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Project PE3

Community Management of Hillside Resources

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Annual Report 1999

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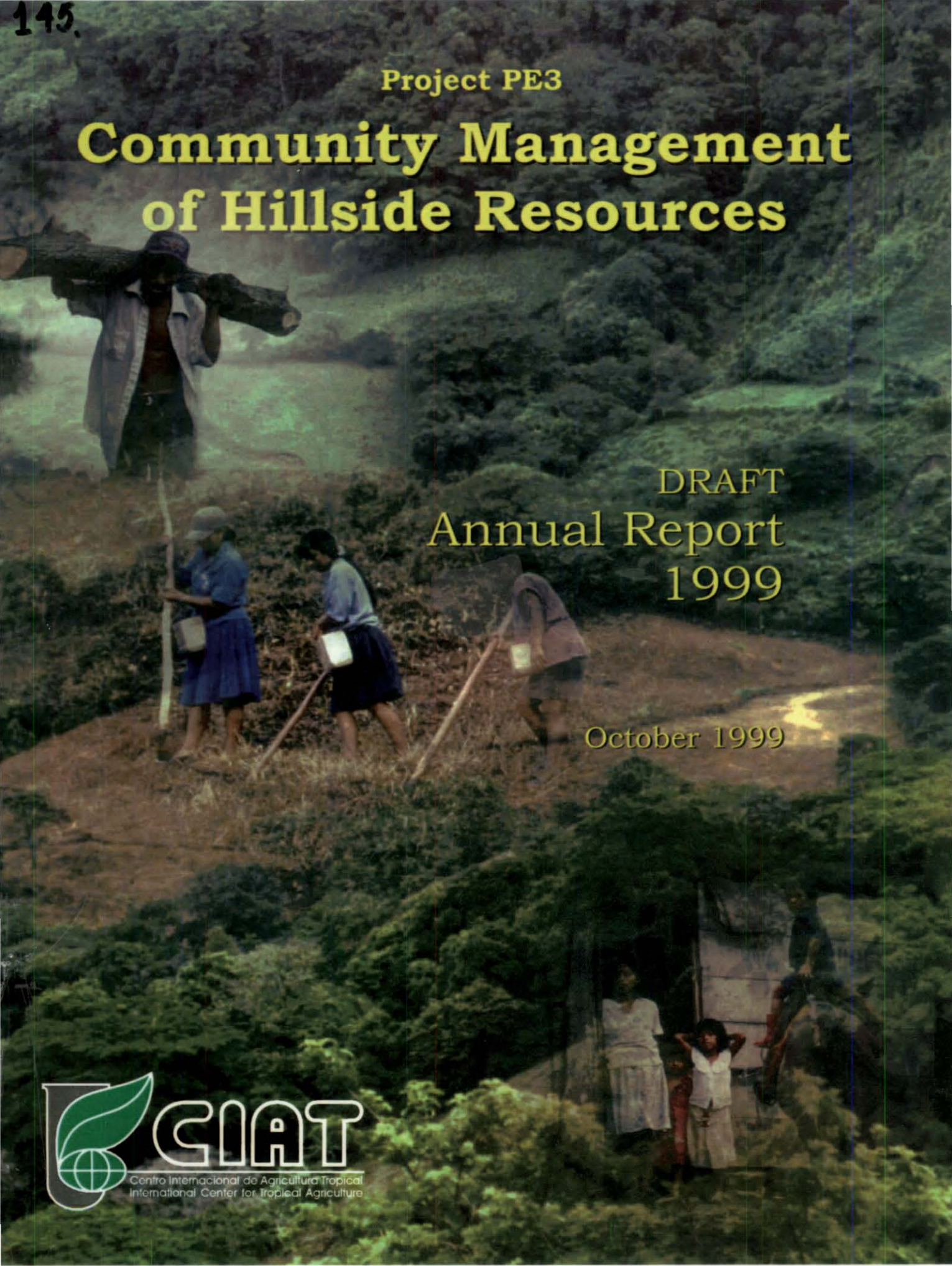

CIAT

Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

PROJECT PE-3

COMMUNITY MANAGEMENT OF NATURAL RESOURCES IN HILLSIDE AGROECOSYSTEMS OF LATIN AMERICA

ANNUAL REPORT 1999

October 1999

Project PE-3: Community Management of Natural Resources in Hillside Agroecosystems of Latin America

CONTENTS

Output 3: Organizations strengthened

Output 4: Decision-makers supported

Output 5: Efficient, participatory project management

Project PE-3: Hillsides - Community Management of Watershed Resources in Hillside Agroecosystems of Latin America

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

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

Gains: Farmers and locally organized producers use technologies, tools, and methodologies developed by CIAT and its partners at the level of reference sites. The results are sustainable and profitable production systems, improved land use, and natural resource preservation at the landscape level.

Partner organizations use technologies, tools, and methodologies developed by/with the project for their planning and activities at the local, national, and regional levels. Decision makers at different levels have more information, tools, and methodologies provided by the project to support their planning, monitoring, and decisions.

Milestones:

2000 Sustainable and profitable production systems, improved land use, and natural resource preservation at the farm level within reference sites.

2001 As for year 2000, but reaching the landscape level within reference sites. Partner organizations use the outputs of the project for their activities at the local, national, and regional levels.

2002 As for year 2001, but beyond the reference sites. Decision makers at local, national, and regional levels use the results of the project for their activities.

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

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

CGIAR system linkages: Enhancement and Breeding (10%); Protecting the Environment (60%); Saving Biodiversity (10%); Improving Policies (20%).

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

Project PE-3: Community Management of Natural Resources in Hillside Agroecosystems of Latin America 1999

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

Output 1
Production systems improved

- **1.1** Diagnose farm reference sites (study land use, analyze sustainability and profitability of production systems
- **1.2** Ex-ante evaluate improved system alternatives (identify markets, perform simulation modeling)
- **1.3** Participatively identify, investigate, and validate alternatives to improve production systems
- **1.4** Validate new alternatives and improved practices

Output 2
More sustainable landscapes

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

Output 3
Organizations strengthened

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

Output 4
Decision-makers supported

- **4.1** Identify, at different levels, decision-makers related with Project tasks and diagnose their needs in terms of support for their work
- **4.2** Generate information, tools, and methods to support decision taking at different levels
- **4.3** Strengthen capacity for management and use of information, tools, and methods (train, diffuse, and follow up the process)
- **4.4** Provide technical support for decision taking
- **4.5** Promote the setting in action of processes of sustainable rural development

Output 5
Efficient, participatory project management

- **5.1** Conciliate the active participation of partners in the Project's planning in the region
- **5.2** Actively and permanently coordinate the reference sites, projects, and individuals working in the region
- **5.3** Maintain an efficient information system within the Project and with its partners
- **5.4** Strengthen joint work with other projects and organizations
- **5.5** Establish a participative system of monitoring and evaluation of the Project to monitor its performance and feed back to planning
- **5.6** Initiate on-site activities of impact evaluation

PE-3 Project logframe for 1999-2001[a]

Narrative summary	Verifiable indicators	Means of verification	Risks/assumptions
Long-term objective/ GOAL To improve the standard of living and food security of hillside farmers in Tropical America and make their interaction with the environment more sustainable.	• Reduced infant mortality • Reduced maternal mortality • Reduced soil erosion • Improved water quality in rivers and streams • Increased income (monetary and/or in kind)	• National and local statistics • Local research	• That the environmental, social, economic, and political conditions, on a macro level, are maintained
Short-term objective/ PURPOSE To strengthen local processes of sustainable rural development in the hillsides of Topical America, based on the experiences of natural resource management at benchmark sites.	• Groups residing at five work sites in Honduras and Nicaragua are successfully implementing land management initiatives consistent with those validated by the Project and its partners • At least 15 key entities of the region have access to at least three tools and methods developed by the Project	• Field verification • Institutional reports	• That local partners continue Project-related activities • That donors remain interested in the proposed Project objectives and continue to give support
OUTPUT 1 **Production systems improved** Farmers use technologies developed by CIAT and its partners to establish sustainable and profitable production systems.	• Screening alternatives in demonstration parcels in San Dionisio, Yorito, and Cabuyal ("supermarket of options for hillsides") • Validating alternatives in at least 25 Committees for Local Agricultural Research (CIAL, its Spanish acronym) in San Dionisio and Yorito • Alternatives adopted by at least 100 farmers at Project work sites • Successful alternatives being transferred to at least 12 sites other than the initial work sites	• Field verification • Project reports • CIAL reports	• That climate variability is normal

Continued.

[a] For acronyms and abbreviations, see page 115.

PE-3 Project logframe for 1999-2001 continued

Narrative summary	Verifiable indicators	Means of verification	Risks/assumptions
OUTPUT 2 **More sustainable landscapes** Land use has improved across the landscape because locally organized farmers are using the tools and methods developed by the Project and its partners.	• Three local consortia of NRM operating at work sites in Honduras, Nicaragua, and Colombia • Five local consortia of NRM in formation at other sites of Central and South America • Stable water quality (sediments and contaminants) as integrating indicator of the status of natural resources in at least three microwatersheds at the work sites • Environmental monitoring initiated in at least two work sites in Honduras and Nicaragua	• Consortia reports • Monitoring reports	
OUTPUT 3 **Oganizations strengthened** Local and national organizations involved in sustainable rural development at various levels (site, national, regional) use the technical and methodological resources developed by the Project in their decision-making and other activities. Inter-institutional coordination is enhanced.	• At least 25 CIALs operating at Project work sites • At least 30 CIALs in formation at other work sites in the region • At least 20 national technicians trained and promoting CIALs	• CIAL reports • Training reports • Institutional reports	
OUTPUT 4 **Decision makers supported** Decision makers at various levels use and have access to more information, tools, and methods to use in decision making, planning, and monitoring.	• At least two technicians of each collaborating institution trained and using tools developed by the Project and its partners • Digital information (CD-ROM and Web site) available and accessible in Honduras and Nicaragua, and in process in other countries • Local decision-makers at the level of three municipalities with access to site-specific information on natural resources and trained to use this information		

Continued.

PE-3 Project logframe for 1999-2001 continued

Narrative summary	Verifiable indicators	Means of verification	Risks/assumptions
OUTPUT 5 **Efficient, participatory project management** Different internal and external partners directly participate in project management to ensure adequate and efficient use of the Project's resources.	• Plans and reports opportunely prepared and approved by previously established authorities • Partners are well informed and actively participate in fieldwork at the Project sites (local consortia) or elsewhere • National hillside consortia operating in Honduras and Nicaragua • Regional hillside consortium operating • Experiences and lessons learned by the Project and its partners disseminated in Latin America through different channels (networks, publications, meetings, etc) • New projects adopt methods, techniques, and experiences generated by the Project and its partners	• Planning documents and reports • Proceedings of the meetings of the Consultative Group and the Executive Committee • Reports of members and consortia • Dissemination materials and Project reports • Direct verification in networks and consortia	

Major Highlights

Output 1: Production systems improved

- Socioeconomic and biophysical data compiled for Honduras and Nicaragua
- Impact of improving water quality assessed for San Dionisio watershed
- Capacity developed to simulate water courses in a community watershed from digital terrain models
- Trial version of forages database on a graphical platform accessible to selected scientists via the Internet
- New booklets produced by CIALs adapted to regional context and include CIAL experiences
- Identification of bean and maize selection criteria used by producers
- Hillsides Options Supermarket (SOL, its Spanish acronym) sites being established in Honduras and Nicaragua with options designed and being implemented in the field

Output 2: More sustainable landscapes

- State of 15 microwatersheds of Calico River evaluated after hurricane Mitch and study results diffused to other institutions active in the area
- Market options evaluated and selected for the pilot subregion of Yorito and Sulaco, Honduras
- Market options of Tascalapa River watershed evaluated in participation with small-scale producers
- Photographic catalog available of land use and cover in San Dionisio, Nicaragua
- GIS characterization completed of Jalapa microwatershed, Honduras
- Database on Honduran soils produced
- Multi-institutional forum held in Tegucigalpa, Honduras as first step to creating a permanent linking mechanism between institutions working on the topic of slash-and-burn alternatives
- Consortium formed for the Manejo Integrado de los Suelos de Centro América (MIS)
- Forest area at Jalapa microwatershed analyzed from aerial photography

Output 3: Organizations strengthened

- Strategic planning meetings and a workshop in Colombia to conform inter-institutional consortia and elaborate project proposal for the application of eight decision support tools in the municipality of Bolívar
- Stakeholder analysis methodology presented at workshops in Colombia and the Dominican Republic
- Training of trainers in the stakeholder analysis methodology in Colombia, the Dominican Republic, and Honduras
- CIAT GIS support to Honduran organizations helped assess the impact of hurricane Mitch and plan relief efforts

Output 4: Decision-makers supported

- Community needs defined in Yorito, Honduras
- Carried out scenario analysis of water and land use interactions for the Cabuyal River watershed using a process-based, data-economic, simulation model
- Simplified hydrological model used in evaluating different scenarios of land use/cover
- Impact of deforestation on slope stability assessed for Ovejas watershed
- Topographical features identified associated with land cover in Cauca, Colombia
- Workshop held at University of Georgia for project research collaborators
- Workshop held in Managua, Nicaragua for donors, Nicaraguan government institutions, nongovernment organizations, and university stakeholders
- A 250-page training workbook on "multiscale goal-driven" methodology for use in workshops developed and tested
- Locally defined poverty indicators extrapolated to national level
- Labor productivity and natural resources assessed at the national level in Honduras
- A manual developed for local organizations on how to use ArcView with local maps; the manual was tested in Yorito, Honduras
- Map of Honduras produced relating "poverty" indicators and soil erosion
- Twenty institutions trained in the use of the Digital Atlas of Honduras
- Productivity and natural resources assessed at the national level in Honduras

Output 5: Efficient, participatory project management

- Project's Web page updated and new products included
- Two issues of the Project bulletin produced and sent to 30 institutions in Honduras and Nicaragua
- Participatory monitoring and evaluation (PM&E) initiated in three case study projects—SOL project, IPCA project in Yorito, GTZ-AFOCO project, Yuscarán, Honduras
- Intermediary and final indicators defined for evaluation of impact in the reference sites

Seeds of Hope Project

- Training of farmers on field management and postharvest management
- 25 of 37 departments and 107 municipalities in Honduras and Nicaragua received project seed
- About 22,000 farmers directly benefited in Honduras and Nicaragua

Executive Summary

Towards the end of 1998, the PE-3 Project revised the existing logframe and changed it significantly. The Project had a firm base in decision support systems, but had become imbalanced since fragmentation into different projects. The new logframe attempts to address short-, medium-, and long-term goals. The reference sites are our biophysical laboratories, our focal points in the countries of Colombia, Honduras, and Nicaragua.

Ouput 1, "Production systems improved", seeks for impact at the farm level. Socioeconomic and biophysical data is being compiled to support development programs carried out by other entities and for research over the long-term. For the Comités de Investigación Agricola Local (*Committees for Local Agricultural Research)* (CIALs) and Supermercado de Opciones para Ladera (*Hillsides Options Supermarket)* (SOL) base we are producing useful information on markets and making ex-ante studies to try and understand the local situation. The SOL sites in Nicaragua and Honduras are putting technological options into action. The communities are participating actively in our research. Examples of work done this year are the market option analysis in Yorito and Sulaco, the ex-ante evaluation of water quality in San Dionisio, and the participatory evaluation of forages.

The sum of the farm-level work and its interaction with the environment around the farms (e.g., watershed) takes us on to the landscape approach. Thus Output 2, "More sustainable landscapes", is a consequence of Output 1 while at the same time preparing the ground for the results coming from farm-level. Studies at watershed or landscape level this year include participatory mapping, surveys of market options, diagnosis of land use, applying the methodological tools, and supporting local institutions. The Manejo Integrado de los Suelos (MIS) consortium was formed to complement research and validation activities carried out by other regional institutions. Support to Campos Verdes continues under a positive relationship with the municipal government and contributes effectively to community development.

How do we achieve more sustainable landscapes? This question leads us into Output 3 "Organizations strengthened". We must strengthen the organizations that are interacting with us and this leads us beyond the landscape level to department and country levels. It involves moving out of the reference sites and, at the same time, the meeting of a demand from outside. Workshops were held in Colombia, the Dominican Republic, Honduras, and Nicaragua. These workshops provide training and at the same time validate the nine guides that the Project has developed. The contents of the guide can then be improved and their applicability broadened. The workshops make CIAT materials accessible to many more people and institutions in the regions. Training was also given to technicians of Red Nacional de Sistemas de Información Geografica (RENASIG) in Honduras.

Decision support (Output 4) has always been a strength of the Project and continues to remain important with the nine methodological tools and other decision support (DS) tools and systems as a firm base. Most of our training is done with the use of the guides, but also with other DS elements. There exists an enormous demand for them from within reference sites and outside (e.g., Dominican Republic). Beyond the training given, the guides demand a commitment from participants to produce action plans. The authorities of the different communities then approve

these plans and they are put into action. An example of successful implementation of action plans is the work of Consorsio Interinstitutional para el Manejo de los Recursos Naturales del Norte y Centro del Valle del Cauca (COMVALLE) consortium in Valle, Colombia. This came as a consequence of the positive results obtained with the Consorcio Interinstitucional Para una Agricultura Sostenible en Laderas (CIPASLA), Cauca. We develop different kinds of tools, meeting the demand of partners with the capacities at our disposal. This year, work on hydrological models and simulation models and the development of mapping tools are some examples of this output.

Output 5 "Efficient, participatory project management" puts our house in order. The historical Hillsides Program was divided into projects, the information acquired was fragmented and moved. We decided to collect together the dispersed data and establish our Webpage to diffuse the information. Coordination of interactions helps our own work and moves outwards to partners and end users. Communication is necessary for this at all levels. The production of 2-monthly bulletins keeps collaborators and partner informed of our current activities. Our reports and documents (see Publications) are kept in centralized form and are easily available.

Coordinating at all levels is an on-going and dynamic activity. Interinstitutional activities disseminate the information generated by the Project and help its positive impact in the region. The participatory monitoring and evaluation (PM&E) study is a new adoption in the search for efficient management and will eventually extend to all outputs. At present the tool is on trial in three case study projects, the SOLs, the Investigación Participativa para Centro América (IPCA) in Yorito, and the German Agency for Technical Cooperation - Apoyo a la Foresteria Comunal (GTZ-AFOCO) in Yuscarán, Honduras.

The Seeds of Hope Project was an unforeseen emergency effort to recuperate agricultural activity in Central America after hurricane Mitch struck. We could not continue to work as usual in a disaster area without becoming strongly involved. All our knowledge and experience was used to put together a form of help, which was highly successful. In only the first few months of operation, the Seeds of Hope Project had already reached 22,000 farmers. We are not just providing seed, we are also encouraging seed production and helping strengthen organizational capacities. We have made, and continue to make, a strongly positive contribution.

Output 1: Production systems improved

Activity 1.1. Diagnose farm reference sites (study land use, analyze sustainability and profitability of production systems)

Honduras

Highlight

✓ Socioeconomic and biophysical data compiled

Objective

This activity aims to provide "baseline" information for the projects and for the process of monitoring and assessment at reference sites in Central America.

Methods

The method used was that of Ostertag (1998)[1] and forms part of a methodological package used to identify market opportunities for small-scale producers. The preparation of the biophysical and socioeconomic profile consists of the review, analysis, synthesis, and documentation of available secondary information and of data from other sources on the reference sites of Yorito and Sulaco. Aspects included in the characterization were:

1. *Physical*, including location, landscape, climate, soils, and irrigation potential.
2. *Social*, covering population, demography, educational level, well-being level, land tenure, ethnic groups, and conflicts.
3. *Economic*, including existing infrastructure, prevailing production systems, livestock inventory, areas under pastures, major economic activities (e.g., agroenterprises), marketing channels, support systems for trade and agroenterprises (financial, transportation, communications), use of agricultural inputs, and problems of natural resource conservation.
4. *Institutional*, covering the system of government and existing institutions and community organizations.

Results

The analysis provided a general panaroma of information, the key points of which are outlined below.

[1] Ostertag CF. 1998. Identification and evaluation of market opportunities for small-scale rural producers. Guide No.7 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 182 p.

- The demographic growth rate and the illiteracy rate are both high.
- Prevailing agroclimatic characteristics could favor a broad range of production systems, which are not observed in the region.
- Traditional crop production systems show low yield indexes, indicating that more profitable technological packages should be adopted.
- Use of agricultural inputs is to some extent traditional.
- The main limitations are crops planted on pronounced slopes, predominance of smallholdings, use of burning, overgrazing, shortage of forages for livestock during summer months, low fertility, loss of natural forests, decrease in water sources, and lack of appropriate technology.
- Marketing activities are to some extent traditional, but are poorly developed. Marketing channels are limited, funding is lacking, markets are distant, and communication channels in poor state.
- Although several institutions support development efforts, they present financial constraints, a deficiency in technical and administrative personnel, and limitations in office equipment and facilities.
- The marketing support system is deficient regarding financial aspects, transportation, communication in general, and market information. However, credit services are provided as well as technical assistance and grain storage.

Output

The data collected provides a basis from which to work for projects in Honduras.

Contributor: M Totobesola
Collaborators: SN-1 Project and Agronomía Genetica y Tecnología (AGROGENET), a consultant company.

Nicaragua

Highlights

- ✓ Socioeconomic and biophysical data compiled
- ✓ Agreement signed with the Universidad Nacional Agraria (UNA), Nicaragua, on project management
- ✓ Training given to students and advisers in modeling methodology
- ✓ Fieldwork begun on characterization, revision, and collection of information

Objective

The aim of the project is to propose development options that improve the production systems of the Calico River watershed, thus enhancing the standard of living of impoverished small-scale farmers, who represent a majority within the target study area.

Methods

Simulation models usually require a considerable amount of information, confirmed on-site, to generate a solution as optimal and realistic as possible. The watershed model uses linear programming, which aims to optimize a linear function of several variables, and is subjected to a set of linear inequalities of several variables. This model allows a target function to be maximized (e.g., farmer income) or minimized (e.g., production costs). This function is evaluated according to technical restrictions imposed by the system itself or by external factors.

The model's information requirement is high to ensure the veracity of the solution. Thus, both primary and secondary socioeconomic and biophysical information was, and is being, gathered. Information and characterization is being carried out through a collaborative agreement with the Faculty of Natural Resource (FARENA), UNA.

Most research projects will focus on the Wibuse microwatershed, which was selected based on a series of criteria, of which the main ones were accessibility, population density, status of water supply systems, studies conducted, conflicts, and poverty. Research methodologies involve fieldwork, laboratory analyses, and data processing.

Results

A large amount of data was compiled. Table 1 summarizes the socioeconomic and biophysical information currently available for the Calico River watershed.

Table 1. Socioeconomic and biophysical data of the Calico River watershed available at present.

Socioeconomic	Biophysical
• Total population (1995) • Volumes of domestic consumption and production, base year 1995 • Production costs, staple crops (1998-1999) • Percentage of arable land vs cultivated land (1995) • Percentage of producers by production item (1995) • Total income and per capita income (1998-1999) • Economically active population • Estimate of number of producers per community • Poverty indexes (1998) • Health and education indicators • Institutional (organizational) presence • State of public services	• Orthophotos (1996) • Orthomosaic (1996) • Digital elevation model (1998) • Watershed and microwatershed boundaries • Hydrographic network • Precipitation over the last 10 years • Soil, road, moisture index, slope, and altitude maps

The main sources of information were government institutions such as the Ministerio Agropecuario y Forestal (MAGFOR), Instituto Nicaraguense de Estudios Territoriales (INETER), Fondo para la Inversión Social y Emergencias (FISE), Instituto Nacional de Estadisticas y Censos (INEC), Programa de Servicios Básicos Integrados (PROSERBI), and the municipality of San Dionisio. Local entities, mainly Centro de Promoción del Desarrollo Local (CEPRODEL), were also used. Studies were also carried out.

The benchmark data can be used for comparisons of production and to find production alternatives. A document is available on an analysis in which estimated data from 1998-1999 are compared. A matrix is also available with complete production costs (which did not exist in the literature reviewed) of major crops and of livestock.

During 1999, a second agreement was signed with UNA to support the research work of four further undergraduate theses of FARENA's Soils and Forestry programs, in the project's study area (Calico River watershed. These will basically continue research on topics defined in the Hillsides Project agenda at the reference site and provide input to the ex-ante evaluation, through the watershed model.

Four short training courses on modeling methodology were carried out with the group of thesis students and advisers. These courses aimed to train participants in linear programming, using the LINGO program to run the models. To date, all project participants have been introduced to the methodology that will be used to achieve the final objective. With the UNA team, a first hypthetical model was prepared at the watershed level, using both real and fictitious information, indicating that the model can be applied with the information already generated.

Fieldwork has begun regarding characterization, revision, and collection of information. Also, in the case of soil loss caused by water erosion, the six plots have already been established and all the equipment installed to make the corresponding measurements. A local farmer, with the support of CIAT and UNA staff will manage data collection.

Outputs

The use of modeling as a tool to pretest technological alternatives was assumed with interest by our main partner in this endeavor, the UNA. Modeling could become a major contribution to university curricula and strengthen the research area. This innovative method to evaluate production alternatives at the watershed and municipality levels has never been attempted at local level. Although several technicians have shown interest in the model, its real usefulness will depend on the degree farmers themselves (as end users) respond to the model to improve their production systems and optimize their income.

The information already compiled and that still pending is another contribution to support development projects carried out by other entities working in the watershed, and can be used for research purposes over the long term.

Contributors: B Barbier, ME Baltodano

Activity 1.2. Ex-ante evaluate improved system alternatives (identify markets, perform simulation modeling)

Activity 1.2.1. Ex-ante evaluation of water quality

Highlight

✓ Impact of improving water quality assessed for San Dionisio watershed

Objective

The aim was to estimate the impact of improving the quality and quantity of drinking water in the San Dionisio watershed. The community identified water management as one of the major natural resource problems they faced, and this study attempted to put an economic value on the resolution of the problem.

Methods

Water markets do not exist in San Dionisio, thus the price and quantity data required for traditional impact studies was not available. Instead, non-market valuation techniques were used to value the importance of improving community water supplies. The first was the time cost approach, in which the time spent by household members carrying water to the house is measured and valued. This time is an expense associated with water consumption. If this time could be reduced either by linking the house to a potable water project or by improving the quality and availability of water in nearby sources that are currently too contaminated to use, this would constitute an economic benefit to the family.

The second method for valuing the impact of improving water supplies is called the contingent valuation method (CVM). With this method, respondents are asked hypothetical questions about how much they would be willing to pay for improvements in water quality. The Nicaragua study tested some innovations in methodology and implementation of CVM for valuing potable water, including valuing changes in quality of existing natural water sources, such as wells or streams, and using local residents as pollsters.

Econometric methods were used to test the validity of the responses to the CVM questions. Because of its hypothetical nature, the CVM is subject to many biases that can affect the reliability of the data. Econometric techniques exist to test whether the responses are consistent with what economic theory would predict based on the characteristics of the household. If the data are found to be consistent with theory, this suggests that we can be confident in interpreting the responses as people's true willingness to pay (WTP) for improved water quality.

Results

We give here a brief description of the major results of the analysis. A more thorough report of the methods and findings of the study can be found in Johnson and Baltodano (1999).[2]

Data for the analysis were obtained in a survey carried out in five of 17 communities of the watershed - El Cóbano, El Jícaro, Wibuse, El Zapote, and Susulí. These were selected because they are representative of the watershed in terms of both water use and water conflict. The sample was selected at about 15% of the population, resulting in a sample size of 153 households.

Table 2 shows the different measures of the value of improved drinking water in the microwatershed. According to the time cost analysis, 42% of households had to spend time carrying water. The average time spent per household was about 37 minutes a day, which is equal to 225 hours or over 5 weeks of full-time work per year.

Table 2. Various measures of the value of improving potable water supply in San Dionisio, Honduras.

Valuation method	Value in US$/year
1. Time cost	
Water carrying time valued at half wage rate	36,278
Water carrying time valued at wage rate	17,718
2. Willingness to pay to participate in a potable water project	88,920
3. Willingness to pay to improve existing water sources	9,456

An econometric analysis of the results of the WTP responses confirmed their reliability as individual measures of WTP for improved water quality. Other determinants of WTP were also analyzed, and several interesting observations emerged. It is believed that one of the benefits of improving water quality will be to improve health in the community.

Women are more willing to pay more for access to potable water than men, and the difference is statistically significant. This makes sense because they would most benefit from the reduction of time spent collecting water. It also suggests that women should be involved in any schemes to improve access to potable water in the community since they are most likely to participate.

Contributors: N Johnson (Rockefeller Foundation and CIAT's Impact Assessment Unit), ME Baltodano

[2] Johnson N, Baltodano ME. 1999. Valuing technological and institutional options for improving natural resource management: the case of potable water in a rural Nicaraguan watershed. Draft working paper available from PE-3, CIAT, Cali, Colombia.

Activity 1.2.2. Ex-ante evaluation of rural agroenterprises

Not reported on this year.

Activity 1.2.3. Bioeconomic simulation to evaluate market options

Highlight

✓ Models designed to evaluate market options and database established

Objectives

The objectives are to:
1) Evaluate the profitability and sustainability of production systems that include products with identified market opportunities for the small producers of Yorito and Sulaco; and
2) Develop and apply improved planning methodology in farms, using mathematical simulations that seek to combine crops that generate a maximum income while evaluating environmental sustainability.

Methods

Models were designed using the participatory methodology developed of instantaneous farm modularization with producers. A research associate and a student from the Escuela Agrícola Panamericana (EAP)-Zamorano were trained.

Data needed to run the models were collected, and a database was established. Producers with farms that represented three economic levels (high, middle, and low) and three types of access (permanent, temporary, and bridle paths) were selected. Both criteria were used to prepare a typology of producers in homogeneous categories and subdivide the reference site into homogeneous areas, taking into account the access criterion, which is a determinant factor for market access.

Data were directly collected using a laptop computer, with producer participation. The simulation of the farms' production systems was done simultaneously, each farm's production system was compared with the optimum production system that resulted from the simulation. Results were discussed with producers, as well as the reasons why the farm's production system differed from that proposed by simulation results. A sensitivity analysis was conducted based on the hypothesis that farmers would have greater access to capital through, for example, a credit program.

To evaluate the profitability and sustainability of systems that included products with identified market opportunities the following steps were performed:

1. Simulations were made to evaluate profitability and environmental sustainability (taking into account erosion) by integrating the identified short-term market options (short-cycle crops) into the previously simulated basic production systems.
2. Systems simulations were also made with identified, long-term market options (avocado, plantain, and coffee, all perennial crops) and with identified options presenting high investment requirements (traditionally processed cheese and butter).

Results

Results are still being analyzed.

Output

Research associate and student trained in the methods. This simulation will help identify market opportunities.

Contributors: B Barbier, M Totobesola, SN-1

Maize and bean modeling with DSSAT

Highlight

✓ Model calibrated for maize

Objectives

The aim is to collect relevant data and apply biophysical modeling calibrated for maize and beans.

Methods

Data was collected on soil analysis, rainfall, temperature, local cropping patterns, and maize and bean germplasm for Yorito and Sulaco. The biophysical modeling was applied with DSSAT (decision support system for agriculture in the tropics). The impact was measured of different techniques (e.g., fertilization, plowing, and irrigation) on the long-term productivity of maize and beans at the project reference site in Honduras. Parameters of maize production functions were provided for in the bioeconomic model on the basis of DSSAT results.

Results

The collected data was used in modeling. The model is calibrated for maize and will soon be calibrated for beans.

Output

The data and modeling provides a base for project work and help in collaborative work, especially with the CIALs.

Contributors: A Gijsman, B Barbier

Activity 1.2.4. Bioeconomic simulation to evaluate market options

This activity is reported jointly under Activity 2.1.4.

Activity 1.3. Participatively identify, investigate, and validate alternatives to improve production systems

Activity 1.3.1. Re-establish and continue trials of maize, beans, and soya with the CIALs

This activity is reported jointly under Activity 1.3.3.

Activity 1.3.2. Participative evaluation of forages

Participatory evaluation, selection, and targeting multipurpose forage germplasm in the hillsides of Central America

Highlights

- ✓ Innovative farmers in Honduras select some superior grasses
- ✓ Extension of approach to Nicaragua

Objectives

In collaboration with national agricultural research systems (NARS), nongovernment organizations (NGOs), and farmer groups, CIAT identifies germplasm preferred by farmers. GIS tools are being developed for strategic targeting of forage germplasm first to environmental and later to socioeconomic niches in the hillsides of Central America. The work is anticipated to also contribute to the development of an overall strategy to guide future research and to aid in the diffusion and final adoption of forage-based technology by small-scale farmers. The interaction with strong national partners – alongside the farmers – will be of paramount importance to the success of the approach.

Methods

A combination of agronomic evaluation techniques, participatory technologies, soil indicators, socioeconomic studies, and GIS tools are employed. The work links closely with the TROPILECHE project, using some of the same germplasm. On the other hand, Forage germplasm selected from this work will be useful to TROPILECHE and to other projects working in developing new forage alternatives for crop-livestock systems in hillsides.

Results

Honduras

Farmers at two sites (San Jeronimo and San Antonio) around Yorito, Honduras assessed and selected (absolute evaluation) a range of grasses. At both sites, *Brachiaria brizantha* CIAT 26110, *Panicum maximum* CIAT 16031(cv. Tanzania), and Brachiaria hybrid FM 9201/1873 were the overall most preferred accessions. Main selection criteria for the farmers were productivity, rooting intensity, color of leaves, ability to cover the soil, and closing the stand. The *Brachiaria* hybrid, FM 9201/1872, was consistently perceived as an accession with soft leaves (seen as an indicator for high palatability) and of high quality and therefore liked by some farmers. Several farmers, however, rated the accession lower for its lower productivity compared to the two other selected accessions. All of the initial farmers involved in testing the three preferred grasses on larger plots on their farms made seed requests.

Although not selected for its forage production, some farmers – in particular those with a stronger focus on crop production – rated *Brachiaria dictyoneura* CIAT 6133 (cv. Llanero) high for spreading and rooting and thus its potential for soil conservation.

For herbaceous legumes, farmers were exposed to far more accessions. Therefore some open-ended evaluations were executed to narrow down the number of accessions interesting to farmers. Based on perceptions of farmers and agronomic performance, a range of eight accessions was selected for absolute evaluation at one site, beginning in July 1999. Table 3 presents preliminary results. Farmers were especially interested in the two *Arachis pintoi* accessions, CIAT 17434 (cv. Pico Bonito in Honduras), for their ability to cover the soil and for their ample leaf material. *Stylosanthes guianensis* CIAT 184 (cv. Pucallpa) found interest mainly for its ability to retain green leaves during the dry season. At another site, only a few accessions persisted because of poor adaptation to soil and problems with pest and diseases. At that site, farmers accordingly selected a different range of accessions, with *Centrosema* spp. (in particular *Centrosema plumieri* DICTA) and *Clitoria ternatea* cv. Tejuana being preferred.

Table 3. Initial absolute evaluation for farmer participatory selection of herbaceous legumes. Legumes were scored on a scale of 1 (least preferred) to 5 (most preferred species), San Jeronimo, Honduras.

Accession	Evaluation score											Total points	Ranking
	1	2	3	4	5	6	7	8	9	10	11		
cv. Pico Bonito in Honduras	5	5	5	5	5	5	5	5	5	5	5	55	1
Arachis pintoi CIAT 22160	5	5	1	1	1	5	5	5	5	5	5	43	3
Centrocema brasilianum CIAT 15387	5	5	1	1	1	1	1	1	1	3	3	23	8
C. macrocarpum CIAT 25222	3	3	1	1	1	3	3	3	3	3	1	25	7
C. plumieri DICTA	5	5	1	1	1	5	5	5	5	5	3	41	4
C. pubescens DICTA (CIAT 434)	5	5	3	3	3	1	1	3	3	1	1	29	5
Desmodium ovalifolium 23762	3	3	1	1	1	5	3	3	3	3	3	29	5
cv. Pucallpa	5	5	5	1	3	3	3	5	5	5	5	45	2

Nicaragua

In July 1999, a new nursery for the participatory selection of forages was established as part of SOL in San Dionisio, near Matagalpa. The following accessions were planted.

Grasses:
Brachiaria hybrid 9201/1873, *B. brizantha* CIAT 6387, *B. brizantha* CIAT 26110, *B. dictyoneura* CIAT 6133, *Panicum maximum* CIAT 16028, *P. maximum* CIAT 16031, and *P. maximum* CIAT 16051.

Herbaceous legumes:
Arachis pintoi CIAT 17434 (cv. Pico Bonito), *A. pintoi* CIAT 18744 (cv. Porvenir in Costa Rica), *A. pintoi* CIAT 18748, *A. pintoi* CIAT 22160, *Centrosema acutifolium* CIAT 5568, *C. acutifolium* CIAT 5277, *C. macrocarpum* CIAT 25222, *C. pubescens* CIAT 438, *C. pubescens* CIAT 5126, *C. pubescens* CIAT 15160, *Clitoria ternatea* cv. Tejuana, *Chamaecrista rotundifolia* CIAT 18252, *Desmodium velutinum* CIAT 13953, *D. heterocarpum* CIAT 13105, *D. heterocarpum* CIAT 13651, and *D. heterocarpum* CIAT 23762.

Outputs

Substantial progress was made, particularly in the participatory selection of grasses for pasture purposes. Interest in some of the herbaceous legumes is rising, in particular in *Arachis pintoi*. Efforts are made to enhance and support artesanal seed production. Farmers and NGOs from neighbouring communities have shown interest in the work presented and a further extension of the approach is planned for the next planting season.

Contributors: M Peters, N Espinoza; P Argel, C Burgos, H Cruz, MI Posas, T Reyes (IP-5)
Collaborators: IP-5, PE-5, SN-3, Dirección de Investigación de Ciencias y Tecnología Agrícola (DICTA), Servicios Técnicos para el Desarrollo Sostenido (SERTEDESO)

Converting the forage database to a graphical platform

Highlight

- ✓ Trial version of database on a graphical platform is accessible to selected scientists via the Internet

Objective

The aim is to convert the Forages Information System to a graphical, user-friendly, and attractive platform. This easy access to important data will help work on forages in the hillsides of Central America.

Methods

The programs in ORACLE FORMS 3 are converted to ORACLE DEVELOPER 2000, with emphasis on user-friendliness and on an attractive platform. In phase 1, the old programs with information available in character mode are transferred to graphic mode. In phase 2, new modules are added.

Results

An initial trial version was developed and tested for year 2000 compatability. At present, the database contains 1537 accessions, evaluated in 315 sites. In many of these sites, available information is incomplete and therefore a great effort is being made to update the database through capturing information from existing publications and through obtaining data directly from scientists in the Forage and Production systems projects.

Outputs

A preliminary version of the graphically and user-friendly database is available for selected scientists through the Internet. During 2000, this database will be refined for use via the Internet and for a CD-ROM. The database will also be used in developing the Decision Support Tool for the targeting of forage germplasm.

Contributors: M Peters; M Herrera, C Lascano (IP-5); A Franco (IS)
Collaborators: IP-5, PE-5, SB-1

Use of GIS models for better targeting forage germplasm

Objective

The activity intends to integrate agroecological, economic, and social information based on two main assumptions:

1) A wealth of information on the agroecological adaptation of forage germplasm is available in CIAT-held forage databases. However, the access and hence utilization of this information needs to be improved.
2) In previous evaluations of forage germplasm adaptation to environmental conditions, the agroecological information is separated from socioeconomic factors influencing forage germplasm adoption.

Based on these assumptions, the targeting of forage germplasm intends to enhance the utility of existing information and, in future, to integrate environmental and socioeconomic adaptation of forage germplasm for multiple uses. It is anticipated that this approach will allow a more accurate and client-oriented prediction of possible entry points for forage germplasm.

Methods

A working group was formed and agreed to follow step-wise procedure for the development of the system.

1) Include the existing Red International de Evaluación de Pastos Tropicales (RIEPT) database – to start with the regional trials A+B – into the GIS system to describe agroecological adaptation of forage germplasm in Latin America.
2) Include supplementary information on agroecological adaptation as existing in CIAT-held forage databases (e.g., the RABAOC database).
3) Include experiences of (former) CIAT scientists and collaborators.
4) Incorporate socioeconomic information based on existing results from characterization studies and from on-going work, first on a regional level (i.e., Central America).

Results

Parameters were identified for the description ecological adaptation and agronomic performance of accessions across environments. Currently the group is revising the classification of agroecosystems to be used for the database because the classification of agroecological zones developed by TT Cochrane may not be suitable for use in the GIS tool to be developed.

Outputs

Progress was made in data preparation of the database underlying the GIS model and some trials were run. For better targeting of climatic and soil conditions, the classification of agroecosystems is being revised.

Contributors: M Peters; G Hyman, A Gladkov (PE-4); LH Franco, A Franco, B Hincapie, G Ramirez (IS); P Jones (consultant)

Activity 1.3.3. Evaluation of trials by Comités de Investigación Agricola Local (CIALs); evaluation of PROFRIJOL lines

Highlights

- ✓ New booklets prepared that are adapted to regional context and include CIAL experiences
- ✓ Collaborative agreements established
- ✓ Identification of bean and maize selection criteria used by producers, thus providing feedback to programs supplying new materials

Objectives

The activity's main objectives are to:
1) Improve agricultural production systems by participatory research that integrates groups of farmers into the process of identifying, assessing, and validating alternatives directed toward improving the decision-making process, and
2) Direct local expertise toward the search for sustainable technologies suitable for their environments.

Methods

The Investigación Participativa en Agricultura/*Participatory Research in Agriculture* (IPRA) method was used. This methodology, which CIAT developed initially for Colombia, promotes farmer participation in identifying criteria and assessing alternatives through participatory on-farm trials. The assessments aim to find out producers' opinions and reasons why they accept or reject a given technology, providing feedback to researchers at different experiment centers.

The CIALs are the organizational base of the IPRA method. These committees group farmers to facilitate the testing of new agricultural technologies. Community priorities and needs are also identified in areas of common interest shared by farmers. Decisions on which topics will be addressed are made jointly with the community.

The main steps involved are:

- Community motivation,
- Community election of Committee members,
- Diagnosis,
- Planning the experiment,
- Trial establishment,
- Technology assessment, and
- Analysis of results and feedback to the community.

Results

Below we list the criteria that producers use to select bean materials in the Calico River watershed as identified by the project.

Well accepted	Moderate	Rejected
• Solid grain	• Dark brown color	• Light red, very pale
• Good brilliance	• Small grain	• Dark brown color
• Similar to Estelí 90	• Mixed color	• Light-weight grain
• Round seed	• Light-weight grain	• Semi-flat (flattened)
• Good weight	• Light red with mixture	• Small
• Clear red color	• Lead color	
• Dark red color	• Little shine	
• Uniform color		
• Looks like Sangre Toro		
• Markets well		

Next we list the characteristics that farmers use to select maize varieties.

NB-12	NB-30	B-833	H-5
• Large ears • Good plant architecture • Easy to shell • Good quality grain • Loose corncob, which affects grain quality • Average height	• More affected by pests • Short-statured • Moderate-sized ears • Fine (small) grain • Early maturing • Thin ears • Good for the second planting season	• Good-sized ears • Large grain • Good (average) height • Good coverage of corncob • Slow-maturing • Ear bent at the end of the growth cycle • Does not rot because of moisture	• Good-sized grain • Well-covered corncob • Tall stature • Lets in moisture • Slow maturing • Good-sized ears

The increasing number of CIALs in the watershed means that more farmers are involved in participatory research. Communities have a grass-roots organization that plays a specific role within the community's agricultural development.

New, promising genetic materials (maize, beans, soybeans) are being evaluated that can improve local agricultural systems. Farmer experimentation in the watershed has been potentiated. New didactic booklets were prepared that are adapted to the regional context and include CIAL experiences in the area.

Several collaborative agreements were established, among which we should mention the Seeds of Hope project that obtained a credit for 7.5 quintals (375 kg) of bean seed for the first and second planting seasons and benefited 60 families, most of them participating in agricultural research. The CIALs constituted the main bridge to direct this benefit toward many farmers of the watershed. Entities were supplied with genetic materials.

Most important was the identification of bean and maize selection criteria used by producers, thus providing feedback to programs supplying new materials.

Outputs

The CIALs and their members have played an active role in other project activities, especially at the organizational level, and continue to do so. An example is their participation in the Reforestation Committee of the "Caminos Verdes" association of local organizations, a vegetable project that shows organizational strengthening and plays a leading role within the community.

Contributor: N Espinoza
Collaborators: INTA, Centro Nacional de Investigación Agropecuaria (CENIA), Proyecto Regional de Frijol para Centro América, México y el Caribe (PROFRIJOL), and Escuela Agrícola Panamerican (EAP)-Zamorano

Activity 1.3.4. Strengthen the development of artisanal system of seed production

See under Seeds of Hope Project.

Activity 1.3.5. Evaluation of improved forages, grasses, and legumes on producers' farms

This activity is also reported in the Tropical Forages Annual Report under TROPILECHE

Highlights

- ✓ Parameters identified for the description ecological adaptation and agronomic performance of forage germplasm accessions across environments
- ✓ Central American GIS database set up

Objective

The aim was to improve access to data on forages for use in project work.

Methods

Progress was made in data preparation of the database underlying the GIS model and some trials were run. The classification of agroecosystems is being revised so that climatic and soil conditions can be better targeted. Data will be overlaid with road maps and a preliminary recommendation for sites for in-situ conservation of forages in disturbed environments will be available by 2000.

Ten forage genuses were selected as test speecies.

Results

A start has been made on setting up the database and adapting models to better target forage germplasm for improved forages.

Outputs

A wealth of information on the agroecological adaptation of forage germplasm is available in CIAT's-held forage databases. However, the access and thus the use of this information must be improved. Based on these assumptions, the targeting of forage germplasm intends to enhance the utility of existing information and, in future, to integrate environmental and socioeconomic adaptation of forage germplasm for multiple uses. It is anticipated that this approach will allow a more accurate and client-oriented prediction of possible entry points for forage germplasm.

Contributors: M Peters; G Hyman, J Klass, A Gladkov (PE-4); P Jones (Consultant); B Hincapie, G Ramirez (IP-5); F Holmann, LH Franco (PE-5); A Franco (IS)

Activity 1.4 Validate new alternatives and improved practices

Establishing the Supermercado de Opciones para Ladera (Hillsides Options Supermarket) (SOL)

Highlights

- ✓ SOL site chosen in Tascalapa River watershed, Honduras and technological options put into action
- ✓ SOL network established in Honduras
- ✓ Wibuse-Jicaro no.1 microwatershed selected for the SOL in Nicaragua
- ✓ SOL farm being established in Nicaragua with active participation of the community

Objectives

The SOL is an initiative of the CIAT-Hillsides project to develop technological options that are economically viable and environmentally sustainable and offer these to technicians, producers, and institutions at our reference sites. The aim is to develop technologies aimed to establish profitable, sustainable production systems through multi-institutional alliances, using a participatory approach (design, planning, monitoring, and assessment) that includes shared responsibility at all decision-making levels.

In Honduras, we aimed to establish the project's SOL at a representative site of the Tascalapa River watershed and to form a network of SOLs with the participation of institutions working in research and technology validation and transfer at that reference site. In Nicaragua, the representative site is the Wibuse-Jicaro no.1 microwatershed.

Methods

In Honduras, the methodology followed to establish the project's SOL included (1) selecting a microwatershed, (2) biophysical characterization of the site, (3) prioritization of topics to be included in the SOL, and (4) design and implementation of options in the field.

Several meetings were held with regional producers and technicians to form the network of SOLs. A common vision about the network was achieved at these meetings and a conceptual action framework was defined.

In Nicaragua, secondary information was used from, for example, biophysical and socioeconomic studies, participatory maps, maps from geographic information systems, interviews with key informants, and reports among others to support that existing at the site. Based on this and on the experiences of similar projects at other sites, a list of criteria was prepared to select the microwatershed.

Using the technique of the transect hike through different parts of the microwatershed, observation points were determined to be able to report farm characteristics and the conditions required for implementing alternatives.

A participatory planning by objectives (PPO) is in progress. It allows communities to identify their problems, causes and effects, and possible ways to solve these problems in the region. It also strives to encourage and promote true collaboration among actors at different levels: producers, local communities, development organizations, research and extension institutions, and the municipal government. Based on the concerns expressed at the Participatory Planning Workshop, the following activities are performed: (a) a floristic survey, (b) a farm soil characterization, and (c) design.

Results

Honduras

Three microwatersheds –Luquigue, Albardilla, and Mina Honda– were selected on the basis of available biophysical information. Yorito community representatives selected the Mina Honda watershed on the basis of qualitative criteria similar to that used in Nicaragua (Table 4). The greatest differences among sites were found regarding institutional presence, conflicts in land use, and representativeness.

The scarcity of suitable land in the Mina Honda watershed precluded locating the SOL there, although it had the highest score. An area was therefore selected in the Luquigue watershed.

Aerial photography was used to show the distribution of classes of land use and slopes in the area selected for the SOL. Areas with the most pronounced slopes (class VII) are dominated by sandy loam and sandy clay loam soils covered with native pine and forage grasses. Class VI soils are clay loams, covered with forage grasses and some remaining pine. Soils with a more clayey texture predominate in the rest of the area, which has more moderate slopes and vegetation consisting of introduced pastures.

The results of soil chemical characterization indicated that most soils in the flattest parts have slightly acid pH. Further, in the areas covered with pine trees, soil pH is higher because these are very superficial soils in which outcropping parent material is essentially of calcareous origin. The greater nutritional limitations of these soils are associated with imbalances caused by the high calcium contents and low potassium and magnesium levels.

The joint analysis of the problem of sustainability with the community, in a Participatory Planning by Objectives (PPO) workshop, showed that the low sustainability of regional production systems was associated with:

1) Low use of inputs,
2) Depleted soils,
3) Inadequate agricultural practices,
4) Limited economic resources,
5) Subsistence culture,
6) Reduced technological diversification,
7) Limited crop diversity,
8) Low profitability of prevailing production systems,
9) Lack of training in new alternatives, and

10) Poor land distribution.

After prioritizing the problems that could be solved by the SOL, several topics and specific activities were identified. Based on recommendations made by the community, several technological options were designed that include the testing and assessment of new components and systems. Table 4 shows these options, which include the testing of new crops and multi-purpose forage and tree species.

Table 4. Technological options included in the Supermercado de Opciones para Ladera (SOL), Yorito, Honduras.

Options	Systems components
1. Livestock	• Observation plots and silvo-pastoral systems
2. Reforestation	• Traditional maize-beans; associated maize-beans; beans; and maize-cowpea
3. Arrangements of systems	• Evaluation of native and introduced multi-purpose species
4. Improved fallow	• Legume species to improve soil fertility
5. Fruit trees	• Species to recover and protect fragile areas
6. Satellite tests	• Evaluation plots of new crops
7. Live barriers	• Multi-purpose species
8. Protection of gullies	• Multi-purpose tree species
9. Vegetables	• Species to enhance the home garden

The selected area is representative of the use given to lowlands in the Tascalapa River watershed. Many of these areas are devoted to cattle raising. The selected site is representative of the overall condition of the watershed regarding soil chemical characteristics: slightly acid pH and high calcium and organic matter contents. This condition is important when extrapolating developed technological options to other areas of the watershed.

SOL Network

Two meetings were held with producers and representatives of Yorito-based institutions to conceptualize the idea of establishing a supermarket of technological options for the community. It was concluded that network activities should be based on the following principles:

1) Services oriented toward client needs,
2) Feedback mechanisms established to determine product adoption and adjustments made by producers,
3) Systems designed to promote and sell technologies, services, and products,
4) Systems designed to promote products and services and make them accessible,
5) Marketing services provided, and
6) Participatory monitoring systems established.

A working group integrated by representatives of the CIAT Hillsides project, the CIAT Rural Agroenterprise project, IPCA, SERTEDESO, and the University of Hohenheim was established

to promote networking and prepare a funding proposal to obtain additional resources needed to establish other SOL components.

A characteristics of the SOL network is that its strategies of generation and validation of technological innovations are more oriented toward satisfying producers and the market than toward the simple self-promotion of SOL products, which makes it different from other strategies. The connection between different SOL actors forms a model that could become a tool to be used by other institutions in the future.

Nicaragua

Table 5 shows the prioritization of the microwatershed for establishing the SOL according to selection criteria. The Wibuse-Jicaro watershed received the lowest scoring and was thus selected.

Table 5. Criteria[a] used to select the microwatershed for the Supermercado de Opciones para Ladera (SOL) project, Nicaragua.

Microwatershed	Wibuse-Jicaro no.1	Susuli	Los Limones	Piedra Colorada	Corozo
Estimated area (ha)	730	1500	900	600	800
Number of inhabitants[b]	950	3486	1372	402	734
Population density per unit area	1.3	2.3	1.5	0.25	0.9
Criteria:					
Access	1	1	2	1	2
Proximity to San Dionisio	1	2	2	4	3
Water sources[b]	3	3	3	3	5
Distribution of watercourses	1	1	4	1	4
Easy water monitoring	1	2	4	1	4
Forest area[b]	1	1	2	3	4
Watershed physiography	1	3	4	1	4
Conflicts over natural resources	1	2	4	4	3
Diversity of production systems	1	1	3	2	4
Appropriate for SOL	1	2	3	2	4
Representativeness (slopes, production systems)	1	1	2	2	4
Institutional presence[b]	3	1	1	3	4
Local organizations[b]	3	5	5	5	5
Level of well-being[b]	1	3	3	3	1
Total	22	29	44	39	54

a Selection criteria are ranked from 1 to 5, where good = 1, moderate = 3, and poor = 4-5.
b Indicators extracted from Vernooy et al. 1998[3].

[3] Vernooy R, Espinosa N, Lamy F. 1998. Participative mapping, analysis, and monitoring of natural resources in a watershed. CIAT, Cali, Colombia. 138 p.

The SOL site is located in the Wibuse-Jicaro 1 microwatershed, 5 km from the municipal capital, at 550 m above sea level, with temperatures ranging between 23 °C and 28 °C. On its predominantly hilly topography, the principal crops grown are coffee, basic grains (maize and beans), dual-purpose livestock (which ranks second in importance), citrus fruits, and vegetables, to a lesser extent. Most households also raise pigs and chickens.

The agronomic management of crop production systems is based on *ronda* (clearing either side of fence to prevent weeds spreading), *chapia* (clearing of lot by machete), burning of stubble (most of it), use of herbicides (Gramoxone, 2-4-D, Fusilade, and Flex), and insecticides (MTD). Fertilizers are mainly applied to maize. Hill-plot planting is performed. The two production cycles are (1) from June to September and (2) from September to November. During the non-productive summer, most rural families harvest coffee or *chapia* paddocks among others tasks, both inside and outside the area. The community has 128 families; of these, 60% have access to drinking water and primary and preschool education.

The livestock lot has alternative grass species for the area and a seed production area for grass and legume species. The silvopastoral system uses tree forage species in association with grasses and legumes. The farm includes a small forest of caducifoliate species, a spring of water, and an area with a geological depression resulting from hurricane Mitch. This area is where soil conservation and recovery activities are carried out, and the natural regeneration of native species.

Different types of observation nurseries and agricultural and pasture trials were established for identifying promising species as alternatives to improve prevailing agricultural and livestock production systems of the area. Forage materials and agricultural crops were planted in small plots to observe their performance. Table 6 shows crops planted and the institutions involved.

An agricultural-commercial lot on the farmc ontains traditional crops of the area, and other types of alternative arrangements for the first and second planting seasons of maize, beans, and green manures. It includes live barriers as a cropping alternative and for soil and water conservation, and nontraditional alternative crops such as pineapple, pitahaya, plantain, and cassava.

Men and women of the community actively participated in the different activities carried out to date. Local institutions, such as Cooperative for American Remittances Everywhere (CARE), PRODESSA, CARITAS, INTA, and the mayor's office contributed plant material to establish and monitor trials and test technologies.

Outputs

While still in their initiating stages, the SOL sites are expected to help develop technological options that will be readily adapted by small-scale farmers.

Table 6. Forage and agricultural crops planted at the Supermercado de Opciones para Ladera (SOL) project farm, 1999.

Forage or crop	Trials and evaluations	Collaborating institution[a]
Forages	• Regional participatory agronomic evaluation trial, including 6 grasses, 16 herbs, and 3 shrub legumes	CIAT-Cali
Beans	• Bean Variety Verification Trial (COVA-99) - 6 materials including the local check (DOR) • Central American Yield and Adaptation Trial for Red Beans (ECAR-99) - 14 materials and a universal check (DOR 364) • Central American Adaptation Nursery for Red Beans 1999-2000	PROFRIJOL INTA
Maize	• Trial to assess improved varieties for areas with limited moisture: Pool 18, NB-30, NB-100, NB-S, PR-8763, QPM-615 (La Posta Sequía), DERR-C3, DMR-MDR, and NB 9043 (Catacama)	INTA
Soybean	Evaluation of adaptability and yield of soybean varieties	
Rice	Evaluation of 11 rice varieties	PRODESSA

a. CIAT = Centro Internacional de Agricultura Tropical, PROFRIJOL = Proyecto Regional de Frijol para Centro América, México y el Caribe, INTA = Instituto Nacional de Tecnología Agropecuaria, and PRODESSA = Proyecto de Desarrollo de San Dionisio.

Contributors: (Honduras) E Barrios, M Ayarza, M Trejo, L Brizuela, K Probst
(Nicaragua) N Espinoza, JT Reyes, E Barrios, M Peters, J Beltrán, JI Sanz, M Ayarza, P Arge

Collaborators: (Honduras) IPCA, SERTEDESO, Municipal Mayor's Office, Comité Local para el Desarrollo Sostenible de la Cuenca del Rio Tascalapa (CLODEST), J Martínez (consultant).
(Nicaragua) INTA, PRODESSA, CARE

Output 2: More sustainable landscapes

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

Activity 2.1.1. Participatory mapping (post-Mitch)

Highlights

- ✓ Environmental Management Plan presented
- ✓ Results of study diffused to other institutions active in area
- ✓ Credit coverage to communities increased

Objective

The aim is to contribute to the reconstruction and reactivation of the Calico River watershed.

Methods

This study used the methodological tool of Vernooy et al. (1998) (see footnote 3), and several indicators from Espinoza and Vernooy (1998)[4], complemented with other indicators identified after hurricane Mitch. Figure 1 summarizes the methods used.

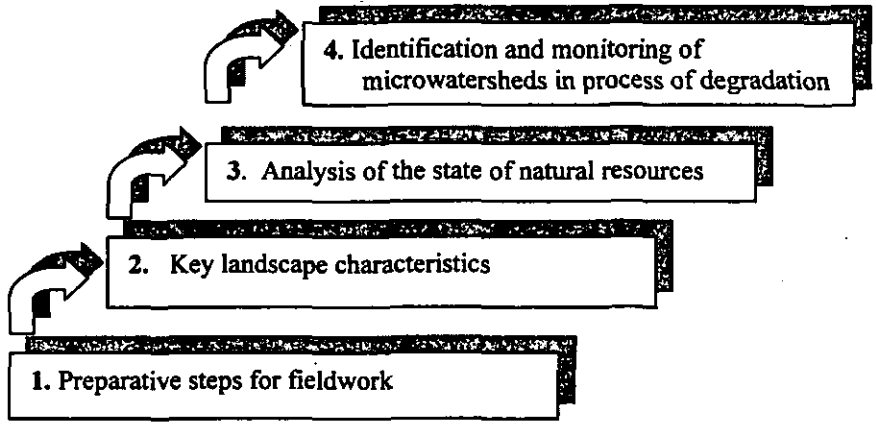

Figure 1. Summary of methodology used.

[4] Espinoza N, Vernooy R. 1998. Mapeo, diagnóstico, priorización y monitoreo participativo de microcuencas: la subcuenca del Río Calico, San Dionisio, Matagalpa, Nicaragua. Paper presented at the Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios (PCCMCA) meeting, Montelimar, Nicaragua.

Men and women of the local community made a valuable contribution to this study, as did the leaders of different community organizations. Most had previous experience in applying this methodology and live in one of the 15 microwatersheds.

Results

The current state of 15 microwatersheds of the Calico River after hurricane Mitch was evaluated based on a series of components (water, forests, soils, and crops among others). The scores or values for each microwatershed were derived from a set of indicators. The microwatersheds showing the highest degradation were Junquillo-Las Cuchillas, El Zarzal, El Carrizal, and El Quebrachal, all with values below 65. The components most affected were soils, forests, water, crops, and infrastructure (Table 7).

Bean was the worst affected crop; excess water causing disease affected 80% of its production. Landslides destroyed other areas planted to beans. Losses in maize were estimated at 60%. The availability of seed for the next planting cycle will be a problem for producers, most of whom lack seed because the crops were destroyed. Storage conditions are inadequate, and producers mostly use sacks and plastic bags.

Among the species that inhabitants reported as most affected by the hurricane are the Congo monkey, armadillo, chameleon, rabbits, *guardiola* (type of bird), and species inhabiting the streams and main rivers. No projects in the area conduct activities directed towards the preservation of wildlife, which is disappearing year by year from the area. All microwatersheds were affected regarding this component.

The conflicts mentioned by watershed inhabitants include the following: use of trees, firewood, and water; land tenure; and deposition of trees destroyed on other properties.

An "Environmental Management Plan" was proposed and presented for approval to community leaders of the territorial unit and entities and institutions working in the area. The "Campos Verdes" Association and other institutions are using the results of this study to carry out several of the activities envisaged in the plan, for example the Sustainable Agriculture Project carried out by CARE, which is implementing strategies within the forests and soils components. The Instituto de Desarrollo Rural (IDR) has directed activities in the forests and soil conservation components. The Municipal Mayor's Office and the IDR are conducting school rehabilitation and housing projects for some of the victim families. The Programa Mundial de Alimentos (PMA) is implementing nutrition projects in coordination with other entities that work in the protection and conservation of natural resources. Credit coverage to communities has increased in the form of credit for seeds for the first and second planting of this year.

Contributors: N Espinoza, J Morales, B Gonzales, JA Beltrán
Collaborators: Inhabitants of the 15 microwatersheds that form the Calico River watershed; technicians working with CARE, the San Dionisio Development Project (PRODESSA), Association of Indian Communities, Municipal Mayor's Office, "Campos Verdes" Association of Community Organizations, UNA. Financial support was provided by the International Development Research Centre (IDRC).

Table 7. Current state[a] of 15 microwatersheds of the Calico River after hurricane Mitch, based on a series of components.

Watersheds	Overall state	Forests	Erosion	Water[b]	Infrastructure	Livestock[c]	Projects and community action[d]
Junquillo-Las Cuchillas	highly degraded		most affected	most affected			most affected
El Zarzal	highly degraded		most affected				
El Carrizal	highly degraded			least affected	affected		
El Quebrachal	highly degraded	most affected			seriously affected	most affected	
El Corozo	average	most affected					most affected
Susuli	average		most affected	least affected			
Jicaro no.2	average	most affected				most affected	
Wibuse	average			most affected		most affected	
El Zapote	good state		least affected		least affected		
Piedra Larga	good state					average	
Los Limones	good state					average	
Piedra Colorada	good state	most affected		most affected			
El Cobano	good state						
Jicaro no.1	good state	most affected					
Ocote	average			most affected	affected	most affected	most affected

a. All microsheds were affected to some extent; spaces in the table indicate less- or medium-affected watersheds.
b. Water supplies were affected because of blocked wells, destroyed latrines, deposition of dead animals, et cetera.
c. Livestock are mainly established in microwatersheds located in middle and lower areas; landslides had affected many pastures.
d. Results indicate the presence of entities and projects is exclusively restricted to areas close to the municipal capital and of easy access

Activity 2.1.2. Soil fertility map (post-Mitch)

The soil samples collected when assessing soil loss are being analyzed in the laboratories of the national University in Honduras (UNA). This activity will be fully reported when analyses are completed.

Contributor: UNA

Activity 2.1.3. Diagnosis of support systems for the development of market options

Not reported on this year.

Activity 2.1.4. Identifying and assessing market options using a participatory approach

Highlights

- ✓ Rapid market survey for the pilot subregion of Yorito and Sulaco, Honduras
- ✓ Market options evaluated and selected
- ✓ Survey of decision-making criteria used by small-scale producers regarding market options
- ✓ Participatory evaluation of market options with small-scale producers of Tascalapa River watershed

Objectives

This activity contains different modules. The overall aims are to:

1) Validate the methodological package developed for identifying and assessing options with market potential for small-scale producers at the Yorito and Sulaco reference sites, and
2) Apply the methodology to determine the most suitable options for conducting subsequent activities to develop rural agroenterprises, agroindustries, and support systems in Yorito and Sulaco.

Methods

Each module is carried out according to a methodology developed by Ostertag (1998)[5].

Results

[5] Ostertag CF. 1998. Identification and evaluation of market opportunities for small-scale rural producers. Guide No.7 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 182 p.

Based on selection criteria, the following products were selected as having market potential: avocado, cassava, tomato, red onion, sweet chili pepper, plantain, cabbage, lettuce, cheese, butter, sawn wood, wooden furniture, coffee, beans, and maize.
Matrices were produced of market, agronomic, and economic characterizations. Variables were determined for participatory evaluation. A survey identified the criteria that producers consider most important for adopting an activity.

Table 8 summarizes the options preferred and considered to be good options by different producers of different economic levels from regions with different types of access.

Table 8. Summary of options preferred and considered good by different producers in Yorito and Sulaco, Honduras.

Type of access	Options preferred at economic level of different producers[a]		
	High	Middle	Low
Permanent	**Milk products**, coffee, cassava, red onion, beans, avocado, plantain	Coffee, milk products, avocado, tomato, cabbage, red onion, sweet chili pepper	Beans, **maize**, coffee, milk products, plantain, tomato, cabbage, red onion, lettuce
Temporary	n.a.	**Coffee**, maize, avocado, red onion, plantain	**Coffee**, red onion, maize, avocado, cabbage, milk products, hand sawn wood
Bridle path	n.a.	**Coffee**, maize, beans, avocado, cabbage	**Coffee**, maize, beans, avocado, red onion

a. The options ranked in first position appear in boldface. No dominant option appeared in the group of producers from middle economic level with permanent access. n.a. = High economic level producers are only found with permanent access to markets.

All options present financial rates of return (FRR) that indicate their profitability. Except for beans, coffee, cassava, and wooden furniture, the other options present a positive net present value (NPV), indicating their attraction as businesses even with financing. Milk products, beans, coffee, avocado, and tomato have low price stability, but the rest of the products show little variation. The activities of sawmills, furniture manufacturing, and milk production require a high level of investment and labor compared with the others.

The participatory evaluation workshops indicated that coffee, avocado, plantain, maize, beans, red onion, and milk products are market options that usually interest producers most. However, preferences are relatively different depending on the type of access and the economic level of producers.

The sawmill and wood furniture options were discarded mainly because of the concern for sustainability of forest clearings. Although it was explained to producers that a forest management plan is feasible, they showed concern about problems such as the complexity of developing a forest management plan, the difficulty of acquiring a clearing permit, conflicts between tribes about forest exploitation, and high investment costs.

Output

Market options were identified. Involving farmers in the participatory analysis should lead to their greater acceptance of decisions made and quicker adoption of technological innovations.

Contributors: M Totobesola, SN-1, AGROGENET consultants
Collaborators: This activity is the product of inter-institutional work because basic decision making to conduct participatory evaluation involved the following local institutions: SERTEDESO, CLODEST, IPCA, Comité Interinstitucional para el Desarrollo de Sulaco (CIDES), CIALs, and the municipal mayors of Yorito and Sulaco

Activity 2.1.5. Diagnosis of land use in microwatersheds

Photographic catalog

Highlight

✓ Photographic catalog made of land use and cover in San Dionisio, Nicaragua

Objective

The aim was to establish a graphic record of land cover in the area of San Dionisio. This work complements the diagnosis of land use of the same area. In both, landscapes are being used to complement the information system for San Dionisio (in preparation) and to support ground truthing of the digital survey of topographical characteristics carried out.

Methods

Between the 29th of April and the 8th of May 1999, 51 landscape photographs were taken of the area of San Dionisio. For each photo, the following data were recorded: date and hour of taking, azimuth, geographical coordinates, altitude, characteristic for which photo was taken, slope, and aspect of the terrain. These photographs were then incorporated into the San Dionisio database as a points file, which allows the graphic opening of the file within the context of accessible digital cartography.

Various documents (Rubiano 1998a; 1999a,c,d,e) were produced on work done in the diagnosis of land use in microwatersheds and are available from PE-3.

Results

Information from photos on land use in San Dionisio is now readily available.

Contributor: JE Rubiano

Monitoring of patterns of soil macrofauna populations, with emphasis on earthworms, for potential use as a local-level resource indicator

Highlight

- ✓ Evidence that choice of land-use type withing small geographic landscapes affects soil macrofauna populations

Objective

The aim is to monitor macrofauna of a variety of land use types in the Cabuyal River watershed to use as an indicator of change so that environmental monitoring efforts can be focused to places at highest risk.

Methods

The methodology being used in this research relies on a spatially aggregated, stochastic, neutral modeling approach. The approach is to "eliminate" mechanisms in question and then compare predictions with empirical information. Expected "controlling factors" are then added to the model and results are compared. This is conceptually similar to stepwise regression and is intended to "keep things simple". For example, it may be that sample variability increases dramatically as a function of space and time in typical landscapes like the Rio Cabuyal watershed. However, sampling an indicator that has rigid spatial and temporal requirements is not likely to be accepted by community stakeholders responsible for local-level monitoring. Therefore, the specific question this research had to address was what are typical patterns and variances in abundance and biomass for a range of soil macrofauna.

Results

Figure 2 shows results of 20 months of sampling of soil macrofauna of a variety of land-use types (LUTs) found throughout the Cabuyal River watershed. Immediately obvious is the variability in macrofauna populations as measured by abundance and biomass across the range of LUTs sampled. A bit surprising is the magnitude of differences observed among the four forested sites. Nevertheless, biodiversiy as measured by number of taxonomic units was significantly higher in the forested sites (except for the pine plantation) compared to the LUTs characterized by increasing intervention. This reinforces the dilemma of abundance/biomass versus taxonomic diversity and respective relevance to the function of environmental filtering.

Another analysis looked at the issue of abundance/biomass and disturbance/intervention. Findings suggest that hope for developing a simple common scale "macrofauna" indicator for monitoring soil quality across a variety of LUTs, even within the same small community-scale ecosystem such as the 6000-ha Cabuyal River watershed, is not encouraging. More encouraging, however, is the evidence that choice of LUT within small geographic landscapes affects soil macrofauna populations. This suggests key plots within a landscape might be "zoned" for specific LUTs as a strategy for managing landscape functions such as environmental filtering.

In addition, other analyses are looking at relationships between abundance/biomass vertical distribution, relationships between abundance and biomass, and relationships between growth and development, for example, the resting, juvenile, subadult, and adult stages. The latter data has relevance to issues of population resilience.

Output

The landscape is being screened so environmental monitoring efforts can be focused on those plots within the overall landscape that are at highest risk. The strategy is then to use macrofauna monitoring as an "early warning" indicator of ecosystem change.

Contributors: A Feijoo (Universidad Nacional, Colombia), EB Knapp

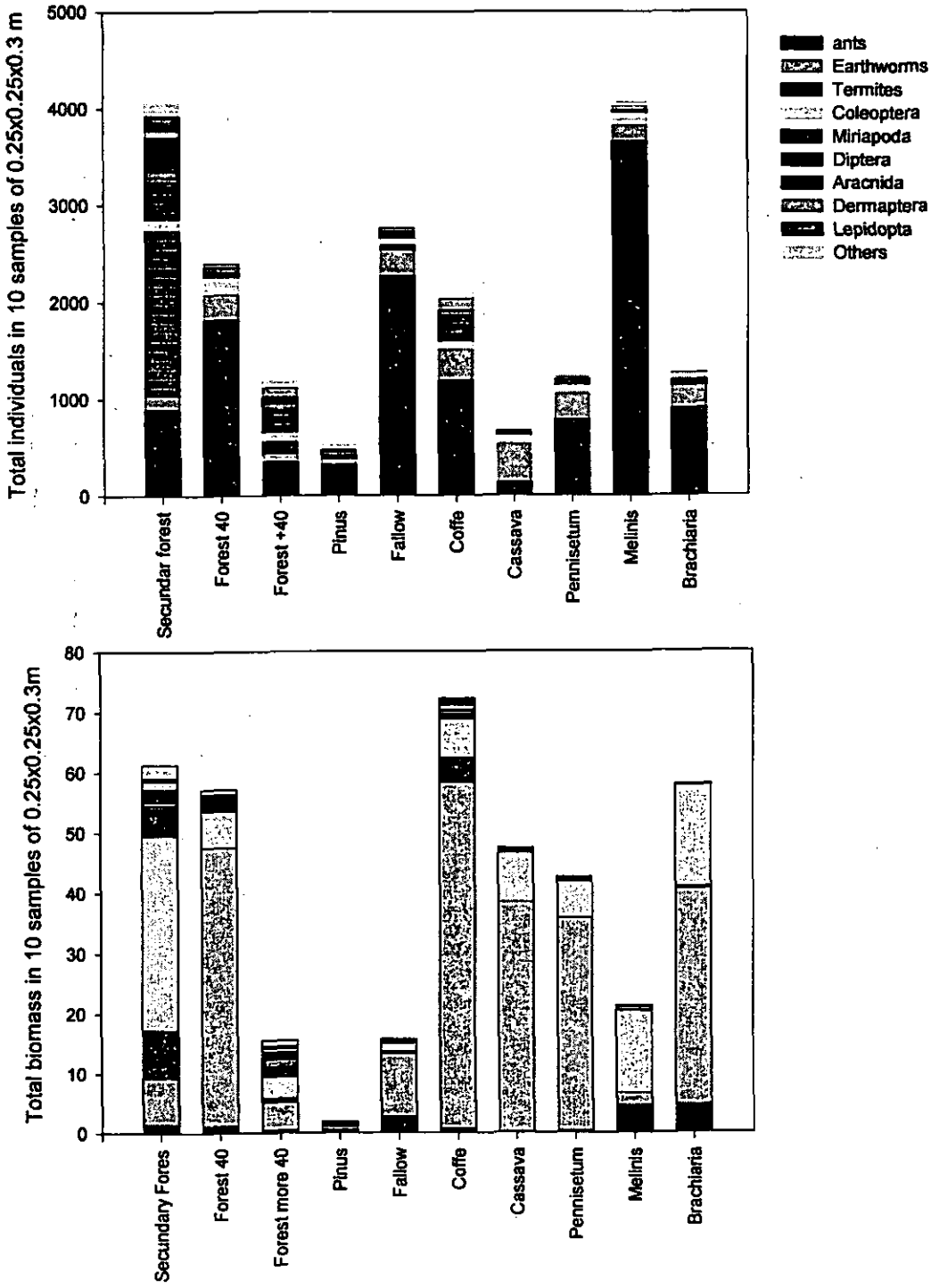

Figure 2. Results of 20 months of sampling of soil macrofauna of a variety of land use types found throughout the Cabuyal River watershed.

Activity 2.2. Ex-ante evaluate alternative scenarios of landscape management

Activity 2.2.1. Identify areas with potential for production and conservation of natural resources in the microwatershed

Characterization of Jalapa microwatershed

Highlight

✓ GIS characterization of Jalapa microwatershed completed

Objectives

The aims were to contribute to the diagnosis of the situation in the watershed and show, in three dimensions, the results of simulations. We also aimed to improve the microwatershed atlas and feed a bioeconomic model whose scenarios will improve decision making in the community.

Methods

Project PE-3 has made an agreement for collaboration with the research department of the Honduran Forestry University (ESNACIFOR, its Spanish acronym). A student (A Hernández) is to be trained in the application of the CIAT bioeconomic model to the Jalapa microwatershed, located between Yorito and Sulaco.

Results

The GIS characterization of the Jalapa microwatershed was completed. Five new maps were added to existing ones. These were a cadastral map made by the Ministry of Cadastre, a new land use map based on 1993 aerial photos, a map of the remaining national forest including tree density, a map calculating access time to roads, and a new 20-m slope map. To show results to the community, 3-D maps were developed. Four maps were overlaid (access to roads, slopes, altitude, and land tenure) to define 72 homogeneous land units that automatically feed the bioeconomic model.

Output

The information accrued can be used by projects and collaborating institutions.

Contributor: M Ayarza

Ex-ante evaluation of alternatives ("Earth" project)

Highlight

✓ Situation of beneficiaries of credit characterized more broadly as producers before and after land acquisition

Objectives

The project aims to analyze the impact over time of land tenure as an economic alternative for improving the quality of life of the poorest rural families in an environment where land is the principal means of subsistence.

Methods

Project participants belong to the poorest communities of the watershed, according to a survey on the level of well being carried out by CIAT's Hillside Project in 1997. A credit was granted for a 6-year period. The average amount approved for each beneficiary was US$600, which financed an average of 1.5 to 2 *manzanas* of land (equivalent to 80 m^2).

The annual interest rate was 8% and the debtors are to deliver 30% of their production each planting season (twice a year) or, in its absence, the minimum quota necessary to effect the payment on time, as initially agreed upon. Results will be monitored year to year, assessing impact 3 or 4 years after project initiation.

Most beneficiaries did not cultivate their land last year and those who did plant on part of it lost the crops when hurricane Mitch hit. Also, they had to prepare and clean the land they recently acquired, so they decided not to plant.

Planting took place during the first season of 1999, and production results are not yet available. According to the payment plan and the commitment assumed by all beneficiaries, the first quota should be delivered in mid September. CIAT is responsible for monitoring this payment. A first meeting was held with beneficiaries to assess several elements of impact and observe the changes that have occurred regarding their initial situation.

Results

The project began in April 1998 and after 1 year, eight of the nine quotas are in arrears of payment because of losses in production caused by hurricane Mitch.

With their participation, the situation of the beneficiaries was characterized more broadly as producers before and after land acquisition to facilitate further analysis and observe changes at the economic and of living standard levels (socioeconomic variables).

Outputs

Several expected changes have been observed, for example:

1) Land owners rent the most neglected soil and at different sites each planting season, thus discouraging any type of investment in conservation or other work, despite having the knowledge and willingness to do so.
2) No diversification options were available because they had to plant profitable crops with short-term income, with the sole purpose of "surviving".

Contributors: ME Baltodano, RD Estrada

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

Activity 2.3.1. Identify three microwatersheds of high priority to initiate actions in NRM for the Consortium

This activity is reported jointly under Activity 2.1.1 as the post-Mitch identification of high priority watersheds.

Activity 2.3.2. Applying methodological tools for managing natural resources at the landscape level (mapping, soil quality indicators, AFT, GIS)

Developing the digital database of Honduran soils

Highlight

✓ Database on Honduran soils produced

Objective

The aim was to develop a user-friendly consultation system on general characteristics of Honduran soils.

Methods

The Administración Forestal del Estado (AFE)/COHDEFOR was contacted about the use of soil data generated for the Project for Identifying and Delimiting Forest Land, carried out by the Dirección Ejecutiva del Catastro (DEC) between 1996 and 1997.

The characterization entries of more than 5000 soil profiles countrywide were added to the original database. Excel was initially used to clean the database and then expand it. Georeferenced information of these profiles was later included, allowing results to be spatially linked with the Honduras Atlas.

Results

We have digitized and preserved the most relevant information produced over the last 3 years and expect to facilitate the general diagnosis of soil conditions for general use and to extrapolate successful experiences to other similar sites. The database is the largest and clearest source of information on Honduran soils at the digital level, and will become a high-quality analysis and planning tool.

The database is currently in Fox Pro format and contains information of 656 profiles and 2422 strata, with their respective laboratory analyses and field descriptions, profile location data, and general information on the project. Contacts were made with the Instituto Hondureño del Café

(IHCAFE) to incorporate the database they recently developed for coffee-growing areas of Honduras.

The database was presented to the scientific and technical soils group, which met to form the Manejo de Suelos Acidos (MAS) Consortium at EAP-Zamorano.The representatives of 18 institutions of Honduras and Nicaragua, the universities of Bayreuth and Rothamstead in Germany, Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), and Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) attended the meeting.

Output

The database on Honduran soils can be used for high-quality analysis and as a planning tool.

Contributor: M Trejo
Collaborators: D Pineda, COHDEFOR; DEC Executive Office; F Sánchez, J Martínez, M Ruiz Identificación de Tierras de Vocacion Forestal (IDTVF) Project

Validation of soil indicators at the microwatershed level

Highlight

- ✓ A floristic map was produced from plants mapped and inventoried as soil indicators, using a participatory approach

Objectives

The aims were to establish quantitative limits to indicators prioritized by producers in the Luquigue microwatershed, identify indicator plants of soil fertility, and conduct a floristic inventory of the microwatershed.

Methods

The methodology followed that of Turcios et al. (1998)[6], López Suazo and Trejo (1998)[7], and Vernooy et al. (1998)[8]. These materials will also be used by EAP-Zamorano students in their thesis work in Agricultural Engineering.

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[6] Turcios WR, Trejo MT, Barreto HJ. 1998. Participatory method for identifying and classifying local soil quality indicators at microwatershed level. Guide No.1 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 146 p.

[7] López Suazo E, Trejo MT. 1998. Photographic analysis of land use tendencies in hillsides. Guide No.2 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 80 p.

[8] Vernooy R, Espinosa N, Lamy F. 1998. Participative mapping, analysis and monitoring of natural resources in a watershed. Guide No.3 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 138 p.

Results

A student activity schedule was established and drafts of theses outlines prepared. The most important indicators of the Luquigue microwatershed were identified. Plants were mapped and inventoried as soils indicators, using a participatory approach; a floristic map was produced. Students carried out a 1-week supervised work tour to obtain georeferenced information at defined points on several predefined transects of the microwatershed. Each thesis student was allowed to use the exercises and practices described in the Guides. Preliminary analysis of results has begun.

Output

Students were trained in the use of three methodological tools developed by CIAT-Hillsides.

Contributors: M Trejo, M Ayarza; D Ruiz, I Sierra, F Zaconeta (EAP-Zamorano students); R Zuñiga, M Andrews (EAP-Zamorano)
Collaborators: EAP-Zamorano and the Luquigue community

Activity 2.3.3. Estimating the impact of burning on natural resources and designing alternatives to burning

Honduras

Highlight

- ✓ Multi-institutional forum held in Tegucigalpa, Honduras as first step to creating a permanent linking mechanism between institutions working on the topic of slash-and-burn alternatives

Objectives

The aims were to determine the state-of-the-art of knowledge on the impact of burning and fires on natural resources in Honduras and to identify, together with other institutions, the causes and effects of burnings, defining strategies to reduce their impact.

Methods

A multi-institutional forum was organized in July in Tegucigalpa to examine management alternatives and environmental implications of the use of fire in hillside ecosystems. The forum was organized jointly with the Department of Natural Resources of EAP-Zamorano.Representatives of 18 institutions participated in the event. The five presentations offered on the topic were fully discussed. A card system was used to group problems found under common themes.

Results

Some of the information presented at the forum indicates that only 20% of the 2200 forest fires registered in Honduras in 1998 were spontaneous. Incendiaries caused most of them. Forum participants, however, agreed that periodic controlled forest burning could be beneficial in that it maintains the low level of accumulated residues. But, no technical recommendations are given for managing burning, nor is there a legal framework that regulates burning. Although Quezungualan producers in the region of Lempira have experimented with agricultural systems that do not use burning, other secondary problems arose such as pest pressure, weed invasion, and waste management (these must be solved to guarantee sustainability of the practice).

Participants assigned the problems related to burning to four areas of interinstitutional action: (1) research, (2) education, (3) involving local organizations, and (4) policies. The institutions that will serve as facilitators in future actions were defined in relation to each of the four topics: (1) EAP Zamorano, (2) ESNACIFOR, (3) CIAT, and (4) Secretaria de Recursos Naturales y Ambiente (SERNA). A committee was created to identify potential sources of funding to prepare joint projects.

Nicaragua

Objectives

The main aims were to:
1) Provide information and suggest action strategies in critical areas,
2) Create new mechanisms of coordination and/or strengthen existing mechanisms to face the problem of on-farm burning, and
3) Prepare work proposals to be carried out in areas under the umbrella of participating entities.

Methods

National experiences were presented in work groups. To promote group analysis, each group was given a set of questions to direct the discussion and reach a consensus on the topic. The guide covered (1) studies and experiences regarding burning on agricultural land, and (2) proposals for action regarding burning on agricultural land.

Results

Land use practices in Nicaragua include burning. Fires can be classified into two types: (1) intentional fires used to clean agricultural land, eliminate crop residues, and manage forests, among others, and (2) intentional fires caused by lightning or to cause harm.

In 1985, 13,184 fires were recorded, accounting for 550,539 hectares of land destroyed. In 1996, 5,023 fires were recorded accounting for 97,898 hectares of land destroyed. Of these, 64,431 hectares corresponded to burnings in agricultural areas and 33,467 to forest areas. National fire

statistics indicate a decreasing trend in the number of fires and area destroyed by fire over the last 12 years.

Output

A first step was taken towards creating a permanent linking mechanism between institutions working on the topic. This strategy will allow the project to capture demands, disseminate existing solutions, and generate other alternatives. In the near future, some of the proposals generated in the Honduras forum will hopefully be linked with those of the recently created Consortium of Integrated Soil Management.

Contributors: M Ayarza, M Trejo
Collaborators: R Zuñiga (EAP-Zamorano), B Bustamante (Programa de Agricultura Sostenible en Laderas [PROASEL]).

Activity 2.3.4. Promote the use of live barriers, improve soil fertility and water quality

This work was undertaken under the SOL initiative (see Activity 1.4.1.).

Activity 2.3.5. Develop multiscale methods for soil quality indicators (lot, system watershed)

This activity is reported under Activity 3.1.1. where the developed methods were incorporated in the updated version of the Indicadores Locales de Calidad de Suelos (ILCS)guide.

Activity 2.3.6. Develop participatory monitoring indicators of projects

Highlight

✓ Test case studies carried out at national level

Objective

The aim is to develop indicators for the participatory monitoring of projects.

Methods

At local level (Matagalpa and San Dionisio, Nicaragua), a project with PE-4 and MAGFOR was defined to produce an Atlas for Matagalpa and San Dionisio. In this context, an indicator set was defined, databases were consolidated and put into operation, and the interface to use indicators and produce the Atlas was defined.

Activities were held with national institutions (COHDEFOR, MAGFOR) to create capacities and

improve the use of information and tools. A Workshop was held with RENASIG on support tools and decision taking, 5-9 October 1998, Tegucigalpa, Honduras. A course was given on ArcView during this workshop. A meeting was held with MAGFOR, PE-4, and the CIAT-World Bank-UNEP Project to define the Indicators Project at local level (Matagalpa, San Dionisio), from March 22-26, 1999, Managua, Nicaragua. A coordination meeting of the same group was held from October 13-15, 1999, in Managua, Nicaragua.

Results

An indicator set was defined at local level for Matagalpa and San Dionisio, Nigaragua.

Output

The linkages and activities together with other projects and institutions at national level allowed the Rural Sustainability Indicators to exchange experience, harmonize frameworks and tools, diffuse results and methods, validate and test information and interfaces, and improve the use of information for policy making and planning

Contributors: M Winograd, M Aguilar (PE-4)
Collaborators: MAGFOR, PE-3

Activity 2.3.7. Develop participatory monitoring indicators of projects

This is an ongoing activity, as can be seen from the report under Activity 5.5.

Activity 2.4. Promote and implement consortia for landscape management

Highlight

✓ Consortium for the Manejo Integrado de los Suelos de Centro América (MIS) formed

Objectives

These were to:

1) Understand the role of MAS and its potential contribution to the region,
2) Develop a cooperation strategy among different consortium participants,
3) Define a strategy for field activities and dissemination of successful experiences, and
4) Develop a joint action plan to initiate the consortium.

Methods

A workshop was held at the EAP-Zamorano, Honduras, to promote the establishment of a Consortium for the Integrated Management of Soils (MIS, its Spanish acronym) in Central America. This consortium will form part of the Consortium for Managing Acid Soils (MAS) under CIAT leadership as well as part of the Systemwide Soil, Water, and Nutrient Management Program (SWNM).

Meetings were previously held in Honduras and Nicaragua to identify the main problems of sustainability related to soil, water, and nutrient management. These results were presented and discussed during the joint workshop, and topics of interest to both countries were identified and prioritized. The Consortium's mission and approach were also defined and, finally, an executive committee was named to monitor preliminary initiatives and prepare a work agenda that would be submitted to consortium members for approval. The Consortium is expected to be fully operational before the end of the year.

Results

The participants defined the consortium as "a multi-disciplinary and multi-institutional effort, whose objective was to create and facilitate the adoption of options for the sustainable management of soils in Central America". The Consortium's mission is "to offer viable competitive and sustainable technological solutions for the Central American region that benefit producers and their organizations".

Workshop proceedings indicate the problems identified per country and topics of common interest identified by workshop participants. The prioritization of topics at the end of the meeting was:
1) Inadequate management practices,
2) Strategies to adopt successful practices,
3) Alternate fertilizer sources,
4) Problems of water availability,

5) Nutrient recycling,
6) Soil biological structure,
7) Water quality,
8) Adapted germplasm, and
9) Policies.

This prioritization will be taken into account when preparing the work plan.

Executive Committee members are Margoth Andrews (EAP-Zamorano), Elizabeth Santacreo (DICTA), Matilde Somarriba (UNA), and Pedro Orozco (PRODESSA). Miguel Ayarza will represent CIAT in the Consortium. The Committee met in Nicaragua on 7 September to prepare its work agenda and define immediate steps to be taken.

Output

The Consortium should complement research and validation activities carried out by other regional institutions, while promoting the exchange of experiences and generating other technological innovations, especially at our reference sites. The success of the Consortium will depend on the interaction between institutions involved in research, technological validation and transfer.

Contributors: M Ayarza, R Thomas (PE-2)
Collaborators: M Andrew (EAP-Zamorano), M Somarriba (UNA)

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

Activity 2.5.1. Supporting local organizational processes such as the "Campos Verdes" Association

Highlights

✓ Effective contribution to community development

Objectives

The aims of the project are to:

1) Study and analyze the organizational process of the "Campos Verdes" Association, emphasizing those elements that have allowed its development and strengthening, and those factors that have limited its operation and are an obstacle to achieving sustainability, and
2) Compare this organizational process with other organizational experiences with similar characteristics, thus learning from the successes and/or errors that can be drawn from these.

Methods

The present study followed the methodological process ofBeltrán et al. (1999).[9]

Since the "Campos Verdes"Association was established 2 years ago, CIAT's Hillside Project has helped by:
a) Identifying social actors,
b) Formulating the Association's purpose, strategy, and expected results,
c) Promoting the development of new forms of local organization (CIALs),
d) Strengthening existing forms of local organization, and
e) Promoting networking or associations of local community groups.

During this period, CIAT staff participated in several Association activities.

Results

Concrete advances were made to legalize the Association in the short- or medium-term by establishing internal norms that regulate its operation. It has established a positive relationship with the Municipal Government.

[9] Beltrán JA, Tijerino D, Vernooy R. 1999. Developing processes of organization at local level for collective management of natural resources. Guide no.9 (in Spanish) of the series "Instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 147 p.

The diffusion strategy implemented by the Association in early 1999, in the 17 communities forming the municipality of San Dionisio, has strengthened community organization. This strategy helped identify those problems that the community considered most important, and assess to what extent the projects approved by the Association have met the priority demands of the rural population of San Dionisio. Also, both the sectorial and the territorial representativeness of the Association improved.

The participation of women in the diffusion strategy was significant, accounting for 40%, which is equivalent to some 200 women of different communities.

The Association shows signs of having reached a certain level of empowerment, in the sense that it has been carrying out an intensive financial management effort with national and international entities to increase its funds and thus be able to approve urgently needed community projects in the different communities. Members of the Association's Board of Directors received training in the management of economic resources and opening and upkeep of account books.

Communities have benefited from the production projects approved by the Association. These were directed toward preserving the environment and ensuring the food security of producers. These projects also benefit the Association because the granting of revolving credits generates income that allows the Association to grow.

Of the three projects approved by the Association in 1998, one involved a group of 15 associated women of El Zapote community, who belonged to the Association of Indigenous Groups, for the construction of an organic manure enterprise (Table 9).

Table 9. Small projects approved by the "Caminos Verdes" Association in March 1998.

Project name	Requesting community	Families benefited	Amount assigned (US$)	Results
Organic manure enterprise	El Zapote	15	70	4 t of fertilizer used in family orchards
Drinking water project	Susulí No.2	85	250	Improved water quality
Reforestation project	El Zapote	30	220	Reforestation along rivers and water sources
Total	3	130	540	

Regarding sustainability, the fact that the Association does not have legal capacity will become a limitation to fundraising in the medium or long term. However, Board members feel that this cannot be achieved in the short term, and that the Association needs to project itself and establish links at different levels (local, regional, national, and international) to facilitate the procurement of financial resources. Strong ties were established with three NGOs (CARE, PRODESSA, and United Nations Development Programme [UNDP]), three government organizations (Mayor's Office, MAGFOR, and UNA) and three local organizations ("Sueños Realizados" Cooperative,

Union de Campesinos Organizados de San Dionisio [UCOSD], and CIALs). This represents about 38% of the 27 entities working in the municipality of San Dionisio.

The Association has successfully obtained funding for community projects through national and international institutions and nongovernment organizations. Less than 2 months after hurricane Mitch, the International Development Research Center (IDRC), Canada, approved a project presented by the Association "Support Fund for the Application of Knowledge" for US$10,000. Also, the Association successfully established a collaborative agreement with the Group Pro Ecological Agriculture (GPAE, its Spanish acronym)/ Programa de Agricultura Sostenible de Laderas en Centro América (PASOLAC) for a Seed Fund of US$340. It participated with CARE and CIAT in the project "Support for planting *apante* beans"[10], for US$2800. Also, through CIAT's "Seeds of Hope" project, the Association negotiated 7.5 tons of seed for a value of US$3750 for the first planting season of 1999, especially with small-scale producers. All these projects pursued a common objective: to contribute to the reconstruction and reactivation of the Calico River watershed.

Output

The Association contributes effectively to community development. Several governmental and nongovernment organizations have found the Association to be an effective support to program activities, an indicator of the interest that has arisen in its permanence and operation in different communities.

Contributors: JA Beltrán, D Tijerino

Activity 2.5.2. Strengthen the organization of community groups related to the management of natural resources

Highlight

✓ Hand over of project control and responsibility to farmers

Objectives

The original aims were to identify new activities and strengthen ongoing activities through participatory evaluation and organizational strengthening. However, these were changed during the year mainly because of public disorder. Instead, the project has gone into a process of phase-out with the objective of handing over control of financial resources, decision-making, and responsibility to the local farmers' organization.

[10] *Apante* beans are those sown in the humid zones of Nicaragua in the months of November and December.

Methods

At the start of 1999, capacity-building activities were conducted. This included (1) presentation of the ant control experience and results by local farmers at a seminar on organic agriculture at the University of Cauca in Popayan, and (2) a visit to a local farmer committee (CIAL) working with maize followed by collective cultivation of maize. To strengthen ongoing activities, an ant control competition was completed with good results.

A major activity to be developed was the cultivation of sugarcane live barriers in collaboration with the CIAT soil project (PE-2). Because of external factors (public disorder), however, work was suspended for long periods of the year. This affected daily contact and the trust and confidence of the farmers, which is so important to this kind of work. Further, the indigenous organization decided to suspend collaborative activities until an arrangement of meetings at higher level decision-making between the *Cabildo* and CIAT could be agreed upon.

It was therefore decided to initiate a phase-out process to enable the local farmers to control and manage the project and its resources independently of CIAT. Thus far, a "Green Fund" (Fondo Verde) managed by CIAT financed research activities. The independent local management of this fund is perceived as essential for the success of locally based initiatives. At a later meeting, the communities selected an executive committee, but decided to limit initial activities to the municipality of La Laguna. Later, other parts of the watershed will be included. Unfortunately, the *Cabildo* decided not to participate.

Output

Control is being passed over to local farmers to manage the project independently.

Contributor: JE Rubiano

Activity 2.6. Monitor and evaluate landscape changes

Activity 2.6.1. Participatory mapping (Post-Mitch)

Assessment of damage caused by erosion in the Calico River watershed, San Dionisio

Highlights

✓ Soil loss assessed in six microwatersheds of Calico River Watershed after hurricane Mitch

Objective

The aim was to rapidly assess the damage caused by erosion post-Mitch. Also we wanted to discover the thoughts of producers and entities about this process in six microwatersheds of the Calico River, and on representative farms selected as having the lowest indexes of the soils component, according to the mapping diagnosis and the participatory analysis of post-Mitch natural resources.

Methods

Twelve farms were selected, located in the upper, middle, and lower areas of the watershed (from 350 to 1250 m), in areas planted to basic grains and located in the SOL project. Soil samples were taken for laboratory analyses, information gathered on farms, and sketches made of each farm. The damage caused by erosion was sampled and mapped on 12 farms.

Results

Table 10 indicates soil losses on 13 farms, of which the first 12 were located in areas used for planting basic grains, in six microwatersheds. Farm 13 was assessed for damages caused by erosion in an area located in the Wibuse-Jicaro microwatershed (SOL project).

Among the relevant characteristics estimated of study areas, slopes and contour length (more than 100 m) contributed to the damages observed, for example, erosion in ditches and higher soil loss in the different microwatersheds. The highest soil losses corresponded to farms located in the microwatersheds in the upper part of the watershed. The area damaged ranged between 3% and 5% of a plot of land. The results were presented to 10 producers who participated in the study, 13 neighboring producers of surrounding areas, five members of the "Campos Verdes" Association, and five of PRODESSA. Producers identified different factors causing landslides in the Municipality of San Dionisio, including:

- Too much water (high precipitation),
- Land slope,
- Water overflow in the upper part of the plots (overflux), which formed an avalanche of sediments,
- Uniform, loose soils with water saturation,
- Lack of soil and water conservation practices, and
- Fissuring of land before hurricane Mitch.

Outputs

Soil losses were measured and factors contributing to erosion assessed.

Contributors: F Ruíz, R Lira, N Espinoza, JA Beltrán

Table 10. Pertinent characteristics of 13 farms of six microwatersheds in the upper, middle, and lower Calico River watershed post hurricane Mitch.

Location in watershed	Microwatershed	Name of producer	Area (mz)[a]	Texture	Slope (%)	Contour length (m)	Soil depth (cm)	Soil loss (t ha^{-1})	Area damaged (%)	Degree of erosion[b]	Total soil loss per site (t ha^{-1})
Upper	El Junquillo/ Las Cuchillas	1. R Rocha	2.0	Silty clay	20-24	114	27	1300	13.4	ME	16,589
		2. M Guido	4.5	Silty clay	17-18	350	28	3132	17.3	ME	
	El Zarzal	3.V Molinares	3.0	Silty clay	12-15	33	20	9575	15.0	SE	
		4. R Zeledón	1.0	Silty clay	12-15	51	25	2582	5.0	SE	
Middle	Susulí	5. S Granado	7.0	Silty clay	25-28	150	18	973	5.4	ME	6,143
	El Carrizal	6. F Huete	2.0	Clay	15-35	129	20	102	1.1	ME	
		7. P Alvarez	2.0	Clay loam	23-35	159	21	4695	25.0	SE	
		8. R Orozco	2.0	Clay	35	205	17	373	2.5	ME	
Lower	Upper Ocote	9. H Valiente	2.0	Silty clay	15-25	180	30	19	0.5	ME	2,351
	Jícaro 2	10. J Orozco	3.0	Clay	25	50	30	106	0.8	ME	
		11. C Porras	1.0	Clay	35-40	55	15	1902	12.0	SE	
		12. L Mercado	1.0	Clay	33	45	20	324	4.0	ME	
Middle	Wibuse-Jícaro 1 pasture area	13. E Huerta	12.0	Silty clay	25-27	160	15	3885	15.0	ME	

a. Manzana = 80 m x 80 m plot.
b. ME = moderately eroded and SE = severely eroded.

Activity 2.6.2. Elaborate field techniques for monitoring microwatersheds

Highlights

- ✓ Forest area at Jalapa microwatershed analyzed from aerial photography
- ✓ Data collected from 1993 forest inventory

Objectives

The aims were to estimate the change in forest area over time at reference sites and assess the importance of forests. We also aim to determine the economic importance and potential of agroforestry and the potential of environmental services (carbon sequestration).

Methods

The 1993 aerial photo of forests in the Jalapa microwatershed in Honduras was digitized. Land use was digitized and area per land use estimated. Data on tree density, volume, and productivity were collected from a forest inventory conducted in 1993.

Results

Two UNA students carried out work in San Dionisio; one of their theses was the floristic inventory. Two UNA students and two professors are studying the economic potential of agroforestry.

Output

The data collected and the analysis of aerial photography form a base from which to analyze the importance of forest in the Jalapa microwatershed.

Contributor: B Barbier
Collaborators: ESNACIFOR, UNA.

Activity 2.6.3. Monitor rainfall distribution at watershed level

We are initiating monitoring in the reference sites.

Activity 2.6.4. Develop and test indicators of water quality

Monitoring patterns of aquatic macro-fauna populations for potential use as a local-level resource indicator

Highlight

✓ Twenty thousand organisms catalogued

Objective

The aim is to assess the potential of monitoring aquatic macrofauna populations as local indicators of resource levels.

Methods

This activity was carried out in two phases. Phase I, from February 1997 to August 1998, was reported in previous Annual Reports. During Phase II, the Cabuyal River was monitored every 15 days to study life cycles of the aquatic insects. Also, during 1999, colonization studies were carried out in the rocky and litter habitats to monitor population dynamics after mechanical and chemical perturbations.

Results

Since 1997, 700 samples have been collected and over 400 have been partially processed. Twenty thousand organisms have been catalogued. Laboratory analysis of the aquatic macro-fauna is still in process. Results will be reported in 2000. To date, eight technicians including four thesis students, have been trained in the monitoring techniques.

Output Technicians trained in monitoring techniques

Contributors: C Mathuriau (Paul Sabatier University, France), EB Knapp

Activity 2.6.5. Case study of the application of sustainability indicators at different scales (country, department, watershed)

Highlight

✓ Interface developed for accessing tool to use basic maps, indexes, and indicators

Objective

The aim is to develop a rural atlas for the department of Matagalpa and the municipality of San Dionisio, where basic cartographic information is combined and a series of indexes and indicators are defined and generated, contributing to decision making and to the monitoring of development and environment issues.

Methods

A digital database was constructed at a 1:50,000 scale for rivers, roads, towns, contour levels, and municipal and departmental limits. Maps were made of current land use, soil, climate, potential land use, and conflicts over land use. A socioeconomic database was designed and set up, georeferenced for the department and for the municipality.

The methodology and application of indicators to help in decision making and in monitoring development and environmental issues were designed. Basic and complementary indexes and indicators by problem were selected. An interface was developed that enables decision-makers to access a tool for using basic maps, indexes, and indicators.

Results

These are being processed by GIS-MAGFOR, and reports of advances will be sent soon.

Contributors: M Winograd (PE-4), MAGFOR
Collaborators: E Marín, I Salinas, R Rivas, M Loyman, C Zuñiga, C Poveda (MAG-FOR); M Aguilar, A Farrow, K Pallaris, A Nelson (PE-4), JE Rubiano, JA Beltrán

Output 3: Organizations strengthened

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

Highlight

✓ Guides 1 and 2 of the nine methodological tools updated and improved

Objectives

The aim was to introduce changes into the ILCS manual [11] to improve technical and scientific aspects of the microwatershed concept to be used in training workshops. Guide no.2,[12] was to be restructured for easier understanding by the end user.

Methods

Guide no. 1 was updated and edited. The organization of Guide no. 2 was reviewed extensively. It required reorganization and expansion or correction of several concepts. It was successfully restructured on the basis of a literature review and on consultation with experts on the topic. Changes were made as deemed necessary, mostly in form and background information. Among major changes made to manual 2, were the new orientation given to the Introduction, and the expansion of the concept of biological activity in soil formation, with relevant exercises and practices. Also, two new sections were introduced: (1) comprehensive soil quality indicators and the concept of plants as soil quality indicators, and 2) soil quality indicators at the microwatershed level: impact assessment of natural resource management at several different scales. These were written by E Barrios.

Results

The revised guides were published.

Output

Constantly updating and improving the methodological tools ensures their validity when used in the field.

Contributors: M Trejo, E Barrios
Collaborators: R Thomas, W Turcios, V Zapata (Consultant)

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[11] Turcios WR, Trejo MT, Barreto HJ. 1998. Participatory method for identifying and classifying local soil quality indicators at microwatershed level. Guide No.1 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 146 p.

[12] López Suazo E, Trejo MT. 1998. Photographic analysis of land use tendencies in hillsides. Guide No.2 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 80 p.

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

Highlights

- ✓ Planning and coordinating decision support tool workshop in Santander de Quilichao, Colombia
- ✓ Strategic planning meetings and workshop in Colombia to conform inter-institutional consortia and elaborate project proposal for the application of all eight decision support tools in the municipality of Bolívar
- ✓ Presenting the stakeholder analysis methodology at workshops in Colombia and the Dominican Republic
- ✓ Training of trainers in the stakeholder analysis methodology in Colombia, the Dominican Republic and Honduras
- ✓ Validation workshop in Ticuantepe, Nicaragua

Objective

The decision support tools consist of eight guides developed by various projects at CIAT in collaboration with farmers and professionals from national counterparts. As a part of its objective to strengthen local institutions in their work with rural development, a training process was initiated in Colombia and several Central American countries, specifically Honduras and Nicaragua. The main objective is to train trainers to diffuse knowledge, capacity, and the final application of the methodologies by a range of different local institutions, NGOs, and government organizations.

Methods

The workshop in Santander de Quilichao, Colombia was held from April 14 to 23, and consisted of a process of identifying and training partners, and presenting the methodologies for the end users. The workshop was organized by CIAT and its partner organizations from the Consorcio Interinstitucional Para una Agricultura Sostenible en Laderas (CIPASLA) and organizations related to the Guadalajara watershed in Buga. Thirty-three technicians from 20 organizations and 20 farmers were trained in using the decision support tools.

As a follow-up on the workshop in Santander de Quilichao, participants were asked to elaborate action plans to specify how and when they would apply the methodologies. At meetings in May and July, agreements were reached to carry on with two larger projects.

1) Ex-ante analysis of the economic feasibility of forage technologies and systems for the conservation and recuperation of degraded soils in the Andean Region of Colombia.
2) August 25-27, a Strategic Planning Workshop was held to conform an inter-institutional consortia and to develop a project proposal for its initial activities.

This second initiative emerged as a desire from some of the participating institutions in the Santander de Quillichao workshop to join forces in using and applying the decision support tools. At present, the Consorsio Interinstitutional para el Manejo de los Recursos Naturales del Norte y

Centro del Valle del Cauca (COMVALLE) consists of 11 organizations: Eco-Futuro, CORPOCUENCAS, Planeación Departemental, INTEP, CIAT, CIPASLA, CORPOICA, FIDAR, UMATA, ASIAVA, and ITA (see p 115 for acronyms). The project proposed aims to incorporate the eight decision-making tools in the member organizations' daily work with rural development and management of the natural resources.

The training course in the Dominican Republic took place from June 22 to July 3. More than 40 participants from 20 different organizations participated in the course, which basically had the same objectives as the course in Santander de Quilichao. The course was requested by the Centro para el Desarrollo Agropecuario y Forestal (CEDAF), at the Instituto Superior de Agricultura (ISA) in Santiago de los Caballeros. Eight instructors/authors of three manuals trained six research partners in the use of Guides 1, 2 and 3. These trainees, in turn, presented the manuals during a course offered to 37 technicians and professionals and 20 farmers of La Cumbre farming community. Overall, 65 individuals from different organizations participated or collaborated in this training event.

The course in Honduras took place from September 12 to 22 and was slightly different in the sense that it aimed at creating a national training team for Honduras (and later for Nicaragua and Colombia) in the use and training of the decision support tools. Participants in previous courses have only trained professionals and extension officers within their own organizations. The idea is that at national level this team will carry out a series of training events for local users of the tools. As a result of their training, users will design "action plans" as has been done in Colombia and the Dominican Republic.

The validation workshop in Ticuantepe (Nicaragua) was attended by 64 participants, amongst producers, agricultural technicians of ADECA, CENADE, INPHRU, INTA, PASOLAC, Aldea Global, and the Mayoral Offices of Ticuantepe and Nindirí; and representatives of UNA (see p 115 for acronyms). Of these, 11 teachers from UNA were also being trained in the application of methodological tools and 25 technicians of the other institutions as final users.

Output

The validation workshops have allowed the content of the different manuals to be improved and their applicability broadened. These workshops have also made CIAT materials accessible to many more people and institutions in the region.

Contributor: O Westermannn
Collaborators: H Barreto, W Turcios, E Barrios, N Espinosa, E López, J Martínez, CLODEST, Campos Verdes, CENADE, CIPASLA, CEDAF

Activity 3.3 Strengthen small-scale producers, managers, and local, regional, and national organizations in aspects related to rural development using participatory investigative methods

Activity 3.3.1. Identify and design integrated productive projects (PPI, its Spanish acronym)

Not reported on this year.

Activity 3.3.2. Support to RENASIG and CNGeomática Networks

Highlights

✓ Support to RENASIG in training in the use of GIS

Objective

The purpose was to raise awareness on the value of information and to judge the feasibility of producing a consolidated dataset of which non-technical users can take advantage for planning.

Methods

A large collection was made of GIS coverages assembled in a user-friendly interface programmed in ArcView Avenue, together with metadata, gray literature, and tutorials. Through RENASIG, the responsibility of updating the Atlas can be taken over by national organizations, with technical assistance from CIAT as required.

An extensive multidonor effort, the Honduras Atlas was formally released in October 1998. The release of the Atlas was followed by a 2-day course in Honduras: Advanced ArcView with the Honduras Atlas, where 20 participants learned advanced GIS techniques while learning how to use the Atlas. The interface, produced in Arcview data Publisher 2.1, was perfectly stable in spite of the randomness in the participant's keystrokes.

Results

Technicians were trained to use GIS for updating the Honduras Atlas. Virtually all participants showed great interest in producing a similar product for their organization, with the help of CIAT.

Output

A national organization received support in using GIS for mapping.

Contributors: G Leclerc, F Lamy, G Grenier, E Barona, B Barbier, representatives from FAO, USGS, ESRI, and MAGFOR

For other information on support to RENASIG, see Table 14 under 5.4.2.

Activity 3.3.3. Elaborate agreements of cooperation

This is a dynamic, ongoing activity. The Project has been updating existing agreements and working on the development of new ones on different scales with different partners.

Activity 3.3.4. Promote support systems for the economic activities of small-scale producers

Not reported on this year.

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

All work originally scheduled under this activity number is at present being integrated into the process of the SOL network and implemented there. See under Activity 1.4.1.

Activity 3.5. Promote and support interinstitutional plans for sustainable rural development

For the sake of brevity, the many events in support of interinstitutional plans for sustainable rural development are reported in the form of join tableswith those for strengthening work with other projects and organizations. They can be found under Activity 5.4.2.

Activity 4.2. Generate information, tools, and methods to support decision taking at different levels

Activity 4.2.1. Develop the San Dionisio Atlas

Highlight

✓ A digital Atlas produced

Objective

The aim is to develop an Atlas of San Dionisio.

Methods

In Nicaragua, a digital Atlas similar to the Honduras one was produced mainly as a startup for a Nicaraguan initiative to produce a national Atlas. We identified MAGFOR, the Nicaragua Ministry of Agriculture and Forestry, as the best partner to carry on this task. An agreement was signed in October 1998, to coordinate the development of a national atlas that would include, among other, the coverages representing the municipal-level plans for agricultural development that MAGFOR is producing under contract with the World Bank. A component of the Atlases that was added later, i.e. introduction of Sustainability Indicators through funding by PE-3 mini-grants program, is described in Activity 2.6.5.

Result

A digital Atlas was produced as a first step in developing an Atlas of San Dionisio

Output

This will serve an important purpose for CIAT: the communication of these plans to our partners in the benchmark sites. In effect, CIAT has a strong commitment in building common knowledge bases, which proves especially effective when a vertical dialog among decision makers can be established together with the horizontal ones that exist in our benchmark sites.

Contributors: G Leclerc (PE-4), F Lamy, G Grenier, E Barona (PE-4), M Ayarza, B Barbier, representatives from FAO, USGS, and Environmental Systems Research Institute (ESRI), MAGFOR

Activity 4.2.2. Update Nicaragua Atlas

This activity is under process

Activity 4.2.3. Elaborate a map of actual and potential land use

Highlight

✓ Processing of the basic geographic information available was worked out

Objective

The aim is to elaborate a map of both actual and potential land use to help decision makers in watershed areas of Nicaragua.

Methods

The information available was documented. It includes:

1) A study of land use/cover of San Dionisio,
2) Revision of information available at the end of summer 1999,
3) Digital map of land use 1988 for the Calico River,
4) Identification of biophysical units in the San Dionisio watershed,
5) A photographic catalog of land use in San Dionisio, and
6) Geographic characterization, together with PE-2, of the reference sites in Central America.

Results

We have made good progress towards the finished product.

Output

All information on San Dionisio is now ready for use in the mapping.

Contributor: JE Rubiano

Activity 4.2.4. Preparing a model of the Calico River watershed

Highlight

✓ A model of the Wibuse-San Dionisio district (Nicaragua) elaborated

Objective

The aim was to produce a model of the Calico River watershed that could be used by the local community to help in decision making.

Output 4: Decision-makers supported

Activity 4.1. Identify, at different levels, decision-makers related with project tasks and diagnose their needs in terms of support for their work

Highlights

✓ Community needs defined in Yorito, Honduras

Objectives

The aims were to determine the way in which tools and knowledge generated by the project can support collaborating institutions in decision making in NRM and to define strategies that allow project products to be incorporated into the agendas of partner institutions.

Methods

During the Advisory Group meeting held in Managua, technical aspects of the project were presented and participants analyzed their needs for training and technical support. A PPO Workshop was carried out at the reference site to evaluate problems of sustainability in the region and to identify topics that should be addressed by the project in the future. On the basis of these activities, a program including training and generation of technological options was designed for the reference site.

Results

Table 11 shows the needs for training and technical support expressed by members of the Advisory Group. Most of the demands were related to training in the use of project tools. The presentation of NRM tools to members of the advisory group allowed the project to determine the demand for project-generated tools. On the basis of this demand, training courses were designed and held in September and October.

The PPO Workshop carried out with institutions and producers of Yorito made it possible to corroborate the causes and results of the low sustainability of production systems in the region. On the basis of this analysis, community needs were defined in order to improve the standard of living of the population in this region. Many of these needs were considered when selecting topics of the SOL.

Output

The needs for training and technical support were defined. Training courses were given based upon this demand.

Contributor: M Ayarza
Collaborators: Members of the project's advisory group, local institutions in Yorito, rural producers of Yorito.

Table 11. Joint training, promotional, and support activities proposed by institutions belonging to the Advisory Group. (For acronyms and abbreviations, see p 115).

Institution	Country	Output 1 Production systems	Output 2 Sustainable landscapes	Output 3 Strengthened organizations	Output 4 Supported decision-makers	Output 5 Project management
UNA	Nicaragua	Ex-ante evaluation Participatory research	Participatory mapping Soil quality indicators	Assistance in national planning Research on natural resources	Information management Dissemination of tools	Support communication forums
MARENA	Nicaragua	Indicators of NRM	Development of biodiversity and NRM indicators	Training of territorial delegates in NRM		Strengthening SIAM
CARE	Nicaragua	Characterization of farms participating in project	Groups interested in landscape management	Strengthening local organizations in use of tools		
PASOLAC	Nicaragua	Guidelines and resources to use tools				
FAO (Lempira)	Honduras	Technical support in validating systems				Coordination of ASEL policy decision-makers
IPCA	Honduras	Improved practices to validate in CIALs	Strengthening landscape management consortia	Support local organizations in research and assessment		
IICA	Honduras	Support of successful multiplication experiences	Identification and promotion of stakeholders	Support to sustainable rural development		Support to CLODEST and CIDES
IHCAFE	Honduras	Farm characterization farms Ex-ante evaluation		Development and validation of tools	Information management tools and methods	
EAP-Zamorano	Honduras	Fellowships for validation of models and indicators	Fellowships for ex-ante simulation of scenarios	Instruction and materials in strengthening organizations		
DICTA	Honduras	Participatory validation Artisanal seed production		Market opportunities ASEL unit		
Municipality	Honduras	Support workshop on technological alternatives	Identification and promotion of stakeholders		Use of Yorito Atlas to analyze problems	
CURLA	Honduras	Development of model farm			Restructuring study plans	
CLODEST	Honduras					Execution of joint activity plan

Methods

A model of the Wibuse-San Dionisio district (Nicaragua) was elaborated for the use of local groups. Local community leaders, professors, and students were trained in the preparation of models and their use.
Field validation was conducted of the preliminary version of the Methodological Manual of Modeling, to be subsequently incorporated into the series of methodological manuals prepared by the project.

Results

This activity is adding to the work done on teaching manuals by the project. Work on the preliminary version of the manual of modeling is progressing well.

Outputs

Training local groups in the preparation of models and their use should help them in their decision taking.

Contributor: JE Rubiano

Activity 4.2.5. Publication of an Agricultural Atlas on Maize in the hillsides of Honduras

Not reported on this year.

Activity 4.2.6. Classification of census variables for DSS

Not reported on this year.

Activity 4.2.7 Workshop for scenario analysis of water balances for monitoring the watershed level

Highlights

- ✓ A scenario analysis of water and land use interactions for the Rio Cabuyal watershed in southwest Colombia carried out using a process-based, data-economic simulation model.
- ✓ Results presented in a modeling workshop attended by 50 participants from various Colombian institutions
- ✓ Underlying social and institutional conflicts in the watershed identified

Objective

The aim of this activity is to develop a computer model that can assess the consequences for water budgets as a result of effects of alternative paths of community- watershed development.

Methods

Three different scenarios for the year 2025 were defined based on contrasting, but plausible, views of development for the Cabuyal River watershed. Each scenario is characterized by a different magnitude and direction of changes in the land cover/use pattern and different growth rates and spatial distribution of the population, resulting in distinct sectoral water demands. These factors are considered key external stresses that act on the watershed ecosystem. The scenarios were used to test the "fitness" of the watershed under these external, unpredictable stresses. The level of fitness is an indicator for the longer-term sustainability of the watershed and resilience of the watershed to external disturbances. The fitness of the watershed was evaluated by applying a stress and evaluating whether, (1) a critical sectoral water shortage occurred, (2) where in the watershed it occurred, and (3) during what time of the year it occurred. In other words, the question to be answered was under what condition(s) would the watershed fail the fitness test for water regulation?

A Workshop was held on Hydrologic Models for Decision-Making, CIAT-King's College, June 1999.

Needs were determined of organizations and projects in Cauca, Colombia, and in Ecuador regarding monitoring and modeling of land use change, hydrology, and erosion.

Results

Measured river flow rates were compared with results of model simulation for the Ovejas River, the larger gaged river of which the Cabuyal River is a tributary. Figure 3 compares the results of simulations of the three scenarios together with current (1995) water use by sector for the peak demand months of August-September.

Output

Armed with this knowledge, strategic decisions can be made regarding policy and investments, which will reduce the risk of supply/demand conflicts. In fact, our analyses indicate that the Cabuyal River watershed supplies enough water to satisfy the demand of all three scenarios if a few small dams are built to store water for use during the dry season. It is also a straightforward exercise to estimate economic agricultural production under constraints of the respective scenarios.

Contributors: JC Luijten and JW Jones (University of Florida), EB Knapp, JE Rubiano

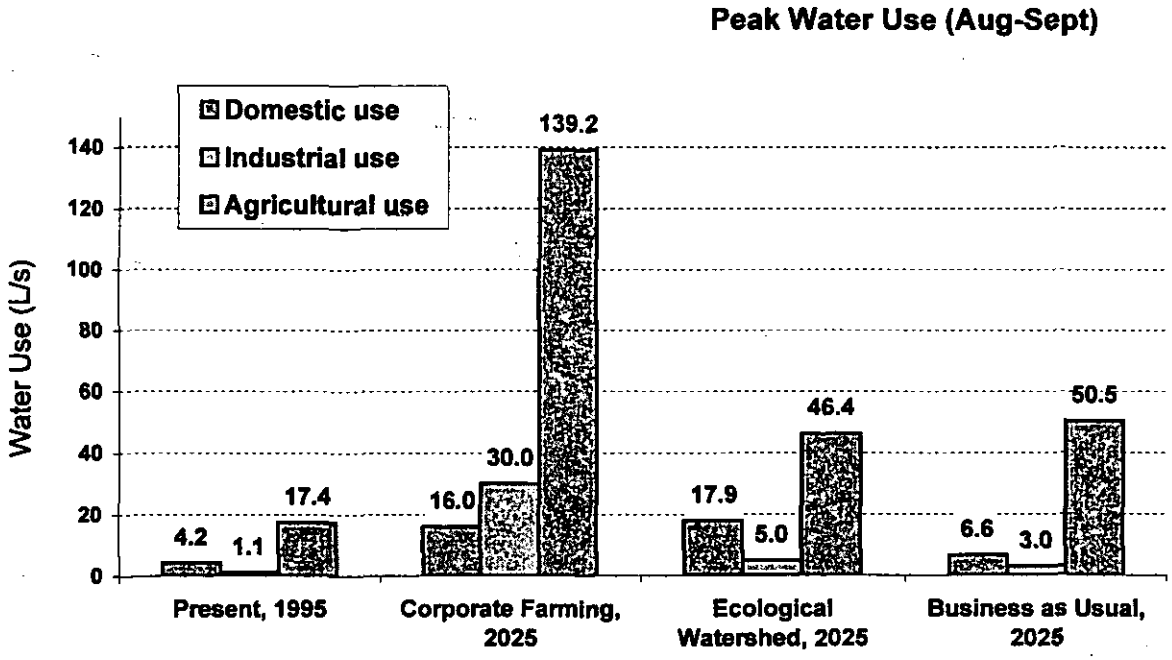

Figure 3. Results of simulations of three scenarios together with current (1995) water use by sector for the peak demand months of August-September.

Activity 4.2.8 Study of the development of models to generate temporary and spatial changes in land use

Highlights

- ✓ Simplified hydrological model used in evaluating different scenarios of land use/cover
- ✓ Integration of empirical models with physically hydrological based models showed great potential in evaluating "future" scenarios of land uses
- ✓ Impact of deforestation on slope stability assessed for Ovejas watershed
- ✓ Topographical features identified, associated with land cover in Cauca, Colombia

Objectives

The objectives were to:

1) Model the potential hydrological impact of scenarios for land use change generated by empirically based cellular modeling,
2) Assess the impact of deforestation on slope stability in the area of the Ovejas watershed, Cauca, Colombia, and
3) Determine whether topographical features are associated with land cover changes within a tropical hillside watershed.

The hydrological model

Methods

Three time series maps (1946, 1970, and 1989) from the Cabuyal watershed were analyzed to identify shape patterns of land use changes and identify neighbourhood relations. The cellular automata (CA) model was then applied to the Tambito catchment and land use cover scenario maps were generated and used as input for the hydrological model. Soil samples were collected from 16 different points in the catchment, which was classified according to slope, aspect, and vegetation cover. Other field measurements were taken.

Results

Results showed that land use change is associated with the presence of roads and rivers. The neighborhhood analysis presented no clear patterns of change that depend on the extent of a specific land use around each category. The model reproduced with good approximation the behavior of parameters like evaporation and infiltration reported in the literature.

For full details on methods and results, see Rubiano (1998)[13].

Impact of deforestation on slope stability

Methods

Eighteen sheet maps were digitized and a DEM was built for each. Following the surface module in Grid Module, slope, aspect, and watershed delineation coverages were produced. Safety factors of slope were calculated.

Results

The analysis shows that when cohesion is reduced, after total deforestation, the area susceptible to landslides increased by 11,000 hectares.

For full details on methods and results, see Rubiano (1998)[14].

[13] Rubiano JE. 1998. Hydrological impact of land use change in tropical hillsides: The impact of patterns. MSc dissertation, King's College, London. Available from PE-3. 83 p.

[14] Rubiano JE. 1998. Assessing the impact of deforestation on slope stability within the Ovejas watershed, Cauca, Colombia. Technical document, available from PE-3. 29 p.

Identifying topographical features associated with land cover

Methods

To examine the relation between the physical variables and land cover series, a chi-squared statistical analysis was carried out. Each series of land use change was compared against features derived from a DEM. These features were slope angle, altitude, wetness topographic index, and terrain aspect.

Results

The results obtained show a high dependence of land cover types upon landscape topographical features. Slope and aspect showed the clearest relationships while altitude and topographic index were not as strong.

For full details on methods and results, see Rubiano (1998)[15].

Output

Developing models to assess land use changes helps in areas where data are insufficient or lacking. They then need validation in the field.

Contributor: JE Rubiano

Simulating watercourses in a community watershed from digital terrain models

Highlight

✓ Capacity developed to simulate watercourses in a community watershed from digital terrain models

Objective

The aim is to simulate watercourses in community watersheds that can then be used to target scenario analysis and monitoring.

Methods

The Spatial Water Budget Model (SWBM) is a watershed-scale model of continuous simulation and distributed parameter that simulates water supply and demand over space and time on a daily basis using raster GIS data structures. It was programmed in Avenue and is fully embedded in ArcView GIS v3.1. Based on a digital elevation model (DEM), the SWBM delineates the locations of streams. The streams are used to determine the locations of possible springs (for the sake of simplicity, we are calling the "plots", springs)

[15] Rubiano JE. 1998. Identifying topographical features associated with the land cover in a hillside environment, Cauca, Colombia. Technical document, available from PE-3. 29 p.

Another aspect analyzed was the prevailing land use near springs. Two different land use datasets were used: 1994 air photography and an image classified from 1989 Landsat TM imagery (by M Langford). Both land use classifications have quite different classes. A 200 x 200-m majority filter was applied to the 1989 image (the original image has a fine 10-m resolution, resulting in an extremely heterogeneous landscape).

Results

The stream network has been delineated for 3 different days in 1994 – a day in the wet season (A), mid season (B), and dry season (C). Results are based on actual simulations. The stream flow at the outlet of the watershed was 2164 L (A), 1030 L (B), and 284 L (C). The number of springs on the 3 days were 69 (A), 30 (B), and 12 (C).

An example priority map might show 1-ha plots across the 3246 ha Cabuyal River watershed. This analysis can be thought of as identifying microdrainage areas where each numbered site is the beginning of a stream originating from leaching and lateral flow across a small drainage area. The analysis focuses scarce diagnostic and monitoring resourcesThe map was generated based on threshold levels of water flow. The technique lends itself to multiple simulations using a range of threshold levels and therefore can produce more refined maps based on sensitivity analyses.

Results of the analysis of prevailing land use seem to suggest a strong relationship between the location of springs and a few specific land use types (e.g., dense pasture, bush scrub), natural clean pasture, and stubble. To investigate if such a relationship does exist, the results must be corrected for the actual area of each land use class. Table 12 gives the areas covered by each land use type. The area covered by each varies strongly. Streams and springs in reality may be located around specific land use types such as forest. This may be partly the result of deforestation projects in the neighborhood of the springs (e.g., creation of natural buffer zones around waterways).

Table 12. Area covered by each land use type (ha), and the spring density indices (based on 1989 Landsat TM imagery) in the Cabuyal River watershed.

Land cover type	Area (ha)	Wet season (day 122)	Mid season (day 168)	Dry season (day 319)
No vegetation	126	1.12	0.86	0.00
Exposed soil	267	1.23	1.22	0.00
Scant pasture	231	0.61	0.47	4.68
Dense pasture	1012	1.16	0.86	1.07
Bush scrub	797	1.24	2.04	0.68
Young woodland	179	0.26	0.60	3.02
Mature woodland	260	0.72	0.00	0.00
Bamboo stand	81	1.74	1.34	0.00
Coffee plantation	83	0.00	0.00	0.00
Cropped land	210	0.45	0.00	0.00
Total	3246			

Outputs

An important aspect of this work is that it greatly reduces the complexity of monitoring landscape properties and creating scenarios of plausible future states by focusing attention and resources on a fraction of the total area. Another output is the capacity to simulate watercourses in a community watershed from digital terrain models. These simulations can be used to prioritize small plots of land within complex landscapes based on lateral flow and drainage properties. Individual plots across the landscape that are sensitive to accumulation of water and therefore accumulation of soluble ions can then be targeted for scenario analysis and monitoring using procedures developed by other collaborators on this activity (see Activity 4.2.7).

Contributors: J Luitjen (University of Florida), EB Knapp

Systematizing procedures for creating explorative scenarios of land use change using an entirely different type of simulation model, cellular automata

Highlight

✓ *Cellular automata* simulation model tested

Objective

The aim of this analysis was to investigate the propensity of the ecosystem to reach equilibrium in proportions of land cover for the different explorative scenarios.

Methods

This type of modeling is structured around statistically based, heuristic rules rather than mathematical relationships. Its role is to fill the gap when strict data requirements of numerical models cannot be met. We have engineered a rule-based model that simulates changing patterns of land cover based on logical rules developed from time-series analysis of historical air and satellite imagery and GIS coverages. Advantages of this class of models is that during scenario analysis, stakeholders are more apt to feel comfortable judging and modifying rules written in common text rather than abstract mathematical functions.

Land cover was projected over a 100-year time series. The year 2025 was chosen as the year of the explorative scenarios.

Results

The graphic projection shows that changes take place continuously over 100 years, but at slower rates. Whether the model reaches near-equilibrium land use distributions depends solely on the selection of land conversion rules. It would be difficult to *a priori* calculate a set of appropriate probabilities for which the land use distribution approaches an equilibrium because (1) the total

number of different probabilities is large and (2) each land unit may have a different set of applicable conversion rules. Moreover, there is no reason to suspect that exogenous land use drivers will drive the system to equilibrium.

Output

The model can be used to help in decision making on land use when data is insufficient or lacking.

Contributors: J Luitjen (University of Florida), JE Rubiano (University of Nottingham, UK), EB Knapp

Activity 4.2.9. Planning workshop using new "multiple goal-driven" methodology

Highlights

- ✓ A workshop held at the University of Georgia, April 22-23 for project research collaborators
- ✓ A workshop held in Managua, Nicaragua on May 18-20 for donors, Nicaraguan government institutions, nongovernment organizations, and university stakeholders
- ✓ A 250-page training workbook for use in the workshops developed and tested in two in-country workshops

Objective

We are engaged in developing and teaching a strategy whereby rural communities can form partnerships to create the environment in which they desire to live.

Methods

The first element of the strategy is to challenge stakeholders to examine their uncertain future through comparisons of a few descriptions of plausible alternative environments called explorative scenarios. The second element, in forums of representative stakeholders, is to identify a set of goals, the simplest of which should be represented by variables whose values can be observed or measured.

All other goals should be framed into one or more alternative sets of these simplest goals, which we call "desired future conditions". All descriptions of alternative futures, whether plausible or desirable, must be internally logical and consistent. Therefore, the third element of the strategy involves simulation modeling of key indicators called system variables (see Activity 4.2.7). The fourth and final element is the accessibility of current data and knowledge bases of system variables or indicators with which to begin the analysis and negotiation. An important use of the databases is to quantify distances or gaps between desired future conditions and current or plausible future conditions. Determining what it would take to close those gaps is what this strategy is all about.

Results

Workshops were held in April at the University of Georgia and in May in Nicaragual. A 250 page workbook was developed for use in the workshops and tested in two in-country workshops.

Output

Government institutions, NGOs, and university stakeholders are being trained in the use of the "multiple goal-driven" methodology.

Contributors: EB Knapp, G Leclerc (PE-4), V Zapata (Consultant); B Verma, S Nath, D Nute (University of Georgia, FL)
Collaborators: University of Georgia FL, Royal Agricultural College UK, CEMAGREF

Activity 4.2.10. Develop software applications for automating the multiple-stakeholder decision-making process

Highlight

✓ Developing software called "groupware"

Objective

The aim is to help build partnerships and create plausible futures.

Methods

The partnerships we are emphasizing in our work are best characterized as multi-institutional alliances affecting resource management of community-scale ecosystems such as watersheds. We have identified six critical tasks that consortia of institutions must carry out to successfully support resource management. They are to:

1) Identify stakeholders and ensure their representation in management efforts,
2) Provide forums for analysis and negotiation of diverse goals,
3) Define rules and norms for the use of resources within the watershed/landscape,
4) Initiate a process of local-level resource monitoring,
5) Formulate demand for services from external institutions in support of local efforts, and
6) Negotiate internal versus external watershed interests.

To facilitate these six tasks, we are engineering an enabling environment we call the Intelligent Team/Decision Support System or IT/DSS. The "Intelligent Team" modifier connotes that our DSS is designed to support a team of multiple-goal-pursuing stakeholders as opposed to single-problem, single stakeholder decisions. The "intelligence" follows from our objective to engineer a T/DSS that has internal capabilities to "learn" by monitoring shared communications between stakeholders and pro-offer or on-demand make suggestions that will facilitate and expedite collaboration.

Information technology products that are used to fortify computer-supported, collaborative work among groups of people are commonly referred to as groupware. Work on the IT/DSS began with an evaluation of groupware either available commercially or those available from public universities that were typically "free" but restricted to noncommercial applications.
Our search concluded with the selection of **Habanero©**, first released in 1996 by NCSA (the National Center for Supercomputing Applications (www.ncsa.uiuc.edu and search for "Habanero").

In our opinion, Habanero©, or any off-the-shelf groupware, does not qualify as a DSS. To fill our needs, we are molding Habanero© around a structured, goal-driven, group-planning methodology, which involves the following phases.

1. Statement of the core issue. Those representative stakeholders who scripted the initial set of

scenarios with a call for creating a forum will have proposed the issue under consideration.
2. Stakeholder identification. This phase involves a detailed identification of all stakeholders with an interest in the issue and examination of their actual or potential stake.
3. Goal formulation.
4. Development and evaluation of indicators (distance).
5. Goal-gap analysis. Identification of factors that are uncontrollable, facilitate reaching goals, or raise obstacles.
6. Generation of decision alternatives.
7. Evaluation of alternatives.
8. Agreement on the decision.
9. Implementation and monitoring.

Results

Drafts of printed instructional material to guide stakeholders through the methodology have been tested and are available. Virtual forums offer opportunities for stakeholders separated by geography to consult colleagues, double-check available data and perhaps carry out rapid surveys to facilitate agreement. We demonstrated the IT/DSS in a local area network (LAN) configuration in Honduras.

Outputs

A short-term alternative to virtual forums could be face-to-face meetings where IT/DSS links small working groups through a LAN. Although some effectiveness would be lost, the IT/DSS + methodology combination still has several advantages: built-in support for accessing databases either on a server or locally like CD-ROMs available from CIAT, spatial analysis functionality (primarily GIS), and access to Internet resources (text documents, online databases, images, etc.). In addition, the IT/DSS guides and automates the entering of information on prestructured forms and by tracking shared communications, it "learns" and can make "intelligent" suggestions.

Contributors: B Verma, S Nath, D Nute (University of Georgia); EB Knapp, G Leclerc
Collaborators: University of Georgia

Activity 4.2.11. Test commercial software for support to decision taking

This activity was carried out while undergoing Activity 4.2.10 in that the commercial software Habanero© was tested and found lacking as a DSS. It is for this reason that we are developing "groupware".

Activity 4.2.12. Obtain information of cattle census for the collaborative project with the University of Guelph.

Not reported on this year.

Activity 4.2.13. Mapping of cattle distribution in Latin America

Not reported on this year.

Activity 4.2.14. Develop georeferenced agricultural databases. ISNAR.

Not reported on this year.

Activity 4.2.15.

Extrapolation of locally defined poverty indicators to national level

Highlight

✓ Extrapolation of locally defined poverty indicators to national level

Objectives

The aim of this work is to examine methodological issues related to the extrapolation of indicators defined from participatory research (see IDB report 1998).

Methods

This is part of the definition of a unique approach to linking *ad hoc* measurements and geographical representations of poverty from community-level, locally constructed "well-being" rankings to standardized maps of national-level rankings. Our work links a measure of local indicators to nationwide databases and may contribute to bridge the knowledge gap between decision-makers and poor farmers.

Ravnborg and her team (see IDB mid-term report) characterized 90 Honduran villages using locally identified indicators to derive locally relevant rankings of "well-being". We then "link" this database to national household databases using neural networks, and then generate a map of the "well-being" composition of all Honduras villages.

Results

The result is an example of a "common knowledge-base" that can bridge the communication gap from international and national perspectives to local community perspectives.

Output

The level of well-being mapped at national level helps identify critical areas of poverty.

Contributors: G Leclerc, H Ravnborg, B Barbier, O Mejia

Labor productivity and natural resources: an assessment at the national level in Honduras

Highlight

✓ Labor productivity and natural resources assessed at the national level in Honduras

Objective

The aim was to establish if a link existed between natural resources and agricultural labor productivity.

Methods

Statistical analysis and GIS were used, based on census data and other biophysical parameters. The method can be applied quickly and can be reduced to smaller areas where projects and program want to focus. Correlation gives a sense of the relations between variables. Regression predicts roughly what would be the return of different investments. Cluster analysis helps to simplify the interpretation of a complex set of variables.

Results

We show through spatial analysis of productivity and natural resources that the relationship between natural resource conditions and agricultural productivity is not as direct as one might think. Length of the rainy season has a strong and quasi linear relation with income. Soil has little impact on productivity as well as slope and altitude since coffee production in the mountain has a strong relation on productivity. Access to the main cities and to the main seaports has little relation with productivity because some of the main cities are located in unproductive areas. Improving the small road network would have more positive impact. The study suggests that good research and good policies can have a good impact on productivity.

Outputs

The study establishes the link between agricultural labor productivity and natural resources variables at the national level in Honduras. The combination of the three statistic techniques, correlation, regression and cluster, improves the understanding of the Honduran situation and may help orient policy reform. This work brings new understanding on the way poverty is being measured, and how it relates to productivity and NRM. An important methodological challenge, i.e., extrapolation to national scale of local indicators, has been solved and can be applied to other areas of work.

Contributors: G Leclerc, H Ravnborg, B Barbier, O Mejía

Map of target areas for sampling

Highlights

✓ A strategy developed for sampling of problem and preference ranking using ancillary data

Objective

The aim was to develop a methodology to ensure that well-being, preferences, and problem rankings are extrapolatable to national level.

Methods

The method is based on the orthogonal design used for market studies. We chose a sample of villages that present contrasting biophysical and socioeconomic characteristics, to better identify the driving forces as to well being, preferences, and problems. We used our household-level census databases, and other GIS primary and secondary data. In contrast to "hard" sampling, where there is a fixed set of villages to study, we derived a "soft" sample, where villages are ranked in terms of their degree of contrast, and from which the user can choose a sample subset. This allows more flexibility for working with partners, or improvement of fieldwork efficiency. We prefer this approach to the one of choosing "representative" villages. In effect, representativity implies that we already know what factors are important, and therefore leads to a strong bias towards the known. The risk in that case is to pave the way to preconceived ideas, and forget to take into account the minorities or the voiceless.

Results

We found that the choice of contrasting sample should be preferred over that of representativity. Participatory research should be planned as a designed experiment to ensure generalization of the results. We found that a "soft" sample, i.e., a broader sample with a criteria to help to select a subsample, has the flexibility needed for field work and better integration of partners (NGOs, National Institutions).

Output

This activity helps towards the mapping of poverty at national level.

Contributors: G Leclerc, A Braun, LA Hernandez, M del P Guerrero

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

Activity 4.3.1. Disseminating and evaluating maps with communities and prioritizing actions with communities

Interactive atlas of the municipalities of Yorito and Sulaco

Highlight

✓ New maps added to Atlas of Yorito and Sulaco, Honduras

Objective

The aim was to promote the use of the interface by decision-makers in Yorito and Sulaco thus improving planning and investment.

Method

New maps from ESNACIFOR, COHDEFOR, and Cadastre were added to the Atlas. A former nonfunctional interface was repaired and improved with new maps. An ArcView interface with menus, with more than 30 maps at the village level, was created. The interface was presented to the community in early September, and was installed on computers of nine organizations in Yorito.

Results

The 23 best maps of the Tascalapa microwatershed are in a user-friendly ArcView interface with easy access to menus. These maps have already been shown several times to the community, but by the former team, without the user-friendly interface.

New maps were added.

Output

The user-friendly interface will ease the end user with GIS maps and help decision makers in Yorito and Sulaco.

Contributors: B Barbier, O Mejia

Training in GIS and database use

Highlights

✓ A manual was developed for local organizations on how to use ArcView with local maps
✓ The manual was tested in Yorito

Objective

The aims were to promote the use of maps by all local organizations at our reference sites for planning, proposals, reports, and analysis and to help all local organizations establish their database.

Method

A manual was developed for local organizations on how to use ArcView with local maps, and was tested in Yorito. Participating organizations answered a questionnaire aimed to determine the demand of GIS and databases. Twenty high-school students were trained in using Excel to work with databases.

Results

Technicians and students were trained.

Output

We are making future provision of personnel trained in databases and GIS.

Contributors: L Ianuzzi, O Mejia, B Barbier

Activity 4.3.2. Prioritize actions with communities based on use of the *maqueta*

Highlight

✓ Manual prepared for entities working with communities

Objective

The aim was to train in the use of three dimensional models for use with the community.

Methods

The manual [16] explains the use and advantages of this geographical tool before going through the steps in its construction. The mechanisms for achieving community participation are also discussed. Photographs give clear illustrations of points made.

Results

The manual is available for use.

Output

Using three-dimensional models is a more effective way of working with rural communities. The manual helps train entities interested in this type of work.

Contributors: JE Rubiano, L Hurtado, M Vidal (Fundación Sol y Tierra), MO Fiscué (Asociación de Cabildos-Norte de Cauca)

Activity 4.3.3. Arrange meetings with key organizations to train members of the communities

This activity is being carried out as required for training and agreed research.

Activity 4.3.4 Developing principles and procedures for multi-scale geographical analysis

Highlights

✓ Map of Honduras produced relating "poverty" indicators and soil erosion

Objective

The objective of this activity is to develop practical procedures for screening data, indicators, and indexes routinely used by decision-makers responsible for managing hillside landscapes, and to demonstrate potential conflicts in interpretation caused by "scale effects".

Methods

A series of tools was developed to allow multi-scale analysis of geographical data. Table 13 lists the measures used. The toolkit is combined with a GIS package (ArcView 3) to enable users to

[16] Rubiano JE, Hurtado L, Vidal M, Fiscué MO. 1999. Como construir modelos tri-dimensionales de cuencas hidrograficas. Un manual para entidades que trabajan con comunidades. Consorcio Interinstitucional Para una Agricultura Sostenible en Laderas (CIPASLA) – CIAT. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 18 p

access the census database and to generate information relevant to their "level" or "scale" of interest. This is the first part of the process. It provides us with information that can then be further analyzed to spot "where the action is" in a dataset, and try to re-express the data in a way that captures the salient information.

Results

Levels of explanation must be extracted from data, not preimposed. To date, our empirical evidence shows that the levels extracted from the data do not correspond in any simple way to traditional levels of organization, but unfortunately the heritage is deeply ingrained. When you change the observation set, you change the level, therefore you cannot logically take a set of a priori levels and impose them on a new observation set, the imposition leads to confusion at best and to serious error at worst.

Table 13. The scale-sensitive measures and selected properties used in our primary analysis toolkit.

Name	Measurements		
	Moment	Standardized	Data types
Local mean	First	Yes	Point / areal / image
Local variance	Second	Yes	Point / areal /image
Local standard deviation	Second	Yes	Point / areal / image
Spatial lag measure	First	-	Point / areal / image
Local semivariance	Second	Yes	Point / areal / image
Local Moran index of correlation	Second	Yes	Point / areal / image
Local Geary index of correlation	Second	Yes	Point / areal / image
Texture measures	Third	No	Image
Getis and Ord's G statistics	First	No	Point

Output

This activity supports the goal to develop common knowledge bases to facilitate collective action among stakeholders whose responsibilities require them to view the world at distinct geographical scales.

Contributors: A Nelson, G Leclerc, EB Knapp

Activity 4.3.5. Training of 15 key technicians of Honduras and Nicaragua in the use of CD-ROMs and Web sites

Highlights

✓ Twenty institutions trained in the use of the Digital Atlas of Honduras

Objectives

The aims were to support urgent decisions after hurricane Mitch, using information from the Digital Atlas of Honduras, train local organizations in the use of GIS and the development of joint databases, and distribute the Atlas and train members of the Red Nacional de Sistemas de Información Geografica (RENASIG).

Methods

Maps were prepared for other institutions on damage caused, floods, location of assistance, and assessment of losses during hurricane Mitch. Training workshops were held, including a short course on how to use ArcView and the Atlas as well as individual and group demonstrations of the Atlas of Honduras version "Mitch". The office responsible for the Atlas of Honduras handled direct requests and users were identified to monitor Atlas use.

With the direct support of the office, more than 16 thematic maps were prepared on the impact of the hurricane on agriculture, infrastructure, services, and support in answer to requests made by 15 international aid organizations and the Secretary of Agriculture and Livestock.
Twenty institutions were trained in the use of the Atlas during the workshop "Tools to Support Decision-Making" carried out in October 1998 in Tegucigalpa. Also, in January 1999, the Atlas of Honduras version "Mitch" was formally presented to representatives of the most important government institutions and international missions. The CD-ROM was also presented at several national and international events.

The Atlas of Honduras version "Mitch" was directly delivered by the office to 85 institutions. An undetermined number of copies were also distributed through an agreement with the United States Geological Survey (USGS).

Result

The Atlas of Nicaragua is currently in process and is being developed under an agreement between CIAT and MAGFOR.

Output

Key technicians of Honduras were trained in using the digital Atlas of Honduras. This was particularly useful given the disaster following hurricane Mitch.

Contributors: F Lamy, V Escober, O Mejía, B Barbier

Activity 4.4. Provide technical support for decision making

Highlight

✓ Productivity and natural resources assessed at the national level in Honduras

Objectives

We aimed to assess the relationship between natural resource quality and labor productivity in Honduras and develop a coherent methodology to analyze the national spatial database. Other aims were to promote the CIAT Mitch Atlas, the soil database, and the use of the national census.

Methods

Workers' productivity in Honduras were calculated and the correlation between variables. A linear regression was run to explain productivity, and a cluster analysis to identify clusters of homogenous farmers.

Results

Productivity in Honduras cannot be explained by distance to main cities. The most productive regions are not close to cities. The month when rains occur is the most important factor. Annual rainfall is not important. Soil characteristics have little impact on overall productivity. Slope and altitude are not strongly related to overall productivity because coffee production compensates the depressing effect of both slope and altitude. Land concentration is in the hands of a few and this decreases overall productivity. Population density has a strong negative relationship with productivity. Education and extension services have a strong relationship with productivity. Ethnic villages have lower productivity. Study results were submitted to colleagues for revision and will be presented to policy makers. A paper was presented at the CIAT Poverty workshop in Costa Rica.

Results

The databases produced have good potential to change the perception people have about hillside areas. The analysis shows that hillside areas have good productive potential.

Contributors: B Barbier, O Mejia, G Leclerc

Activity 4.5. Promote putting into effect the processes for sustainable rural development

This activity is pursued through the PPOs. These are reported under Activity 5.4.2. and published proceedings appear under Publications.

Output 5: Efficient, participatory project management

Activity 5.1. Facilitate the active participation of partners in the Project planning in the region

The Annual Operative Plan (POA, its Spanish acronym) for 1999 was approved in March and published in May (see under Publications, CIAT 1999).

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

Activity 5.2.1. Ecoregional coordination

See the Ecoregional Report 1999.

Activity 5.2.2. Coordination in the reference sites

Objectives

Our aims are to maintain a close relationship with institutions working in Yorito and Sulaco, Honduras and to identify complementary actions with regional institutions. While supporting CLODEST we also aim to help establish a network of local institutions.

Results

The project set up its office in Yorito in March 1999, strengthening institutional presence in the region and allowing it to participate more actively in the coordination of interinstitutional activities.

Support to CIAT researchers participating in the project has improved. The support group, of which the project is a member, aims to improve the way CLODEST operates. Project staff have participated in all support group meetings and in the general assembly of CLODEST.

The project recently began to support the establishment of a network of local institutions. So far, 154 organizations have been identified in the watershed.

Output

The permanent presence of the project in the region is fundamental to improving the relationships with project partners in the region.

Contributor: L Brizuela

Activity 5.2.3. Coordinate research activities with other entities that use a participatory approach

This is an ongoing, dynamic activity at all reference sites.

Activity 5.3. Maintain an efficient information system within the project and with its partners

Activity 5.3.1. Updating the Web page

Highlight

✓ Project's Web page updated and new products included

Structure of the Hillside Project's Home Page

Objective

The aim was to update the home page of CIAT's Hillside project on the World Wide Web.

Methods

Different structure proposals for the Hillside project's home page were designed on the basis of a revision of different home pages and the project's annual reports published to date. These proposals were discussed internally until the project agreed on the structure. We have defined the information that will be included in the different parts of the project's home page, and their location within the hierarchy.

Meetings with the CIAT WWW home page group have helped us identify basic design concepts.

Results

So far four hierarchical levels have been defined:

Level 1.	Introductory information
Level 2.	Information on project background, strategy, products, partner institutions, activities, and staff
Levels 3 and 4.	Information detailing the aspects presented at level 2.

Output

The Project's Web page makes project information easily accessible to collaborators and interested partners.

Contributors: JE Rubiano, A Jiménez

Honduras and Nicaragua on the home page

Objectives

The aims were to make information about the project and its products available in an organized form, and to improve local and outside access to information about the project.

Methods

The Web page, designed in 1997 using Netscape Composer, integrated the information generated by the project since 1994. In 1999, it was completely revamped to include more detailed information on project reference sites and on products developed by the project over the last 2 years. The project's home page was recently linked to the CIAT general home page, and a space was created for the new MIS Consortium.

Results

At http://www.intertel.hn/org/ciathill, users can rapidly consult the biophysical and socioeconomic characteristics of project reference sites in Honduras and Nicaragua. They can also obtain general data on characteristics from the Atlas of Honduras and other decision-making tools. Information contained in newsletters and documents produced by the project can also be accessed. Figure 4 shows the structure of the project's Web page.

With the updating of the Web page, new project products were included and the number and variety of users able to access the page increased.

Output

National partners are better informed about project activities.

Contributors: V Escober, M Ayarza

Figure 4. Structure of the CIAT-Hillsides Web page, Honduras and Nicaragua.

Activity 5.3.2. Publishing of a Project bulletin

Highlight

✓ Two issues of the Project bulletin produced and sent to 30 institutions in Honduras and Nicaragua

Objectives

The aims were to inform members of the project's Advisory Group and other key institutions in the region about the advances in project activities as related to the 1999 annual operational plan, and to expand activities carried out by other CIAT projects in the region.

Methods

An editorial committee was established to identify topics and write the items that would appear in the bulletin, to be published every 2 months. The text and photographs are incorporated into a simple format using Microsoft Word.

To date two issues have been published. Copies were sent to 30 institutions in Nicaragua and 30 in Honduras. The first issue focused on the general description of project activities, and the second included practical examples of how the project helped strengthened rural communities through the Rural Agroenterprise and Seeds of Hope projects.

Results

The bulletin has become a direct communication channel for members of the Advisory Group. Its members are informed about project activities and potential benefits. The two issues published to date are a source of up-to-date information.

Output

Production of 2-monthly bulletins is part of our strategy to keep collaborators and partners informed of current activities.

Contributors: M Ayarza, JA Beltran, V Escober

Activity 5.3.3. Prepare annual reports

The AOP was published in May 1999. The SDC and ISNAR reports have been submitted. The IDB report has been completed. The IDRC report is due in January 2000.

Activity 5.3.4. Prepare and publish technical documents

See under Publications.

Activity 5.3.5. Compile, systematize, and disseminate existing information and experiences

Objectives

The aims were to centralize all information generated and compiled by the project and toallow project staff to use this information through a user-friendly system.

Methods

All documents published by the staff of Hillsides-Colombia were inventoried and systematized. The Hillside Project's digital database of photos, covering 1993-1999 was launched. Documents in digital format, databases of surveys, and geographical studies pertinent to Hillsides, were identified followed by recovery and compilation.

The title page indicating the information included was developed in htlm format, forming links with the files in their original format. Netscape Composer was used to design the access to existing information.

Results

Figure 5 shows how digitalized information on the project is presented

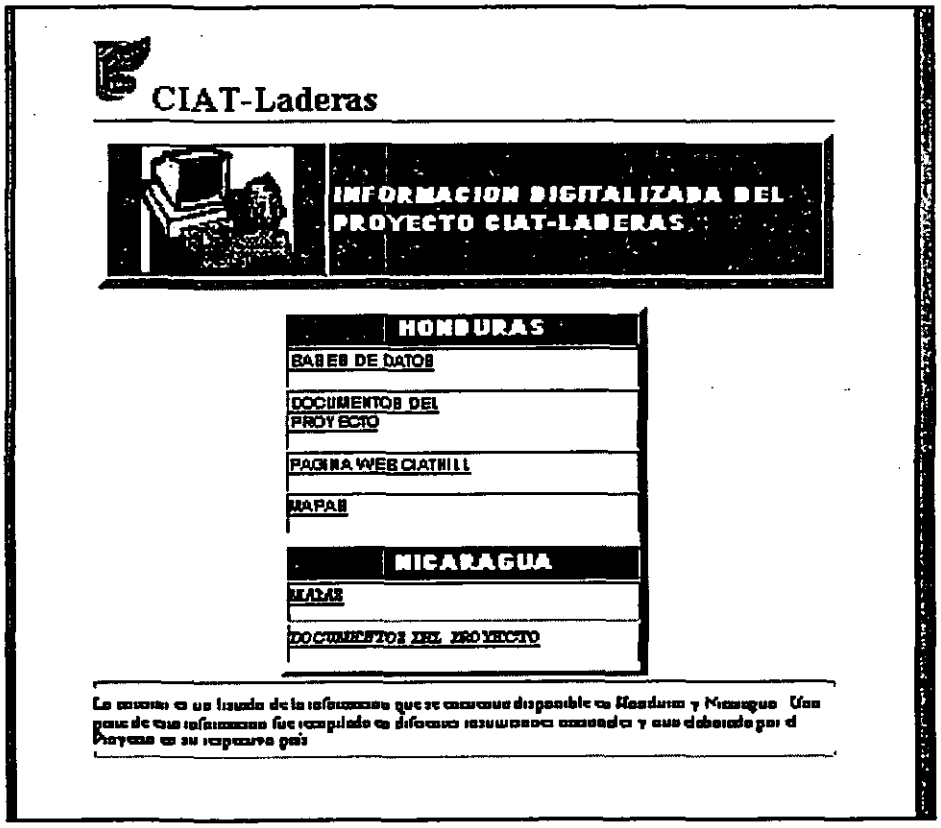

Figure 5. Initial presentation of information on the Project.

The centralized information has been structured to date in the case of Honduras. The databases can be used to access project documents and the maps generated in ArcView. A similar structure is being implemented in the case of information for Nicaragua. So far, most of the information scattered in files, databases on different computers, proceedings, reports, and specific maps has been centralized. However, to increase its usefulness, this information should first be revised to avoid duplications and then organized systematically.

Output

The centralization of information is the first step to inventory the types of information generated by the project over time and its usefulness as a work tool.

Contributors: V Escober, JA Beltran, M Ayarza, JE Rubiano

Activity 5.3.6. Systematize and publish the CIPASLA study case

Information was collected and is in the process of publication.

Activity 5.3.7. Put GIS of Nicaragua and Honduras on sale to the public

All products aer being sold in different parts of both countries.

Activity 5.4. Strengthen joint work with other projects and organizations

Activity 5.4.1. Identify and generate new collaborative projects and programs

Highlight

✓ Contribution to the elaboration of the Collaborative Research Program: "Landscape management: Between consensus and conflict"

Objective

The overall objective of the related research is to contribute to the understanding of long-term management of natural resources to the benefit of rural communities.

Methods

The core of the collaborative research program is the biophysical and the social and institutional aspects of landscape-level NRM as a new approach to sustainably increase the agricultural production of poor farmers. The program is based on a comparative approach between sites in Nicaragua and Tanzania. It draws on the involved partners' extensive research experiences from Honduras and Nicaragua (CIAT - Laderas and GIS) and Tanzania (Institute of Resource Assessment (Tanzania). Other collaborators are the Center for Development Research (Denmark), Institutes of Geography at Roskilde University Center (Denmark), and the University of Copenhagen.

The strategy is to look for four cases or problems of NRM that would require collective actions to be solve. The problems could relate to water, soils, biodiversity, pests, et cetera.

Output

The proposal is awaiting approval from the Danish Council for Development Research. If approved, a full report will be given next year.

Contributor: O Westermannn

Activity 5.4.2. Strengthening relationships with regional institutions and networks (PASOLAC, CONASEL, universities)

Objectives

The aims were to create a transparent relationship with regional partners and provide technical assistance and identify opportunities for collaborative projects. Also we aimed to determine the potential demands for other actors of the region.

Results

Table 14 summarizes all interinstitutional activities in which project staff in Honduras has participated (July 1998-late 1999). This participation includes workshops and events organized by the Project at the national and local levels, as well as other events to which the project was invited.

The project–especially its coordinators in Honduras (M Ayarza and L Brizuela)–have spent much time coordinating events and participating in meetings and workshops.

Table 15 shows work with local development plans and in support of municipal development committees in Nicaragua.

Nicaragua's Red de Agroindustria (REDAR) made a commitment to collaborate with the project, and participated in the development of a project proposal to identify market opportunities for small producers at the San Dionisio reference site in Nicaragua. The joint CIAT-REDAR proposal was submitted to IDRC to establish a rural agroenterprise development project at the San Dionisio reference site in Honduras.

The different institutions belonging to REDAR have the capacity and experience to implement the rural agroenterprise development project proposed for San Dionisio. The following institutions have been consulted and have expressed their interest in participating in the project:

1) Instituto Nacional de Pequeños y Mediano Empresas (INPYME)
2) Servicio de Información de Mercado (SIMAS)
3) The Department of Agricultural and Food Technology of the University of León
4) International and nongovernment development organizations, such as CARE, PRODESSA, and the "León 2000" Foundation and Nieborowsky Foundation that specialize in support services for small agroenterprises.

Outputs

The implications these activities can have for disseminating information generated by the project are significant, as well as the positive impact that the project can have in the region.

Contributors: All project staff

Table 14. Workshops and interinstitutional activities carried out in Honduras during 1998-1999. (For acronyms and abbreviations, see p 115.)

Type of event	Organizers	Date	Participating institutions (no.)	Number of participants	Results
Advanced course on ArcView, based on the interface of the Atlas of Honduras	CIAT-Hillsides	7-8 Oct 1998	20		• Main achievements presented to participating institutions in terms of geographical systems tools produced by CIAT-Hillsides in Honduras • Work carried out on GIS by institutions belonging to RENASIG presented
Workshop "Tools to support *decision-making*" (DSS)	CIAT-Hillsides	9-10 Oct 1998			• The DSS concept validated
Workshop "Experiences in managing cover crops, soils, and agroforestry with validation groups in Honduras", Siguatepeque, Honduras	CIAT-Hillsides, CIDICCO, PASOLAC, FAO-Lempiras Sur	15-16 Oct 1998	15	29	• Experiences of CIDICCO with cover legumes presented • Experiences of FAO-Lempiras Sur with cover legumes presented • CIAT presented results of cover legumes
Workshop "Participatory Planning by Objectives (PPO)", Yojoa Lake, Cortés	CIAT-Hillsides, CLODEST, IICA/Neth, Hillsides	3-6 Feb 1999	21	32	• Fundamental problem of the poor quality of life of inhabitants of the Tascalapa River watershed identified • Objectives to improve quality of life and lines of action determined
Field day: Presentation of the CIAT-Seeds of Hope project, Comayagua, Honduras	CIAT-Seeds of Hope, CIMMYT, PROFRIJOL, DICTA	25-Mar 1999		60	• Invited institutions and Vice-Minister of Agriculture participated
Workshop on "Postharvest handling of bean seed", Zamorano, Honduras	CIAT-Seeds of Hope	25-30 Apr 1999	14	38	• 14 entities (both governmental and NGOs) participated • Farmers and technicians from different parts of the country participated • Farmers and technicians interacted in the teaching-learning process. • Basic management knowledge transferred
Workshop to present results of activities in Yorito (Yoro, Honduras)	CIAT-Hillsides	25-26 May 1999			

Continued.

Table 14. Continued.

Type of event	Organizers	Date	Participating institutions (no.)	Number of participants	Results
Participatory workshop on organization of SOL activities, Yorito (Yoro, Honduras)	CIAT-Hillsides	19 Mar 1999	11	18	• PDA-Yoro to form part of the group of local institutions distributing seed • Participants exchanged information on activities of their respective institutions • Doubts clarified about mechanisms used by institutions to benefit to target population • Prioritization matrix of microwatershed generated
Consultation workshop of options that should be included in SOL, Yorito (Yoro, Honduras)	CIAT-Hillsides	26 May 1999	41 farmers	41	• Objective of the SOL explained • Results of PPO presented
Workshop "SOL network", Tela (Atlántida, Honduras)	CIAT-Hillsides	27-28 Jly 1999	10	16	• Vision of the SOL network developed • Consensus reached regarding project results and objectives • Components of a participatory monitoring and assessment system established to improve the orientation of the SOL network • Consensus reached regarding the preparation of a proposal to obtain funds
Forum "Use of burning in hillside ecosystems: management alternatives and environmental implications", Tegucigalpa, Honduras	CIAT-Hillsides, EAP-Zamorano	1 Jly 1999	18	23	• Information presented indicating that only 20% of the 2200 forest fires registered in Honduras in 1998 were forest fires • Consensus reached among participants that periodic, controlled forest burnings can be beneficial to maintain low accumulation levels of residues • Participants allocated problems related to burnings to four areas of interinstitutional action: (1) research; (2) education; (3) local organizations, and (4) policies • Institutions to serve as facilitators in future activities related to each of the four areas designated (EAP-Zamorano, ESNACIFOR, CIAT, and SERNA)

Continued.

Table 14. Continued.

Type of event	Organizers	Date	Participating institutions (no.)	Number of participants	Results
Workshop on the use of GIS in decision-making, Yorito (Yoro, Honduras)	CIAT-Hillsides	1-2 Jly 1999	9		• Nine institutions trained in the management of ArcView and introduced to the Atlas of Honduras
Internal review of CIAT-Hillsides project, Tegucigalpa, Honduras	CIAT-Hillsides	6 Aug 1999		10	• Results to be included in the project's annual report presented and discussed
Workshop to create the Consortium for Managing Acid Soils in Central America, EAP-Zamorano, Honduras	CIAT-Hillsides, EAP-Zamorano	10-11 Aug 1999	17	25	• Objectives and mission of Consortium defined • Advisory group conformed • Topics relevant to the Consortium identified
Forum "CIAT's contribution to the sustainable development of hillside areas in Central America", Tegucigalpa, Honduras	CIAT-Hillsides (Visit of CIAT Director General, Dr G Scobie)	19 Aug 1999	18	30	• CIAT's general strategy for Central America disseminated • Socialization of project results
Workshop "Operational Plan of Training in Methodological Tools", Tegucigalpa, Honduras	CIAT-Hillsides	23 Ago 1999			
Training workshop on methodological tools, Honduras	CIAT-Hillsides	13-22 Sept 1999			• Pending
Workshop on external project review, Honduras	CIAT-Hillsides	14-15 Oct 1999			• Pending

Table 15. Workshops and interinstitutional activities from September 1998- September 1999, Nicaragua. For acronyms and abbreviations used, see list p 115.

Event Place	Organizers	Date	Participating institutions	Number of participants	Results
Workshop "Methodological tools for decision-making on natural resource management" Ticuantepe, Santa Teresa, Nicaragua	CIAT-Hillsides, UNA	27-29 Oct, 1999	6 (5 local) 11(7 local)	30-35	• The nine methodological tools validated • Nine UNA professors trained in use of methodological manuals
Meeting of the advisory group of the project Community Management of Natural Resources in Hillside Areas. Managua, Nicaragua	CIAT-Hillsides	19-20 Jan, 1999	24	53	• Logical framework of project (objectives and results) discussed and recommendations made • Work plan for reference sites discussed and recommendations made • Joint and complementary activities defined with partner institutions • Commitments established with partner institutions
II Nicaraguan Workshop of Geomatics Managua, Nicaragua	CIAT, UNA, RDS, MARENA/PANIF, UCA, INETER	25-26 Nov, 1998	17	38	• Constitutional minutes of the Nicaraguan Geomatics Committee approved • INETER's proposal to form a standards committee of GIS and technology accepted • National Biodiversity and Natural Resources Network set up
IV National Seminar of Soil and Water Conservation Managua, Nicaragua	UNA, PASOLAC, CIAT-Hillsides, GPAE	9-10 Mar, 1999	23	90	• Alternatives to replace burning considered • For soil and water conservation, an integrated approach should be considered, including diversification, markets, forest development, and aggregated value to agricultural and livestock products • Greater use should be made of tools to assess natural resources and for decision making at the local level

Continued.

Table 15. Continued.

Event Place	Organizers	Date	Participating institutions	Number of participants	Results
Workshop: Results of farmer experimentation in Central America Managua, Nicaragua	PASOLAC, INTA	20-21 Apr, 1999	10	12	• Identified successful types of technology generated by farmer experimentation compared with other processes of technology generation • Not enough documentation from the economic viewpoint is available on farmer experimentation and on its efficiency
Workshop on participatory planning by objectives (PPO) San Dionisio, Matagalpa	CIAT-Hillsides	13 and 26 May, 1999	10 14 local organizations	42	• Communities and institutions of San Dionisio identified problems, causes, and effects of low sustainability of current production systems • Priority research topics identified based on objective analyses • Identification of technologies tested in the region and definition of topics to be included in the activities of the Supermarket of Options for Hillsides (SOL, the Spanish acronym) • SOL technical committee elected
Workshop: Support Systems for Decision Making Managua, Nicaragua	CIAT-Hillsides, University of Guelph	18-20 May, 1999	10	17	• Manual on Support Systems for Decision Making by Objectives validated at different levels • Possible applications identified in different contexts in which participants act
Workshop: Postharvest handling of artisan-produced bean seed Managua, Nicaragua	CIAT-Seeds of Hope, CARE, CIEETS, INTA, UNA, PROMESA	9-14 May, 1999	6	13 farmers, 8 technicians	• Six government organizations and NGOs participated • Farmers and technicians from different parts of the country participated • Farmers-technicians interacted in the teaching-learning process • Basic knowledge in postharvest management of artisan-produced bean seed transferred

Continued.

Table 15. Continued.

Event Place	Organizers	Date	Participating institutions	Number of participants	Results
Workshops: Artisan production of bean seed Managua, Nicaragua	CIEETS/ CIAT-Seeds of Hope	29-30, Jly 1999	2	33 farmers	• Massive participation of farmers summoned by CIEETS • Once trained, the farmers acted as promoters to train other farmers • The transfer of knowledge within the workshop was dynamic because the farmers themselves were the trainers
	INTA agencies, CIAT-Seeds of Hope	1-30 Jly, 1999	2	70 farmers	• INTA workshops were given on 4 events • Agencies giving the workshops are from Grenada, Carazo, and Ticuantepe, as continuity to workshop held by CIAT-Seeds of Hope
Workshop on Operative Training Plan	CIAT-Hillsides	30 Jly, 1999	6	10	• Training plan disseminated • Other national institutions identified
Seminar "Contribution of CIAT's Hillside Project to the region" Managua, Nicaragua	CIAT-Hillsides	16 Aug, 1999	18	32	• Information diffused on CIAT's general strategy for Central America • Socialization of project results
Induction workshop on the operational plan for incorporating methodological tools into decision making about NRM Managua, Nicaragua	CIAT-Hillsides	19 Aug, 1999	15	34	• Workshop scheme for training of trainers and for national workshops disseminated • Institutional commitments made for training of trainers
Workshop on methodologies used for soil and water conservation in the department of Matagalpa Matagalpa, Nicaragua	INTA – UNAG, the whole village	26 Jne, 1999	15	36	• Results of participatory mapping (post-Mitch) survey presented • Methodology of soil quality indicators disseminated
International Seminar "Impact Assessment of Participatory Research and Gender Analysis" Quito, Ecuador		6-9 Sept, 1998			• Presentation: "Towards participatory management of natural resources: experiences of the Calico River watershed in Nicaragua"

Continued.

Table 15. Continued.

Event Place	Organizers	Date	Participating institutions	Number of participants	Results
Central American workshop on sustainable rehabilitation of the small-scale agriculture after hurricane Mitch	GAAS	28 Apl, 1999	15	20	• Strategic actions with the methodology "Participatory Mapping of Natural Resources" presented • 13 institutions of El Salvador, Honduras, Guatemala, and Nicaragua requested copies of the methodological document • Proposal to coordinate the analysis hurricane Mitch's impact on natural resources presented • CIAT-PASOLAC proposal on "Monitoring the status of agricultural soils in Nicaragua, after hurricane Mitch" given
Meeting on institutional work related to NRM and environmental protection after hurricane Mitch Managua, Nicaragua	UNA, PASOLAC, MARENA, CIAT-Hillsides	17 Nov, 1999	17	31	• Real status of natural resources identified in areas affected by hurricane Mitch • Geographic areas, topics of interests, and available resources for each institution established • Institutional needs assessed and offers made for assistance in areas affected by hurricane Mitch
Meeting on institutional work related to NRM and environmental protection after hurricane Mitch Managua, Nicaragua	UNA, PASOLAC, MARENA, CIAT-Hillsides	9 and 17 Dec, 1999	8	14	• Format to diagnose institutional support established • Information survey made of damages caused by hurricane Mitch to natural resources
Meeting on institutional work related to NRM and environmental protection, after hurricane Mitch Managua, Nicaragua	UNA, PASOLAC, MARENA, CIAT-Hillsides	29 Jan, 1999	11	22	• The research work "Evaluation of the current status of natural resources", carried out in San Dionisio (CIAT-UNA) presented

Continued.

Table 15. Continued.

Event Place	Organizers	Date	Participating institutions	Number of participants	Results
Meetings on the assessment of information on soil erosion Managua, Nicaragua	Banco Central, UNA, PASOLAC, CIAT-Hillsides	21 May, 1999 9 Jly, 1999	4	8	• Integrating natural assets in the national account system discussed and analyzed • A group on soils formed to identify information required by models of national environmental accounts
II Meeting of the Project's Executive Committee	CIAT-Hillsides	15 Mar, 1999	5	8	• Approval and agreements reached on the logical framework (1999-2001), objectives, and results • Approval and agreements on activities included in the AOP • Agreements made on terms of reference for external project review by SDC and IDRC
Workshop: Results of the participatory mapping survey after hurricane Mitch San Dionisio, Matagalpa, Nicaragua	CIAT-Hillsides, UNA, CARE	Feb 1999	6 5 local organizations	22	• Watersheds with natural resources in critical state identified • An action plan and monitoring of communities and institutions formulated
Quarterly meetings of Coordination Committee	CIAT-Hillsides, PASOLAC	Dec 1998 Jan 1999 Jly 1999	2	3	• Progress reports made on both projects • Information exchanged on project activities to be conducted in Nicaragua before approval of AOP
Workshop: Municipal Plan for Social Development	PROSERBI	10-11 Sept, 1998	10	22	• Municipal Social Development Plan prepared • Diagnosis, actions, and commitments made on the Plan of Social Action for Children, Adolescents, and Women
Interinstitutional Coordination Workshop	Mayor's Office, CIAT-Hillsides	25 Jne, 1998	16	28	• Proposal given on program for municipal and community strengthening • Municipal Plan for Social Investment defined
Workshop: Planning platform, phase 2000-2003	PASOLAC, PROASEL	8-11 Jne, 1999			• Logical framework for the new PASOLAC-PROASEL program defined

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

Highlight

✓ Participatory monitoring and evaluation (PM&E) initiated in three case study projects—SOL project, IPCA project in Yorito, GTZ-AFOCO project, Yuscarán, Honduras

Objective

The purpose of this research is to generate knowledge on PM&E as an instrument to support collective learning among different stakeholders about the impact of participatory processes in NRM. We expect that PM&E will contribute to make NRM research more responsive to farmers' demands. The research activity is executed by the University of Hohenheim and funded by the CGIAR Systemwide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation" (PRGA Program).

Methods

Three participatory NRM projects were selected to develop and introduce a PM&E system. They were (1) GTZ- Apoyo a la Foresteria Comunal (AFOCO), Yuscarán, (2) IPCA, Yorito, and (3) CIAT Hillsides – SOL project.

Exploratory interviews with different stakeholders were conducted in the project regions to collect some baseline information and to become acquainted with the communities and their perceptions.

The action research process was initiated by a series of workshops, which were conducted in each project to develop PM&E together with different stakeholders. The PM&E approach that is followed is oriented by a concept of Germann et al. (1996)[17].

As a first step, exploratory interviews were conducted in each project region of the two selected case study projects CIAT-Hillsides and GTZ-AFOCO. From 19th-23rd of April and 3rd-7th of May, 53 semi-structured interviews were realized with local people and key informants in CIAT's reference site Yorito / Sulaco; and from 12th-21st of May, 42 interviews were conducted in AFOCO's project area Yuscarán, El Paraíso Department.

On 28th of June and 27th-28th of July, meetings were organized to conceptualize the idea of a "supermarket", to identify the objectives of the SOL Network, to develop first ideas related to an M&E system, and to establish an interinstitutional working group, which further promotes the establishment of the network of supermarkets. The idea is to elaborate a joint proposal which

[17] Germann D, Gohl E, Schwarz B. 1996. Participatory impact monitoring. Four Booklets. GTZ/GATE. Vieweg, Braunschweig, Wiesbaden.

allows us to apply for some additional funds. Given that the SOL Network is still initiating and that it adopts a marketing strategy rather than working on self-help promotion, makes it different from the other two cases, which were selected to introduce the PM&E concept.

The IPCA is a partner institution collaborating with CIAT-Hillsides in the reference site of Yorito where it initiated and supports more than 20 community-based farmer research teams (CIALs). On the 24th and 25th of August, workshops were conducted with two CIALs (1 of men and 1 of women), to support them in developing their own M&E systems.

The project AFOCO in Yuscarán, El Paraíso Department, lays strong emphasis on self-promotion. On 19th of July a meeting was held with the AFOCO project staff to review the existing M&E activities, and to introduce the PM&E concept. It was agreed to (1) support local groups in developing their own M&E systems, and (2) build a complementary project M&E based on the staff's expectations and fears that allows amplification of the conventional logframe-based M&E. The team suggested starting to develop an M&E with the "Cooperativa Agroforestal La Guadalupe Ltda." The cooperative is a key actor in the process of developing a model for community-forestry. On July 22nd, a workshop was held with the directive of the cooperative to establish their M&E system. Two persons (members of the "*junta de vigilancia*") were nominated as observers (M&E committee), and started to document and record their observations in simple form. A series of complementary meetings was held with the project team to improve and harmonize the project-based M&E.

Results

A preliminary report (in Spanish) of the exploratory interviews, summarizing people's statements is available. This does not yet include the full information, which was recorded on cassettes, and it does not yet attempt to analyze and comment on the statements people made.

So far a first step has been taken to initiate PM&E systems in the three case study projects. More experience on the benefits and usefulness of this instrument will be gained by carrying out and adjusting PM&E over the following months.

Output

Having been involved in the above-mentioned meetings, the AFOCO project staff regards themselves capable of also supporting other local groups in the establishment of their own M&E systems.

Contributor: K Probst

Activity 5.6. Initiate on-site activities of impact evaluation

Highlights

- ✓ Intermediary and final indicators defined
- ✓ Defined a chain of impact from the product to the farmer with an emphasis on the adoption process
- ✓ Each researcher from Honduras defined a chain of impact for own product

Objective

The aims were to measure, in the reference sites, community advance in terms of natural resources, production, and poverty and to assess where investigation needs are the most important.

Methods

A task force of four researchers working in the four CIAT reference sites (Yorito in Honduras, San Dionisio in Nicaragua, Pucallpa in Peru, and the *Llanos* in Colombia) meet every 3 months to define a clear strategy of indicator monitoring. Bruno Barbier is in charge of the monitoring at the watershed and municipality levels in Yorito and Sulaco. Kirsten Probst is in charge of the monitoring for several farmers groups (CIALs) working with IPCA and for the SOL Project.

Intermediary and final indicators were defined. The chain of impact was mapped between the initial indicators and the final indicators. A chain of impact was defined from the product to the farmer with an emphasis on the adoption process. Each researcher from Honduras defined a chain of impact for own product (e.g., agroenterprises, Seeds of Hope, SOL project, soils, and simulations). A review was made of what other organizations are doing in Yorito and Sulaco. A large part of the NRM monitoring in Honduras and Nicaragua (rainfall, stream flow, erosion, sedimentation) was begun.

Results

A good start has been made to assessing impact in the reference sites. The task force has not yet defined a strategy for watershed- and municipality-level monitoring.

Output

This is, in effect, measuring CIAT' s impact on poverty and NRM.

Contributors: B Barbier, K Probst

Seeds of Hope Project

This is a joint project funded by the Canadian International Development Agency (CIDA) and United States Agency for International Development (USAID). Four international centers are involved: CIAT, Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT); Centro Internacional de la Papa (CIP); and International Plant Genetic Resources Institute (IPGRI). These Centers joined efforts with government institutions in Honduras (Secretary of Agriculture and Livestock, DICTA/MAG) and Nicaragua (INTA), several NGOs, and CIALs in both countries.

The project is an emergency effort to recuperate agricultural productivity after hurricane Mitch. This project was unforseen and is not in the AOP, thus is reported here after other activities.

Highlights

- ✓ Training of farmers on field management and postharvest management
- ✓ 155,400 kilos of clean and packed seed produced in first planting season
- ✓ 25 of 37 departments and 107 municipalities in Honduras and Nicaragua received project seed
- ✓ 16 organizations – NGOs and CIALs – gave direct support
- ✓ About 22,000 farmers directly benefited in Honduras and Nicaragua

Objectives

The general goal of the Project is to support communities in both countries that were affected by the hurricane to recuperate their agricultural production and move towards more sustainable practices. To do so, the project identified short-, middle-, and long-term objectives and the strategies to fulfill them.

Methods

Between December and January, 123 hectares of beans were planted in four departments of Honduras: Danlí, Francisco Morazan, Juticalpa, and Comayagua. Three improved varieties were planted: Dorado, Tio Canela, and Don Silvio. Twelve producers, plus one national experiment station, Centro Experimental de Desarrollo Agricola (CEDA), participated in the effort. All had good infrastructure and irrigation facilities.

During March and April 1999, 155.3 tons of clean seed was harvested and packed (Table 16). Seed recuperation efficiency was about 94%. Seed was processed and packed in 25-lb bags by Hondugenet Enterprises. Bags were labeled with the "Seeds of Hope" logo, including participating International Centers and donors.

The areas most affected by hurricane Mitch were identified, with the support of CIAT's geographic information systems (GIS) in Honduras and MAGFOR's GIS in Nicaragua. Seed was distributed through NGOs and CIALs.

Table 16. Seed yields in the Seeds of Hope Project by department and variety, Honduras.

Departments	Yields (t) of each variety		
	Dorado	Tio Canela	Don Silvio
El Paraiso	22.9	-	-
Francisco Morazan	30.6	16.9	13.8
Olancho	54.1	-	4.0
Comayagua	-	13.0	-
Total yield/variety	107.6	29.9	17.8
Total yield of all 3 varieties		155.3	

Seed produced during the dry season (Dec-Jan) was distributed at beginning of the first planting season (Apr-May) to the poorest farmers most affected by hurricane Mitch in Honduras and Nicaragua.

In Honduras, seed was distributed in 14 of its 16 departments by nine institutions. Seed reached 63 municipalities and 7,687 farmers. In Nicaragua, seed was distributed in 11 of the country's 20 departments by seven institutions. Seed reached 34 municipalities and 3,199 poor farmers affected by hurricane Mitch.

From May to June, another 123 hectares were planted in four departments: Francisco Morazan, El Paraiso, Olancho, and Comayagua. Yields in this area are about 150 tons of clean, packed seed. Therefore another 12,000 farmers in Honduras and Nicaragua were benefited with the second delivery of seed.

A training course for postharvest management of bean seed of artisan production was held in Honduras and Nicaragua. In Honduras, this event received the support of DICTA, Secretaria de Agricultura y Ganadería (SAG), EAP-Zamorano, and PROFRIJOL, and in Nicaragua that of INTA, MAGFOR, UNA, PROEMSA, and PROFRIJOL. Among farmers and technicians, 59 people were trained, with the participation of 17 collaborating institutions (Table 17).

Table 17. Trainees in Honduras and Nicaragua in postharvest bean seed technology, Seeds of Hope Project, 1999.

Participants	Honduras		Nicaragua		Total no.participants
	No.	Institutions[a]	No.	Institutions[b]	
Technicians	16	14	8	4	24
Farmers	22	-	13	-	35
Total	38	14	21	4	59

a. CARE, IPCA, PROLESUR, World Vision, PDA-Yoro, CIAT, CCD, SERTEDESO, PROLANCHO, FEPROH, EPRODAS, EMAPRAS, El Cajón Project (see p 115 for acronyms in full).

b. INTA, CARE, CIEETS, CIALs (see p 115 for acronyms in full).

Later, technicians from different institutions that had received training on postharvest management of bean seed organized training courses themselves and, as a result, 198 technicians and farmers were trained by three Honduran and four Nicaraguan institutions.

Milestones

Achievements of short-, middle-, and long-term objectives are given to date in percentages below.

Short- and middle-term goals	Percentage achieved
Seed production	100
Seed distribution	50
Monitoring seed delivery	50
Local contacts	90
Support provided by CIALs	30
Training	100
Decentralization of production	30
Support provided by GIS	50
Long-term goals	
Impact assessment of hurricane Mitch	10
Conservation of genetic resources	10

Contributors: G Giraldo A, M Méndez, J Bosco

Map of target areas for sampling

Highlight

- ✓ A method and support maps helped determine what *aldeas* would receive seed help before the planting season

Objective

The aim was to produce maps that would help determine most pressing areas of need for seed.

Methods

We developed a method to do a first screening of the villages that would receive seeds produced by the Seeds of Hope project. We relied essentially on the Mitch Atlas, but also on more extensive databases such as the unit-level agricultural census of 1993 and data from USGS. We used a set of criteria discussed with our partners in country to produce a series of maps to help identify sites for beans, maize, and potato distribution. In addition, we had a consultant assemble in a GIS, information about our possible partners for this project.

The criteria table was not used as we intended, i.e., GIS could not be used as a prescriptive tool, but mainly provided data and maps that were used to support the decisions on the sites that would receive seeds.

Results

The maps that we produced from the CIAT-Cali office, with an educated guess about what should be the parameters to take into account for prioritization, resulted necessary and sufficient. The use of GIS allowed better targeting of communities to receive seed help in Honduras and Nicaragua.

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Publications

Book and Journal

Vernooy R, Baltodano ME, Beltrán JA, Espinosa A, Tijerino D. [1999]. Towards participatory management of natural resources: experiences from the Calico River watershed in Nicaragua. In: Ashby JA, Lilja N, Sperling L, eds. Assessing the impact of participatory research and gender analysis. Feriva SA, Cali, Colombia. Forthcoming. p 246-261.

Feijoo MA, Knapp EB. 1998. El papel de los macroinvertebrados como indicadores de fertilidad y perturbación de suelos de laderas. Rev. Suelos Ecuatoriales 28: 249-253.

Feijoo MA, Quintero H. 1998. Glossoscolecidae de una región de los andes del departamento del Valle, Colombia. Rev. Suelos Ecuatoriales 28: 249-253.

Feijoo MA, Knapp EB, Amézquita E, Lavelle P. 1999. Dinámica de poblaciones de lombrices de tierra (Annelida, Oligochaeta) en áreas de laderas del departamento del Cauca, Colombia. Suelos Ecuatoriales. Forthcoming.

Feijoo MA, Knapp EB, Lavelle P, Moreno A. 1999. Quantifying soil macrofauna in a Colombian watershed. Rev. Pedobiologia. Forthcoming.

Feijoo MA, Ochoa W, Amézquita E, Knapp EB. 1999. Relación entre el ambiente físico y la dinámica de lombrices de tierra en áreas de laderas andinas, Colombia. Suelos Ecuatoriales. Forthcoming.

Feijoo MA, Knapp EB, Quintero H. 1999. La salud y calidad de suelos una mirada agrosistémica desde el punto de vista de los macroinvertebrados. Suelos Ecuatoriales. Forthcoming.

Conference Papers and Presentations

Barbier B, Mejía O, Leclerc G. 1999. Labor productivity and natural resources: an assessment at the national level in Honduras. Paper presented to the International Conference "Assessing the impact of agricultural research on poverty alleviation", 14-16 Sept San Jose, Costa Rica.

Leclerc G, Nelson A, Knapp EB. 1999. Extension of GIS through poverty mapping: the use of unit-level census data. Paper presented at the 6th Japan International Research Center for Agricultural Science (JIRCAS) International Symposium: GIS applications for agro-environmental issues in developing regions, 7-8 Sept, Tsukuba, Japan. 28 p.

Leclerc G, Nelson A, Knapp EB. 1999. The use of unit-level census data for research on poverty: a multiscale approach. Paper presented to the International Conference "Assessing the impact of agricultural research on poverty alleviation", 14-16 Sept San Jose, Costa Rica.

Other

Baltodano ME, Estrada R. 1999. Evaluación del impacto de adquisición de tierra como alternativa económica para el pequeño productor en la subcuenca del Río Calico, Matagalpa, Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 8 p.

Barbier B, Baltodano ME. 1999. Modelo de simulación bioeconómica para la sub-cuenca del Río Calico, San Dionisio, Matagalpa, Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia 9 p.

Barona E, Leclerc G.1998. Interface de Nicaragua. CD-ROM, CIAT, Cali, Colombia.

Barona EA, Barreto H, Couillaud P, Cox J, Jimenez P, Urbano P, Lamy F, Nelson A, Farrow A, Leclerc G. Atlas de Honduras - versión "Mitch". CD-ROM.

Beltrán JA, Tijerino D. 1999. Fortaleciendo los procesos organizativos a nivel local La Asociación "Campos Verdes" una estrategia que facilita el desarrollo Municipio de San Dionisio, Matagalpa, Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 38 p

Beltrán JA, Tijerino D, Vernooy R. 1999. Developing processes of organization at local level for collective management of natural resources. Guide no.9 (in Spanish) of the series "Instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 147 p.

CIAT (Centro Internacional de Agricultura Tropical). 1998. Asociación de Organizaciones Comunitarias "Campos Verdes", San Dionisio, Matagalpa. Reglamento interno.10 p.

CIAT (Centro Internacional de Agricultura Tropical). 1998. Taller "Instrumentos metodológicos para la toma de decisiones sobre el manejo de los recursos naturales en laderas". Programa y resúmenes de las presentaciones. San Dionisio, Matagalpa, Agosto 1998. 37 p.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT Laderas: Manejo comunitario de recursos naturales en laderas. Plan Operativo Anual: 1999. CIAT, Managua, Nicaragua. 41 p.

CIAT (Centro Internacional de Agricultura Tropical). 1999. Memoria del taller Planificación Participativa por Objetivos del Supermercado de Opciones para Laderas (SOL). Cefer, San Dionisio, Mayo 13 y 26 de 1999. CIAT, Cali, Colombia. 42 p.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT – Laderas, Plan Operativo Anual: 1999. CIAT, Cali, Colombia. 41 p.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT – Laderas Report "Estudio rápido de mercados para la sub-región piloto de Yorito y Sulaco" por Agronomía Genetica y Tecnología (AGRONET), Feb 1999. Available from CIAT-Hillsides, Honduras.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT – Laderas Report "Evaluación participativa de opciones de mercado con pequeños productores de la cuenca del Río Tascalapa" por Agronomía Genetica y Tecnología (AGRONET), Agosto 1999. Available from CIAT-Hillsides, Honduras.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT – Laderas Report "Evaluación y selección de opciones de mercado para la región piloto de Yorito y Sulaco" por Agronomía Genetica y Tecnología (AGRONET), Marzo 1999. Available from CIAT-Hillsides, Honduras.

CIAT (Centro Internacional de Agricultura Tropical). 1999. CIAT – Laderas Report "Informe del sondeo sobre criterios de decisión de opciones de mercado por los pequeñnos productores de la cuenca del Río Tascalapa", for Servicios Técnicos para el Desarrollo Sostenido (SERTEDESO), Abril 1999. Available from CIAT-Hillsides, Honduras.

CIAT (Centro Internacional de Agricultura Tropical). 1999. Valoración de daños por erosión en la Subcuenca del Río Calico (San Dionisio). Marzo de 1999. CIAT, Managua, Nicaragua. 26 p.

CIAT-UNA (Centro Internacional de Agricultura Tropical- Universidad Nacional Agraria). 1998. Workshop "Instrumentos metodológicos para la toma de decisiones sobre el manejo de los recursos naturales en laderas". Program and summaries for presentations. Ticuantepe and Santa Teresa, Nicaragua, Nov 1998. CIAT-Hillsides, Nicaragua.

CIAT-UNA (Centro Internacional de Agricultura Tropical- Universidad Nacional Agraria). 1999. Memoria del Taller de Planificación Participativa por Objetivos del Supermercado de Opciones para Laderas (SOL). CEFER, San Dionisio. 20 p.

Espinoza N. 1999. Comités de Investigación Agrícola Local (CIALs). Subcuenca del río Calico, San Dionisio, Matagalpa. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 51 p

Espinosa N, Vernooy R. 1998. Las 15 microcuencas del Río Calico, San Dionisio, Matagalpa: mapeo y análysis participativos de los recursos naturales. CIAT, Managua, Nicaragua. 99 p.

Espinoza N, Morales J, Gonzales B, Beltrán JA. 1990. Evaluación post-Mitch de los recursos naturales en la Subcuenca del río Calico, San Dionisio, Matagalpa, Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 45 p.

Espinoza N, Reyes T, Barrios E, Peters M, Sanz JI, Beltrán J. 1999. Supermercado de Opciones Para Laderas (SOL) en la Subcuenca del Río Calico, San Dionisio, Matagalpa. "Una convivencia compartida, una fuente fértil de soluciones". Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 25 p.

Johnson N, Baltodano ME. [1999]. Valuing technological and institutional options for improving natural resource management: the case of potable water in a rural Nicaraguan watershed. Draft working paper, available from PE-3. CIAT, Cali, Colombia. 11 p.

Leclerc G. 1999. La extrapolación de problemas y preferencias. A. Una estrategia para el muestreo, usando datos auxiliares. Internal Document, CIAT, Cali, Colombia.. 17p.

Leclerc G, Ravnborg H, Nelson A, Barbier B, Couillaud P, Oyana T, Knapp EB, Ashby JA. 1999. Human welfare in Honduras and natural resource management: the search for the missing link! CIAT Internal Seminars Series. CIAT, Cali, Colombia. 8 p.

López Suazo E, Trejo MT. 1998. Photographic analysis of land use tendencies in hillsides. Guide No.2 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 80 p.

Mulligan M, Rubiano JE. 1999. Hydrological impacts of land use change in the hillsides of Colombia: the impact of pattern on process. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 11 p.

Murillo K, Ososrio D. 1999. Caracterización de los recursos naturales edáficos de la subcuenca del río Calico, San Dionisio, Matagalpa, Nicaragua. Dissertation, Facultad de Recursos Naturales (FARENA), Universidad Nacional Agraria (UNA). CIAT, Managua, Nicaragua. 64 p.

Ostertag CF. 1998. Identification and evaluation of market opportunities for small-scale rural producers. Guide no.7 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 182 p.

Rubiano JE. 1998a. Mapa digital de uso de la tierra de 1988 de la cuenca del Río Calico.

Rubiano JE. 1998b. Hydrological impact of land use change in tropical hillsides: the impact of patterns. Part of M SC dissertation, King's College, London. Available from PE-3. 83 p.

Rubiano JE. 1999a. Caracterización fotográfico del uso de la tierra del área de San Dionisio, Nicaragua.

Rubiano JE. 1999b. Catálogo fotográfico del uso/cobertura de la tierra del área de San Dionisio, Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 5 p.

Rubiano JE. 1999c. Estudio de uso/cobertura de la tierra en San Dionisio. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 8 p.

Rubiano JE. 1999d. Identificación de unidades biofisicas en la cuenca de San Dionisio, Nicaragua.

Rubiano JE. 1999e. Revisión de la información disponible al fin de verano de 1999. Resumen para ilustrar a los asistentes al taller de Sistemas de Apoyo a Decisiones, 18-29 Mayo, 1999, Managua, Nicaragua.

Rubiano JE, Jiménez A. 1999. Estructura de la pagina Web del Programa de Laderas. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 6 p.

Rubiano JE, Jiménez A. 1999. Evaluación del Taller "Monitoreo y Modelaje de procesos Hidrológicos en Laderas Tropicales para la Toma de Decisiones", Junio 28 y 29, 1999. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 3 p.

Rubiano JE, Hurtado L, Vidal M, Fiscué MO. 1999. Como construir modelos tri-dimensionales de cuencas hidrograficas. Un manual para entidades que trabajan con comunidades. Consorcio Interinstitucional Para una Agricultura Sostenible en Laderas (CIPASLA) – CIAT. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia. 18 p.

Sánchez CU, Madrigal N. 1998. CEPRODEL (Centro de Promoción del Desarrollo Local) – Alcaldia Municipal de San Dionisio. Plan municipal de inversión social. San Dionisio, Matagalpa, Oct 1998. CIAT-Hillsides, Matagalpa.

Turcios WR, Trejo MT, Barreto HJ. 1998. Participatory method for identifying and classifying local soil quality indicators at microwatershed level. Guide No.1 (in Spanish) of the series "Instrumentos metodologicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 146 p.

UNA-CIAT (Universidad Nacional Agraria- Centro Internacional de Agricultura Tropical). 1998. Taller "Instrumentos metodológicos para la toma de decisiones sobre el manejo de los recursos naturales en laderas". Programa y resúmenes de las presentaciones. Ticuantepe y Santa Teresa, Nicaragua. 15, 23, 27-29 Oct, 1998. 26 p.

UNA-CIAT (Universidad Nacional Agraria- Centro Internacional de Agricultura Tropical). 1998. Taller "Instrumentos metodológicos para la toma de decisiones sobre el manejo de los recursos naturales en laderas". Programa y resúmenes de las presentaciones. Ticuantepe y Santa Teresa, Nicaragua. 27-29 Nov, 1998. 32 p.

UNA-FARENA (Universidad Nacional Agraria- Facultad de Recursos Naturales). 1999. Aplicación de modelos de simulación en sistemas de producción en la subcuenca del río Calico, San Dionisio, Matagalpa. Protocolo de Tesis, financiado por CIAT-Laderas. Managua, Nicaragua. 12 p

UNA-FARENA (Universidad Nacional Agraria- Facultad de Recursos Naturales). 1999. Evaluación de pérdidas por erosión hídrica en parcelas de escurrimiento establecidas en la Microcuenca de Wibuse-Jicaro de la Subcuenca del río Calico, San Dionisio, Matagalpa. Protocolo de Tesis, financiado por CIAT-Laderas. Managua, Nicaragua. 13 p.

UNA-FARENA (Universidad Nacional Agraria- Facultad de Recursos Naturales). 1999. Modelación hidrológica de la microcuenca del río Wibuse, San Dionisio, Matagalpa. Protocolo de Tesis, financiado por CIAT-Laderas. Managua, Nicaragua. 7 p.

UNA-FARENA (Universidad Nacional Agraria- Facultad de Recursos Naturales). 1999. Modelo de simulación agroforestal para el manejo de la subcuenca del río Calico, San Dionisio, Matagalpa. Protocolo de Tesis, financiado por CIAT-Laderas. Managua, Nicaragua. 7 p

UNA-FARENA, PASOLAC, CIAT (Universidad Nacional Agraria- Facultad de Recursos Naturales, Programa de Agricultura Sostenible de Laderas, Centro Internacional de Agricultura Tropical). 1999. Manual de métodos sencillos para estimar erosión hídrica. Draft document. Managua, Nicaragua. 26 p

UNA-PASOLAC-CIAT-Hillsides (Universidad Nacional Agraria- Programa de Agricultura Sostenible de Laderas-Centro Internacional de Agricultura Tropical- Hillsides). 1999. Planificación de fincas en seis microcuencas de la subcuenca del Río Calico, San Dionisio, Matagalpa (de mayor afectación por el Huracán Mitch). Práctica de asignatura: Conservación de Suelso y Agua II. Managua, Julio 1999. 45 p.

UNA-PASOLAC-CIAT-GPAE (Universidad Nacional Agraria- Programa de Agricultura Sostenible de Laderas-Centro Internacional de Agricultura Tropical- Grupo de Promoción de Agricultura Ecológica). 1999. IV Seminario Nacional de Conservación de Suelos y Agua. Memoria. 9 y 10 de Marzo de 1999. CIAT-Hillsides, Managua, Nicaragua.

Vernooy R, ed. 1998. Taller "Instrumentos Metodológicos para la Toma de Decisiones sobre Manejo de los Recursos Naturales en Laderas". Programa y resúmenes de las presentaciones. CIAT-Hillsides, San Dionisio, Matagalpa, Nicaragua. 37 p.

Vernooy R, Baltodano ME, Beltrán JA, Espinosa N, Tijerino D. 1998. Towards participatory management of natural resources: experiences from the Calico River watershed in Nicaragua. Internal Document, CIAT-Hillsides, CIAT, Cali, Colombia.

Vernooy R, Espinosa N, Lamy F. 1999. Participative mapping, analysis, and monitoring of natural resources in a watershed. Guide no.3 (in Spanish) of the series "Instrumentos metodológicos para la toma de decisiones en el manejo de los recursos naturales". CIAT, Cali, Colombia. 152 p.

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List of Abbreviations and Acronyms

Acronyms

ADECA	Asociación para el Desarrollo Comuntario de Carazo, Honduras
AFE	Administración Forestal del Estado, Honduras
AFOCO	Apoyo a la Foresteria Comunal, Yuscarán, Honduras
AGROGENET	Agronomía Genetica y Tecnología, Honduras
AOP	Annual Operational Plan, CIAT-Hillsides, Colombia
ASIAVA	Asociación de Ingeniero Agrónomos del Valle, Colombia
CARE	Cooperative for American Remittances Everywhere
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica
CCD	Comisión Cristiana de Desarrollo, Honduras
CEDA	Centro Experimental de Desarrollo Agricola, national experiment station, Honduras
CEDAF	Centro para el Desarrollo Agropecuario y Forestal, Honduras
CENADE	Centro de acción y de Apoyo al Desarrollo Rural, Honduras
CENIA	Centro Nacional de Investigación Agropecuaria, Nicaragua
CEPRODEL	Centro de Promoción del Desarrollo Local, Nicaragua
CETEC	Corporacíon para Estudios Interdisciplinarios y Asesorías Técnicas, Colombia
CGIAR	Consultative Group on International Agricultural Research
CIALs	Comités de Investigación Agricola Local
CIDA	Canadian International Development Agency
CIDES	Comité Interinstitucional para el Desarrollo de Sulaco, Honduras
CIDICCO	Centro Internacional de Información sobre Cultivos de Cobertura, Honduras
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
CIP	Centro Internacional de la Papa, Peru
CIPASLA	Consorcio Interinstitucional Para una Agricultura Sostenible en Laderas, Colombia
CLODEST	Comité Local para el Desarrollo Sostenible de la Cuenca del Rio Tascalapa, Honduras
COMVALLE	Consorsio Interinstitutional para el Manejo de los Recursos Naturales del Norte y Centro del Valle del Cauca, Colombia
CONASEL	Coordinadora Nacional de Agricultura Sostenible, Honduras
CORPOICA	Corporación Colombiana de Investigación Agropecuaria
CORPOCUENCAS	Corporación Vallecaucana de las Cuencas Hidrograficas y el Medio Ambiente
CURLA	Centro Universitario Regional del Litoral Atlántico, Honduras
DEC	Dirección Ejecutiva del Catastro, Honduras
DICTA	Dirección de Investigación de Ciencias y Tecnología Agrícola, Honduras
EAP-Zamorano	Escuela Agrícola Panamerican-Zamorano
EMAPRAS	Empresa de Asesoria en Produccion Agropecuaria Sostenible, Honduras
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Brazil

EPRODAS	Empresa de Professionales en Producción Agropecuaria Sostenible, Honduras
ESNACIFOR	Escuela Nacional de Ciencias Forestales, Honduras
ESRI	Environmental Systems Research Institute, Redlands, California
FAO	Food and Agriculture Organization of United Nations, Italy
FARENA	Facultad de Recursos Naturales, UNA, Nicaragua
FEPROH	Fomento Evnagélico para el Progreso de Honduras
FIDAR	Fundación para la Investigación y el Desarrollo Agrícola, Colombia
FISE	Fondo para la Inversión Social y Emergencias, Nicaragua
GAAS	Grupo de Asesoria en Agricultura Sostenible, Nicaragua
GPAE	Grupo de Promoción de Agricultura Ecológica, Nicaragua
GTZ	Deutsche Gesellschaft für Techische Zusammenarbeit (*German Agency for Technical Cooperation*)
IDR	Instituto de Desarrollo Rural, Nicaragua
IDRC	International Development Research Centre, Canada
IDTVF	Identificación de Tierras de Vocacion Forestal Project, Honduras
IHCAFE	Instituto Hondureño del Café
IICA	Instituto Interamericano de Cooperación para la Agricultura
ILCS	Indicadores Locales de Calidad de Suelos Guia
INEC	Instituto Nacional de Estadisticas y Censos, Nicaragua
INETER	Instituto Nicaraguense de Estudios Territoriales
INPHRU	Instituto de Promoción Humana, Honduras
INPYME	Instituto Nacional de Pequeños y Mediano Empresas, Honduras
INTA	Instituto Nacional de Tecnología Agropecuaria, Nicaragua
INTEP	Instituto Técnico Profesionales, Roldanillo, Colombia
IPCA	Investigación Participativa para Centro América
IPRA	Investigación Participativa en Agricultura/*Participatory Research in Agriculture* of CIAT
IPGRI	International Plant Genetic Resources Institute, Italy
ISA	Instituto Superior Agropecuario, Dominican Republic
IT/DSS	Intelligent Team/Decision Support System
MAG	Ministerio de Agricultura, Honduras
MAGFOR	Ministerio Agropecuario y Forestal, Nicaragua
MARENA	Ministerio de Ambiente y Recursos Naturales, Nicaragua
MAS	Manejo de Suelos Acidos consortium, part of SWNM
MIS	Manejo Integrado de los Suelos de Centro América consortium
NCSA	National Center for Supercomputing Applications
PASOLAC	Programa de Agricultura Sostenible de Laderas en Centro América of IICA
PCCMCA	Programa Cooperativo Centroaméricano para el Mejoramiento de Cultivos Alimenticios
PDA	Proyecto de Desarrollo de Area, Yoro, Honduras
PMA	Programa Mundial de Alimentos, Nicaragua
PNUD	Programa de las Naciones Unidas para el Desarrollo
PPI	Proyectos Productivos Integrados

PRGA	Participatory Research and Gender Analysis for Technology Development and Institutional Innovation, systemwide Program of the CGIAR
PROASEL	Programa de Agricultura Sostenible en Laderas
PRODESSA	Proyecto de Desarrollo de San Dionisio, Nicaragua
PROFRIJOL	Proyecto Regional de Frijol para Centro América, México y el Caribe
PROLANCHO	Proyecto de Desarrollo de Olancho, Honduras
PROLESUR	Proyecto Lempira Sur, Honduras
PROMESA	Proyecto Mejoramiento de Semilla, Nicaragua
PROSERBI	Programa de Servicios Básicos Integrados, Nicaragua
REDAR	Red de Agroindustria, Nicaragua
RENASIG	Red Nacional de Sistemas de Información Geografica, Honduras
RIEPT	Red International de Evaluación de Pastos Tropicales
SAG	Secretaria de Agricultura y Ganadería, Honduras
SDC	Swiss Development Cooperation
SERNA	Secretaria de Recursos Naturales y Ambiente, Honduras
SERTEDESO	Servicios Técnicos para el Desarrollo Sostenido, Honduras
SIMAS	Servicio de Información de Mercado, Honduras
SOL	Supermercado de Opciones para Ladera (*Hillsides Options Supermarket)* Nicaragua
SWBM	Spatial Water Budget Model
SWNM	Soil Water and Nutrient Management program
TROPILECHE	Sistemas de Alimentación a base de leguminosas mejoradas para pequeños productores con ganado de doble proposito en América Latina tropical ("Improved legume-based feeding system for smallholder dual-purpose cattle production in tropical Latin America"), a CGIAR project
UCA	Universidad Centroamericana
UCOSD	Union de Campesinos Organizados de San Dionisio, Nicaragua
UMATAs	Unidades Municipales de Asistencia Técnica Agropecuaria, Colombia
UNA	Universidad Nacional Agraria, Nicaragua
UNAG	Union Nacional de Agricultores y Ganaderos, Matagalpa, Nicaragua
UNDP	United Nations Development Programme
USAID	United States Agency for International Development, WA
USGS	United States Geological Survey
VADEA	Valoración de Daños por Erosión Actual, Calico River watershed, Nicaragua

Abbreviations

AFT	análisis fototopográfico (*photo-topographical analysis*)
CA	cellular automata
CVM	contingent valuation method
DEM	digital elevation model
DSS	decision support system
FRR	financial rates of return
GIS	geographic information systems
LAN	local area network
LUT	land-use type
ME	moderately eroded
NARS	national agricultural research systems
NGO	nongovernment organization
NPV	net present value
NRM	natural resource management
PM&E	participatory monitoring and evaluation
PPO	participatory planning by objectives
SE	severely eroded
TEB	total exchangeable bases
WTP	willingness to pay