Science
Grégoire Leclerc and Charles Hall (Eds)

Preface

Part 1. Introduction: Defining development and economics from the perspective of science

Overview
Development and conceptual models of development as drivers of land use change in the tropics
A brief history of development: Models and foreign aid
The need to reintegrate the natural sciences with economics
The biophysical and economic efficiency of tropical economies, especially with respect to energy, forests, and water

Part 2. National success stories, national failures and a lot of ambiguity

Overview
An explanation of South Korean experience for economic development
Preliminary simulation of the potential for sustainability in Eritrea
Development confusion: Free trade, colonial legacy, and the Philippine "puzzle"
Is the Argentine national economy being destroyed by the Department of Economics of the University of Chicago?
Development in the country of Niger

Part 3. Science for development

Overview
3.1. Analysis of regional resource potential
- The application of land use analysis tools across different scales to the Atlantic Zone of Costa Rica
- Deriving land quality indicators from the landscape units used in soils surveys
- Simulation modeling for characterizing strategic stream water availability in the Tascalapa River watershed, Honduras
- Trade-off between income and erosion in a small watershed: GIS and economic modeling in the Jalapa River watershed, Honduras
- Modeling land use dynamics with remote sensing data: The case of intervened ecosystems in the central mountain range of Venezuela
- The effect of scale on carbon estimates

3.2. Social parameters
- An attempt to integrate multiple perspectives to improve pro-poor policies: Deriving classic and local poverty indicators
- Farmers' decision making on land use – the importance of soil conditions in the case of the Cabuyal River watershed. Colombia

Social capital

3.3. Assessing environmental impact and its economic impacts
Multiscale data sets for highlighting and assessing forest change in the tropics
Reducing pesticide run-off to the Caribbean Sea: A formidable regional challenge
Soil erosion: A food and environmental threat

3.4. Enhancing economics so that it can do the job required
A spatial model of accessibility: Linking population and infrastructure to land use patterns in the Honduran hillsides
Rural accessibility decision making: Issues of integration, scale, and sustainability
Alternative poverty mapping strategies to address needs at national and subnational scales
Agent-based systems and policy analysis: Perspectives and challenges
Making tropical agriculture more sustainable by using bioeconomic models
The Grande de San Ramón River basin input output matrix: Sectorial linkages analysis

Part 4. Working with decision makers

Towards sustainable agricultural development in Costa Rica: Role and complementarities of technical assistance and science
Watershed scales and levels: Experiences with projects in Central America
A systems approach to planning for rural development in Colombia
An attempt to integrate multiple perspectives to improve pro-poor policies: Contrasting and harmonizing representations

Part 5. Postscript: The elephant in the living room

Elephants and scientists
Making development work

Index

5.6. CD-ROMs

With the financial cooperation of the Swiss Development Cooperation (SDC), a new version of the five most demanded decision support tools (DSTs) was prepared, following the Tool Book format. After this preparation, a series of seven workshops were delivered in Honduras and Nicaragua from the 17th to the 26th of February 2003. The workshops were attended by members of 26 institutions (NGOs, universities, and government programs). A previous induction meeting was held in both countries in November 2003. During these meetings, commitments were made by the directors of institutions in terms of the incorporation of these tools into their regular programs, projects, and activities.

The seven workshops included the trainers' teams, trained by CIAT between 1998 and 2000. They were in charge of presenting the content of DSTs using the CDs. Given this new form of presentation, a thorough evaluation was conducted among participants. Results of this evaluation

are presented in the "Informe sobre la difusion del paquete de cinco instrumentos de decisión en CD (2003)". This report presents (a) the evaluation carried out by the participants about the workshops, (b) the work plans designed by institutions in terms of the application of the DSTs after the workshops, (c) the evaluations made by the trainers about the CD, (d) the evaluation made by a random sample of participants to evaluate the CD with the DSTs, and (e) the database of all participants to be able to follow up the application of the DSTs.

A technical report was presented to SDC (March 2003) in closing the execution of the corresponding grant.

5.7. Web Page

The C&W Web page (http:www.ciat.cgiar.org/laderas/inicio.htm) is a subsite of the CIAT Web site (www.ciat.cgiar.org), thus the graphic design and contents pass through the CIAT Communications Unit and Graphic Arts.

Initially, in 2001, the Web subsite (Figure 10) was available in Spanish; since April 2003, it is also available in English, reaching a wider audience.

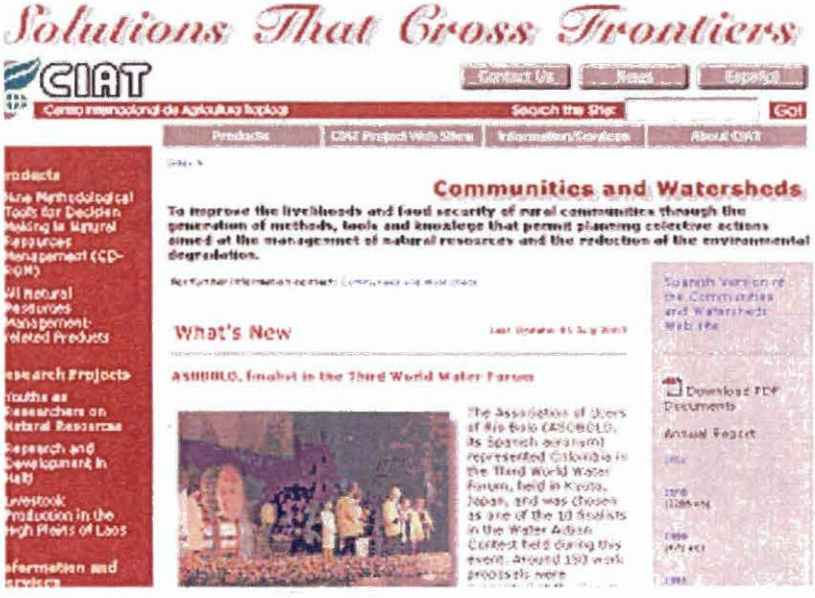

Figure 10. The Communities and Watersheds Web page.

5.7.1. The transition

At present, the site continues to have available information on the previous PE-3 project of Hillsides for those seeking out this work in areas related to NRM and watersheds. At the same time, the advances and results of the present work being generated in C&W are available.

5.7.2. Statistics

Despite this transition stage, and its implications for the Web subsite, an increasing number of visitors access the site (Figure 11). The archives downloaded most frequently by visitors are the Annual Reports for 2000 and 2002, and documents showing the progress and activities of the Youth project in Colombia and Honduras (Figure 12).

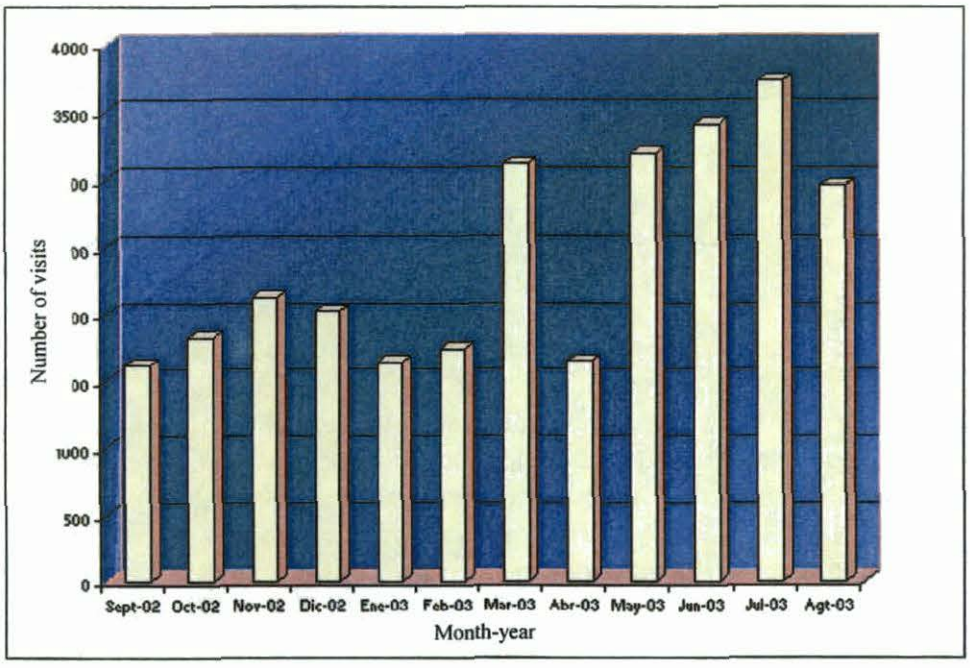

Figure 11. Visits to the Communities and Watersheds Web page.

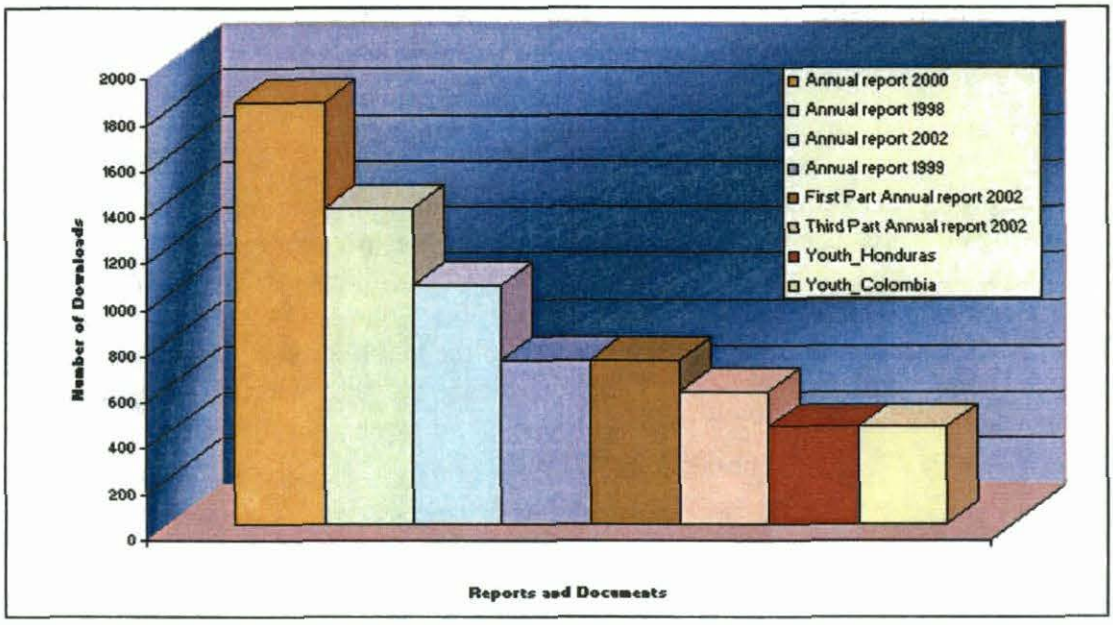

Figure 12. Main downloads from the Communities and Watersheds Web page.

5.8. Documentation Center

The C&W continues the Documentation Center that began under PE-3 in 2000. The Center stores materials for external consultancy on themes related to C&W interests and objectives, such as NRM, integrated management of watersheds, and sustainable development. Documents include internal management reports and scientific articles. During the last year, the Center has indexed 94 new bibliographic references giving an overall total of 1506 available for consulting. Also, the qualification and improvement of key words has been completed, optimizing search results by users of the Center and partners.

6. Proposals

6.1. Scaling Water Use, Quality, and Equitable Water Distribution Issues in the Andes and Himalayas

The goal of this project is improved capacity for the management of water at multiple scales. This requires efficient water use, conservation, reuse, quality, and equitable distribution for both food production and environmental services. The project will develop methods and concrete examples illustrating how water use, quality, and distribution operates and can be tackled at multiple scales within the context of integrated watershed management. The project will be implemented in eight watersheds, four in each mountain region (Andes / Himalaya). A NARES, NGO, or international project will lead the local-level research activities in each watershed. CIAT will coordinate comparisons between watersheds, and UBC will provide academic / methodological support. The WFCP Consortium Steering Committee has selected the proposal as part of the portfolio of 50 approved projects from the first call. This decision means that the proposal is endorsed as suitable to be marketed by the WFCP as a good, fundable project, relevant to their goals. The proposal was not amongst the 16 approved for immediate contract negotiations, because of limits on funding available. However a further 5-10 approved projects will be invited to negotiate as additional core funding becomes available.

6.2. Youth in Watershed Research for Water-Land Management

The goal of this project is to contribute to the development of improved local-level NRM practices focusing on water as a scarce resource, vegetation for recuperation of degraded areas, and innovative production systems that conserve water and biological resources. The study area is the Quebrada Grande watershed, Cauca Valley, Colombia – one of C&W's long-term research sites. The approach used for the analysis and research of the biophysical components incorporates the active participation of local communities as research partners, and the full integration of youth into research activities. This concept note has been submitted jointly with CIPAV and Herederos del Planeta to IDRC for consideration.

6.3. Youth - Andes

CONDESAN and C&W have submitted a concept note to GTZ to expand the youth and environmental research initiatives developed at PE3-CIAT to other CONDESAN sites throughout the Andes. The goal of the project is to provide alternatives to out migration for rural

youth, while simultaneously enhancing NRM. Youth research initiatives in NRM, information technologies, youth-to-youth exchanges between countries, and a revolving fund for local initiatives are core activities. Youth groups will be established and/or existing groups support enhanced in Ecuador, Colombia, Peru, and Bolivia building on our existing network of research watersheds.

6.4. Mesoamerican Biological Corridor (MBC)

"Conservation, restoration and production in rural communities of the non-protected areas of the Mesoamerican Biological Corridor – Pre-project." Based on discussions with the donor—Norwegian Agency for Co-operation for Development (NORAD)—and project partners CATIE, CIPAV, CARE International, and UBC, we developed a proposal for a 1-year pre-project that would constitute the first phase of a long-term research initiative in the non-protected areas of the MBC. The immediate objective is a proposal for technical interventions, monitoring, and evaluation of improved land use in non-protected areas of critical importance in the MBC developed by a multi-stakeholder group. GIS, hotspot analysis, local indicators, and baseline studies would be conducted in seven countries in Central America with Phase II to focus on Nicaragua, Honduras, and Guatemala, the poorest countries in Central America, and the focus of NORAD's work. The participation from CIAT includes C&W and Land Use (PE-4).

6.5. Global Environment Fund (GEF)/ United Nations Environment Program (UNEP)

6.5.1. Methodological development for understanding the socioeconomic and institutional factors that drive land degradation in Central America: The case of Nicaragua and Honduras

The project aims to model the effect that alternative profitable sustainable production systems—aiming at better land use and natural resource conservation—have in three watersheds in Honduras and Nicaragua. An Integrated System for Decision-Making Analysis at the Watershed level (ISDAW) will be developed and utilized in collaboration with national and regional institutions. Capacity building and outreach will be implemented through CATIE's MSc Environmental Socioeconomics and PhD in Socioeconomic Aspects of Water and Land Resources programs, plus national and regional workshops. The proposal has been endorsed in its Adobe Portable Document Format (PDF) form by GEF political and operational focal points in both countries. Currently, the PDF format in under revision at UNEP's Headquarters in Nairobi, Kenya. Project coordinators are Dr. Mario A. Piedra and Dr. Eliécer Vargas.

6.5.2. Agroforestry Project, San Dionisio: An experience in capitalization, conservation, and utilization of tree resources in the San Dionisio watershed in Nicaragua

The project recollects successful experiences in establishing agroforestry systems as a means of increasing income and reducing the impact of current hillside production systems on the natural resource base in dry forest ecosystems. The project comprises packages of interventions to improve both livelihoods and the economic well-being of local people (baseline actions), and to preserve or restore ecosystems functions and services through sustainable land management (incremental actions). Baseline activities at the community level may include: the rehabilitation

of degraded areas through reforestation and agroforestry. Complementary incremental actions include:

- Pilot or demonstration activities aimed at strengthening the use of indigenous multiple tree species to rehabilitate degraded areas;
- Protection and/or rehabilitation of riparian forest and wetlands, and groundwater recharge areas;
- Establishment of community woodlots to provide fuel wood as an alternative source to natural forest and woodland; and
- Piloting of mechanisms to compensate local communities for protecting ecosystem function and services in watersheds to ensure stable flow of high-quality water for downstream users.

Of course, these interventions would have additional global environmental benefits, such as conservation of biodiversity, carbon sequestration, and reduction in carbon dioxide emission effects. The proposal has been endorsed in its PDF form by Nicaragua's GEF political and operational focal points. Project coordinators are Dr Mario A Piedra and Dr Guillermo Navarro.

6.6. Facing the Challenges of the Millenium

This proposal aims to strengthen the institutional capacity of INTA in alliance with CIAT-UNA-CARE International and local partners in the focus on integrated management of watersheds. It is based in the subwatershed of the Cálico River, San Rafael-La Concordia, Nicaragua. The FUNICA foundation is donating US$120,000 total funds, of which US$67,000 are for CIAT activities.

6.7. Socioeconomic and Environmental Evaluation of Soil Erosion and Conservation

The aim of this project is to examine the economic, environmental, and social profitability of agroforestry systems at the level of private farms. It is located in the subwatersheds of the Cálico River, Chile-Jinotega, and Tisey-Estanzuela, Estelí, Nicaragua. The donor approached for funding is the Inter-American Development Bank (IDB), through the Programa Socioambiental Forestal (POSAF), Nicaragua.

6.8. Validation of Crop Systems with Legumes Introduced as Green Manure / Cover Crops on the Sustainability of Traditional Production Systems

This proposal aims to identify and diffuse crop systems with the use of legumes, which improve fertility and reduce soil erosion in the Wibuse-Jicaro microwatershed, Nicaragua. The donor approached for funding, FUNICA, has approved US$10,000 in total with US$2000 for CIAT activities. This activity is developed with producers.

7. Staff List

Colombia:

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Andrea Carvajal (50%)	BSc Journalist, Documentation Center
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Sandra Brown (50%)	PhD Resource Management, Senior Research Fellow, UBC-CIAT Alliance
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Jorge Rubiano (40%)	PhD Geography, Posdoctoral Fellow
Pedro Lorenzo Burgos	BSc Agronomic Engineer, Research Assistant

CIAT – CONDESAN in Colombia

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Honduras:

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Elvis Cayetano Chavarria	Field Assistant, San Dionisio

Haiti:

Gardy Fleurantin (*)	MSc Agronomy, Liaison officer

Southeast Asia

Rod Lefroy	FLSP Project Director and Regional Coordinator of CIAT in Asia
Keith Fahrney	PRDU Project Director
Peter Horne (40%)	Regional Coordination
Phonepaseuth Phengsavanh	CIAT Regional Research Fellow (20% with FLSP)
Chintana Chanhdeng	CIAT Financial Administrator (100% with FLSP)
Panida Phommalisack	Administrative Assistant (70% with FLSP)
Sukanya Chanhdeng	Technical Assistant (100% with FLSP)

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Honduras:
Lina Andrea García, MSc studies, CATIE

Costa Rica:
Ricardo Calles, MSc studies, CATIE

(*) Left during 2003

8. Acronyms and Abbreviations Used in Text

Acronyms

ACERG	Asociación de Centros Educativos del Cañon del Río Garrapatas (*Association of Educational Centers of the Garrapatas River Gorge*), Colombia
ADYS	Autogestión, Desarrollo Y Sociedad (*Self-management, Development, and Society*), Colombia
AID	Agency for International Development
ANDA	Administración Nacional de Acueductos y Alcantarillados (*National Administration of Aqueducts and Sewage Systems*), El Salvador
APK	Asosyasyon Plante Kafechene, Haiti
APLAKAB	Asosyasyon Plante Kafechene, Haiti
ARI	Agricultural Research Institute
ASOBOLO	Asociación de Usuarios del Río Bolo (*Bolo River Water Users Association*), Colombia
ATICA	Agua y Tierra Campesina (*Rural Water and Soil*), Bolivia
C&C	Communidades y Cuencas (*Spanish for C&W*)
CACGAVA	Cooperative Agricole Cafetière Gabard le Vaillant (CACGAVA), DonDon, Haiti
C&W	Communities and Watersheds project, CIAT, Colombia
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (*Tropical Agriculture Research and Higher Education Center*), Costa Rica
CCA	Canonical Correspondence Analysis
CG	Shortened form of CGIAR
CGIAB	Commision for the Integrated Management of Water in Bolivia
CGIAR	Consultative Group on International Agricultural Research
CIAL	Comité de Investigación Agrícola Local (*Local Agricultural Research Committee*)
CIAT	Centro Internacional de Agricultura Tropical (*International Center for Tropical Agriculture*), Colombia
CIBK	Center for Biodiversity and Indigenous Knowledge
CIDA	Canadian International Development Agency
CIDERBO	Consorcio Interinstitucional para el Desarrollo Rural en Bolivia (*Institutional Consortium for Bolivian Rural Development*)
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (*International Maize and Wheat Improvement Center*), Mexico
CIPAV	Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuária (*Center for the Investigation of Sustainable Agricultural Production Systems*), Colombia
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (*Center for International Cooperation in Agricultural Development Research*), France
CJBC	Cooperative Jean-Baptiste Chavannes, Grande Rivière du Nord, Haiti

COHDEFOR	Corporación Hondureña de Desarrollo Forestal (*Honduran Corporation of Forestry Development)*
CONDESAN	Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (*Consortium for the Sustainable Development of the Andean Region*)
CORPOVERSALLES	Corporación para el Desarrollo del Municipio de Versalles (*Corporation for the Development of the Municipality of Versalles*), Colombia
COSUDE	Cooperación Suiza al Desarrollo (*Swiss Development Cooperation*)
CPPHM	Cooperative Petits Planteurs Haut Martineau, Plaisance, Haiti
CRSP	Collaborative Research Support Project of USAID
CVC	Corporación Autónoma Regional del Valle del Cauca (*Regional Autonomous Corporation of the Cauca Valley*), Colombia
DAI	Development Alternative Inc.
DFID	Department for International Development, UK (previously ODA)
DDT	División de Desarrollo Técnico (*Technical Development Division of the Ministry of Agriculture*), Bolivia
ENSA	Ecole nationale supérieure agronomique (*National Agricultural College*) of INRA
ESF	Environmental Science and Forestry Department of SUNY, USA
ESNACIFOR	Escuela Nacional de Ciencias Forestales (*National School of Forestry Science*), Honduras
ESSA	Environmentally and Socially Sensitive Area analysis
ETHZ	Eidgenössische Technische Hochschule-Zentrum (*Federal Institute of Technology*), Switzerland
FAO	Food and Agriculture Organisation, Rome, Italy
FDTA	Fundaciones del Desarrollo de Tecnología Agricultural (*Agricultural Technology Development Foundations)*
FoCAM	Fomentando Cambios (*Fostering Changes*) project
FSHA	Food Security and Humanitarian Assistance, of USAID
FUNICA	Desarollo Tecnológico Agropecuario y Forestal (*Foundation for Technological Development in Agriculture and Forestry*), Nicaragua
GEF	Global Environment Fund
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (*German Technical Cooperation*)
HAP	Haiti Agricultural Project
HPB	Herederos del Planeta Juventud, Vida y Naturaleza de Bellavista (*Inheritors of the Planet Youth, Life and Natureof Bellavista*), Colombia
IAAE	International Association of Agricultural Economists
ICIMOD	International Centre for Integrated Mountain Development, Nepal
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
IDB	Inter-American Development Bank, USA
IDRC	International Development Research Centre, Canada
IGAC	Instituto Geográfico Agustín Codazzi (*Agustin Codazzi Geography Institute*), Colombia
IMF	International Monetary Fund

INTA	Instituto Nacional de Tecnología Agropecuária (*National Institute for Agricultural Technology*), Nicaragua
IPCA	Investigación Participativa en Centro América (*Participatory Research in Central America*) project
IPRA	Investigación Participativa en Agricultura / *Participatory Research in Agriculture*, of CIAT
IRES	Institute for Resources, Environment and Sustainability University of British Columbia Canada
IRRI	International Rice Research Institute, the Philippines
ISDAW	Integrated System for Decision-Making Analysis at the Watershed level
ISNAR	International Service for National Agricultural Research, The Netherlands
ISP	Instituto San Pedro (*San Pedro Institute*), Yorito, Honduras
KAPAB	Komite Presten Bonaksyon, Haiti
KADG	Kooperativ Agrikol Devlopman Gobert, Plaisance, Haiti
KKLD	Koperativ Kapwan Lamo Dondon, Haiti
MAG	Ministerio de Agricultura y Ganadería (*Ministry of Agriculture and Livestock*), Ecuador
MAGFOR	Ministerio Agropecuário y Forestal (*Ministry of Agriculture and Forestry*), Nicaragua
MASS	Metropolitan Area of San Salvador, El Salvador
MBC	Mesoamerican Biological Corridor
MIS	Manejo Integrado de Suelos (*Integrated Soil Management*)
MOVIMONDO	NGO for international cooperation and solidarity, Honduras
NARES	National Agricultural Research and Extension System
NORAD	Norwegian Agency for Co-operation for Development
ODH	Operation Double Harvest
OREL	Organization pour Relèvement de la 3a Section, Haiti
PAAR	Programa de Administración de Areas Rurales (*Administration of Rural Areas Program*), Honduras
PADF	PanAmerican Development Foundation
PARDYP	People and Resource Dynamics Project
PDA	Proyecto de Desarrollo de Area (*Area Development Project*), Yoro, Honduras
PDF	Portable Document Format
PES	Productores Empresarios de Semillas Artesanales (*Small Seed Production Agro-enterprises*)
PIEN	Proyectos de Innovación Estratégica Nacional (*Strategic Innovation Projects*)
PITA	Proyectos de Innovación Tecnológica Agropecuaria (*Agricultural Innovation Projects*)
POSAF	Programa Socioambiental Forestal, Nicaragua
POT	Plan de Ordenamiento Territorial (*Territorial Planning*), Colombia
PROINPA	Fundación Promoción e Investigación de Productos Andinos (*Foundation for Promotion and Research of Andean Products*), Bolivia

PROLESUR	Proyecto Lempira Sur (*Lempira Sur Project*), Honduras
PRONADERS	Programa Nacional de Desarrollo Sostenible (*National Program of Sustainable Development*), Honduras
REDCAPA	Red de Instituciones Vinculadas a la Capacitación en Economía y Políticas Agrícolas en América Latina y el Caribe (*Network of Institutions Linked to Training in Economics and Agricultural Policies in Latin America and the Caribbean*)
RII	Rural Innovation Institute, CIAT
RNRRC	Renewable Natural Resources Research Centre, Bhutan
SANREM	Sustainable Agriculture and Natural Resource Management, a CRSP project
SDC	Swiss Development Cooperation
SEC	Secretariat of the TAC
SERTEDESO	Servicios Técnicos para el Desarrollo Sostenido (*Technical Services for Sustained Development*), Honduras
SIBTA	Sistema Boliviano de Tecnología Agropecuario (*Bolivian National Agricultural Technology System*)
SIPSE	Sistema de Planificación, Seguimiento y Evaluación (*Planning, Monitoring, and Evaluation System*) of SIBTA
SOL	Supermercado de Opciones para Ladera (*Supermarket of technology options for Hillsides)*
SUNY	State University of New York, USA
TAC	Technical Advisory Committee of the CGIAR
TPMs	Transitional Probabilistic Matrices
UBC	University of British Columbia, Canada
UCOSD	Unión de Campesinos Organizados de San Dionisio (*Union of Organized Rural People of San Dionisio*), Nicaragua
UMATA	Unidad Municipal de Asistencia Técnica Agropecuaria, (*Municipal Unit of Agricultural Technical Assistance*), Colombia
UMC	Unidad de Manejo de Cuenca (*Unit of Watershed Management*)
UNA	Universidad Nacional Agraria (*National University of Agriculture*), Nicaragua
UNAH	Universidad Nacional Autónoma de Honduras (*National Autonomous University of Honduras*)
UNAN	Universidad Nacional Autónoma de Nicaragua (*National Autonomous University of Nicaragua*)
UNEP	United Nations Environment Program, Geneva
UNORCAC	Unión de Organizaciones Campesinas Indígenas de Cotacachi (*Union of Peasant and Indigenous Organizations of Cotacachi*), Ecuador
USAID	United States Agency for International Development, Washington
USDA	United States Department of Agriculture
WFCP	Water and Food Challenge Program
WV	World Vision

Abbreviations

CBO	community-based organization
CBWM	community-based watershed management
DST	decision-support tool
ESSA	environmentally and socially sensitive areas
F	female
GIS	geographic information systems
INRM	integrated natural resource management
LDC	less developed countries
M	male
NGO	nongovernmental organization
NRM	natural resource management
PM&E	participatory monitoring and evaluation
WTP	willingness to pay

APPENDIX 1 FLSP and PRDU Projects, Southeast Asia

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.

Background

CIAT has been conducting forage research in Southeast Asia since 1992, commencing with forage varietal selection and evaluation, both in experimental plots and on farms, in seven countries. One main outcome of this work was the identification of ~40 broadly adapted and robust forage varieties with demonstrated potential to deliver significant impacts on smallholder farms throughout the region. The outcomes of this research are documented in several CIAT publications (Horne and Stür, 1999; Stür et al., 2000; Stür and Horne, 2002; Stür et al., 2002).

In 2000, CIAT secured funding from the Australian Agency for International Development (AusAID) for a five year project to "integrate forage and improved livestock management strategies into upland farming systems of Laos using participatory research approaches". The project works with 36 partner staff from national, provincial and district government agencies, conducting research and extension aimed at:

- increasing income by improving the productivity of small and large livestock;
- increasing labour efficiency and reduce women's workloads in the livestock production systems;
- enhancing sustainable cropping systems by increasing soil fertility and reducing soil erosion; and,
- sustaining livestock production within the national policy of stabilising shifting cultivation

In the first field season (starting June 2001), the project supported **small scale testing** on farms during which time farmers evaluated forage varieties in small plots and sorted out which they preferred and wanted to expand. This was a time when the district and provincial staff also learned about the varieties, their environmental adaptation and the **process of working in partnership with farmers**

Building on the experiences of the first year, the second field season (starting June 2002) was a period of **expansion** based on targets set by the project (e.g. the number of villages was doubled and the number of farmers tripled) or targets set by farmers (based on the desire to get large enough areas of forages to have some significant quantities of feed for their animals). Farmers generally started to look for ways of utilising the most promising forage varieties to either help resolve current problems or to develop new opportunities. During that second year the project challenged field staff with **new villages, new technologies** and **many new farmers** to encourage them to move away from a dependence on the very intensive one-to-one processes that had been used in the first field season and move more towards farmer group processes.

Leading up to the third field season of the project (starting June 2003), interesting, sometimes novel, often unexpected impacts started to emerge. The district staff had become very familiar with the processes of working in partnership with farmers. Indeed these processes are now becoming their 'comfortable norm' back to which they will retreat naturally, given the support of their organisations. Further expansion will not now be driven by project targets but by **IMPACTS**. This focus on "impacts driving expansion" will be the focus of the project for the next two wet seasons. By 2004, the project will be supporting the most experienced and confident farmers as field extension workers to help with the expansion of impacts to more people and more villages. At the same time the Extension Managers (the bosses of the field staff) will become much more actively involved in the process.

Project Review

In August 2002, AusAID sent a technical reviewer to:

> (i) assess FLSP progress to date in relation to achievement or likely achievement of project objectives
>
> (ii) 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 and
>
> (iii) make recommendations as appropriate to enhance the quality of FLSP implementation in a manner that does not lead to significant project cost increases.

The review concluded that "the project is on course for meeting its objectives and is pursuing the wider outcomes necessary for the sustainability of the program, as indicated by the following:

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

The review went on to recommend that to continue this process and to accelerate adoption, the project needs to:

(i) expand the extension strategy concept to an enlarged community-based group approach with selected farmers having a training role,

(ii) within this framework, increase the capacities of extension staff in on-farm analysis of options within smallholder farming systems,

(iii) focus in the coming year on consolidation of impacts and on skills of field staff rather than just on expansion,

(iv) increase its outreach to rural women,

(v) give priority to the issue of nutrient recycling

(vi) implement the proposed strategy of disease minimization to meet farmers' needs for improved animal health

These recommendations defined the project's field activities in 2003, which aimed to:

- **enhance information exchange**, (i) between farmers within villages (ii) between villages and (iii) between extension workers and farmers
- **generate genuine impacts** not just increases in area.
- **work with focus groups** in the field rather than individual farmers
- **work with women's groups**
- **develop case studies** to quantify impacts not just outputs
- **expand** to new farmers and villages **only where there is real momentum**
- support district teams with the training, mentoring and resources they need to be able to **organise cross visits / field days**
- **develop extension materials** for scaling out from local successes.

Progress with Institutional Strengthening

1. Development of institutional capacity through formal training

The FLSP continues to provide on-going training inputs to consolidate the skills, knowledge and confidence of the field teams. In 2003 year, the FLSP organised ~260 individual training opportunities for staff (see Table on following page) most of which were in-the-field, on-the-job mentored training events.

2. Development of institutional capacity through informal, on-the-job training

In a review of the project's institutional strengthening activities, AusAID commented that...

> "The GOL Extension staff working with FLSP are providing to farmers the opportunity they need to get started. They are doing this in three ways.
>
> - By talking with farmers in a supportive, facilitative way as partners in achieving a common goal.
> - By being the source of planting material for forages.
> - By being knowledgeable about the characteristics of the species and their method of planting and management.
>
> The quality of communication is put first because it remains paramount in all development work whereas the other two factors will change. Planting material increasingly will come from other sources and farmers will know how to plant and tend forage species. The character of the technical information required - the accuracy of which is the core of Extension staffs' credibility - will change. Farmers will want to

discuss with Extension staff the mix of elements within his farming system that best meets his goals. Therefore the next challenge in staff development is to raise the analytical capacity of staff to a level where they can add value to that discussion."

In a workshop in January 2003, district staff identified the following two issues in response to the AusAID review:

Issue 1 with the decrease in technical problems, the main extension issue will be to **facilitate opportunities for more farmers to become aware of the impacts from using forages**. Farmers will need to plan their livestock systems based on their various resources. This is difficult for inexperienced field staff to supervise. Thus they need to rely on 'farmer to farmer' extension approaches using cases of impacts and cross visits

Issue 2 due to the rapidly number of farmers involved, it will be necessary for staff to interface with villagers through **groups**, rather than working with individual farmers as in the past

The training events conducted throughout the year addressed these issues:

Training event	Timing	Location	Participants
Case Study and Cross Visit methodology workshop	19 – 22 November 2002	Luang Phabang	16
Case Study and Cross Visit methodology workshop	24 – 29 November 2002	Xieng Khouang	11
Workshop to develop cross visit methodology	08-13 December 2002	Luang Phabang	17
Workshop to develop cross visit methodology	16-19 December 2002	Xieng Khouang	11
Opportunities for improved feeding, management and health of village goats (run by ILRI)	16 – 19 December 2002	Luang Phabang	14
Workshop to review case studies of impacts	13-14 January 2003	Vientiane	8
Training workshop on Cross Visit and Case Study Methods	10-14 February	Luang Phabang	26
Staff Cross visit to another participatory R&D project	16-20 February 2003	Sayaboury	24
Smallholder forage seed production systems	09 – 15 March 2003	Pakchong and Khon Kaen, Thailand	1
Village planning workshop methodology	25-29 March 2003	Luang Phabang	16
Village planning workshop methodology	31 March – 02 April 2003	Xieng Khouang	9
Technical training workshop	01-03 May 2003	Luang Phabang	23
Technical training workshop	05-08 May 2003	Xieng Khouang	17
English training for district staff	On-going (from 1-2 hours / d)	Luang Phabang	13
Computer skills training for district staff	5 days/week X 1h/d X 3months	Phonsavanh	3
Field visit to forage systems in Vietnam	18-23 August 2003	Tuyen Quang	20
Workshop on Village Focus Group meetings	08-19 September 2003	Luang Phabang and Xieng Khouang	40

In early July 2003, Dr. Patten Bridge (a training specialist from Charles Sturt University working with FLSP) observed the substantial progress made by district staff and suggested that we establish a training and development framework to give a clear articulation of the relevant competency requirements for district staff to be effective in their forage extension work. Developing such a framework would provide a range of benefits:

- a clear articulation of management expectations from extension staff
- a pathway for participants to follow in developing the required competencies
- a mechanism for identifying priorities and planning for training interventions
- an opportunity for most of the learning to happen on-the-job rather than in a classroom
- an opportunity to create a level of "Certification" which would provide recognition for achievement for district extension staff which would be relevant past the life of the FLSP project.

3. Development of institutional capacity through policy makers

Livestock systems across Southeast Asia are incredibly diverse. Farmers in some countries tend to be more market-oriented than others, with Vietnam being the best example. There are many reasons for this...cultural, socio-economic and infrastructural. Laos is a country at the other end of the spectrum and yet, the pressures of shifting cultivation farming systems are resulting in real opportunities for farmers to make a major 'systems-shift' away from cropping and into specialisation in livestock. The introduction of forages is the key factor enabling farmers to make this shift, providing fo rthe first time a controllable feed resource that has in turn allowed them to contemplate developing a livestock enterprise that generates cash to buy staple foods. But what institutional changes are needed to support such fundamental changes?

In northern Vietnam in 1997, CIAT was asked to assist livestock staff in one district of Tuyen Quang province to assist them in finding new feed resources for buffalo. The main problem was a lack of feed in the dry season. The area is dominated by rice paddies and intensive upland cropping on the low elevation intervening ridges. CIAT worked with staff from the Department of Agriculture and Rural Development (DARD) to evaluate a small range of forages over the subsequent two years in trials with farmers. After these two years most of the farmers said that while the forages grew very well, they didn't really have enough land to devote to forages and, besides, the problem was not serious enough to warrant such effort as their animals could roam freely to find feed. If their buffalo lost weight in the dry season, they'd always gain weight again in the wet season. CIAT almost decided to stop working in this location except that two farmers experimented with the forages and discovered that 3 varieties were excellent feed for their fish. This was a revelation because (i) ponded fish are an important livelihood activity in this area (ii) farmers spend up to 4 hours per day collecting feed from far away for their fish (iii) the feed is poor quality and (iv) in the dry season their fish were dieing from lack of feed. As the local saying goes, "no-one hears the cries of the hungry fish". Suddenly there was renewed interest in the forages. The number of farmers planting forages started to climb again...and now they were planting significant areas integrated into their intensive farming systems. By 2001 there were more than 500 farmers growing forages.

At this point the system started to diverge. The local authorities banned free grazing of buffalo and cattle, so farmers became interested again in forages for their large animals. The local authorities saw an opportunity for commercialising livestock production so invested in a dairy project. Some farmers started to grow forages as a cash crop, both for leaf and for cuttings. Some farmers replaced paddy land with forages, doubling their economic returns per unit of

land. By 2003 there were ~3000 farmers and more than 600 hectares of intensively managed forages.

Such changes do not happen spontaneously. Strong technical, institutional and regulatory support was needed from local government institutions. Similar support will be needed in Laos to facilitate a similar scaling-out of local successes. To start an on-going engagement with policy makers on these issues, FLSP organized a field visit to Tuyen Quang for 20 key national, provincial and district officials from Laos with two objectives in mind:

1. to meet with some farmers who have changed their livelihood systems using livestock and to discuss what impacts this has had on their lives.

2. to discuss the history of development of specialized smallholder livestock systems in the uplands of Tuyen Quang and to find out the kinds of support that the district, province and national organisations had to give to encourage this specialisation in livestock systems.

This field visit proved to be a powerful 'vehicle' for convincing government officials that significant change is possible in Lao upland systems based on intensification of livestock production and that they have a key role to play in such intensification.

4. Development of institutional capacity through partnerships

Through FLSP, CIAT is helping its Lao partner government organisations develop new methods to support Scaling Out and Scaling Up of emerging impacts in livestock systems. To help bring this about, in 2003 we worked with Charles Sturt University (in Australia) to develop a new ACIAR-funded project to work with FLSP: "*Accelerating the Impacts of participatory Research and extension on shifting cultivation farming systems in Laos*".

The main rationale of this new project is that some impressive, sometimes unexpected, impacts are now emerging from the FLSP, both on farming systems and on social capital in villages and government institutions. These impacts are currently localised but could potentially be widespread. The FLSP does not, however, have the capacity to independently develop the processes that are needed to help spread the benefits of these impacts to more people, more quickly and more equitably. So, within this context, the broad objectives of new ACIAR project are to investigate effective ways to:

1. Understand how and why farmers are able to move away from a reliance on shifting cultivation through their use and innovation of livestock technologies.
2. Accelerate and spread impacts resulting from participatory research and extension.
3. Facilitate organisational learning and development towards participatory approaches.

Many development projects concentrate their efforts on changing farming systems through technical interventions, expecting that expansion of impacts will somehow occur naturally. This rarely happens. The focus of this new research project on the other key areas, namely research & extension processes and the organisational setting, will develop insights into 'scaling out' that

will have implications beyond the geographic and institutional limits of the FLSP. The expected direct outputs are:

1. Understanding of the factors influencing farmer capacity and willingness to make the transition to more sustainable farming systems in upland areas
2. Practical guidelines on how to accelerate and spread the impacts of participatory research and extension, published as a book in CIAT's "Research for Development Series"
3. Improved, innovative and culturally appropriate methods for institutionalising participatory research approaches for upland systems development

The project commenced in August 2003 and will work closely with the FLSP for the subsequent two and a half years. Findings will be presented at the CIAT Annual Review in 2004.

Progress with developing Extension Methodologies

For scaling-out to occur in the field, extension needs to be based on well documented cases of local successes with improved livestock systems. These cases of impacts can then be the focus of well structured field days, cross visits and farmer exchange meetings. Through FLSP, CIAT has been developing these methodologies and strengthening the abilities of field staff to use impacts to drive expansion.

Case studies are starting to emerge that show how smallholder farmers are making fundamental changes to their livelihood systems using simple technologies that improve their livestock systems. These cases are being used as:

1. ***Posters*** which highlight maybe one to three cases in a single poster around a common theme
2. ***Case study sheets*** which highlight the main features of each case of impact in detail, to be used by the district staff for field days and cross visits
3. ***Fliers*** of each case study of impact that can be given to farmers in a small form and posted in villages in a large form

These extension materials developed from cases of impact will be complemented with ***"tech sheets"*** which highlight common technical problems and opportunities associated with each case. Ten case studies have been documented so far. An example case study is shown below:

Free-range grazing was more like fishing or hunting; sometimes farmers would find their cattle, sometimes not. Teo Singh is shifting from this traditional minimal-management system, to penning his cattle near the house and feeding them on forages. Cattle will soon replace upland rice as the most important source on income for the family.

Hunting for cattle

Houei Hia is a village of the Kasak ethnic group, half way up the main mountain range just south of Laung Prabang. The Kasak use slash and burn techniques to cultivate upland rice, on a rotational basis, which has allowed the village to remain in the same location for over a hundred years. Teo (Mr.) Singh is one of the 78 households of the village. But through some health problems and having a young family, they have had less labor available and so been able to cultivate less upland rice than other families.

Teo Singh also owned a cow and calf. However for Houei Hai villagers, keeping livestock has been more a means of capitol accumulation, than a source of income. The traditional management practices for cattle raising were minimal to non-existent. Cattle were left to roam and graze in the hills, and in the wet season would cause damage to crops, often resulting in conflicts within the village. He or his wife would go to inspect their cattle once every 3-4 months, usually taking 2-3 days to find them in the forest. Villagers often lost animals without knowing the reason, whether through disease, injury or theft. When villagers wanted to slaughter an animal, it was often easier to shoot it than to try to catch it and bring it back to the village. Raising cattle this way was like fishing or hunting, sometimes you got something, sometimes you didn't.

Bringing the Cattle Home

When forages were first introduced as a trial to the village in 1997, Singh did not expect they would be useful. Of the seven farmers who participated in the trial, only his plot established and became productive. With a supply of forages on his doorstep, he decided to keep his cow and calf tethered next to the house for the production season and use the forages to feed them. The cattle from the forest were shy to begin with, but by the end of the season they had become accustomed to the feed, and their owner. When Singh released them to graze again at the end of the wet season, they continued to graze close by, and every few days return for a little forage grasses and some salt.

With the forages close by, Singh was able to feed them three times a day, so he could provide more feed than when he had to travel to collect native forages. Not only the quantity, but the quality was better also. Even when fed large quantities of native grasses, he found that the cattle's stomachs shrunk quickly, whereas with forages they stayed full. When feeding them he provided them a mix of different grasses, but always included some stylo. The cow and calves gained better condition and he could gain a higher price when he sold them. He compared one calf he raised this way which he sold at 10 months for 850,000 Kip, while his neighbor Teo Ouan, obtained just 650,000 Kip for a calf 12 months old. His wife who raised pigs, began to use stylo too. She normally sold pigs once their girth reached '2 fists'. When she added stylo to the feed, the pigs reached 2 'fists' in just 3 months, instead of 5 months as before.

As his herd increased, he expanded his original plot near the house until by 2002 it was about 0.6 ha. By the beginning of 2003 Singh's herd had increased to 5 cows, with 2 pregnant. Singh is now committed to keeping his cattle close to the house so that he can feed and manage them; "this is the only way to gain income from raising cattle". But without forages, he would need to

spend large amounts of time collecting native grasses, and so would be able to raise no more than 3 cattle at a time.

A New Family Livelihood

Singh has reduced the area of upland rice he cultivates from about 2 ha to less than 1 ha and plans to stop altogether next year. If he can build up his herd, he will be able to rely on the sale of animals to purchase rice. He aims to increase his herd to 5-7 cows so that he can sell 3 calves each year. Then, along with the sale of pigs and goats that his wife raises, they would have enough income for rice and their other needs. To have enough feed for all these animals he estimates he will need about 1 ha of forages. The plot close to their house has already reached its limit, so Singh has cleared and is fencing a large new field. Forage grasses will be established in the bottom half of the field, and in the top half he will corral his herd. Manure from the cattle fed on the forages will then flow down the hill and fertilize the forage grasses below.

Two years ago 2 more farmers began to grow forages to feed their cattle like Singh. As they began to see the benefits of forages, a further 12 households have begun growing forages in 2003. This represents a dramatic transition from free-range grazing, where just finding and catching the cattle was in doubt, to an integrated system of livestock management and feed is being established. It will release the families from the endless cycle of swidden cultivation. With the income generated and the time and labor released, the Houei Hia villagers will begin to have the opportunity to diversify into other enterprises and do better than struggling to just have enough. As Singh's wife said, "we want our children to go to school, and not to be poor like us".

Participatory Research for Development in the Uplands (PRDU) Project: Southeast Asia

3.6 Southeast Asia

Though considerable advances have been made in poverty alleviation in Southeast Asia, poverty still remains high in upland rural areas, particularly among ethnic groups. Major lending agencies are now devoting attention to development of new approaches for poverty alleviation, including consulting the poor as to their problems and possible solutions. Rural communities need to be strengthened at the village level so that they can play a greater role in working towards more sustainable livelihoods.

The International Fund for Agricultural Development (IFAD) is funding the *Participatory Research for Development in the Uplands* (PRDU) Project for four years (2003 to 2007) under grant number TAG-607: *Programme for Integrated Upland Agricultural Development Using Participatory Approaches in China, Laos, and Viet Nam.*

PRDU is a joint project between CIAT and the International Potato Center (CIP) and works alongside five IFAD investment projects in the P.R. China, the Lao PDR, and Viet Nam. The overall goal of the project is to improve sustainable livelihoods of resource-poor farmers in steep

upland areas through the introduction of technical innovations that build on indigenous knowledge and by demonstrating institutional innovations that facilitate the development process.

The project's research and development activities will be implemented largely through partnerships with national government organizations working at the provincial and district levels. The project coordinator (Dr. Keith Fahrney) began his appointment in January 2003 and initiated consultations with various stakeholders in the three countries. Field visits were made to each of the five investment projects, to discuss agricultural development and land-use management problems and opportunities with staff of the investment projects, their implementing partners, and farmers in the target areas. Investment projects and their implementing partners made preliminary selection of focus sites (village clusters), which will be used for research and development activities with PRDU. Focus sites are representative of the larger target area and will serve as centers for participatory technology development and subsequent training for dissemination of promising technologies and methodologies.

In September 2003, PRDU convened a start-up 'Stakeholders' Workshop.' Representatives from each of the IFAD investment projects and implementing partners met with staff from IFAD, CIAT, and CIP to exchange information and plan research, development, and training activites for the first project year. Each of the investment projects presented information on social and bio-physical conditions in their proposed focus sites and suggested topics for research and development with PRDU. CIAT and CIP reported on their respective areas of expertise, including crop and forage technologies and participatory approaches for technology development. On the second day of the workshop, each of the investment projects and their implementing partners proposed research and training activities (Table 1). Priority for first-year activities will be given to training on participatory methodologies for development of technologies with villagers and for technical areas where CIAT and CIP can provide direct support. When necessary, the PRDU project will facilitate support from external resources (other CG centers, national partners, NGOs, etc.) to assist villagers to solve their production and land management problems.

Table 1. **Proposed Research and Training Activities for First PRDU Project Year**
(Listed in approximate order of frequency of requests &/or accordance with CIAT/CIP strengths)

Research	• Forages for Large Ruminants (grasses, legumes, fodder trees) • Forages for Small Ruminants (mostly roots, tubers) • Alternative Famine Foods (food/feed roots & tubers) • Multi-purpose Legumes (food, feed, conservation) • Sloping Lands Technologies (contours, perennial plantings) • Forages/Feed Processing • Variety Trials of Maize • Domestication of Non-Timber Forest Products • Market Surveys (vegetable crops) • Vegetable Production • Specialty Tea Production • Mushroom Production • Improving Livestock Breeds
Training	*Participatory Methods* • Village-level Diagnosis of Problems and Opportunities • Market Surveys *Technologies* • Promising technologies (extension staff) • Promising technologies (farmers) • On-Farm Research Methods • Forage Production • Feed Processing • Livestock Management • Sustainable Management of Non-Timber Forest Products
Study Tours	• Livestock Production (large ruminants) • Community Forage Management • Community Forest Management