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SANREM CRSP ANNUAL REPORT
YEAR 4
1 August, 1995 - 31 July 1996
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PREFACE

From the Management Entity.....

We have just completed a fourth productive year in the SANREM CRSP, and we have many accomplishments to highlight. We are presenting those accomplishments in this annual report in a different format from what we have utilized in the past. Our annual report consists of a compilation of the reports from each individual project funded by the SANREM CRSP. These Program Highlights are grouped by country.

We thank you for your interest in the SANREM CRSP and hope that you will find this annual report informative and useful. For more information you may contact the SANREM CRSP Management Entity or the Project Principal Investigator.

We look forward to another productive year in 1996-1997.

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TABLE OF CONTENTS

BURKINA FASO

CAPE VERDE

CENTRAL AMERICA

ECUADOR

SANREM CRSP
PROGRAM AT A GLANCE

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

Who We Are

A Program and a Partnership

We are a five-to-ten year international research and training program launched in January 1992 and funded by the United States Agency for International Development (USAID). From our base at the University of Georgia, we at SANREM work in close partnership with thousands of farmers and their families around the world, as well as a variety of institutions and organizations including:

- 11 U.S. and Host-Country Universities
- 12 Non-Profit and Development Organizations (NGOs)
- 10 International and National Research Centers
- 5 Host-Country Government Agencies

What We Do

Science for a Better Environment

We do research and training for the joint purpose of improving quality of life and preserving natural resources by:

- sustaining agricultural productivity
- improving water quality and availability
- protecting and fostering biodiversity

We bring together scientists and farmers to work side-by-side as equal partners. By joining scientific expertise and indigenous knowledge, we seek solutions to the challenges farmers and their families face as they strive to make a living in the most fragile environments.

Where We Work

In Landscapes at Risk

We focus on areas of the developing world most exposed and vulnerable to environmental degradation and most subject to food scarcity and water-borne illness. Our sites represent two main types of tropical ecosystems:

- humid tropics (Philippines, Ecuador, Costa Rica, Honduras)
- semi-arid tropics (Burkina Faso, Cape Verde)

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SANREM CRSP

CORNERSTONES OF SUSTAINABILITY

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

SANREM CRSP seeks to develop and promote more sustainable ways of using natural resources. Sustainability is achieved when the resources with which we are entrusted are used in ways that do not deny the same opportunities to future generations. The program addresses these challenges through an innovative methodology that rests on four cornerstones:

Landscape/Lifescape

Our research looks at an entire watershed as a dynamic whole, rather than at its component parts in isolation, to understand how it is being affected by the interaction of biophysical (landscape) and socioeconomic (lifescape) factors at play within and around it.

Interdisciplinary Teamwork

Because of the scope and complexity inherent in studying landscape/lifescape relationships, we feel that the age of "Lone Ranger" research is over and that collaboration is the way of the future. Hence, our research combines methods and insights from a variety of scientific disciplines, such as ecological, agricultural, and social sciences, into an integrated perspective.

Institutional Partnerships

Our work reaches beyond the doorsteps of academia to integrate the expertise and experience of a diverse range of partners by bringing together U.S.-based and host-country researchers and representatives of development agencies, government institutions, grassroots organizations, and rural communities in an equal partnership.

Participatory Methodologies

Some of these partners have never worked together and some, such as farmers of developing countries, have never been actively involved in scientific research. The SANREM CRSP approach builds on the experience and knowledge of farmers, beginning with their own assessment of problems and priorities and ending with their testing and adaptation of proposed solutions.

SANREM CRSP stands for a new way of doing science: ours is a partnership among equals around a common commitment to addressing the problems faced by farmers and their families today. We believe that only by integrating concerns for environmental conservation, livelihood security, and social equity in a long-term, holistic approach to research, will our work contribute to a better quality of life in a more peaceful society on a healthier earth.

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SANREM CRSP

PARTNERS AROUND THE WORLD

Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

United States Partners

- Auburn University
- Colorado State University
- Heifer Project International
- Iowa State University
- PVO/University Center for Collaboration in Development
- Tuskegee University
- University of Georgia
- University of Wisconsin
- USDA-ARS Soil Tilth Laboratory
- Virginia Polytechnic Institute
- Washington State University

Philippines Partners

- Asian Vegetable Research Development Center
- Bukidnon Provincial Planning and Development Office
- Bureau of Soil and Water Management
- Central Mindanao University
- Central Queensland University
- Department of Education, Culture and Sports
- Dept. of Environment and Natural Resources
- Green Mindanao
- Heifer Project International/Philippines
- Internat'l Council for Research in Agro-Forestry
- Internat'l Potato Center/User's Perspective with Agricultural Research and Development
- Internat'l Rice Research Institute
- Municipal Government of Lantapan
- National Power Company
- Network for Environmental Concerns, Inc.
- Northern Mindanao Agricultural Research Center, Department of Agriculture
- Philippines Council for Agriculture, Forestry and Natural Resource Research and Development
- San Herminigildo Agro-Industrial School Foundation
- University of the Philippines, Los Baños

Burkina Faso Partners

- Institute for Agricultural Research and Studies
- Institute for Tropical Ecology and Biology Research
- Institute for Rural Development, University of Ouagadougou
- Plan International/Burkina Faso

Ecuador Partners

- COMUNIDEC
- Center for Data on Conservation
- Heifer Project International/Ecuador
- Terra Nueva
- Latin American Faculty for Social Sciences (FLACSO)
- Sustainable Utilization of Biological Resources (SUBIR)

Cape Verde Partners

- Directorate General for Agriculture, Silviculture, and Animal Husbandry
- Nat'l Institute for Rural Engineering and Forestry
- Nat'l Institute for Agricultural Research and Development

Honduras Partners

- Escuela Agricola Panamericana (Zamorano)

Costa Rica Partners

- EARTH University

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Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
funded by U. S. Agency for International Development (USAID)

September 1996
Program Highlights
G1-1

Communication and Information Exchange

Rationale

The SANREM CRSP is now coordinating research projects in Central and South America, Southeast Asia, and Africa with a consortium of investigators that includes universities throughout North America. Clearly, communications is vital to the success of this program, and SANREM CRSP's methodology adds an additional dimension to our information exchange and educational needs. As an international research program based on equal participation of: local people from a wide variety of cultures, host-country institutions, and researchers from many disciplines, SANREM CRSP gathers together a diverse audience, which requires us to develop a full repertoire of communication and educational tools.

Objectives

■ To develop a communications strategy for the SANREM CRSP.

■ To develop and implement appropriate information dissemination materials.

■ To disseminate information about and build awareness of SANREM CRSP among significant publics, the media, researchers, and organizations.

Accomplishments

Considerable Progress has been made in public outreach and information exchange over the first four years of the program implementation. Consistent with the SANREM CRSP philosophy, the program's communication strategy stresses participation and collaboration, soliciting and utilizing reader's feedback and contributions. It also recognizes the diversity of its audiences by addressing their various needs and interests through a repertoire of communication tools, ranging from grassroots to specialized ones.

■ Public Relations Media Pitches

We began an earnest effort to raise awareness among the media about SANREM CRSP's efforts. From that awareness comes greater understanding and eventually story assignments. We have contacted over 30 newspapers, 17 magazines, and six radio stations, calling, faxing, and mailing news releases and letters (accompanied by an information kit) highlighting SANREM CRSP projects and accomplishments. We have also arranged for SANREM CRSP scientists to present to a World Congress of environmental journalists.

■ Quarterly and Annual Reports

Our quarterly and annual reports, compiled and produced by the Management Entity, provide an exhaustive documentation on every stage of the SANREM CRSP process as it unfolds both locally and globally. This material is a valuable resource for future efforts that seek to replicate the program's innovative approach and methodologies in domestic and international programs seeking to address issues of agricultural sustainability.

■ Newsletters and Updates

LAST Update is a quarterly newsletter produced by the Communications Office that reports on the worldwide network of SANREM CRSP activities. This publication contains articles to update a broad readership on current SANREM CRSP research projects and results, recent conferences, sustainability and resource management issues, as well as invited editorials. It is written by our researchers for a diverse audience, from the lay public to experts.

SANREM CRSP Email News is a monthly electronic supplement produced by the Communications Office that provides up-to-date summaries of SANREM CRSP activities and travel plans of researchers going to the research sites.

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Ecolinks is a semiannual newsletter produced by the PVO/ University Center that contains in-depth articles on SANREM CRSP site and global activities. It is written in a nontechnical, popular style appropriate for its diverse audience of field-level collaborators, such as development workers, community-based grassroots groups, NGOs, and other host country partners. The newsletter is translated into French and Spanish for our African and Latin American sites.

In light of our foundation in the farmer-back-to-farmer model, Site Newsletters are now produced by the SANREM CRSP site Coordinators in the Philippines and Ecuador to maintain host-country and local community communications.

Program Highlights or scientific "silver bullets" are a new addition to the SANREM CRSP communications portfolio. Each of these two-page highlights features a specific work plan and its research accomplishments, outcomes, and potential impacts.

■ **World Wide Web**
The SANREM CRSP has a homepage on the World Wide Web which offers the internet audience access to information on all site activities as well as access to newsletters and listings of available publications. The homepage receives as many as 50 hits per day. To augment the Environmental Education component of the SANREM CRSP, a Kid's Homepage was also developed to stimulate environmental awareness among students and provide a link from us to others. The page includes sights and sounds from each site.
For "in-house" purposes, the SANREM CRSP Web page has been augmented to provide more technical and management information on the program from the Management Entity to the Global Technical Committee and Board of Directors.

■ **Displays**
To get a visual flavor of the SANREM CRSP out to a wider audience, the Management Entity, the Henry W. Grady College of Journalism and Mass Communication, and the consortium's best photographers joined forces to produce two high quality 4'x8' displays. One display covers the global SANREM CRSP program highlighting the cornerstones and philosophy as well as progress in the areas of research, education, and benefits to the U.S. The second display emphasizes the strong environmental education component of the SANREM CRSP featuring the Global Classroom Linkages, graduate education, and non-formal community education. One display made specifically for the Cape Verde audience is now housed at the national research institute (INIDA) in San George, Cape Verde.

■ **Information Kit**
The information kit was created to provide a more reader-friendly summary explanation of SANREM CRSP's activities and philosophy. Written for a readership level between that of the scientist and the lay person, the information kit is ideal for sending out to the media and members of the general public who have an interest in environmental and development issues. The information kit includes: a fact sheet of basic facts about the program with its philosophy on back; a list of collaborating organizations at each site with a world map pointing out SANREM CRSP sites on back; a sheet of Benefits to the United States with SANREM CRSP's global impacts on back; and sheets describing the landscape/ lifescape of each SANREM CRSP site and highlighting some key project accomplishments.

■ **Research Library and Data Base**
A central library for materials on sustainable agriculture and natural resource management, including site-specific "grey" literature collected on SANREM CRSP missions, has been created within the Georgia Station Library, Griffin, GA. The materials are organized into general categories as well as by site information, and are computer referenced by author, titles, document type, key words, journal name, and publication year. The library provides SANREM CRSP collaborators access to site-specific and comparative information to aid them in the planning and implementation of their research projects and in the elaboration of conceptual and methodological frameworks for research on environmental sustainability. Furthermore, it is available for use by University of Georgia students and faculty with related interests, thus assisting them in expanding the scope of their research to the international arena.

Outcomes

■ An earnest effort to raise awareness among the media about SANREM CRSP was launched and resulted in increased interest among journalists. Some newspaper articles have been published and an ongoing rapport has been established with some reporters.

Potential Benefits

■ Taken together, the dissemination of information about the goals, philosophy, activities, and accomplishments of SANREM CRSP has been extensive. This information exchange has resulted in increased understanding and collaboration among the many constituents. The methods and scientific findings from the project have fertilized numerous fields of endeavor in agricultural sciences.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G2-1

SANREM CRSP Monitoring and Evaluation: Expectations, Reality and the Value of an Iterative Plan.

Rationale

The SANREM CRSP is breaking new ground in participatory agricultural research and natural resource management. When the program began, it was expected that the landscapes and lifescapes in which the program was working would shape the research and training activities. There was no blueprint. Because this program adopted a nontraditional, participatory, and iterative approach, the monitoring and evaluation (M&E) had to be creative and serve as a resource for learning and improvement while enabling a transferable process. Continuous monitoring and evaluation of the site-based and global projects and the process are essential for internal management, for accountability of human and financial resources, for compliance with the philosophy and approach, and for dissemination of learning from experience.

A Global Monitoring and Evaluation (GM&E) committee was formed to design and implement a monitoring and evaluation program that includes technical reporting, process documentation, and participatory monitoring and evaluation. As part of this plan, personnel made a commitment to the project at each host-country site (Philippines, Burkina Faso, Ecuador, Cape Verde, Costa Rica, and Honduras) as well as within the management entity; trainings were then carried out in participatory monitoring and evaluation at all sites and within the U.S.

The SANREM CRSP is a complex and ambitious program designed to effect long-term change; as a result, identification of short-term impacts can be a difficult task. The unique character of the SANREM CRSP enables it to apply both qualitative and quantitative measurements of impacts and progress towards impacts in a long-term, participatory manner. The SANREM CRSP has responded by devising a framework to recognize and record a logical progression towards impacts (Figure 1).

Additionally, process documentation is invaluable in the SANREM CRSP and addresses issues such as participation, partnerships, points of weakness and strength, as well as opportunities. insights and lessons learned. Lastly, participatory or self-evaluation techniques incorporated into research, management, and community organizations have enabled stakeholders to identify indicators of success for the activities which they are involved in as well as a system to implement real-time improvements. The multifaceted approach has helped turn the concept of evaluation into a celebration in learning.

Objectives

- Develop a comprehensive plan for monitoring and evaluation for the SANREM CRSP.
- Develop a framework for technical reporting, process documentation, participatory monitoring and evaluation, and assessing progress towards impacts.
- Do planning and provide training, and implement participatory monitoring and evaluation activities globally and at each site of the SANREM CRSP.
- Oversee and ensure timely reporting of all technical progress and documentation of process.
- Publish and distribute quarterly and annual reports.

Accomplishments

- A global monitoring and evaluation plan was developed to identify the components of monitoring and evaluation and a timeline for implementation.
- A format for technical reporting and process documentation was developed.
- A framework for assessing impacts as well as the progress towards impacts was established.
- Training workshops in participatory M&E for site teams were held in the Philippines, Burkina Faso, Cape Verde, Ecuador, and the U.S. Over 150 individuals were trained based on the methodologies of Aaker and Shumaker (1994) and Rugh (1992) who also served as trainers.
- At the global level, participatory evaluations were done with two crosscutting working groups, the Global Technical Committee, the Board of Directors, and the Management Entity. At all sites such evaluations are underway; in the Philippines evaluations were conducted with the Site Coordination Office, the NCC, the CAC, and several site projects.
- Global and site-tailored (Cape Verde and Burkina

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Duration of Project

September 1993 - July 1997

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Faso) guidelines for M&E have been developed.

■ Annual and quarterly publications produced and distributed.

Outcomes

■ Progress Towards Impacts

To monitor short- and long-term impacts and progress towards impacts, a classification system was adopted. An impact is defined as a change in the behavior of participants that results in an enhanced quality of life or improvement in environmental conditions such as the quality or quantity of natural resources. This hierarchical classification scheme illustrates an ordered process of progress towards impacts. It begins as changes in people's involvement in or reaction to sustainable resource management activities and issues. As these first-order changes crystallize, they form a foundation for changes in people's knowledge, attitudes, skills, or aspirations regarding sustainable resource use. To produce an impact with long-term significance these second-order changes must ultimately bring about changes in behavior regarding sustainable agriculture and natural resource management.

For example, when a program is initiated, farmers of sloping lands might be invited to get involved in a program for soil conservation. Through training and on-farm research, the farmers are exposed to alternative soil management practices which will control erosion. Participation can enhance their skills related to soil conservation and even their aspirations (desire to control erosion on their farms or maintain certain organic matter or yield levels). If farmers adopt or adapt soil conservation measures, this constitutes a change in behavior which may: improve yields, require less external inputs to the farm, and change the labor or fiscal situation of the household.

Community members in the Philippines were trained in water quality monitoring and have presented their data to the local government. In this case, the local policy makers are using this data to guide policy changes related to sediment in streams and health issues.

Records are being used by individual projects at each site and globally. The outcome is a much clearer tracking of progress through better documentation and a better understanding and integration of a demand-driven research agenda. Keeping informed enables the program to better respond to community members who demand concrete benefits.

■ Participatory Monitoring and Evaluation

Participatory Monitoring and Evaluation allows the program constantly to improve its ability to meet its goals based on lessons learned. This flexibility allows stakeholders to identify their expectations and the indicators of success and to reflect on and evaluate the activities and progress. In doing so, participants systematize their experience, reflect on the results, and can plan for future challenges.

In Participatory Evaluation, it is imperative that the stakeholders reflect honestly on their efforts and constantly ask themselves: 1) What are we doing well? and 2) What are we doing less well? From these dialogues come action plans collectively designed to improve the project or committee under discussion. The Participatory Monitoring and Evaluation method as described by Aaker and Shumaker (1994) is used by technical assistants at each site. Individual meetings are also held with each site project team to engage in on-going participatory evaluation.

The results of all Participatory Evaluations to date within the SANREM CRSP resulted in an enormous number of lessons learned and in immediate and effective responses to problems encountered. For example, a participatory evaluation of the Management Entity called for a restructuring of the management to better serve the program. The restructuring was done in conjunction with decentralizing some program decision-making; clearly articulating roles of participants; and streamlining flows of information, authority, and money.

■ Process Documentation

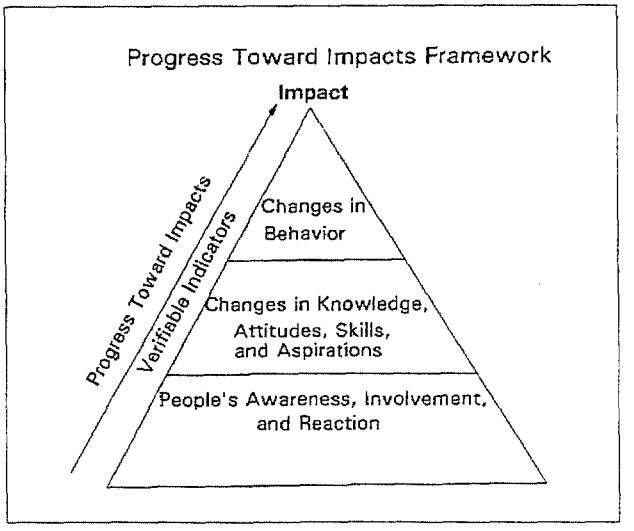
Although process issues are at the heart of the SANREM CRSP approach, process documentation was not readily seen as a useful tool by some scientific disciplines. For scientists, the tradition has been strictly quantitative. Partners coming from the development background were more keenly attuned to documentation of process as a component of development communications. Therefore, SANREM CRSP had to design creative process documentation to fit different field situations.

Process documentation provides a mechanism to reflect and record information related to the participatory nature of the program, constraints to program progress (unforeseen conflict, inappropriate equipment, etc.), opportunities that might have been overlooked (such as a necessary partner for spreading the results), and weaknesses (such as insufficient expertise in a given area). This information gives clear insight into lessons learned which do not arise from research data.

Distillation of the process documentation has to be well grounded so that the output is valid and useful. Distillation is done by a process documentation team of outside resource persons and SANREM CRSP partners at the site in conjunction with project holders. Outside experts provide guidance and a less biased assessment of the situation. The process documentation has clearly helped identify strengths, weaknesses, and potential problems.

Potential Benefits

■ The SANREM CRSP M&E program evolved to become an intricate component of project design. The resulting framework has been integrated into later starting site programs and is working successfully. There is a need to ensure that all participants understand the importance of M&E and consider themselves stakeholders in the process. By becoming stakeholders, participants experience the ownership of self-directed improvement versus the traditional evaluation which puts the participants under the microscope of external "judges."



(After Bennett USDA)

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Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G3-1

SANREM CRSP and INFORUM Collaboration on an Electronic Conference on Indicators of Sustainability and in the Development of SARD-FORUM

Rationale

Collaborative research is not possible unless mechanisms can be developed to facilitate exchange of information among partner institutions. The SANREM CRSP has invested much of its resources in workshops and meetings where people could meet face-to-face and exchange what they are learning. As part of its initial design, the SANREM CRSP recognized the potential of using electronic communications technology to complement these meetings. As electronic communications cost is reduced and as more countries have access to these tools, electronic conferencing's potential grows. Recognizing this potential, the SANREM CRSP contracted INFORUM, an NGO specializing in supporting global networking, to: a) organize an electronic conference on indicators of sustainability and b) set up an electronic forum to facilitate the exchange of information among institutions interested in Sustainable Agriculture and Rural Development (SARD).

Objectives

- Identify who (individuals and institutions) was working on the development of indicators of sustainability.

- Develop a set of case study information and examples that could be used by those attending the face-to-face symposia on the same subject held in Washington, D.C. in August, 1994.

Accomplishments

Electronic Conference

INFORUM organized the electronic conference by setting up: (1) an unmoderated electronic bulletin board for people to register and describe their specific interest in indicators, (2) a moderated electronic "table" for participants to exchange ideas and discuss issues (also a listserver), and (3) a "file cabinet" where longer documents could be stored and accessed via electronic mail using an Almanac information server software program.

Approximately 235 people from 35 countries subscribed to the Indicators Bulletin Board and Indicators Table. More than 170 people sent in registration information with names, addresses, and specific interests in indicators; 42 people from 16 countries participated in the discussion on the Indicators Table. More than 20 documents were sent in to the Indicators File Cabinet. Because these documents are retrieved automatically by electronic mail, it is not known how many people have taken advantage of this information.

An evaluation form posted on the Indicators Bulletin Board was returned via electronic mail by 40 of the conferees. Of those responding, more than 92 percent rated the conference as either a high return on their investment of time (63 percent) or a medium return on their investment (29 percent).

The moderated discussion at the Indicators Table was organized around a sequence of questions that might typically be addressed by an interdisciplinary group working together to develop and use indicators of sustainability as part of a process to find more sustainable land use systems. The questions addressed over the 14 weeks of the conference were: (1) what are the characteristics of the conceptual framework you are using?, (2) what system, resource, or phenomenon are you trying to sustain?, (3) how do you identify possible indicators?, (4) how do you evaluate and select which indicators to measure?, (5) in what type of analyses do you use the indicators?, (6) what is the state-of-the-art of the methodology to develop and use indicators of sustainability?, and (7) what follow-up activities to this conference should be considered?

The conference made some progress in defining the type of conceptual framework needed in order to develop indicators of sustainability. It was clear that indicators must be developed within a framework linking a hierarchy of systems from field to farm, community, and on up to national policy level systems. The perspectives of the conference participants were extremely diverse, with interests ranging from soil microbes to global trade. Different approaches to developing sets of possible indicators were suggested. Examples were, the development of menus of possible indicators based on experience with similar systems and the measurement of total factor productivity based on measuring all system inputs and outputs. Among those participating in the conference, few seem to have experience with systematically evaluating possible

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Duration of Project

February 1994 - July 1997

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indicators, and even fewer had actually used indicators in different types of analyses.

Outcomes

■ This electronic conference demonstrates that there is strong global interest in the question of how to develop and use indicators of sustainability. But there is still a great deal of confusion regarding how to make the concept of sustainability operational, which is why processes to develop and use indicators of sustainability are just beginning to emerge. Some of the confusion comes from people applying the concept of sustainability at different hierarchical levels (field, farm, community, region, country, etc.). Also, some people take a more narrow approach that focuses on maintaining the productive potential of natural resources; others take a wider approach, where factors such as equity in the distribution of the benefits from using the resources are included within the concept of sustainability. Some important conclusions from this electronic conference on Indicators of Sustainability were:

There are many different multilateral, bilateral, and national public and private institutions interested in indicators of sustainability.

Because of different definitions of sustainability and interest in sustaining different systems, there are different approaches to the concept of indicators of sustainability.

The current state-of-the-art of the methodology needed in order to develop and use indicators of sustainability is, in general, not well developed; but ideas on how to identify possible indicators are emerging.

While many different mechanisms should be developed to promote information sharing and the development of cooperative initiatives, the experience gained from this electronic conference suggests it has great potential as a cost effective tool.

■ **Development of SARD-FORUM**

The SANREM CRSP's experience collaborating with INFORUM on the electronic conference described above suggested that future electronic communications services, such as moderated electronic conference, could be a very important tool in facilitating exchange among SANREM CRSP partners. The SANREM CRSP agreed to support INFORUM's involvement in working with the Sustainable Development Department (SDD) of the Food and Agriculture Organization (FAO) of the United Nations Sustainable Energy and Environment Division (SEED) of the United Nations Development Programme (UNDP) to set up SARD-FORUM. SARD-FORUM is an electronic venue for the global exchange of information among people and institutions that are involved with Sustainable Agriculture and Rural Development (SARD).

The concept of SARD-FORUM evolved directly as a result of the SANREM CRSP supported electronic conference on indicators of sustainability. Because of UNDP's staff involvement in that conference, they asked INFORUM to set up an electronic bulletin board (called SARDBB-L) on their computer. Discussion on this bulletin board led to the proposal to set up an electronic forum that would include various services. SARD-FORUM is basically a centralized set of unmoderated and moderated electronic services.

SARD-FORUM uses a listserver and various lists to provide three interconnected services: (a) an unmoderated matrix of SARD topics, (b) moderated electronic conferences, and (c) a library where users can send and retrieve longer documents.

Approximately 300 people have subscribed to SARD-FORUM, but fewer people than expected have taken advantage of this service. Some information (approximately 100 messages) have been exchanged on SARD-NEWS, but the other topics have not been used extensively. One of the reasons subscribers suggest for the lack of information exchange is that many of the current subscribers are not presently involved in research or field level development, most are in administrative jobs.

■ The SARD-Library has just been set up. Users that are willing to share longer documents can send them via Email to a special address (SARD-UPLOAD@UNDP.ORG) and include in the subject line of their message the information that will appear in the table of contents of the library. Users can find out what documents are in the library by sending an Email message to the Listserver asking for the table of contents. Users can then request specific documents by sending an Email message to the Listserver asking for a specific file.

■ SARD-FORUM moderated conferencing capability has been used for the following electronic conferences:

a) Insitu Conservation of Biodiversity.
This conference was organized by CIP and IPPRI. Approximately 70 people, primarily from the Andean region of South America, exchanged 17 technical papers (using the SARD-Library) and discussed technical issues (using the SARD-ROOM3 conference room) over a three month period. Most papers were written in Spanish. The organizers provided English abstracts of the papers.

b) Privatization and Agrarian Reform in Russia.
This conference was organized by FADR, an NGO in Russia. The conference was organized both in English (on SARD-FORUM) and in Russian (on the computer at Moscow State Univ.). Eight papers were presented in English and 27 in Russian.

c) Addressing Natural Resource Conflicts through Community Forestry. This conference was organized by the FAO Community Forestry Group. The Conference used nine conference "rooms" (Email Lists) within SARD-FORUM for meeting of various groups (exchanging information in English, Spanish, and French) that reported back to a "plenary meeting room." The conference objectives were to: (1) bring together information on conflicts relevant to community forestry, (2) provide a forum for people and institutions to exchange experiences and knowledge and a opportunity for them to form and/or strengthen their own networks, (3) identify and fill gaps where information is currently missing, and (4) identify approaches, methods, and tools needed to analyze and intervene in conflict situations. The conference brought together more than 450 subscribers from 46 countries.

d) Critical issues and promising future options for FSR.
This conference has been organized by the Farming Systems Development Group at FAO and INFORUM to gather ideas with regards to issues that people feel need to be considered at an International Farming Systems Symposium that will be held November 1996 in Colombo, Sri Lanka and for a face-to-face workshop that is being organized by GTZ and FAO, also tentatively scheduled during November in Rome. A task force of 25 people held a three-week electronic meeting in one of SARD-FORUM's conference rooms and then a larger group of approximately 300 subscribed to one of the unmoderated lists on the SARD-FORUM matrix (called FARM), where various stakeholder, institutional, methodological, and systems issue will be discussed.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G4-1

Learnings in the Lifescape: The Gender/User Working Group of the SANREM CRSP

Rationale

Sustainability depends on promoting resource management rooted in equitable social relations. Through gender analyses, we are able to show that men and women may have separate yet interdependent spheres of activities, resources, constraints, and opportunities. Because these relations are grounded in cultures that ascribe a subordinate role to women, their relationships to the landscape are often defined within the context of this subordinate status. A correlation therefore exists between the level of gender sensitivity and ability to perceive and act on constraints and opportunities. Moreover, we cannot assume that researchers are sufficiently sensitive to, or possess the requisite skills for illuminating gender relations in the context of natural resource management. The gender/user working group therefore aims to ensure that gender sensitivity is heightened and is made an integral part of research at the conceptual as well as field levels. Innovative strategies and skills for gender/user analyses also become an important cornerstone of SANREM CRSP research.

Objectives

■ To foster an understanding of the gender dimension of diagnosis, research, and adaption among SANREM CRSP researchers and to realize its goals of enhancing the identification of gender indicators of sustainability.

■ To formulate key principles of gender to guide researchers in developing work plans and to monitor the integration of the gender element in all SANREM CRSP processes and activities

■ To develop a methodological framework for identifying gender indicators of sustainability at the landscape/lifescape intersection

■ To develop innovative gender analyses tools and strategies that will engender the full engagement of community members (men and women across class, age, and socioeconomic levels)

Accomplishments

■ Conducted two global training workshops in the U.S. Participants gained important skills for conducting gender sensitive research and employing landscape ecology, farmer first approaches. The workshops were held at the University of Georgia, Georgia Station, Griffin, Georgia and Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Team building was a central component of both training workshops, reflecting the importance given to collaborative research in SANREM CRSP. Participants included USAID personnel, the NGO community and SANREM CRSP researchers. A similar training workshop has been held at each research site in which participants are trained in the use of innovative tools to integrate gender and implement participatory research in a lifescape/landscape framework.

■ Conducted a workshop on participatory development and participatory research in domestic and international programs. The workshop was held at Tuskegee University Alabama. The focus was on participatory methodologies, including the definition of participation, measuring participation, doing participation, monitoring/evaluation, and engendering and sustaining participation in the collaborative research process.

■ Served as an important resource service to integrate gender components in all phases of research. This service included the collection of resource materials on gender relations in natural resource management specific to each site that is available to other principal investigators when required. In the Manupali watershed important gender-based data on soil,

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water and biodiversity management, forest resources, water resources, and livelihood strategies were generated during a two-day intensive participatory session. In Donsin, Burkina Faso, the PLLA indicated that women work multiple fields during the agricultural season (the head of the family's field, women's individual plots, and women's group plots).

■ Completed documentary analyses of participatory research worldwide. The analyses showed that the descriptive aspects of research are equally amenable to local as well as expert interpretation. It also drew attention to the varieties of participatory approaches and the limits and potentialities under different research conditions. A paper entitled, "Community and Gender: Indicators for Sustainability" has been completed for publication.

Outcomes

■ **Impacts of participation on field level projects.** The water resource management project in the Manupali in the Philippines has resulted in an indigenous water quality citizen monitoring group (Tigbantay Wahig) which serves as an important data source for the project. Participatory training in Lantapan, Philippines enabled researchers in partnership with farmers to set up an experiment utilizing true progeny on farmers' lands. In Donsin, Burkina Faso, participation of men and women has provided concrete feedback on gendered labor constraints, conflicts over resources, and the implications of tenurial relationships on land. Indigenous perceptions and attitudes towards deforestation, loss of biodiversity, and land degradation in the Philippines and Burkina Faso have been solicited and point to important culturally-based indicators of sustainability.

■ **Gendered indicators of sustainability at field level.** Gender is a critical variable at all the sites. The identification of resources and constraints by gender through the innovative strategies employed at the field level has facilitated the identification of indicators of sustainability specific to women and men. Gender differentials in migration and the impacts on natural resource management and sustainable agriculture in Donsin, for example, provide clarification of migratory trends that lead to identification of related indicators of sustainability.

■ **Gender sensitivity and gender integration in research work plans.** Perspectives on natural resource problems often depend on individuals' age, sex, and ethnicity factors which shape potentials for sustainability. Not only are environmental and agricultural problems an important concern in the community, social issues also hold an important place. In the Mindanao watershed, a community appraisal suggested that prevailing land and tree tenure patterns that preclude women from land ownership hold implications for sustaining soil fertility and lowered soil degradation.

Potential Impacts

■ The gender/user working group's activities and projects have generated a cadre of trained and informed U.S. and in-country researchers and administrators. Their training and practice with the wide range of participatory methodologies and tools for gender integration should considerably enhance their sensitivity to the importance of gender on the landscape/lifescape.

■ Gender research projects designed for implementation at field level. User sensitive methodologies are facilitating the compilation of indigenous taxonomies that are assisting farmers to find more sustainable and less costly ways of controlling vegetable pests that force them to abandon land and clear more forests.

■ Inclusive participation across different socioeconomic classes, age, and gender in landscape/lifescape research in field level research. The participatory research model of farmer-back-to-farmer on which SANREM CRSP research is based assumes incremental change at the level of the household, but also moves towards transformative change by including issues of inequality and distribution of resources.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G5-1

Indicators of Sustainability

Objectives

■ Provide a critical review of the literature and ongoing work on indicators of sustainability and environmental impacts.

■ Develop a rationale and framework for indicators of sustainability in fragile or threatened areas of developing countries which are useful within and across the SANREM CRSP sites.

■ Identify measurements and indices that can be used to monitor sustainability and evaluate options at SANREM CRSP research sites.

Accomplishments

■ Literature on indicators of sustainability was reviewed. Review papers were prepared on economic indicators and biophysical indicators of sustainability. A third paper covering "An Interdisciplinary Review of Indicators of Sustainability" provided an overview of principles and processes for defining and using indicators.

■ Indicator activities of other projects and entities were identified and dialogue established for exchange of ideas and experiences. Ongoing research was reviewed for concepts and approaches that could be helpful in formulating an indicators activity for SANREM CRSP.

■ An international conference/workshop on indicators of sustainability was organized. Twenty-two papers and 21 posters were presented by representatives of a wide range of disciplines, perspectives, and affiliations. Workshop sessions focused on translating the concepts and experiences into workable approaches for use in SANREM CRSP research activities. The proceedings were published by SANREM CRSP.

■ A workbook was prepared for use in developing indicators of sustainability for SANREM CRSP research projects. The workbook spells out a participatory process designed to lead to indicators that will be understandable and helpful in the personal and community decisions affecting sustainability of agriculture.

■ Provided guidance and a presentation at an Indicators of Sustainability Conference for the SANREM CRSP/Burkina Faso site.

■ Formulated six integrative indicators and scoring functions for use within and among sites.

Outcomes

■ Reviews of the literature and of ongoing sustainability programs revealed a plethora of suggested indicators of sustainability. Simple compilations from these lists do not lead to an operational set of verifiable indicators. Moreover, selections by researchers and program leaders do not provide the needed opportunity for farmers and the local community to contribute their knowledge, interests, and perceptions of sustainability processes. A systematic and participatory procedure that adheres to the principles of indicator development is needed.

■ Principles that can be used to systematically develop a more useable set of indicators of sustainability include:

■ Indicators are relatively accessible pieces of information about important underlying matters that may not be either directly observed or interpreted. It is important that indicators be simple and understandable and able to communicate information that motivates action and enables informed personal and public decisions.

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■ Indicators serve different purposes, including monitoring the status of important conditions, predicting future changes in conditions and outcomes, and reflecting the reaction to and impact of those changes.

■ Indicators of sustainability need to be directed primarily to the key dimensions of sustainability including resiliency, integrity, productivity, and stability.

■ Sustainability of agriculture and other natural resource based activities depends on interactions and balances within extremely complex and widely interactive bio-physical and socioeconomic systems. It is important to have a good understanding of the underlying systems and processes and then to identify and develop meaningful indicators that can be tested and verified to be linked, as hypothesized, to key determinants of sustainability.

■ "Grassroots" indicators originating with farmers and other community members are especially important because they reflect not only their experience-based understanding of how the systems function but also their goals and values and their vision of a sustainable future.

Potential Benefits

■ The thorough review of both principles and practice provides a sound basis for developing a set of indicators of sustainability for use in SANREM CRSP research as well as for extension to other projects and applications.

■ The workbook provides procedures and a participatory process that can be used to establish indicators of sustainability that are meaningful and useful to communities and residents as well as scientifically sound.

■ Other research investigations and development programs will benefit from a better basis for choosing indicators and developing participatory research and communication activities.

■ The research program of SANREM CRSP and other related projects can be made more effective by focusing on estimating relationships and testing parameters that relate to the goals, concerns, and knowledge of the people.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
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September 1996
Program Highlights
G6-1

Linking Research and Education: The Global Working Group on Education and Training

Rationale

■ Education is an "all-inclusive process" of gaining life-centered wisdom that leads to living well, in a particular place, for a long period of time. Both education and training are essential for the dissemination of SANREM CRSP research findings and for making a lasting impact toward sustainable livelihoods. Environmental Education is broadly defined to include the overall awareness that a person gains regarding sustainability and interactions with their biophysical and social surroundings.

■ Through the SANREM CRSP Environmental Education Working Group, promotion of partnerships and the exchange of information among communities and scientist becomes an integral part of the SANREM Research Process. Both formal and informal means are needed to convey the results of participatory research to all citizens of the SANREM sites, as well as to the educational community in the U.S.

■ Most efforts of the working group will are guided by existing educational programs at the research sites. The working group has the capacity to provide technical back stopping and resource materials to teachers so that children and youth will become more aware of the environment and take an active role in discovering ways to live more sustainably. The working group also sets the stage for SANREM researchers to communicate their findings to the community so that the adoption of more sustainable practices will be enhanced.

Objectives

■ Assess Environmental Education programs and networks, needs, and perceptions at the national level and in the schools and community at each SANREM site.

Assist Local Educational Programs at the SANREM CRSP sites through:

■ Incorporation of SANREM CRSP training and research activities into the classroom and community. This entails working closely with teachers and communities to understand the needs for SANREM CRSP resource persons and providing a mechanism for researchers to relate SANREM CRSP research findings.

■ Development of Environmental Education "source books" with local teachers and researchers targeted for classrooms at the SANREM CRSP sites.

■ Promotion of partnerships among U.S. and SANREM CRSP site students and teachers through a Global Classroom Linkages program.

Accomplishments

■ Assessments in the Philippines, the Department of Education, Culture and Sports (DECS) has been very supportive of the efforts to integrate SANREM CRSP materials into the classrooms of Lantapan and potentially beyond. A portrait of the education system of the Philippines and associated environmental education programs was conducted through the water resources project. Similar efforts are in progress for Burkina Faso and Ecuador.

■ Classroom/Teacher/Scientists Activities
A teachers meeting with representatives across the Philippines municipality was held at the San Hermanigildo Agro-Industrial School (SHAISI) to discuss the perceptions and needs of environmental education and to identify interests by the teachers in specific activities of the Working Group. These teachers expressed a strong interest to be a part of the SHAISI Environmental and Economic Foundation to Sustainable Agricultural Systems (EEFSAS) training the request was accommodated with a training of 77 teachers.

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■ A teacher training was also held in conjunction with citizen water quality monitoring efforts of the Water Resources Project where 30 teachers participated.

■ A one day workshop was held for 25 teachers representing schools across the municipality of Lantapan to initiate the development of a teachers "source books" based on water quality and quantity issues and particularly research outputs from the water resources work project. Teachers designed potential school activities related to water for three grade sections. A follow up meeting identified partners at a local teachers college.

Global Classroom Linkages

■ Global classroom linkages were between the following: An elementary school in Blacksburg, VA and the Agua de Gato elementary school in the republic of Cape Verde.

■ Elementary schools in Alabama have had exchanges with local schools of in Nanegal, Ecuador and Lantapan, Philippines

■ A global classroom linkage is being initiated between elementary schools in Georgia and Donsin, Burkina Faso and Nanegal, Ecuador

Other Outreach

■ A display was developed entitled *Global Linkages through Environmental Education* to extend SANREM CRSP environmental education activities.

■ The Global Studies Summer Institute of the Center for Environmental Studies in Milwaukee, WI was addressed to engage teachers on the topics of sustainable agriculture and natural resource management in the tropics.

■ The SANREM CRSP was represented at the North American Association of Environmental Education (NAAEE).

■ SANREM CRSP - U.S. Linkages were topics of presentations at the Global Rivers Environmental Education Network (GREEN) and the Volunteer Monitor Meetings.

■ A paper entitled *Water Spirits and Watershed Education in the Philippines* was submitted to the International Journal Watershed Education".

Outcomes

■ In the Philippines, the Secretary of DECS has two written endorsements of the SANREM CRSP and the provincial level superintendent of DECS also helped organize teacher - SANREM CRSP linkages. In this regard, the SANREM CRSP has been welcomed at the national, provincial, district levels to participate in environmental education curriculum enhancement. Teachers and administrators in the Philippines were interested in the development of source books, global classroom linkages and using scientists as resource persons in the classrooms. Global Classroom Linkages are in place in the Philippines and the implementation of a source book on water is underway. Teachers have been trained in sustainable agriculture practices and water quality testing and have been able to bring lessons learned to the classroom.

■ Teachers and their students have actively participated in the actual fieldwork - putting awareness into action.

■ Several on-going projects in the Philippines and Ecuador have incorporated an environmental education aspect in their work including research gardens and plots on the school grounds.

Potential Benefits

■ The notion of sustainability involves children. Although SANREM CRSP research is providing interesting outputs, there must be a mechanism in place for bringing this to the children so as they become the farmers and policy makers, that they come up with research data that has enlightened them on their "place". As community members also become aware and/or engaged in research, they too can have an impact on their constraints to sustainability.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G7-1

Characterizing the Climate of the SANREM CRSP Research Sites

Rationale

Climate plays an important role in determining the agricultural systems favored by farmers at each research site. As part of an effort to characterize the biophysical nature of the research sites, this project is collecting detailed weather information, in partnership with community members, from networks of automatic weather stations and rain gauges installed at each site.

Objectives

- Install and operate a network of Campbell Scientific weather stations and manual rain gauges at each site.
- Train local co-principal investigators and technicians to manage the maintenance of the weather stations and rain gauge networks, and to download and manage the recorded data.
- Provide the information in both raw and summarized form to other interested SANREM CRSP researchers, the local community, including local government, and any other interested groups.
- Provide a series of workshops and other community based information exchange efforts to discuss the role weather plays in the lives of the community.

Accomplishments

- A database of weather records has been collected at each site. The quantities measured are solar radiation, photosynthetically active radiation, air temperature and humidity, soil temperature at three depths, wind speed and wind direction, and rainfall intensity and totals. Each measurement is recorded as a daily average or total and also as an hourly average or total. Daily maxima and minima for each value are also recorded in the data logger.

A monthly summary of the daily meteorological data collected from each site is distributed to each site. This summary is then distributed to interested groups, including farmers, municipal and regional government offices, non-governmental organizations and other SANREM CRSP researchers.

- **Philippines**

Weather station records have been collected from four stations (three on site) since December 1993. Nine rain gauges installed along the main axis of the watershed provide additional information. Regular monthly meetings are held with farmers at each barangay in which the weather data from the automatic weather stations and the rainfall data are discussed. While forecasts of future weather are more valuable to farmers than knowledge of the recent past, the meteorological information provided, in conjunction with agronomic advice, may provide farmers with a clearer idea of the climatic conditions in their area and how these relate to farm management decisions.

- **Burkina Faso**

Weather station records have been collected from two stations (one on site) since April 1994. Seven rain gauges installed around the northern end of the study site provide additional information about the spatial distribution of wet season rainfall on a daily basis.

- **Ecuador**

Two weather stations were installed in August 1995 at the research site. Six rain gauges were installed in school yards of local communities and are read daily by the staff and students. Local field staff provide training to the schools on the use of the rain gauges and are responsible for downloading data from the weather stations and for routine maintenance. During regular meetings with the community the previously shared monthly summaries are discussed.

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Outcomes

■ For each site, detailed meteorological information is now available to SANREM CRSP researchers, the communities, and governmental and non-governmental partners. This data set is providing a record of the particular weather experienced during research activities at the sites and is beginning to describe the climate of each site. Several years of data must be collected before reliable statements can be made about the climate of a site, the 'average' weather experienced at a location over several years.

■ The weather data are being used to calibrate weather generation simulation models, which in turn are being used to simulate soil erosion at the Philippines site, and will be used to simulate crop growth and management practices at the Burkina Faso site.

■ There is now a group of scientists at each site who have been trained in the maintenance and data management of automatic weather stations. With some continued support and further training, this group will be able to maintain the long-term series of meteorological measurements at each site.

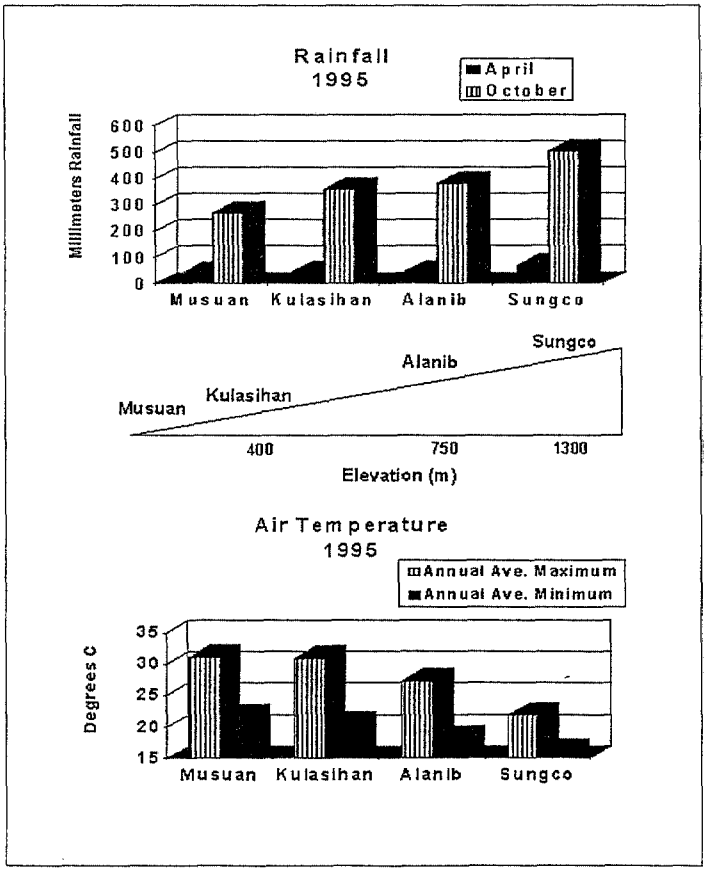
■ In the Philippines and Ecuador, regular meetings with the communities has ensured that the information collected by this project is shared with the farmers and other potential users. An enhanced understanding of the cropping calendar has resulted from the enhanced knowledge of the local climatic conditions and has guided agricultural planning at the farm and municipal levels.

Potential benefits

■ Other projects are beginning to make use of the data in their work. The detail provided by on site meteorological measurements will improve the research results of other projects. For example, in the Philippines, the Auburn/HPI project on water quality monitoring will use the detailed rainfall records to help interpret samples of stream quality taken throughout the year.

■ Modeling (computer simulation) activities have a role to play in SANREM CRSP, particularly in assessing the long-term effects of management practices. The database of meteorological information being collected will be very useful in aiding realistic simulations of, for example, soil erosion or long-term sustainability of particular cropping systems.

■ In the long-term, the accumulation of daily records describing the weather will provide a detailed picture of the local climate at each site. In addition, the records will prove useful in distinguishing between natural long-term trends and those from management of the landscape. For example, in Burkina Faso the drier regime which the area has experienced since the early 1970s may or may not persist in the future (an historical perspective suggests that it will not). It will be important, therefore, to be able to distinguish between changes in the sustainability of agricultural practices resulting from climatic changes and those arising from better or worse management of the landscape.



SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
G8-1

Using Geographical Information Systems as a research tool in the SANREM CRSP program

Rationale

Research by the CRSP is focused on three sites in the tropics, each with an area between 10,000 and 50,000 hectares. Much of the data collected by individual projects is of a spatial nature, and some of the analyses of these data will require the use of other spatial data sets. A Geographic Information System (GIS) is a software package designed to organize, analyze and display spatial data; it provides a powerful means of organizing the data sets acquired by SANREM CRSP projects. Individual layers of data are known as coverages. Our project is charged to set up a Geographic Information System for each site which would consist of baseline characterization information and biophysical and socioeconomic data sets from other individual projects where applicable.

Objectives

■ Determine existing biophysical and socioeconomic baseline data sets for each site which would be of general use to other SANREM CRSP projects.

■ Where baseline data were absent, procure satellite imagery and aerial photography with which to create baseline maps.

■ Use the existing maps and create new ones to build a Geographic Information System for each site; continue to add GIS coverages as they become available.

■ Distribute the GIS coverages to other projects requiring them, or work with individual project holders to make full use of the GIS data sets in conjunction with other specific data sets.

■ Build institutional capacity in GIS in the host countries through informal information exchange, informal training, and through formal workshops on GIS.

■ Educate project holders on opportunities and potential use of spatial data sets.

Accomplishments

■ A comprehensive search for baseline information through the government offices of site countries was conducted. The search included historic aerial photography which was found to exist at all three sites. Paper maps at various scales were collected and catalogued. Appropriate maps for each site were digitized and added as layers in the GIS.

■ A database of GIS layers has been created for the Philippines consisting of the following themes: topography (elevation, slope and aspect), hydrology, watershed and subwatershed delineation, land use in 1994 and in 1973, roads, towns, municipal and barangay boundaries, and Mt. Katanglad park boundaries.

■ Geographic locations of field trials have been determined for three other Philippines-based projects using a Global Positioning System (GPS).

■ A workshop was held in Bangkok, Thailand on the application of GIS to sustainable agriculture and natural resource management. More than thirty participants from the Southeast Asia region attended and the workshop concluded with two days of discussion where country decision-makers were shown GIS products developed by participants during the workshop practical sessions.

■ In the Philippines, a study of land use change in the Manupali watershed has been completed, resulting in a master's thesis and an invited conference paper. The study developed GIS maps of the Manupali watershed to describe land use as it was in 1973 and as it is today (1994). (Figure 1) The maps were developed from a Landsat image taken in 1973 and from a SPOT satellite image acquired for the project in 1994. These two digital maps formed the basis of a quantification of the changes in land use over the last twenty-five years. The land use maps were combined with a digital terrain model (DTM) and other coverages to show how conversion of forest to agricultural land has occurred, how these changes are connected with the topography, and where the greatest changes have occurred.

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24

■ A database of GIS layers has been created for the site of Donsin, Burkina Faso. This database was built using maps of geomorphology and land use developed by INERA from a set of aerial photographs taken in 1990. The maps were rectified using numerous ground truth control points collected in the field with a GPS. The original aerial photographs were scanned, rectified and mosaiced to form a 'photo-map' of the site which may be used as a base map of the site. Satellite imagery of the site has also been purchased, processed, and printed.

■ Some data sets characterizing the site in Ecuador have been completed. Six topographic maps of the site were purchased and the twenty meter contour intervals were digitized. This task resulted in a highly detailed digital terrain model of the site. A SPOT satellite image of the site was acquired in 1994 and this is being used to map the land use of the area. Additionally, contemporary and historic photography has been purchased in order to assess land use change in the area.

■ In the Philippines and Ecuador strong ties have been built with partner institutions (IRRI and CDC respectively) which serve as local managers of their sites' GIS database. These ties have resulted in the joint development of GIS coverage.

■ The GIS project serves as a focal point for any GIS type analysis and as a provider of GIS products, from maps to analysis of data sets. We work with individual project holders to fully utilize the common GIS data sets available and to provide further analysis of certain data sets. Using the Philippines GIS database, seven other SANREM CRSP projects have been assisted, from providing information derived from the GIS and giving technical assistance to doing GIS analysis which is used to interpret research results.

Outcomes

■ Through cooperation with other project holders through workshops and dissemination of GIS products to other groups, the usefulness of GIS as a research tool in sustainable agricultural development and natural resource management has become more apparent. A number of project holders have used GIS to assist their research, and local and municipal governments have begun to plan for the use of GIS in their management and planning activities.

■ By providing a service to the CRSP, creation of a compatible set of baseline maps in GIS format has been assured. The compatibility not only allows the seamless overlay of two or more data layers but is also apparent across sites.

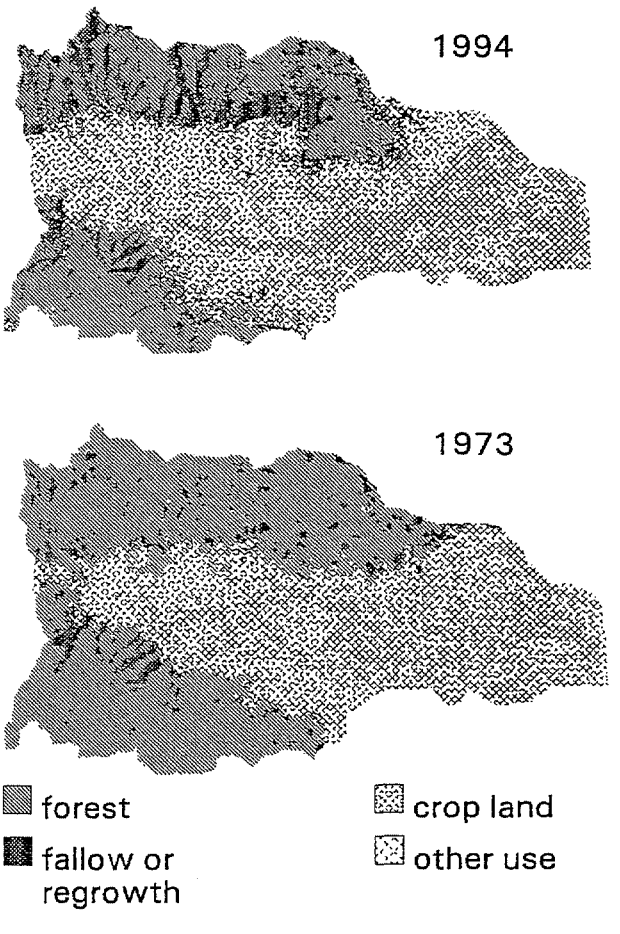
■ Results of the study of land use change in the Philippines show that forest was converted to agricultural land at a rate of approximately 500 ha a year. The figure below shows the extent of forest and agricultural land in 1973 and 1994.

Potential Benefits

■ The potential benefit of using a Geographic Information System to organize spatial information was foreseen at the beginning of the program, particularly as a landscape approach to sustainability has been adopted. This benefit has been partly realized in that multiple projects are able to make use of a coherent set of baseline spatial information. Project holders have also required further specific analysis, or more detailed data sets for particular areas.

■ As projects complete fieldwork, their results will be incorporated, where appropriate, into a GIS so that there is a cumulative building of information pertinent to the site. Using a GIS ensures that information is readily exchangeable and that the spatial aspects of a research question can be quantified. Interpretation of data presented spatially has been shown to facilitate understanding during oral or written demonstrations.

Figure 1



SANREM CRSP
Sustainable Agriculture and Natural Resource Management
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September 1996
Program Highlights
G10-1

The Center for PVO/University Collaboration in Development Western Carolina University

Objectives

- Promote the operationalization of PVO/NGO, farmer, and end-user/community participation in the SANREM CRSP.
- Assist in monitoring and evaluation with a focus on PVOs/NGOs and end-users.
- Publish and disseminate technical and programmatic information generated through the SANREM CRSP.
- Provide support for and participate in SANREM CRSP workshops and training activities.

Accomplishments

■ Operationalization of PVO/NGO, farmer, and end-user/community participation in the SANREM CRSP.

Contributed to the promotion of PVO/NGO and end-user participation in SANREM CRSP through involvement in the Philippines Participatory Landscape Lifescape Appraisal (the initial gathering of on-site information, landscape /lifescape characterization, and problem identification in SANREM CRSP); SANREM CRSP planning workshops in the Philippines and Burkina Faso; SANREM CRSP planning teams for Cape Verde, Honduras, and Costa Rica; and SANREM CRSP Technical Committee and other planning meetings.

Prepared an interim progress report on user/community participation in SANREM CRSP which identified several key issues in bringing together the landscape and lifescape approach and user participation in the SANREM CRSP research process.

■ Publications, Reports, and Information Dissemination. Published and disseminated two English, two French and one Spanish issue of *SANREM Ecolinks*, a newsletter that provides in-depth reports on SANREM and related activities in sustainable agricultural development and natural resources management in 1993, 1994, and 1996.

Published and disseminated the *Proceedings of the SANREM CRSP Conference and Workshop on Indicators of Sustainability, August 1-4, 1994* (edited by Barbara Bellows, Washington State University), August 1995.

Published and disseminated the report on the Philippines PLLA entitled *Participatory Landscape/ Lifescape Appraisal, Volume I, The Manupali Watershed, Province of Bukidnon, The Philippine, SANREM CRSP/Philippines: The Practice and the Process* (edited by Barbara C. Bellows, Washington State University, Gladys Buenavista, HPI-SANREM CRSP/Philippines, and Mahrz Ticsay-Ruscoe, IESAM, UPLB), October 1995.

Prepared an article on intersectoral collaboration in the SANREM CRSP entitled *Collaboration: New Partnerships, New Approaches for Last Update*, the SANREM CRSP ME newsletter, January 1995.

Prepared a position paper entitled *The PLLA in Relation to the Broad Constraints Identified in the Original Proposal for SANREM CRSP Applied to the Philippines Site,* September 1995.

Prepared articles for *SANREM Ecolinks* entitled: *Towards a User-Participatory Process Across the Landscape* and *SANREM Builds Linkages in Burkina Faso.*

Prepared a poster presentation for the SANREM CRSP Conference and Workshop on the Indicators of Sustainability as a "web" of interactive, interconnected processes entitled *Core Indicators of the Web of Sustainability*, August 1994.

Prepared Workshop Book for the SANREM CRSP Workshop on Participatory Collaborative Research Methodologies (including case studies and other materials), June 1995.

Reviewed/assembled documents for and wrote a section, *The Making of the Workshop*, for the summary and synthesis report of proceedings of the SANREM CRSP Workshop on Participatory Collaborative Research Methodologies (edited by Carla Roncoli), Spring 1996.

Developed with Bob Rhoades of the Department of Anthropology, University of Georgia, *The Unsustainability Clock,* April 1996.

■ Training and Workshop Activities. SANREM CRSP Workshop at Virginia Tech University (Mary

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Lou Surgi served as a trainer and participant), November 1993.

Workshops on Gender Tools and Natural Resource Management (March 1994) and Managing Environment with Gender Emphasis (March-April 1995) sponsored by the University of Florida. (Mary Lou Surgi represented SANREM CRSP and discussed SANREM CRSP as a model for farmer and end-user participation in sustainable agriculture and natural resource management.)

SANREM CRSP Conference and Workshop on Indicators of Sustainability in Washington, D.C. (August 1994). Participated in planning for the Conference and Workshop, served as a rapporteur and reviewer of the proceedings, and provided input for the proposed indicators workbook.

SANREM CRSP Workshop on Participatory Collaborative Research Methodologies, Tuskegee University. We provided the major planning and coordination for the workshop, including: (1) identification of case study and other presenters, participants for panels, facilitators and rapporteurs; (2) preparation of pre-workshop material on participatory collaborative research; (3) preparation of the workshop book; (4) workshop logistics; and (5) workshop support.

Ralph Montee served as the workshop co-coordinator with Cornelia Flora of Iowa State University with staff support from Iowa State, Tuskegee University, and the University of Georgia. The Workshop brought together 73 participants from 17 countries and the United States to share experiences and examine critical methodological issues in participatory collaborative research.

Cape Verde SANREM CRSP Training Program in Agricultural Planning, Monitoring and Evaluation with Iowa State University (lead institutions) and the University of Arizona. The two universities and the PVO/University Center conducted a three week training program for ten Cape Verdean Agricultural Research and Development Agency administrators in April-May 1996.

Outcomes

■ Although end-user/community and PVO/NGO participation need more strengthening, they have been firmly established in SANREM CRSP. Such participation has become an intregral part of: the organizational structure at the various sites; representation in such bodies as the SANREM CRSP GTC; and in the research, training, and other activities being implemented at SANREM CRSP sites.

■ Distributed information on SANREM CRSP to a network of over 1,000 individuals in 96 countries and the United States, using a mailing list developed by the Center of individuals and organizations concerned with sustainable agriculture and natural resource management.

■ The SANREM CRSP Workshop on Participatory Collaborative Research Methodologies provided a forum for SANREM CRSP participants to be exposed to, learn from, and share their experiences with practitioners of participatory collaborative research from fields other than sustainable agriculture and natural resource management. The workshop provided information on the roots and principles of participatory collaborative research, reviewed techniques for conducting such research, examined different methodologies, and identified problems that need further investigation.

■ Participation in the Indicators Working Group has helped contribute to a conceptual scheme that is interactive, iterative, dynamic and holistic. Process models rather than hierarchical ones have gained widespread acceptability in SANREM CRSP.

■ Center staff assisted Cape Verdean participants in developing action plans based on training learnings and their own agency/institutional situation. In addition, the Center developed some recommendations with the participants and trainers/mentors for integrating training learnings with follow-up support to the Cape Verdean participants and their institutions/organizations.

Potential Benefits

■ Strengthened participation of end-users, communities, and PVOs/NGOs with scientists/researchers in the research process. Such collaboration is accompanied by the recognition that we are all learners in this endeavor.

■ Increased understanding of the advantages, obstacles, and problems involved in participation and collaborative research. Generated insights and technologies that can improve the performance of SANREM CRSP and others.

■ Increased awareness and generation of greater interest in the SANREM CRSP approach through disseminating information to a wide and varied audience.

■ An inclusive dynamic concept of indicators of sustainability capable of future refinement through experience, that can be an important tool in assessing technologies, in evaluating natural resource management strategies and practices, and in informing policy analysis and decision-making.

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September 1996
Program Highlights
P1-1

The Priming Program of SANREM CRSP/Philippines

Rationale

The Priming Program of SANREM CRSP was meant to use effectively the time between the finalization of the SANREM CRSP Philippines Framework Plan and the initiation of program implementation. It was aimed at setting the stage for the onset of major SANREM CRSP activities in Lantapan, Bukidnon.

Objectives

■ Form a social anchor in the community for the introduction of major SANREM CRSP research projects.

■ Strengthen the existing formal and indigenous community organizations by enhancing awareness and skills of its members with regard to program and organizational planning.

■ Enable the community participants to articulate their socioagricultural situation and to effectively participate in natural resource conservation and management.

■ Provide formal and informal training related to sustainable agriculture and natural resource management.

Accomplishments

■ Identification of five sites that fully reflected the diversity of the ecosystem's landscape/lifescape. The five sites represented the following agro ecological zones: rice land, maize land, lower grassland, higher grassland, and forest margin. The identification was facilitated in close coordination with the Community Advisory Committee of SANREM CRSP and the local officials.

■ The priming program staff familiarized themselves with the bio-physical and sociocultural make-up of the community by immersing themselves in the community through informal interviews with the local people and frequent area visits. The immersion proved to be invaluable in gaining the trust of and establishing rapport with the local people.

■ Selection of program participants was facilitated through the aid of a sociogram. Interest and commitment to participate in the priming program activities were the common criteria in selecting participants. The exercise resulted in the formation of one hugpong (workgroup) in every agro ecological zone with five farm household partners in each hugpong.

■ Community consultations were facilitated which provided the community and the SANREM CRSP partners with the opportunity to exchange ideas regarding the SANREM CRSP. Additionally, it served as a forum to explain the objectives and activities to the community participants and to understand the community members expectations and ideas.

■ A three-day training entitled "SANREM Value Formation and Technical Training." A week long cross-site visit to Davao del Sur and Cotabato exposed participants to various sustainable technologies in agriculture and natural resource management.

■ Community research was implemented utilizing a participatory approach to agricultural analysis by facilitating a series of workshops that allowed the farmer-participants to identify constraints in their respective farming systems. The result of the whole process was the implementation of their on-farm development options.

Outcomes

■ **Five farmer workgroups (35 individuals from 25 farm families) with enhanced awareness and skills on sustainable agriculture.** The trainings and exposure trips were one of the major initiating instruments in facilitating the education of the community

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about sustainable agriculture and natural resource management.

■ **High level of enthusiasm for the participants to apply the learnings from the priming program activities.** Introduction to alternative farming practices gave participants concrete examples which could make their farms produce a sustainable output of benefits for improved income.

■ **Enhanced community awareness of the objectives of the SANREM CRSP.** Meetings and workshops allowed the priming partners to explain the purpose of the SANREM CRSP and allay misconceptions which may have arisen regarding the program.

■ **Drafting of the Farm Development Options by the priming program participants.** The development options outlined short- and long-term plans of the priming program participants for improving their farm productivity and income.

■ **Presentation of a Poster.** "Priming Program of SANREM CRSP in the Philippines: A Participatory and Systems Approach Towards the Design and Implementation of Sustainable Farm Development Options" during the 3rd Asian Farming Systems Association Symposium held at the Midtown Hotel, Manila on November 7-10, 1996.

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September 1996
Program Highlights
P2-1

Enhancing Biodiversity Conservation and Family Security through Homegardening and Sustainable Field Production of Vegetables: Community-based Pest management for Sustainable Vegetable Production.

Rationale

In higher elevations of the watershed of the Manupali landscape in the Philippines, potatoes and other vegetables are currently a major source of income for poor farming households. Evidence generated in the Participatory Landscape/Lifescape Appraisal of the elevated zones of the watershed indicated several processes which threaten the sustainability of the whole landscape: erosion of soil due to up-down plowing; pollution of water supplies in the lower areas from pesticides used to control fungal diseases and insect pests attacking potatoes and other vegetables; and loss of forest cover and forest biodiversity as vegetable farmers seek land free of bacterial wilt (caused by *Pseudomonas solanacearum*). This disease, which affects solanaceous plants (such as potatoes and tomatoes), is soil and/or seed borne and cannot be treated. It can be avoided only by planting in uncontaminated land, taking sanitary measures, using uncontaminated seed, and in some measure by incorporating host plan resistance into new germplasm.

Objectives

Generate a sustainable income from potato production while overcoming its negative effects of incorrect utilization of pesticides and reduction of biodiversity. Specific objectives are to:

- Analyze socioeconomic and agronomic factors determining cropping systems patterns across the vegetable growing zone.
- Provide a systematic account of vegetable seed supply, especially for potatoes.
- Determine the most effective integrated pest management strategies for vegetables through evaluation of alternatives based on individual, communal, or group decision-making and/or consultation.
- Identify the comparative advantages of True Potato Seed (TPS) and rapid multiplication approaches for dissemination of clean potato seed.
- Determine the institutional strengths and weaknesses of alternative methods and strategies for promoting integrated, communal management of crop pests, including improved seed management.
- Intensify exposure of research staff to participatory approaches to pest management and the concept of "joint learning" in IPM implementation.

Accomplishments

- Farmer Research Workshop on TPS.
- Census on insect pests and diseases in vegetable cultivation, with particular emphasis on potatoes.
- Validation of findings of the census on insect pests and diseases of vegetables. Information drive on IPM methods and principles of TPS technology.
- Planning of TPS trials: twelve groups and three individual farmers were identified as TPS evaluators. The total number of farmers being exposed to the TPS technology was sixty-three.
- Soil sampling for presence of *Pseudomonas solanacearum* (Bacterial Wilt).
- Experiments with true seed and with seedling tubers produced with the true seed. Five progenies of TPS were given: HPS 1/67, HPS 7/67, HPS II/67, Serrana x LT7, and 989009.

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■ Review workshop and distributed some new TPS materials, September 1995.

■ Soils sampling for identification of biovars and races of *Pseudomonas solanacearum.*

■ Distribution of certified seed tubers (G-zero) for on-farm trials. Three cultivars were tested: a CIP clone released as a variety in the Philippines, BSU-PO3; and two imported varieties, Granola and Berolina.

■ Integrated Pest Management Evaluation Workshop.

■ Presentation of results in the "Kapehan sa Lantapan."

Outcomes

■ Seed Supply Systems

Farmers mostly obtain potato seed materials from neighors or relatives. Seed is either for free (in case of neighbors) or for the prevailing market price of ware potatoes. Most of these seed materials are Black Wilt (BW) infested. Although the farmers recognize this, some of them continue to use them as planting materials, while many others simply abandon potato cultivation.

Notwithstanding the draw-backs of TPS (laborious, fragile) farmers are seriously interested in growing TPS potatoes. The cross visit to Sumilao further confirmed their desire to continue potato production. Likewise, farmers are also interested in continuing production with the BSU-PO3 variety. At this time, this variety has a limited availability.

■ Integrated Pest Management Strategies

The folk taxonomies of insects, documented with key informants, categorize insects on the basis of behavior, especially "damaging" versus "non-damaging" behavior; the form of the insect (adult, immature) that causes damage; and the time when it is active. Folk taxonomies contrast with "scientific" taxonomies, which depend much more on gross and subtle differences of morphology. However, folk taxonomies are weak at classifying beneficial insects; only a few classes of spiders and ants were recognized as predators.

Due to the presence of persisting types of BW, land quarantine measures as a means of controlling bacterial wilt is ineffective. The bacteriological assay on BW in Lantapan indicated the presence of a cool-climate-adapted "potato-strain" of Pseudomonas solanacearum (biovar three and four, race one). This strain has broad ranges of host plants that encompass several solanaceous crops, including many weeds and native hosts. It persists in the soil for longer periods and can survive under different environmental conditions.

However, farmers are encouraged to grow potatoes by the relatively high market prices and the stable demand for potatoes compared to other vegetables. For this reason, the original communal IPM approach of not planting potato for three years (quarantine) failed and has been replaced with a more informal type of transfer of knowledge called the Farmer Field School approach.

Releasing Diadegma, a biological control agent of Diamondback moth (DBM), in a communal IPM pilot site in Victory was established as part of the project; it effectively lowered the population of DBM and its damage on cauliflower and broccoli.

■ Comparison of Potato Planting Materials

Of the TPS progenies, HPS II/67 and HPS 7/67 were the best performers in terms of vegetative characteristics, disease resistance, yield, and tuber quality. These progenies are competitive to the farmers' varieties in terms of yield and marketability. Moreover, farmers recognize the importance of using the disease free TPS materials. However, major technical constraints remain due to high labor requirements at the nursery stage, presence of BW, and production and storage of seed tubers.

Of the certified seed tubers, BSU-PO3 outyielded Granola and Berolina. BSU-PO3 showed strong vegetative growth, less late blight incidence, and slightly less bacterial wilt incidence. Yields varied from five to twenty tons per hectare for the seed tuber varieties. The reduction of BW confirmed the hypothesis that a healthy crop under good management is able to perform under BW conditions.

Economic analysis showed a monthly internal rate of return of 90 percent, equal for TPS and seed tuber potato cultivation. Eventually, results will depend on how these seed technologies will perform under the conditions of heavy disease incidence.

Results of the experiments and ex-ante economic analysis renewed farmers' interest in potato cultivation. The true seed technology is the first source of planting materials, both relatively inexpensive and easily available. The seed tuber variety BSU-PO3 is also promising, yet it is difficult to obtain sufficient quantities of seed materials for a sustainable potato production scheme. Additionally, the build-up of diseases in vegetative multiplication remains a serious constraint in mid-elevation areas.

SANREM CRSP
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September 1996
Program Highlights
P4-1

Integration of Gender Activities in Work Plans

Rationale

Households are economic and social units which control, allocate, and exploit resources. Patterns of resource control and use are the results of numerous factors, including cultural norms (i.e., ethnicity), socioeconomic status, age, gender, family tradition, and individual relations (e.g., relations between a specific, cohabitating woman and man). Any or all of these factors may be significant in explaining resource allocation and may be influenced by change (i.e., new technology and development). The application of sociological variables, including gender, can reveal current patterns of resource allocation and help to monitor how such patterns change with changes in resource management and resource endowments. Because social relations, and especially gender relations within households, play key roles in resource management, research must examine them when investigating long-term, sustainable solutions to resource degradation. Our purpose is to increase the potential of applied research for improving the income, employment, and health of rural families on a long-term, sustainable basis.

Objectives

- Reveal current patterns of resource allocation and management by region, ethnicity, class, age, and gender.
- Reveal the contributions of different household members to participatory natural resource management research activities.
- Develop activities to be integrated into research programs for promoting equity in participation, especially for women.
- Reveal potential problems in research programs which might result in inequities in income and employment in households/communities.
- Develop research methods and activities to be integrated into research programs for revealing equity issues.
- Develop research methods and activities to be integrated into research programs for responding to equity issues.
- Monitor impact of research programs on individual and household income, employment, and health.
- Develop training activities for improving the sociological and gender focus of participatory research.

Accomplishments

- Two work plans (Nazarea, et. al., and Prain and Ramos) have fully integrated women farmers into research, utilizing women's knowledge of agriculture and the environment as sources of potentially sustainable NRM interventions. Women are being trained and are serving as trainers.
- Women are playing a fundamental development role in another research activity (Deutsch et. al.) monitoring community water sources for bacteria.
- In two additional work plans, gender-disaggregated data on commercial agricultural production (Midmore and Ramos) and the sustainability of production (Singh and Josue) are helping to reveal gender variation in livelihood systems. The impact of changes in NRM practices thus can be measured on men and women separately.

Future Directions

- Ascertain existing (i.e., baseline) relationships between livelihoods (e.g., natural resource utilization, employment, and income) and natural resource management practices, according to key sociological variables (e.g., gender, class, ethnicity, age, or other pertinent variables as revealed by participatory analysis).
- Reveal potential impacts of change in NRM on livelihood variables according to key sociological variables.
- Inform researchers of the significance of gender and other key sociological variables in specific research programs.
- Develop gender and sociology research interventions for research programs.

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Program Highlights
P5-1

User-First Research For Sustainable Development and Natural Resource Management

Rationale

This project aims at testing community-based approaches to the development of sustainable farming systems for the Lantapan community. Actively involving the end-users in every stage of the development process is a factor that affects the extent of its success and sustainability. It is important to recognize the legitimacy of the farmers' preferences and priorities and their ability to effectively utilize available resources to ensure sustainability of land use. This approach will result in the generation and dissemination of technologies that are appropriate and acceptable to farmers.

Objectives

- To understand the conditions and constraints faced by farm households and define a range of options to address them.
- To promote team building among the farm households parnters and familiarize them of the approach and objectives of the research project.
- To establish linkages and coordination among the farm household partners, local government representatives, and other SANREM CRSP research projects.
- To increase awareness among farm household partners and the local officials of the socioeconomic and environmental conditions and constraints of the watershed.
- To undertake a farmer-managed research on appropriate interventions chosen by the farm household partners to improve productivity and promote sustainable land use systems.
- To facilitate participatory monitoring and evaluation within the project, including reflection and dissemination of lessons learned.

Accomplishments

- As a result of consultations with the community and local leaders, the project facilitated the identification of 123 farm household partners (FHP) from different barangays of Lantapan. Pundoks (work-groups) were formed in every barangay. Orientation activities informed farm household partners and the community (including the local officials) of the objectives and activities of this project and of the SANREM CRSP in general.
- Training workshops were conducted to enhance the FHPs' understanding of sustainable agriculture and natural resource management issues and practices. Topics included: integrated pest management, sustainable agriculture, and post-harvest handling operations. Visits to agricultural demonstration farms were also carried out, such as a one-week cross-site visit to the Mindanao Rural Life Center (MBRLC) enabled the partners to learn about agroforestry, crop-livestock integration, lowland integrated farming technology, contoured (hilly) farming, organic farming, seed production, and a variety of sustainable farming practices.
- After a series of training workshops where farmers learned how to diagnose problems and identify feasible solutions, sets of on-farm experiments were conduced to test farmer-devised solutions for weeds/kuhol infestation, soil infertility, soil erosion, and white potato pests. Tested practices included contoured farming, crop diversification/rotation, establishment of leguminous hedgerows, and appropriate weed and pest/disease management.
- A Research and Development Committee (RDC) was established in every Barangay Development Council across Lantapan. During a seminar on the Role of the Local Government Unit in Research and Development, attended by all barangay officials, it was agreed to include the new

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committee to the existing local government structure (barangay level). Ways to strengthen the effectiveness of this committee are being addressed by the Local Government Unit of Lantapan and the HPI/Philippines.

■ Recognizing the advantages of belonging to a formal organization, the FHP created the Association of the Lantapan Sustainable Agro-Ecological Zones, whose mandate is to continue to promote the "User-First Model" after project is phased out. Training seminars were carried out to strengthen the association' capacity, and to draft a program to improve production and income among farm households. A Pundok Development Fund was also established to support the promotion of the "User-First Model" in sustainable land use.

■ A livestock profiling activity was carried out to obtain baseline information to use in community development planning and to develop questions for future research activities.

■ A participatory monitoring and evaluation was carried out, including farm visits and individual consultations.

Outcomes

■ **A community organization for sharing information on sustainable agriculture and natural resource management is established.** Participants in research and trainings have actively shared learnings and experiences with other people in the community.

■ **A partnership with local institutions for sustainable natural resource management was formed,** including the local government of Lantapan, Bukidnon, which played an active role in the constitution of the Research and Development Committees (RDC) in each Barangay Development Council in the area.

■ **The establishment of a potato seed production station/ screenhouse** in Lantapan, also resulted from this collaboration, an endeavor that responds to both the felt need among local potato planters for the availability of a clean potato planting materials as well as to the current concerns of the Philippines' Department of Agriculture.

■ **Data from three seasons cropping experimentations shows promising results** especially in terms of yield and soil parameters. Analysis shows that the experimental cropping patterns have high net benefits and marginal cost-benefit ratios compared to traditional farming practices.

■ **The experimental plots also serve as demonstration sites where other members of the community can learn about the technologies being tested.** In some cases this has resulted in spontaneous adoption of them by farm households who are not among the FHPs.

■ **The Pundok Development Plan** will enable farm household partners to extend the "User-First Model" to other projects operating in the area on problems of sustainable agriculture and natural resource mangement.

Potential Benefits

The participation of "end-users" in every step of the process, from problem diagnosis to testing of potential solutions in field experiments, will enhance the end-users' ability to conduct systematic research and mobilize and manage natural resources in sustainable fashion.

The Research and Development Committee will draw from the research and/or lessons learned through the participatory process to formulate appropriate policies and agricultural support systems in the areas under their jurisdiction.

Appropriate technologies that are being tested in the on-farm experimentation are showing promising results in enhancing soil fertility and improving farm productivity/income will be replicated in other areas and countries that share the same concerns for soil conservation.

Figure 1

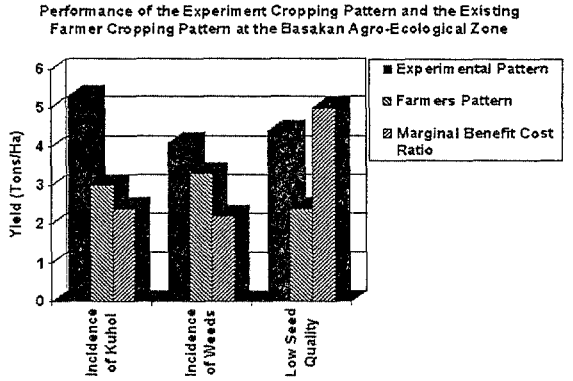
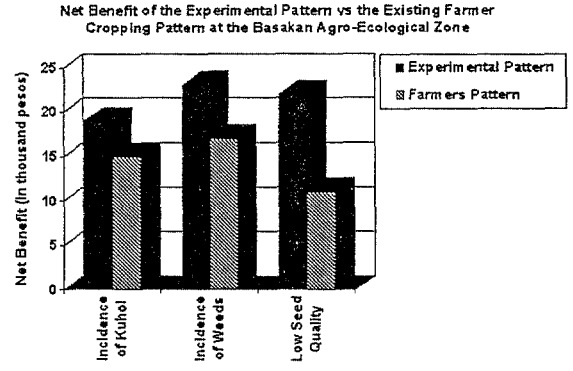


Figure 2



SANREM CRSP
Sustainable Agriculture and Natural Resource Management
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June 1996
Program Highlights
P6-1

The Economics of Sustainability: Production, Prices, and Policies in the Manupali Watershed, Bukidnon, Philippines

Rationale

Production, technology and investment decisions by farmers are the immediate causes of most agricultural land degradation in the uplands of developing countries. An appreciation of how farmers' decisions are reached requires a clear understanding not only of local institutional and geographic constraints, but also of how markets operate to create a setting conducive to, or discouraging of, soil conservation. Our project aims to contribute to such an understanding, and to suggest policy and program changes leading to more sustainable use of land resources in watersheds like the Manupali.

Objectives

■ Identify and monitor land use, technology, and resource management strategies employed by farmers in Lantapan.

■ Assess how institutions, culture, prices and markets influence farmers' decisions regarding crop choice, technology and resource management.

■ Analyze market structure and sources of price formation (within the watershed, the province or the national/international economy) for major crops, inputs, labor and credit.

■ Identify key government policies affecting farmers' incentives to adopt, or retard adoption, of environmentally sustainable technologies, and the likely economic and environmental implications of changes in these policies.

Accomplishments

■ Post-production surveys monitoring crop choice, technology, and resource management by a sample of 190 farmers in 9 barangays throughout the watershed. We are building a panel of farm-level and plot-level data for econometric analysis of technology, input use and profitability. Two annual rounds of the survey have been completed and a third is under way. These surveys enable us (a) to monitor plot-level crop changes and to relate them to economic conditions and the characteristics of households, soils and other relevant variables; and (b) to quantify the economic implications of alternative cropping patterns and technologies as used by farmers in the watershed. This information is vital if we are to understand the present agricultural system and how it might respond to future environmental or economic change.

■ Weekly monitoring of key commodity prices at the farm gate (interviews with 10 traders in the watershed), and in provincial and regional markets (data collected in wholesale markets by BAS cooperators). Price series, collected since late 1994, are now being analyzed econometrically to identify whether prices of major crops (corn, coffee, cabbage, potato) are influenced by events within the watershed, within provincial/regional markets, or in national markets primarily based in Manila. It is widely believed by farmers and by many researchers that local supply shocks (such as a big harvest of some crop) will have large price effects. Preliminary results suggest this not to be the case for easily stored and widely traded crops like corn, but that local conditions may indeed affect short-run prices of highly perishable crops like cabbage.

■ Construction of a model explaining farmers crop choice and resource management decisions in terms of economic factors, cultural, geographic and institutional constraints, income levels, and risk preferences. This model uses data from both farm and price surveys and helps connect price changes to predicted land use and technology changes, thus relating economic phenomena to key factors affecting environmental sustainability. The model helps us predict how land use could change, for example, if relative crop prices change; since we know some crops are less environmentally damaging than others, we are

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able to infer some environmental outcomes resulting from price policy reforms.

■ Construction of models relating local prices to national and international market developments, including the influences of national government price and trade policies. In an era of rapid economic liberalization in the Philippines, the local market effects of policy changes such as the ending of import bans on potato and cabbage, or abolition of the state monopoly in corn trade, could be far-reaching if farmers do respond to relative price changes.

Outcomes

■ **Economic influences on resource allocation**. Both narrative and quantitative evidence from our farm surveys confirm the importance of relative prices and other economic factors in farmers decisions. This is an important finding since it implies that in addition to direct, extension-related interventions directed at changing farmers behaviour, there exists scope for indirect interventions, for example through price policy reform. This type of economic connection has often been postulated for farmers on fragile lands in developing countries, but seldom empirically explored.

■ **Environmental impacts of economic policies**. The Philippines has long pursued policies that discriminate against exports and perennial crops in favor of annual (food) crops for the domestic market. Some of this discrimination has been a deliberate facet of development policy: in corn, for example, farm price supports were adopted with the goal of national self-sufficiency. Other policies, like the long-standing ban on potato and cabbage imports, appear to be more purely political in origin; others still (like exchange rate overvaluation that reduces the profitability of export crops) are the side-effects of policies directed at other sectors. In the upper Manupali watershed, price trends influenced by these policies - along with migration due primarily to low growth of employment opportunities in lowlands - has spurred land conversion from perennial crops (forest, pasture, coffee) to soil-eroding, input-intensive commercial corn and vegetable crops. The benefits, if any, of national self-sufficiency in corn and vegetables must be weighed against its costs, both in the form of higher consumer prices and in accelerated land degradation and possible water pollution.

■ **Policy reforms and economic sustainability**. The Philippine government is debating major changes in agricultural trade policy that will undoubtedly lead to price changes for Lantapan farmers. To comply with the GATT, quantitative restrictions on corn imports are to be abolished and replaced by a tariff. Similarly, the present ban on imports of fresh potato and cabbage is likely to be converted to tariffs. In the short run, these reforms could raise the farm gate price of corn and possibly that of vegetables. However, both sets of tariff rates are predicted to be reduced in subsequent years as the scope and jurisdiction of the ASEAN Free Trade Area (AFTA) is expanded.

Temperate climate vegetable crops are of great economic significance to Lantapan farmers. If cheaper imports reduce domestic prices, it is not clear that vegetable production in Lantapan will continue to be commercially viable. Future profitability will depend as much or more on import regulations as on improvements in efficiency and technology at the farm level.

Potential Impacts

Our predictive model of farmers' land use responses to price changes is a new and very powerful analytical tool for economic and environmental policy analysis. It recognizes that not all farmers will respond in the same way to an economic shock; rather, their responses will depend on household wealth, education, land tenure, and other characteristics, especially those relating to a households willingness to bear risk. The model thus helps answer such questions as "what will happen to land use and net farm incomes if the vegetable import ban is relaxed and potato and cabbage prices fall?" To illustrate, Figures 1 and 2 show predicted land use responses by risk-seeking and risk-adverse farmers. Risk-seekers grow mainly commercial crops, but even they cease growing the most risky crop, cabbage, as vegetable prices fall. The most cautious group concentrates on corn, which provides lower but more stable revenues. As vegetable prices and farm incomes fall, this group concentrates on white corn in order to be assured of food for the household.

Most agricultural land in the watershed is planted to corn, and since erosion rates under corn are relatively high, future environmental sustainability in the watershed will depend critically on reducing erosion on land currently planted to corn without reducing net farm incomes. This could be achieved by promoting investments in soil-conserving structures such as contour strips, and the potential for these may be high in some parts of the watershed. Alternatively, erosion could be reduced if corn land were to be converted to production of less erosive crops. In the middle watershed areas, public investment in improved coffee varietal selection, cultivation techniques and bean processing may be merited. Progress on these fronts could benefit not only coffee farmers but also the wider community through reduced land and water degradation.

Figure 1. Land use choices by farmers with low risk aversion

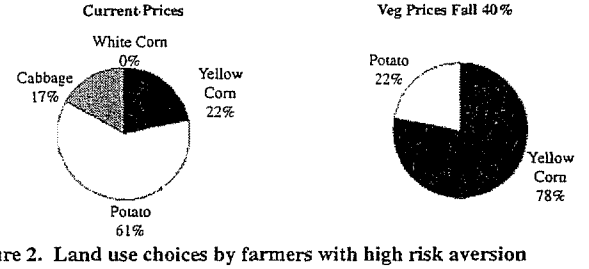
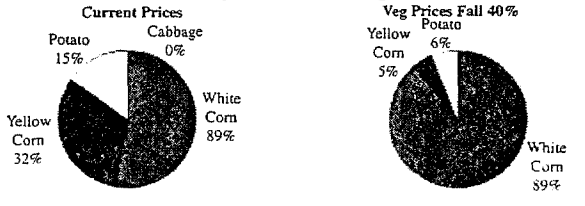


Figure 2. Land use choices by farmers with high risk aversion



SANREM CRSP
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Program Highlights
P7-1

Sustaining Commercial Vegetable Production in the Manupali Watershed, the Philippines

Objectives

■ Through formal and informal survey with farmers, identify present and past cropping systems involving vegetables and current agronomic practices.

■ Postulate relationships between cropping systems, agronomic practices, slope, geology, landform, elevation, soil properties and water loss.

■ Develop measures, in consultation with farmers, for improved productivity and enhanced soil and water conservation.

■ Monitor the influence of alternative vegetable production including those for erosion control and promotion of tree vegetable associations on net income, decline/improvement of soil physical/chemical properties and community adoption of the concepts involved on researcher-managed and farmer-managed plots.

■ Understand the nutrient balance and cycling on sloping fields and within intercrops (strip, hedgerow, agroforestry) involving vegetables.

■ Identify the requirements for successful farmer adoption of those sustainable vegetable production systems.

■ Provide reliable data for the purposes of modeling soil and water movement in the watershed, as a predictive/research tool in combination with socioeconomic functions, for sites elsewhere.

Accomplishments

■ A complete formal survey of the farming community in the mid to higher reaches of the watershed allowed characterisation of farming typologies, which revolved largely around the level of purchased inorganic fertilizer. The informal survey gave insights into the amount of 'abandoned' (i.e. long-fallow) lands and their management, and highlighted (a) the low number of farmers with abandoned lands, and (b) the positive correlation with farm size and propensity to abandon lands.

■ Farmer-managed erosion plots have been established across the vegetable ecozone to test hypotheses that income generating strip and hedgerow species grown for erosion control and commodity diversification would be readily adopted by farmers.

■ Researcher-managed plots have been established on 1 hectare, installed in a highly visible site to compare effectiveness of agronomic practices in reducing erosion and enhancing income. Soil loss in first season reduced by 50-75% by strip and contour planting (from 54 t/ha to 13 t/ha), but hedgerow species without effect. Significant water runoff in all plots (> 1.0 Ml/ha), and modest NO_3 loss (2-6 kg/ha).

■ Economic analyses on researcher-managed plots illustrate how easily losses in income come about. Labor costs comprise a large proportion of total costs, and price fluctuations for tomato and cabbage increase risk of financial loss. Bean production is less risky, and positive returns ($2500/ha) were achieved in the first season.

■ Monthly farmer meetings take place, rotating amongst the research site, the Department of Agriculture offices, and farmers' fields. These allow information exchange and feed-back amongst participants, pinpointing of problems and potential solutions, and increasing awareness of common farming difficulties. Farmers and other cooperators bring their own agenda for discussion.

■ Data set, including rainfall (pluviometer on site), for calibration of the EPIC erosion model continually being increased.

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Outcomes

The research site is being used to inform farmers, teachers and politicians of the potential to reduce soil erosion through management practices and the impacts of these practices on improved water infiltration, less soil loss, and cleaner and more reliable sources of water. Farmer-cooperators demonstrate, during monthly meetings, how they interpret their and researcher results, and modify their own practice. Visual assessment on-farm and at the research site of eroded soil volumes impress farmer cooperators, and other visitors to the site, of the immensity of the soil eroded, and the efficiency of control practices. Farmer cooperators have requested installation of further plots for the testing/quantification of benefits of other erosion control practices (each farmer currently tests one practice, but has seen a number installed at the research site).

Visits to the site by regional/national/international policy makers, and industry representatives (such as BRCI) are creating demand for similar activities elsewhere. Already BRCI is evaluating and implementing some of these practices. Bukidnon Resources Company Incorporated, a subsidiary of Del Monte is responsible for production of paste from 6-10,000 hectares of tomatoes. They now are testing strips and hedgerows, quantifying reduction of eroded soil, on farmers' fields before recommending to all farmers on sloping lands.

The participatory model that we are using, namely the combination of scientist-managed and farmer-managed plots, is being extended to other research and development projects in the region, such as the ACIAR-funded reforestation project in Bukidnon, Mindanao.

Potential Benefits

The potential impact of adoption by BRCI of soil conservation practices such as those being researched by this project, represents a significant saving of eroded soil on 6,000 to 10,000 ha, with the benefits of more water infiltration and improved water quality.

Inter-linking of projects within SANREM CRSP in terms of coordinated (spatially and temporally related) data collection on runoff from fields, from micro-watersheds, and on suspended solids in stream and river water will result in a more complete understanding of the influence of land management on sustainability.

When the EPIC model is calibrated, we will be able to use the model to evaluate the impact of changes in management practices on soil erosion on a larger scale (a watershed). We can also interface with socioeconomic models that permit "what if" scenarios to be evaluated for use by policy makers. For example, it will be possbile to model how changes in market price induce shifts in farmers' crop choices and how they lead to changes in land use with concomitant propensity for more or less soil erosion. This innovative modeling approach will have applications in both developed and developing countries.

Table 1 Soil (kg/ha) water (Ml/ha) and nitrate losses (kg/ha) from erosion plots in rainy season 1995, Victory (no statistical analyses).

Soil

Crop \ Treatment	Up/down	Contour	Strip	Perennial
Cabbage	54015	14614	13499	76925
Potato	20106	36805	12805	28818
Tomato	26857	13108	23749	76925

Water

Crop \ Treatment	Up/down	Contour	Strip	Perennial
Cabbage	1674	0803	0990	1019
Potato	0961	0802	1205	0556
Tomato	0538	0755	0707	0781

Nitrate

Crop \ Treatment	Up/down	Contour	Strip	Perennial
Cabbage	4805	6408	3736	1541
Potato	4401	4401	0865	1177
Tomato	1269	1269	0724	1715

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Program Highlights
P8-1

Farming Systems Interactions in the Landscape/Lifescape of the Manupali Watershed in Lantapan, Bukidnon, Philippines

Rationale

Marginal corn farmers in the watershed are usually considered resource poor and impoverished. In spite of this image, these small farmers manage to subsist on food that they produce and from incomes generated from several sources. Throughout the years that they have been cultivating corn, they have evolved their own organized system of farming systems activities. The manner in which many corn farmers organize their farming systems in the watershed is analogous to how farm households organize and allocate farm resources both on and off the farm for various activities on the farm and outside the farm. They allocate resources for the satisfaction of their own goals and aspirations, whether it is for profit or for subsistence, in a given biophysical and socioeconomic environment at the agroecosystem and landscape levels.

This project focused on identifying major problems of farming systems of marginal farmers in the Manupali watershed, particularly in the corn agroecosystem or "kamaisan." The project is designed to develop, in collaboration with the farmers, sustainable cropping system options which they can adopt. This project used the participatory, interdisciplinary approach that involves the participation of farmers and interdisciplinary experts and the on-farm experimentation of alternative farming systems.

Objectives

■ Identify the existing farming systems (EFS) in the "kamaisan" agro-ecological zone of the Manupali watershed.

■ Describe farm household characteristics, farm resources, corn production practices (including material inputs for corn production), labor utilization, and marketing practices. Assist in training and information needs of corn farmers. Identify farm household objectives, problems and constraints in corn production.

■ Identify problematic interactions in the corn-based farming systems.

■ Develop, together with farmers, solutions to identified problems in the form of sustainable alternative cropping systems to sustain corn productivity in the "kamaisan." More specifically, work with farmers to identify alternative sustainable corn-based cropping systems to overcome problems in the "kamaisan" and to conduct the on-farm testing of such alternatives. Assess the economic feasibility and ecological soundness of alternative cropping systems.

■ Promote and disseminate the most promising sustainable alternative corn-based, multi-location, on-farm demonstration trials from larger experimental plots. Conduct training of farmers, agricultural technicians, and key leaders in the "kamaisan" to facilitate the adoption of alternative cropping systems.

■ Develop support communication for the alternative cropping systems through traditional and indigenous media approaches involving farmers and other household members. Recommend policy options to the local government to promote and accelerate the adoption of alternative cropping systems.

Accomplishments

■ Completed the Participatory Agricultural and Rural Systems Appraisal (PARSA) and formal survey for the Barangays of Alanib, Baclayon, Poblacion, Bantuanon, Bugca-on, and Kulasihan. The existing agricultural and rural systems in the site were described; basic characteristics and major interactions in the farming system were identified. Problems, opportunities, potentials, and constraints for the improvement of existing farming systems were analyzed. The results of the PARSA and formal survey were further validated by presenting it during the regular barangay assembly in places where the study was conducted. Prioritization of problems and alternative solutions which will sustain productivity were discussed with farmers during these meetings.

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■ On-farm evaluation/introduction of twelve open-pollinated varieties of white corn in cooperation with farmers in four locations during the second cropping of the 1995 season (September-February). Evaluation of twelve white corn varieties to various environments in the "kamaisan" were done in the Barangays of Kulasihan (310 masl), Poblacion (650 masl), Alanib (820 masl), and Cawayan (1250 masl).

■ On-farm screening/selection from eighty corn entries for adaptation to high elevation (1250 masl) environments of the "kamaisan" watershed for such agronomic characteristics as early maturing, resistance to diseases and pests, tolerance to acid soil, and low soil fertility conditions.

■ Conducted three training sessions on Corn Seed Production and Maintenance for eighty-one corn farmers and agricultural technicians from the Barangays of Bugca-on, Kulasihan, Bantuanon, Poblacion, Baclayon, and Alanib.

■ Conducted detection survey and identification of toxin producing fungi corn grains produced in the "kamaisan" in all barangays.

■ Conducted survey of farmers' practices on organic matter amelioration on their respective farms in Barangay Alanib. Conducted routine soil analysis of sixty farmers' fields, including formulation of fertilizer recommendations and liming practices.

■ Implemented two on-farm experiments on the Development of Strategies for Organic Matter Maintenance in the "Kamaisan" Agroecological Zone during the first cropping of the 1996 season (April-September).

■ Conducted a consultation meeting with various cooperatives, including chairpersons, board members, and key leaders, to assess and strengthen their respective organizations.

■ Conducted on-farm varietal evaluation/introduction of seven promising varieties of open-pollinated varieties of corn in two locations (Upper Poblacion and Kibangay) for the first cropping of the 1996 season (April-September). The varieties are being tested for adaptation to acidic soil conditions, resistance to pests and diseases, and yield. At the same time, seeds of varieties selected by farmers outside of the on-farm trials are being distributed for planting in their respective farms. To date, approximately 42.5 kg of foundation seeds of OPV corn have been given to farmers who were trained in seed production and maintenance for multiplication.

Outcomes

■ The Participatory Agricultural and Rural Systems Appraisal (PARSA) and formal survey that was conducted with farmer key leaders, researchers, and local administrators resulted in a better understanding by the corn farmers of the complexities of the existing farming systems. The research activity provided a good description of the existing farming systems, including the major interactions in the corn-based farming systems in the site.

■ The consultation dialogues with corn farmers, financiers, administrators, technicians, and other stakeholders in the corn-based farming systems, resulted in the identification of organizational problems, such as capital build-up, leadership, financial management, project development and management, and how these can be addressed by the group. The project, together with the stakeholders, also identified the areas where training could be done. During these consultations, the farmers identified the problems and proposed and prioritized their training needs.

■ The on-farm varietal evaluation of white corn varieties have demonstrated to the farmers that their local corn varieties (OPV) can be outyielded by new and improved varieties that are adapted to various environments in the watershed. Experimental results from several trials on-farm have shown corn farmers that there are better corn varieties that could be grown in the "kamaisan," specifically those that are early maturing, resistant to pests and diseases, and adapted to acidic soil conditions in the "kamaisan" agroecological zone. Moreover, the on-farm research and farmers' training in corn seed production and maintenance have generated interest from the local schools which are interested in conducting demonstration trials for students and teachers to learn and benefit from this form of production activity. In addition, more farmers want to plant the new varieties that were tested in the watershed; there is an increasing demand for seeds of these OPVs.

■ The results of the survey and identification of toxin producing fungi obtained from corn grown in the watershed resulted in a better understanding among corn farmers of the danger of consuming contaminated grains for food and feeds. Survey results show that most corn samples taken from various locations in the watershed are contaminated with aflatoxin producing fungi called *Aspergillus* sp., *Fusarium* sp., *Diplodia* sp., and others. Measures to reduce or eliminate the fungal contamination have been discussed with farmers. Some practical recommendations include: proper timing of harvesting and drying and storage of corn.

Potential Benefits

■ The potential impact of adopting the improved alternative cropping systems for corn production such as the use of new high yielding, acid and pest tolerant varieties in conjunction with proper fertilizer, and soil management practices will alleviate current production problems and sustainable production overtime.

■ The researcher-managed experiments conducted on farmers' fields on the development of strategies to maintain soil organic matter content in the acidic soil conditions of the "kamaisan" will help alleviate the effects of soil erosion in many sloping and hilly corn areas of the watershed and sustain yield levels.

■ The campaign for awareness of the hazards of mycotoxin contamination in corn grains and other food sources and the implementation of measures to reduce or eliminate the contamination will greatly reduce health risks among many corn farmers in the watershed.

■ The implementation of training activities designed to strengthen community-based farmer organizations will result in a more highly motivated farmer group with stronger managerial capabilities. These trainings will improve the likelihood of a more dynamic and member-oriented organization which can diagnose problems collectively and propose solutions appropriate to their situation.

SANREM CRSP
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Program Highlights
P9-1

Characterization of the Soil Resource in the Lantapan Area of the Manupali Watershed

Objectives

■ To describe, sample, and characterize major soils on different geomorphic surfaces within the Lantapan area of the Manupali Watershed.

■ To enhance community awareness of different soil characteristics and the interactions between soil characteristics, soil capability, and soil management practices.

Accomplishments

■ In the Lantapan area, four broad geomorphic units were identified and designated as Mountains, Upper Footslope, Lower Footslope, and Collu-Alluvial Terraces (Fig. 1). The Lower Footslope was further subdivided based on topography into undulating to rolling, gently sloping to undulating, and level to gently sloping.

■ Thirteen pedons were sampled in the region with at least two pedons representing each of the four geomorphic units. Basic characterization of the physical, chemical, and mineralogical properties of these soils has been completed.

■ General relationships among soil properties, parent materials, and geomorphic units have been developed for use by other researchers in the region and by the residents of the area.

■ Community awareness of differences among soils in the region and the importance of these differences to use and management has been increased through meetings with Barangay Captains and informal discussions with community members during sampling of the soils.

Outcomes

■ An extensive database of soil properties has been developed that is useful for other research projects, educators, policy makers, and the general public as an aid for management decisions to help preserve the soil resources and insure sustainability of the region. In general, the soils are well drained, have clayey surface and subsoil horizons (Fig. 2), are slightly to moderately acid, have low organic matter, have high P fixation capacity, and have a low capacity to retain nutrients. Differences among soils are related to differences in age of volcanic ash deposits forming the four geomorphic units identified. Soils on the Lower Footslope are the most developed (deepest weathering, highest clay contents). Soils on the Mountain unit are the least developed and have many characteristics associated with young to intermediate-aged volcanic ash. These soils have a recent ash cap, about 20 cm thick with high organic matter, low bulk density, high infiltration rate, and high P fixation capacity. Soils on the Upper Footslope have properties intermediate between those on the Lower Footslope and those in the Mountains (Fig. 2).

Potential Benefits

■ Information on the non-renewable soil resources is a necessary part of any attempt to design and implement sustainable management systems. Systematic sampling of identifiable geomorphic and landscape units can allow relationships to be developed among soils and landscape features that can be used in place of a detailed soil survey. If the distribution and properties of the soils are understood, a soil's or landscape's response to management inputs can be predicted, and management systems can be designed to increase or maintain production while protecting the environment and the soil resources. These data also aid in technology transfer across the region. If a particular set of practices increases crop yields or helps maintain long-term productivity, these practices should be applicable to other areas with the same or similar types of soil. Another benefit of an inventory of the soils in an area is the addition of this knowledge to the resource data set. Information from a detailed soil inventory is

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useful long beyond the life of the project. It is hoped that this information will be used in the future as an aid to watershed development while ensuring the protection of the soil resources and the rest of the environment.

Figure 1. Topographic transect across study area

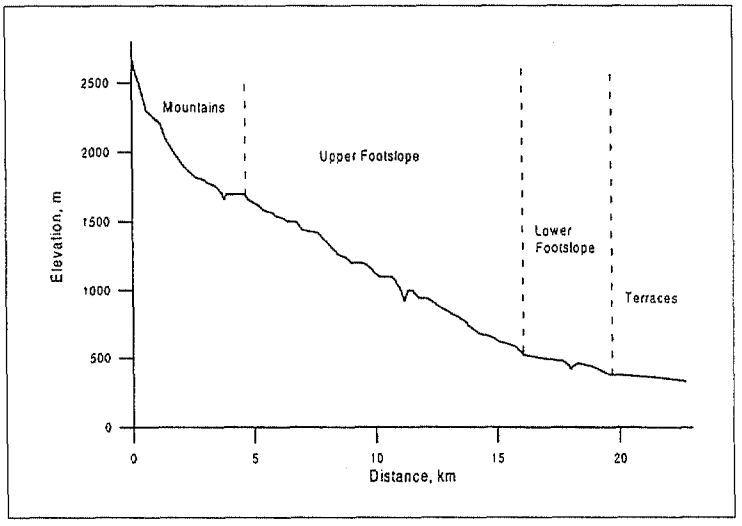
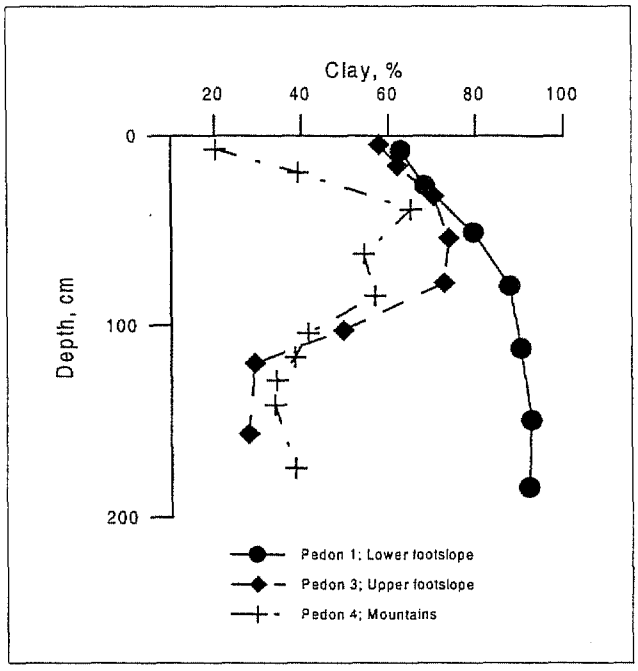


Figure 2. Clay distribution for pedons from the three upland geomophic units



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Program Highlights
P10-1

Water Resource Management and Education in Watersheds of Bukidnon, Philippines

Objectives

■ Facilitate the formation and development of community-based water quality monitoring teams and raise community awareness of water issues.

■ Conduct training workshops for analyzing chemistry (eight parameters), biology (aquatic biodiversity), coliform bacteria and total suspended solids in water.

■ Monitor water quality of streams (including the Pulangi IV Reservoir) throughout the project site and relate it to land use within the watershed.

■ Monitor concentrations of coliform bacteria in drinking water, including in spring sources, community faucets and home water storage containers.

■ Develop action plans with community leaders (local government units, Department of Health, etc.) to conserve and protect water resources and improve drinking water quality.

■ Improve and develop aquacultural technologies for "back yard" fish ponds with farmer/researchers.

■ Assist teachers with environmental education that brings SANREM CRSP research findings into the classrooms of elementary and secondary schools.

Accomplishments

■ As a result of training workshops, a community-based, water quality monitoring team called the Tigbantay Wahig ("Water Watchers," or TW) formed in 1994 and incorporated as a registered non-governmental organization in August 1995. As a work plan partner, HPI has conducted seminars for the TW on group formation, goal setting, accounting, etc. Other people's organizations, such as BAND (Bukidnon Association for National Development) and the FLWO (Federation of Lantapan Women's Organization) have participated in water quality training workshops and water quality monitoring.

■ Fourteen training workshops, attended by about 320 people, have been conducted. Workshop topics have included basic water quality testing, bacteriological monitoring of drinking water, data interpretation and presentation to the community, fish pond site selection and fish production.

■ More than 1,800 water samples have been collected at 29 sites on five rivers in Lantapan and at the Pulangi IV Reservoir (500 chemical, 900 suspended solids, 80 aquatic invertebrates and 350 bacteriological). Various parameters of water testing were evaluated for practicality, community acceptance, expense and value of data for researchers and local policy makers.

■ Three bacteriological surveys of drinking water were conducted (Oct 95, Jan 96, Mar-Apr 96) in the 14 barangays along the main road. Concentrations of coliforms were quantified, with determinations of seasonal, watershed and site differences.

■ Several existing fish ponds and proposed pond sites in Lantapan were evaluated and an aquaculture feasibility study was conducted. Two aquaculture workshops were conducted. An aquaculture site (owned by one of the TW) was surveyed and fishponds are being constructed there. Other TW members have constructed ponds on their farms, and the group proposes to do farmer-based research on various fish production systems.

■ Several teachers have attended training workshops (some with their students), and a special environmental education workshop was conducted using citizen data as the basis for teaching elementary students about water. In conjunction with the Environmental Education work plan, research findings about water quality will be grade-adapted and developed into activity sheets by teacher/researcher writing teams for use in all schools in Lantapan.

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Outcomes

■ **A watershed-level data base of water quality that is useful for educators, policy makers and the general public.** By collecting and analyzing hundreds of samples at several sites on the four major tributaries and main stem of the Manupali River, the citizen monitors of the Tigbantay Wahig have detected a west-to-east pattern of environmental degradation that is generally correlated with human population densities and deforestation (Fig. 1). This pattern is particularly revealed by concentrations of suspended solids (primarily eroded soils) and coliform bacteria (*Escherichia coli*), and these parameters are being evaluated as indicators of sustainability. Preliminary findings indicate that information on suspended solids and *E. coli* concentrations are not only scientifically valuable, but are also good indicators because they: 1. can be measured with inexpensive and simple methods, 2. pertain to land productivity and human health and are thus relevant and accepted by the community, and 3. are important to policy makers at both local and national levels.The research has also identified community drinking water supplies that are contaminated with bacteria. Such information can be used by the local government units to reduce human health risks, identify and repair broken and leaking pipes, and to more convincingly propose for federal grants to replace outmoded or damaged water supply systems. Research findings of water quality in general and bacterial contamination of drinking water in particular were presented to the Department of Health, Municipal Council, some Barangay Captains, women's organizations and other community members.

■ **A people's organization focused on water issues of Lantapan and skilled to continue the project in the municipality and in other regions of the Philippines.** A growing number of citizens are becoming involved in water quality monitoring and the community-based groups are collecting credible data that are essential for management decisions. These data are important to the SANREM CRSP Philippines program because they form a baseline to evaluate the success of other work plans that are focused on reducing water quality problems, such as farm runoff of soil and nutrients. The simple methodologies and training materials developed have been successfully used in Ecuador, Costa Rica and Honduras, and are potentially useful for other research sites. The TW group has been strengthened technically, socially and organizationally through training workshops and have the capacity to continue the work if local or outside funding is provided. Assisted by work plan partners, the TW plans to seek their own funding for research through in-country foundations and possibly work as consultants or advisors in water quality and aquaculture to other communities in Mindanao. The TW maintain an office and billboard to present water quality information to the community, and have made presentations in schools and at municipal and barangay meetings.

■ **New institutional partnerships in natural resource management.** Institutional partnerships have been strengthened and lay a foundation for continued participatory research in natural resource management. The partnership of Auburn University with Heifer Project International demonstrates how NGOs and universities can provide a unique and important mix of research/technical and developmental/social expertise to foster the development of community-based environmental groups. The National Power Corporation (NPC) partners facilitated an institutional tie with the Bukidnon Sugar Company (BUSCO) and BUSCO now provides laboratory analyses for NPC water samples. The Barangay Captain of Kulasihan requested the services of the TW to test a potential new spring source for public drinking water. Preliminary tests revealed a contamination problem; this finding may have reduced a public health risk and saved the local government unit the time and money required to convey this water to the community.

Potential Benefits

The water monitoring teams of Lantapan provide a valuable community service and model of citizen action that applies to other regions of the Philippines and to other countries, including the U.S. The methodologies and training philosophy used in this work plan are being used in similar, concurrent programs in Alabama with clear, mutual benefits. For example, bacteriological sampling techniques developed in Lantapan are currently being introduced to citizen monitors of the Alabama Water Watch and will soon be utilized in a partnership study with the Alabama Department of Environmental Management to assess the quality of public swimming beaches in the state. Groups in both the Philippines and U.S. are motivated by the "global to local" focus of their work, and educators are participating in an "environmental pen pal" program across SANREM CRSP sites and the U.S. to share general information and lessons learned regarding water issues.

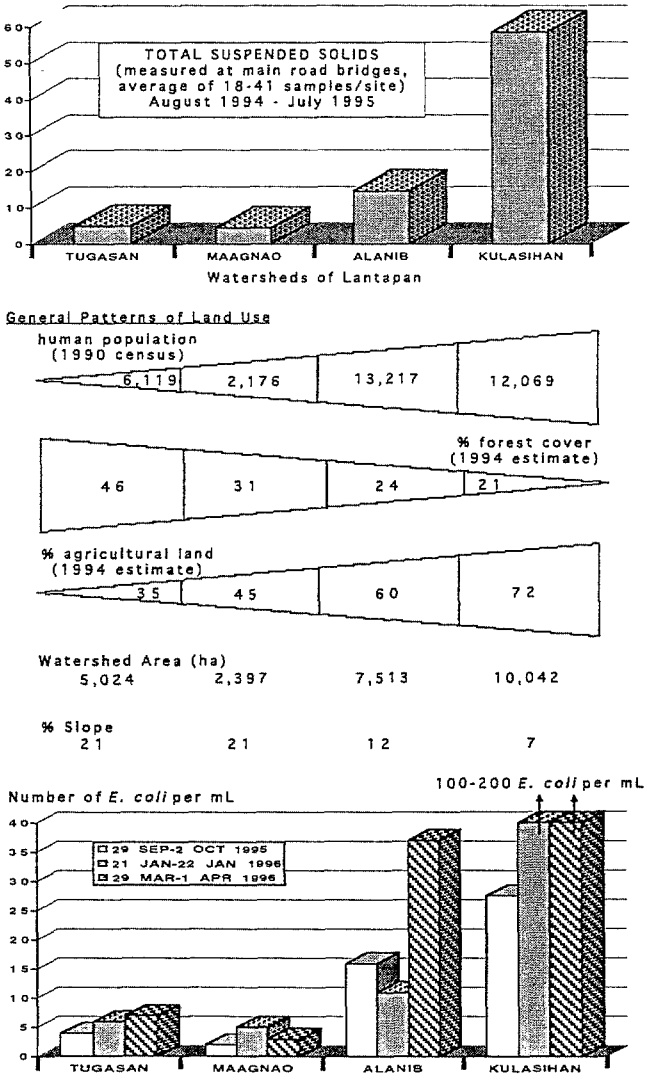

Figure 1. Total suspended solids, general patterns of land use and concentrations of *E.coli* bacteria in four watersheds of Lantapan, Bukidnon, the Philippines.

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Sustainable Agriculture and Natural Resource Management
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Program Highlights
P11-1

Assessing and Developing the Contribution of Home Gardening to Biodiversity Conservation and Household Nutrition

Objectives

■ Determine the variability of home garden species portfolio both in space, between different home gardeners within and between major agroecological zones of the watershed, and in time, and the reasons for these variations.

■ Assess the contribution of home gardens to household nutrition according to the typology developed.

■ Characterize the social networks linking household and their contribution to gene flow and food flow.

■ Evaluate alternative technologies for their appropriateness, contribution to increased home garden productivity, biodiversity and nutritional potential.

■ Through formal and informal training and knowledge dissemination activities, sensitize researchers and local people to the potential of gardens as a neglected production system with potential for increasing household nutritional well-being in the short term and over the long-term to improve the conservation of plant genetic diversity in the landscape.

Accomplishments

■ A database of home gardening-related variables in the Manupali watershed was established through a documentation workshop participated by 119 home gardeners. It is composed of information on species/variety composition, spatial arrangement, labor requirement and seasonal distribution of output of the home gardens. Accordingly, typologies of home gardens were developed to characterize the variations among the home gardens. Initially, home gardens are classified according to the major use, beautification only and beautification and utility, and to agroecological zones.

■ Documentation and subsequent analysis of the socio-economic profile of the workshop participants led to further categorization of home gardens according to availability household/farm resources, main occupation of the home gardener and her honorary position in the community.

■ With a sample of 24 cases from the original workshop participants, the variability of the home gardens was monitored in detail for changes in the species and number of plants over time. Furthermore, the practices in species/variety selection, seed production and seed storage are continually documented.

■ Household nutrition data, which included food consumption, food habits and food preference, were collected from the 24 pilot home gardeners and a comparison group of non-food home gardeners. The food exchange network was also documented to compare the intra-household food allocation of these two groups. The home gardeners perception on the fluctuation of the household food supply was documented recently.

■ Informal networks of the pilot home gardeners on food, seed, information, labor and credit were mapped out through participatory techniques. The role of the home gardens in these social networks was identified as well as the opportunities and constraints that these social networks present in enhancing the nutrition potential and biodiversity of home gardens.

■ Composting workshop was conducted to demonstrate the methods of making compost and to discuss the advantages of this technology. Pilot home gardeners and other interested individuals attended the workshop.

■ Planting materials of exotic plant species and/or new varieties of indigenously cultivated species were procured and distributed to the 24 pilot home gardeners for evaluation. These species were evaluated for their yield,

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acceptability as food, compatibility to other plants and adaptability to local bio-physical conditions.

■ Four meetings/workshops have been conducted either to validate the database, to plan future activities or to evaluate the methods and activities of the project. Cross visits of home gardens were also organized to provide opportunities for exchange of information, experiences and planting materials among the pilot home gardeners.

Outcomes

■ The home gardens across the Manupali watershed varied widely in terms of their species composition. In general, the kinds or species of plants in a home garden ranges from 4 to 35 with an average of 13 species. The vegetation is dominated by fruit trees in 57% of the home gardens included in the documentation workshop, vegetables in 28% and ornamentals in 15% of the home gardens. This distribution reflects the proportion of home gardens classified as beautification and utility (88%) and beautification alone (12%).

■ The biodiversity of the home gardens also varied according to their agroecological zones. Home gardens found in the middle agroecology have more variety/species of plants (average =15) than either the home gardens found in the upper or lower agroecology (average = 12). Fruit trees and forest trees are dominant in home gardens in the lower and middle agroecology while ornamentals and vegetables dominate in the home gardens found in the upper agroecology.

■ Home gardens with higher diversity (18-35 species) are managed by professionals (Barangay Health Workers, Teacher, Daycare Worker) or skilled laborers (dressmaker, beautician) and barangay officials. They also tend to have more household resources (television and/or refrigerator, vehicle) and farm resources (> 2 ha of farm land, > 2 heads of cow, goat or pig). These home gardens are dominated by fruits and ornamentals in contrast to fruits and vegetables in the less diverse gardens (4-9 species) primarily managed by homemakers with less resources. No relationship was observed between diversity of home gardens and job of husband, number of household members and residential status.

■ Among the pilot home gardens, species present in the lower and middle agroecology are more similar (Sorensen's Similarity Index, IS = 71%) than those in the lower vs. higher agroecology (IS = 63%) and middle vs. higher agroecology (IS = 67%).

■ Over a 12 month period, there was no significant change in the number of species present in the home gardens found in the lower and middle agroecological zones. However, there was a 12% decrease in the number of species in the home gardens found in the upper agroecology. It appears that the major reason for the decline is the lack of planting materials.

■ Preliminary analysis of the nutrition study show that although the calorie intake for many of the households is above the recommended daily allowance, there is an extremely low level of essential nutrients such as Vitamin A, riboflavin and iron.

■ All home gardeners planted the seeds of the new species even where cultural practices and possible uses of species were not clear. Successful growers of these novel species did not only use the harvest for home consumption but also shared it with neighbors or sold it in the market. Ten out of the 24 home gardeners collected and stored the seeds of some species for future planting. The stage of the developmental cycle of the household strongly influenced the number of species present in the home garden and the success or failure in the evaluation of the new species.

■ Composting continues to be an unattractive option for most gardeners, despite evidence of poor soil fertility in some gardens. Four out of the 11 pilot home gardeners who attended the composting workshop are composting at present. The reasons behind this low adoption are being studied.

■ An increased awareness and interest of the pilot home gar- s in the potential of home gardens is reflected in the consistently high attendance at meetings and workshops.

Potential Benefits

■ Databases on home garden biodiversity, management practices and socio-economic variables are useful for research and development efforts in biodiversity conservation or household welfare.

■ Planting materials of novel species and new varieties of indigenous crops will eventually spread to other non-pilot home gardeners in the watershed as evident in the high percentage of women storing seeds of the introduced species and the presence of informal seed exchange network.

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Program Highlights
P12-1

Sociodemographic, Technological, and Economic Factors Affecting Biodiversity in the Lantapan, Philippines

Objectives

■ Draw upon censuses, vital registration data, survey reports, and the annual reports of the Lantapan municipality to analyze the past and current demographic situation in the study site.

■ To trace technological transition in Lantapan agriculture to explain current production systems.

■ To analyze the economics of varying levels of chemical use in the current production systems and to qualitatively investigate the influence of institutional arrangements (labor, tenure, and credit) in the choice of these technologies.

■ To provide a socioeconomic database that could be used to explain levels of biodiversity in the study site.

Accomplishments

■ A key respondent survey describing the sociodemographic, economic and technological profile of 108 farm households across the three ecozones (Kapatagan, Kamaisan, and Kasagbutan), and covering 12 barangays. The criteria used in selecting the samples include type of crop grown, ethnic origin, tenurial status, farm size, and social status. The results of the survey are contained in a sourcebook which was shared with other SANREM CRSP partners.

■ Demographic data analysis which revealed that between the period 1970-1990, fertility has remained high; mortality is declining; and there is a trend toward marriage at a later age. Family planning is practiced by some couples, but knowledge and use of contraceptives overall are still at a very low level. Migration data suggest that migrants arriving between 1950 - 1989, were mostly from Cebu and Bohol and other towns of Bukidnon. Women were more mobile and chain migration was most common. Motive to migrate is economic. Analysis of social data reveals that, compared to other upland areas in the Philippines, Lantapan population has lower incidence of malnutrition; more access to clean and safe drinking water and sanitary toilet facilities now than in the previous decade; and higher literacy rates. In 1980, the literacy rate was 72 percent for males and 78 percent for females. The 1990 figures show that rates are 91 percent and 92 percent, respectively for males and females. Higher female literacy over the 10-year period could explain the observed delays in marriages among females.

■ Analysis of the dynamics of technology looked at factors affecting farmers' decisions in land use and cropping pattern, in crop varieties planted, in the use of chemical inputs, and in farm mechanization. Farmers use a combination of indigenous and modern technologies promoted by government programs. The latter is used if the farmer is not financially constrained. Choice of crops is influenced by pests and prices.

■ Economic analysis of various levels of chemical use in tomatoes and cabbage revealed that high levels of pesticide use yield zero or negative marginal returns. Qualitative data revealed vegetable farmers' perceptions of high pests and low natural enemy population in intensive pesticide use areas. In corn, higher levels of chemicals were used with modern varieties, but use of traditional varieties yielded a higher benefit-cost ratio. In corn productivity analyses, farm size is a significant source of growth, however, expanding area for corn could have some dire environmental consequences.

■ Results of data analyses were published in the local dialect in the SANREM CRSP *Balita* (vol.1, no.1), a poster newspaper that was distributed to farmer respondents and posted in strategic public places in Lantapan. Because of the researchers' observations that the presentation and content of the municipal statistics could still be improved, a list of key indicators for sustainable agricultural development was framed that could serve as a basis for future planning by the local government.

Outcomes

■ In general, there is a dearth of socioeconomic and demographic, micro level data that describe the situation in the Philippine uplands. This primary survey and secondary data analysis of upland systems contribute to our understanding of the kinds of interventions

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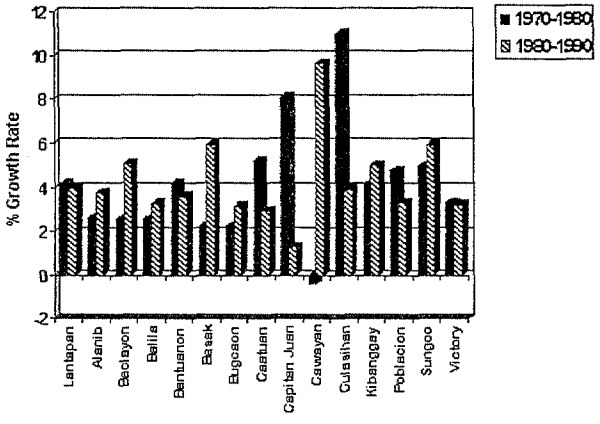
that could be done to improve the quality of life of its inhabitants.

■ Assessment of the quality of demographic data in the uplands has shown that mortality and birth statistics are not reliable, and thus there is a need in other upland areas to raise awareness of the importance of this information. Lantapan has started this campaign already.

■ There is a need for alternative nonchemical pest management technologies for sustained productivity and profitability. Results of the analysis on chemical use in vegetables is fed back to the national Integrated Pest Management (IPM) program to help design a vegetable IPM program in the Philippines and to advocate for a Farmer Field School to promote sustainable agricultural technologies in the study site.

■ Technological data on upland corn systems are used as reference in the current effort to define research directions of the International Livestock Research Institute (ILRI) and by the UPLB Technical Working Group on Food Security. Demographic and other household data were used as reference in project documents prepared by the Bukidnon provincial development office.

Population growth rate by barangay, Lantapan



Potential Benefits

■ This project hypothesized that changing agricultural practices, population pressure, and economic factors would result in loss of biodiversity. The end goals were to define concrete measures to minimize losses of biodiversity through policy recommendations and to increase farmer awareness of the consequences of their current practices. We are making strides with farmers; however, these socioeconomic data have to be correlated with the technical biodiversity indices to have a stronger basis for policy recommendations.

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Program Highlights
P13-1

The Ethnoecology of the Manupali Watershed

Objectives

Year 1: 1993-94

■ Identify culturally relevant indicators of sustainability (Thematic Apperception Tests, human activity grids, time allocation, and migration history).

■ Develop cognitive maps of natural resources by gender, age, and ethnicity.

■ Stimulate local initiatives in situ germplasm conservation.

Year 2: 1995-96

■ Identify culturally relevant indicators of sustainability related to biodiversity.

■ Facilitate sharing of traditional sustainable practices through cultural corridors comprised of oral, visual, and modern means of information exchange.

■ Enhance local access and control over resources — both natural and intellectual — through community-led memory banking, in situ conservation, tissue culture, and rapid plant multiplication.

Accomplishments

■ An in-depth analysis of landscape-lifescape integration in three communities (Alanib, Songco, and Kaatuan) along the watershed was completed in Phase I. Responses to thematic apperception tests (TATs) were collected and analyzed. Human activity grids with reference to resource clusters were investigated and related to time allocation (productive and domestic activities) of men and women belonging to different ethnic groups. The migration history and history of resource use in the area was reconstructed. Cognitive maps were elicited and drawn by local informants and further analyzed through GIS as "mental maps" in comparison with objective scientific maps.

■ Four local women were trained in tissue culture and rapid multiplication. The initial efforts with in situ germplasm conservation saw the establishment of communal gardens in three public elementary schools located in the three communities. To date in Phase II, the tissue culture cum herbarium laboratory was constructed at Sungco. In situ gardens were established and expanded in other communities, including a communal garden around the herbarium cum tissue culture laboratory. Economic analysis of the tissue culture and rapid multiplication project completed.

■ Two ethnobotanical surveys were completed. The first involved local experts and a botanical taxonomist and covered systematic transects in three sitios. The second involved the local experts in directing the collections and explaining the local uses for each plant. Video documentation of expert's knowledge are available.

■ Local theater groups and performing ensembles (story telling, poetry through epics and poetic debates) for enhancement of biodiversity were supported. A local theater groups, EDCADS, worked with local youth and trained them in writing and producing plays based on their oral traditions.

■ Codification and recording of local law related to ancestral lands and resource use undertaken by tribal partners. Talaandig datus and elders were convened under the leadership of project collaborator who is himself a highly regarded local datu to codify tribal laws. This activity will culminate with the validation of codified laws by an assembly of datus and elders.

■ Ethnocultural Museum project (with Bukidnon State University) undertaken for purposes of collecting traditional agricultural implements and the video documentation of agricultural rituals.

Outcomes

■ An Ethnology of the Manupali Watershed Monograph, that is useful for local communities, planners, policy makers and scientists interested in the development and preservation of this zone. The monograph reflects work undertaken by team members: 1) Patterns of Human Settlement in the Manupali Water-

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shed: A Study of Social and Ecological Change (to be published separately by M. Costello in a Philippine Press); 2) Culturally Relevant Indicators of Sustainability and Perceptions of the Environment; 3) Human Activity Grids; and 4) Memory Banking related to plants, soils, and water.

■ Ethnobotanical Collection. Herbarium specimens and scientific drawings have been preserved and deposited in the Ethnoecology/ Biodiversity Laboratory at UGA and at the Songco Herbarium. Local knowledge inventories and documentaries of ethnobotanical surveys are also on file.

■ Ethnocultural Museum with a modest collection of traditional agricultural implements is now set up at Bukidnon State University. Archives of documentaries about agricultural rituals will be set up in the local herbarium.

■ Tissue Culture Laboratory/Herbarium dedicated to preserving biodiversity established. Memory banking protocol for youth has been translated into the local dialect and tested in the three schools.

■ Ancestral Laws related to traditional resources codified, thus giving local people a voice in determining their own destiny in agriculture and watershed management. Ancestral laws are often more protective of the environment than regulations forced upon the local inhabitants by outside agencies.

■ Training of Filipino Students and USA students. One Filipino student is now in the Ph.D. anthropology program at the University of Georgia. Students from Xavier University and Bukidnon State University have been successfully integrated into the project. One American trained in the Manupali Watershed under an NSF grant.

■ Community Theater Groups supported, thus providing a culturally acceptable media through which to pass environmental knowledge among groups and between generations. Presentations in the School of Living Traditions sensitize people to their traditional sustainable practices.

Potential Benefits

■ The project demonstrates the relevance of ethnoecology for sustainable agriculture and natural resource management research. The findings and methods developed are applicable in other sites.

■ The application of low-cost biotechnology (tissue culture and rapid multiplication) by local women demonstrate the relevance of this technology (generally considered too expensive and sophisticated) to local populations interested in preserving their own plants and profiting from their natural resources.

■ The memory banking protocol has widespread use and, in fact, is now being applied by numerous organizations in the American Southwest, US South, and South America.

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Environmental Awareness Of, By, and For Empowerment of the Manupali Watershed Farming Families

Rationale

■ The SANREM CRSP maintains that community participation is an irreplaceable avenue for appropriating long term changes in sustainable agriculture and natural resources management. To this end, the work plan described in this document chose to start at the grass roots level of the community and assist community members to enhance their capacity for change. This was done using the Environmental and Economic Foundation for Sustainable Agriculture Systems (EEFSAS) model to enhance awareness of the community human condition, demonstrate optional practices related to sustainable agriculture and natural resource management, and to assist individuals in realizing the role of the landscape/lifescape in making changes.

Objectives

■ To provide training/forum discussion for farm families and community members which will provide motivation and encourage farmers to adopt sustainable agriculture and natural resource management technologies through the EEFSAS trainings. These seminars or fora would also provide opportunities for community members (farm families) and scientist to reflect on research activities, discussions of relevance, irrelevance, and the future activities. Through these activities, people's perception of the "environment" and education needs are assessed and a "sustainable vision" could be elicited.

■ To initiate the creation of Enlightenment Gardens at SHAISI and potentially in other agroecozones across the landscape in conjunction with on-going SANREM CRSP research activities (Community work, Home gardens, agroforestry, etc.) which engage the farm families - especially upland farm families, to set an example for adoption of sustainable agricultural practices, aquacultural systems, and other farming technologies.

■ To trace the introduction of community organization as the basic development element to generate peoples' participation, awareness, and empowerment and to characterize the evolution of peasant organization according to sectoral lines.

■ To conduct a participatory survey across the landscape to determine the extent of aquatic resources that can possible be harnessed to sustain aquaculture and related farming systems for the purpose of strengthening food security, health and nutritional bases in the community.

Accomplishments

■ **Training.** Four Ecological/Economic Foundation for Sustainable Agriculture Seminars and Field Trips have been held at SHAISI to bring the people to express their innate thoughts, ideas, concepts and perceptions to dealing with physical environment (Table 1). The total of 179 individuals were trained. These workshops have served as motivating seminars related to sustainable agriculture and natural resource management. Field trips also provided an enhanced understanding of the landscape/lifescape perspective and visits to demonstration farms in Mindanao.
The four trainings included the following:
• July 1994 Farmers and high school students were trained.
• October, 1994 Community members, farmers and Lay Religious leaders were trained.
• December 1994, Teachers from across the Manupali Watershed were trained.
• April 1995, Teachers from across the Manupali Watershed were trained.
A full methodological description and photo essay have been developed for the EEFSAS Trainings.

■ **Enlightenment Gardens.** The first Enlightenment Garden (EN-Garden) has been established at SHAISI and will incorporate existing ideas for sustainable livelihood and will provide a testing ground for ongoing research activities as information becomes available

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from other research work plan holders. The EN-Garden serves as the resource center of experiential and informational exchanges of workable farm systems and technologies. Here, the demonstrative element is also the living condition, quality of life, and the enhancement of Filipino Culture, of the Farm Families who are translating SANREM CRSP into Organic Diversified Intensive Scientific Cooperative ODISCO farming practices. High School students are also participating in the En-Garden Establishment. It is hoped that further gardens will be developed with input from other SANREM CRSP project results.

■ **History of Farm-Family Community Organization.** Documentation of historical introduction of community organization as the basic development strategy for participatory activities. Based on numerous meetings and the EEFSAS trainings, a history of what a Hugpong is and what it is not and the usefulness has been described and is published in the End of Phase Report.

■ **Aquacultural Feasibility**. In conjunction with environmental education and information exchange at the international, national and provincial level, and work included in the water resources project of Dr. Bill Deutsch, a report of available aquaculture systems and the potential for others was developed. A report from Dr. Evellyn Belleza, Auburn University related the established fishponds in the Lantapan Municipality is published elsewhere. In 1996, Dr. David Teigert-Coddington held a workshop to provide information on fish pond development and suitable locations. The reports of these activities are housed in SANREM CRSP management office.

Outcomes

■ To date, 179 human persons "graduated" from the "square world". The farmers formed their hugpong and re-established their farmstead by using the A-frame to terrace their hilly lands. At the school the combined effort of the teachers and the students produced an integrated corn-camote-vegetable-piggery project which changed the landscape of the school ground and the environment. This did not only restore the mind set of the teachers to be more environmentally sensitive, it also created an atmosphere of sustainable agriculture conducive to making the students sensitively aware of the ecological issues. EEFSAS participants have given top priority to planting vegetables on the front or backyard instead of ornamentals and there is keen interest to integrate livestock into the farming system.

■ In the case of the teachers, there is now a strong desire to go back to their own family farm and attend or focus their attention to its development with the total cooperation of the family. Many have started composting and using organic farming measures. The training created an immediate impact. The teachers have transformed the school campuses into fruit tree-forestry and gardening projects with livestock components for sustainable agriculture and natural resources management and are showcasing them. The school campuses will now be turned into a showcase of Enlightenment Gardening and sustainable farming, given the realization that the Lantapan schools have a combined farmland of 148 hectares. The District coordinator, Mr. Roger Cajilog announced during the Bansalan MBRLC closing program that Mayor Pajaro had provided the district the amount of Peso 100,000.00 to start the teachers off with their experiment in sustainable agriculture in the school grounds.

■ The training design submits itself to the natural evolutionary process of life. It is not perfect. But it is striving to attain perfection. It is open-ended to allow for contributions of the people, to be enriched by the people, and to be actualized by the people. The EEFSAS trainings have been extremely popular and the present project needs to be augmented to take on the great interest by community members and include the different scientists that are available in the community via SANREM CRSP.

■ The combined efforts of the farmer hugpongs and the lay leaders and the SHAISI Teachers resulted to the first organization of EEFSAS graduates into a Farmers Organization of Lantapan which was called LASAFA, or Lantapan association of SANREM CRSP farmers under the titular leadership of Carling Nulo. The members are planning to graduate the association into a network of hugpongs to promote marketing of products and exchange of market information.

Potential Benefits

■ To take full advantage of the training that has taken place will be further open-ended participatory research, where the "birds" (scientists) will dialogue meaningfully with the "small fish" (farmer families) in the Manupali, and hopefully come up with the wisdom to guide the process of change and renewal. It would be very invigorating to meet all of them in a general assembly where we can reminisce and "plot" the transformation process. The testimonials of those who took the "fall" could provide valuable insights on how to proceed with the SHAISI environmental education and hugpong organization efforts (to "touch the ground, and heal the Earth") for the second round of SANREM CRSP activities.

Table 1. Why Are We Poor? Reasons and Solutions Solicited by EEFSAS Participants

Reasons	Solutions
Lack of Know How, Lack of Education, Ignorance of Technology	1. Have self interest in attending seminars/meeting, joining cooperatives, and lifestock raising. 2. Educating people through seminars, meetings, and field trips. 3. Attend seminars on livelihood. 4. Attend seminars and go for further schooling.
Laziness	1. Get advice, counseling, and attend seminars. 2. Self discipline. 3. Work hard 4. Plan your work and work your plan and have faith in God.
Lack of Financial Support	1. Join cooperatives to have additional knowledge and development. 2. Spend wisely, budget, and show self discipline. 3. Participate in workshops, conferences, formal and non-formal education. 4. Get aid from government.
Vices	1. Self Discipline. 2. Counseling. 3. Stop making vices.
Lack of Spiritual Aspect	1. Have Faith in God
Unemployment	1. Be resourceful - gardening, start a small business, poultry raising. 2. The government should provide sufficient employment to graduates.

SANREM CRSP
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Program Highlights
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Assembling the Elements for a Realistic Buffer Zone Resource Management Plan in the Philippines

Rationale

Protected areas are in crisis throughout the developing world. Communities near protected ecosystems frequently bear substantial costs as a consequence of their proximity to these areas, yet often gain little in return. Local residents are usually poor, and often see encroachment as a means to rectify this. It is now widely accepted that the successful management of protected areas critically depends on the cooperation and support of local people. The key unresolved questions are how to successfully integrate approaches to conservation and development and how can the biodiversity be maximized under the jurisdictional conditions and the social and economic realties?

Objectives

■ Develop and test the elements of a practical social contract for successful buffer zone management at the Katanglad National Park.

■ Develop improved agroforestry systems to enhance agrodiversity and livelihood in the Katanglad National Park buffer zone.

■ Characterize, regenerate, and expand the natural biodiversity of the national park and buffer zone, and incorporate this information into a realistic natural resource management system for the upper watershed.

Accomplishments and Outcomes

■ A study of the perceptions and actions of the native Talaandig people toward stewardship of park resources was completed. Our results confirmed that there is strong self-perception among communities on the boundary of Kitanglad National Park that protection of natural biodiversity is critically important to the Talaandig and that they are implementing effective enforcement mechanisms to ensure the protection of the upper watershed. The evidence suggests that recognition of the Talaandig claim for ancestral domain over the park is likely to improve enforcement of the park's integrity.

■ A historical analysis of the institutional environment of Kitanglad National Park was conducted and emphasizes past experience in public land management in the area. A series of village meetings were held to appraise institutional mechanisms for resource management that would be acceptable. The outputs were used in refinement of the Talaandig ancestral domain claims that are now filed with the Department of Environment and National Resources.

■ The consortium sponsored a National Buffer Zone Management Workshop attended by over 70 persons from a diverse range of government, NGO, and academic institutions. SANREM CRSP's experience and approach in integrated conservation and development was shared through a number of consortium paper presentations, and through a field trip to the Kitanglad buffer zone. Experience with integrated conservation and development projects (ICDPs) throughout the Philippines was synthesized into proceedings. Working groups critically analyzed progress in several key national parks, and developed recommended action plans.

■ A farming systems survey was completed with the participation of 67 farm households in three villages adjacent to the national park. The information enabled the characterization of the farming systems and determination of appropriate technical research and development directions to enhance the evolution of land use systems that increase income and conserve biodiversity. Through present and visioned farm maps, farmers revealed strong interest in expanding the numbers of trees grown on their farms. As a result, three key technology thrusts were identified for research and impact with farmers: contour hedgerows for soil conservation, timber production, and home tree-gardens.

■ Community development facilitators were placed in each of the three target villages to build strong relationships with the community, liaisons with the village leader and council on the project's natural resource management strategies, conduct surveys and resource inventories, conduct training, and provide an information bridge to researchers regarding effectiveness.

■ On-farm experiments showed that the installation of contour hedgerows on intensively cultivated sloping fields reduced soil losses 50 to 95 percent and created natural terraces that stabilized the landscape and facilitated further management intensification. Pruned leguminous tree hedgerows were found to be unpopular due to their high labor needs (greater than 100 person-days per year for pruning). Farmers developed a low-labor solution to the problem of hedgerow installation by laying out the contours and allowing natural revegetation.

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■ Observation of widespread spontaneous adoption of natural vegetative strips (NVS) at the Claveria research site led to development and testing of a farmer-to-farmer conservation team approach to technology extension. The team involves a farmer experienced with NVS on his farm, a Dept. of Agriculture extension technician, and a researcher familiar with the technical aspects. Initial evaluation of the method has proven very successful in generating rapid NVS adoption. Over 100 farmers from the target villages joined cross-visits to observe NVS and other hedgerow systems. A data collection system was put in place to monitor hedgerow adopters, identify their progress and constraints, and inform the research team.

■ The most frequent reasons why non-adopters have not installed contour hedgerows is because they lack knowledge of the technique of laying out contour hedges. Some farmers proceed to lay out hedgerows without an A-frame or other leveling device. We identified a radically simpler method to lay out contour hedgerows that was developed by a local farmer. He discovered that reasonably accurate contour lines can be laid out by observing the level of the backbone of the cow as the plow is pulled across the slope. We found that this method produces contour lines that are off-level by only 1.5 percent per 100 meters (well within the range of practicality). A conservation extension guide was produced to spread information of this contouring solution.

■ On-farm experiments showed that ridge-tillage methods can be successfully adapted to the simple moldboard plow equipment of upland farmers. Ridge-tillage reduced soil losses dramatically on open slopes, and when combined with natural vegetative strips cut soil losses by 99 percent. Redistribution of soil occurs from the upper alleyway to the lower alleyway due to the normal slumping of soil due to tillage, which causes a "scouring" of topsoil on the upper part, often drastically reducing the annual crop yields due to soil fertility decline. With ridge tillage, rows were maintained permanently and soil redistribution was insignificant. These encouraging results have led to establishment of several farmer trials comparing ridge-till and conventional practices under normal farm management situations. A preliminary extension guide has been distributed for extensionists and farmers on the successful results.

■ A number of different methods to monitor soil loss from fields were tested under different conservation practices, and resulted in the development of a new type of sediment trap lined with split bamboo. A bamboo trap lasts 18-24 months before repairs are needed under hot, humid conditions. The trap should enable more widespread monitoring of soil loss on farmers' fields. The method was reported in a short SANREM CRSP bulletin available to researchers, extensionists, and farmers.

■ Indigenous strategies to intensify shifting cultivation were characterized, particularly farmers' methods to improve their fallows using local species. The advantages of farmers' preferred fallows of perennial sunflower (*Tithonia diversifolia*) and falcata (*Pereserianthes falcateria*) were intensively studied through plant and soil sampling to compare their soil amelioration benefits with the undesirable derived fallows of Imperata cylindrica grass and the wild fern Pteridium aquilinium.

■ A comprehensive database on multipurpose tree species performance by elevational belt in the upper watershed was developed. A database was derived from the ICRAF Multipurpose Database. A survey of 67 farms and a follow up survey focusing on farmer experience with species performance on the landscape were conducted. The database and survey summary have been distributed. A tree nursery was established that supplied thousands of seedlings for on-farm experiments established to evaluate a range of local and introduced timber species at elevations ranging from less than 500 meters to greater than 1,700 meters. Collaborating farmers were trained in timber tree establishment methods and farmer-managed nurseries were established that have raised 11,500 seedlings for farmers' trials.

■ We learned from farmers of the forest margins about the naturally-occurring tree species they value. Over 40 indigenous timber species were catalogued; we are evaluating wood quality and propagation methods in order to diversify the range of available species with commercial value in agroforestry systems.

■ A GIS was developed using IDRISI software to analyze current and historical land use changes in the study villages. The maps generated will provide inputs to village-level land use and environmental planning, and assist in resolving land tenure conflicts.

■ A ravine habitat survey was completed to assess the extent to which park biodiversity may extend down into the agricultural landscape outside the park boundaries. A map was prepared and shared with the village leaders to include in their village conservation plans.

Potential Benefits

■ Practical policy implications for an enabling environment for national park management. Our studies have provided clear evidence to clarify the appropriate action to take in implementing a protection system for Kitanglad. The research supports the view that recognizing the ancestral claims of the Talaandig people will strengthen the park protection effort. These results are expected to significantly influence current efforts by the DENR and the Integrated Protected Areas System to achieve an effective management strategy for the park.

■ There is exceptional richness and high endemism of floral biodiversity in ravines, strengthening the case for investment in conserving this park. The concept we proposed of viewing the ravines as "corridors of biodiversity" has received an appreciative response from the communities and enthusiasm for us to include their management in village resource management plans. The three-dimensional model of the watershed that we constructed as a tool for "seeing" the complex landscape generated requests from the municipal mayor and the DENR to assist them in building models of the entire park for natural resource planning.

■ Previous reforestation efforts in the Kitanglad buffer zone failed due to top-down efforts that neglected to recognize land and tree tenure and the needs of the smallholders occupying the area. A successful evolution of tree cover through the gradual reforestation efforts of farmers producing trees for profit through agroforestation, with extrapolation prospects for many other buffer zone management programs in the tropics, is expected. Tree productivity varies enormously with elevation in these tropical mountain settings. Data and farmer evaluation of the range of prospective species will provide guidance to other smallholder timber extension efforts.

■ The enthusiastic uptake of natural vegetative strips by farmers in northern Mindanao suggests that a profound prospect may exist for broad impact of this practice in the region. Our success in identifying new and simpler methods for laying out contour lines (the cow's back method) overcomes an additional constraint. These components have been combined with a novel farmer-to-farmer team approach that shows evidence of being uniquely suited to rapid assistance in getting hedgerows established on interested farmers' land. We have been asked by the National Power Corporation to help scale up these methods from the Manupali Watershed to erosion "hot spots" across the entire Pulangi River Basin, the Philippines' largest potential reserve of hydroelectric power.

SANREM CRSP
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Development of Sustainable Production Systems for Different Landscape Positions in the Manupali Watershed

Rationale

The need for optimal land use strategies has never been greater than at present, considering land degradation statistics and increased population pressure on limited resources. The adoption of intensive land use for agriculture coupled with deforestation have resulted in high soil erosion rates and degradation of land and water resources throughout the tropics, especially in sloping lands where upstream springs are drying up and land productivity is either declining or has already been lost. This degradation leads to heavy siltation of downstream reservoirs and irrigation canals, seasonal flooding, and a decline in quantity and quality of irrigation water, thus affecting productivity of the lowlands.

The Manupali River Watershed, which drains into Pulangi River and covers an area of approximately 60,000 ha, is typical of such a situation. The upper area still has some forest cover, while the lower stretches are cultivated. More than 40 percent of the watershed is hilly with slopes of 40 percent. Migration of people into the area from Luzon and Visayas has led to a rapid population increase (approximately 11 percent annually between 1970 and 1992 in the municipality of Lantapan), resulting in further deforestation and increased agricultural activities in cleared areas. The need to understand soil and water resource use at the watershed level is critical in order to recommend sustainable farming practices and to extrapolate the methodology and results to other threatened regions.

Objectives

■ Characterize the upper, mid, and lower watershed areas in terms of topography, soils, hydrology, land use, and cropping practices.

■ Establish interrelationships of upland resource use, management, and farming practices with downstream hydrology and productivity.

■ Identify sustainable land management practices for soil and water conservation, through optimal management of key resource parameters.

Accomplishments

■ **Characterization of the upper, mid, and lower watershed.** Three microwatersheds were selected for study, namely: Kinosuhan (Basac), Kimanga (Kibanggay and Victory), and Tanhaga (Alanib). The study of Tanhage also included detailed physical measurements of water flow rate, siltation load, and rainfall intensity at different landscape positions, etc. in addition to the relatively general characterization of the microwatersheds. Agroecosystem analysis, problem identification, and diagnosis were done through individual and group interviews with the farmers, supplemented with field observations and measurements. Secondary information, e.g. thematic maps, weather data, soil properties, demography, and other relevant socioeconomic parameters, were also collected.

Site descriptions of Kinosuhan and Kimanga microwatersheds included demographic and landholding characteristics and cropping information. The cropping data included cropping patterns, land preparation, sowing/planting, fertilizer application, weed/pest/disease control, and harvest/post harvest.

Agroecosystems analysis relative to spatial patterns included a social map, topographical/hydrological map, enterprise map, and transect. Problem identification and diagnosis addressed factors such as soil erosion, pests, and poor seed quality.

■ **Estimation of soil erosion.** Farmers were visited and interviewed at least once every two weeks. An electronic sensor and rain gauge were installed to continuously log water level in the creek and in the watershed, respectively. Water sampling during runoff was done every five minutes, manually and automatically. Water samples were then sent to Central Mindanao University for the analysis of sediment concentration and electrical conductivity. Results and discussion covered site description, instrument installation, testing, calibration and data collection, as well as farming activities within the microwatershed.

■ **Assessment of sedimentation impact on productivity of irrigated lowlands.** Farm surveys of about 2/3 or 150 farm samples were conducted to gather data on irrigation category, degree of sedimentation, crop yields, farming practices, farmer income, production costs, land ownership, and other relevant socioeconomic informa-

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tion. The farm survey method is referred to as Manupali River Irrigation System (ManRIS).

Rainfall, river flow pattern, and canal siltation data in ManRIS was analyzed for the years 1991-1995. Longer-term assessments over a twenty-year period were possible through historic records of rainfall and land-use records.

■ **Farmer-based practices and constraints in natural resource (soil) management and farmers' classification into natural resource management domains.** Important research issues emerged from Sam Fujisaka's initial reconnaissance in 1993. These issues included credit, land tenure, farmers' use of more that one sub-systems, and possible conflicts between native and migrant settlers. The discussion of these issues resulted in the development of the following activities: 1) locating farmers engaged in agricultural activities at representative elevations throughout the watershed; 2) constructing farmer discussion groups composed of members with similar vested interests in farming and conservation, including gender and ethnicity; 3) conducting focus discussion groups with various vested interest groups on issues of soil and water management, including constraints and incentives to the viable management of soil degradation; 4) interviewing key informants on the classification of soils and the farming environment; 5) collecting data from household members across the landscape and cropping systems on farm work and soil management, disaggregated by gender and adult/child; 6) matching indigenous soil classification with cropping history of farmers' parcels; and 7) matching indigenous soil classification with soil sample analysis and the geo-position of the field.

Outcomes

■ Analysis of 20-years of rainfall in the Manupali Watershed indicated that rainfall is **not** decreasing over time. However, the 20-year period was marked by two successive drought years (1991 and 1992).

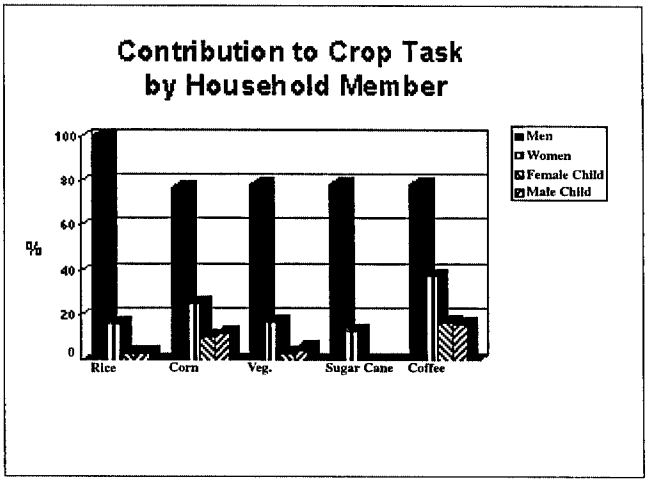
■ About one-fourth to one-third of the service area of ManRIS has been irrigated in the past in either the wet or dry season. There was **no** major reduction in the irrigation capacity of ManRIS.

■ While siltation problems differ between canals, it appears that the siltation problem is increasing overall based on the: total amount of siltation, more widespread siltation during 1993-1995, and because ocular inspection revealed that some canals that were desilted 2-3 months ago have silted up again.

■ Dramatic changes in land use occurred in the Manupali Watershed from 1973-1994.

■ Ethnicity and ethnic conflict: Sample farmers were a mix of native Talaandig and in-migrants, locally known as Dumagats. The majority (62 percent) were in-migrants. From our topic guideline interviews, we found that ethnicity was not a source of conflict among farm families.

■ Household member contributions to agricultural labor: Lantapan census data indicates that 70 percent of households cultivate corn, 15 percent vegetables, 15 percent coffee, 3 percent rice, and 1 percent sugarcane. When contribution of household members to agricultural tasks were investigated, it became clear than adult men are responsible for 80-100 percent of the farming tasks. Women's contributions ranged from 15-40 percent. This is shown by the figure below.



■ Land holdings and tenure: Owner operators held 59 percent of the parcels, followed by rentees at 25 percent, CLT holders and mortgagees at 6 percent each, and tenants at 4 percent. Tenure and soil erosion control measures. Tenure status has a significant effect on a farmer's willingness to invest in erosion control measures.

Potential Benefits

■ These activities provide a fuller understanding of the intricate nature of relationships and the various forces affecting the water resources of the microwatershed. The empirical data enhances the socioeconomic data, which included farmers' perceptions and constraints. Based on the constraints to resource conservation we identified (tenure, land availability, perceived erosion severity, economic constraints, and knowledge opportunities for women), future activities will be more cognizant of the interrelationships of social and biophysical forces. Future opportunities include: 1) modification of tractor technology, 2) farmers' consensus for modification of rental agreements to include soil erosion control incentives, 3) owner's willingness to invest in more long-term erosion control measures, and 4) training of women in erosion control measures.

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Engaging the Whole: Operationalizing the Spread Effect at SANREM CRSP Sites

Rationale and Objectives

In addition to the administrative responsibilities of the Site Coordination Office (SCO), it serves the role of communications node for the host-country for the SANREM CRSP by a) conducting monitoring and evaluation activities; b) facilitating inter-partner information exchange; c) providing program partners with information regarding the global program; d) networking among local non-government organizations, government organizations, and community members; and e) initiating linkages between the SANREM CRSP and other institutions and donors active in that country or region. This role requires enormous creativity and innovative actions in a self described "value added" research. This document describes some of the accomplishments and outcomes of the site coordination offices in the Philippines and Ecuador.

Accomplishments and Outcomes

Philippines

To enhance dialogue among SANREM CRSP researchers and between SANREM CRSP researchers and the community, the SCO launched *Pulong-Pulong sa SANREM CRSP. Pulong-Pulong sa SANREM CRSP* is a quarterly meeting designed to enable project researchers to share research highlights, which include activities, accomplishments, significant findings and process learning.

The first SANREM CRSP Farmers' Field Day was implemented in collaboration with the Araw ng Lantapan (or charter day) celebration. The Farmers' Field Day consisted a SANREM CRSP booth and a site tour to the different experiments/research sites across the watershed. About 70 people, which included educators, Local Government Unit representatives, project staff, farmers, farmer-partners, students, wives, media, and other community residents, participated in the tour. Researchers and farmer partners led project briefings.

PCARRD presented a paper entitled "The Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM CRSP) and Use of Indicators of Sustainability" during the Experts Consultation on National Agricultural Research Systems (NARS) Vision Towards Future Challenges and Opportunities for Sustained and Enhance Productivity and Food Security in the Asia/Pacific Region November 1994 at PCARRD Los Baños, Laguna. Another paper entitled "PCARRD experience in linking with LGUs: Focus on SANREM CRSP Philippines" was presented June, 1995 to the National workshop on strengthening National Agricultural Research and Development Systems (NARDS) and Local Government Unit (LGU) Linkage. Participants included governors, mayors, planning officers, agricultural production technicians, representatives from the Department of Environment and Natural Resources, Department of Science and Technology, state colleges and universities, non-governmental organizations, and private sectors.

A program update was provided to the staff of the Office of Environment of USAID-Manila. A program briefing was also provided to PCARRD's Governing Council, comprised of representatives from national line agencies, the academe, and the business sectors. An initial meeting with the Governance and Local Democracy Project (GOLD) of the Associates in Rural Development, Inc. led to an exchange of experiences on fostering partnerships with the local government unit.

SANREM CRSP Philippines and the Department of Education, Culture and Sports, Province of Bukidnon and District of Lantapan, are working together to implement the Environmental Education project. The program provided technical input towards the creation of the Bukidnon Watershed Protection and Development Council (BWPDC), a multi-sectoral council created in response to the instruction of Philippine President Fidel V. Ramos. Organized at the provincial level, the BWPDC serves as a coordination body which would link research and development-oriented organizations and government line agencies working towards economic sufficiency and sustainability of Bukidnon watersheds. SANREM CRSP's participation in the BWPDC opens opportunities for the program to disseminate information as well as potentially respond to research demands on watershed R & D in the province.

SANREM CRSP Philippines has continued to collaborate with the CPPAP-Mt. Kitanglad Range National Park through information exchange and technical support to the Integrated Protected Areas (IPAS) project. SANREM CRSP is represented in the IPAS project's Technical

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Working Group (TWG), which provides technical assistance to the Protected Areas Management Board's Education and Research Committee. Linkage with provincial government through the Provincial Planning and Development Office has provided opportunities to disseminate information about the program. Linkage with Bukidnon Resources Company Incorporated (BRCI) is facilitated through information exchange between BRCI and SANREM CRSP Philippines projects.

Assistance was provided to the Lantapan Local Government Unit (LGU) in developing a planning grant proposal to SANREM CRSP. This proposal seeks to assist the LGU in coming up with its own Local Development Plan, integrating research outputs generated by our research activities into the comprehensive municipal profile as well as into the LGU research and development programs.

Institutions such as the Farm and Resource Management Institute from the Visayas State College of Agriculture located in Leyte province, the Central Luzon State University located in Nueva Ecija province, and the International Rice Research Institute working on a research project in Myanmar visited the site. Other visitors include an environmental project funded by the Asian Development Bank in Mindoro province and staff from the International Livestock Research Institute. The program will host a one-day field visit by the participants from the Integrated Conservation and Development Project, Training Program (Asia/Pacific) of the World Wide Fund for Nature. SANREM CRSP Philippines will also be showcased at International Congress on Environmental Journalism.

Strengthened collaborative undertakings with the LGUs, leading towards the enhancement of our activities related to information outreach and networking. Collaboration with the Lantapan LGU influenced the organization of a municipal information and education committee, whose mandate is to assist the LGU in addressing the municipality's information and education needs. Comprised of volunteers, Lantapan's Information and Education Committee (IEC) adopted the SCO's brainchild, Kapihan sa Lantapan. Kapihan sa Lantapan is a monthly seminar series fully supported by the LGU. Speakers are invited each month to shed light on various topics identified by IEC members. Kapihan sa Lantapan provides a venue to encourage community members, in particular policy makers, to discuss together topics which are relevant to the community.

The Provincial Planning and Development Office (PPDO) has been instrumental in facilitating SANREM CRSP's participation in provincial level fora and membership in key committees, organized to address the research and development activities of the Bukidnon watershed. The PPDO has opened avenues for SANREM CRSP Philippines to disseminate information pertaining to program activities and initial results to other municipalities. Recently, the PPDO organized a municipal planning coordinators' meeting in which the project on water quality monitoring was invited to present its initial results. Several coordinators expressed interest to monitor water quality at their respective municipalities.

Ecuador

Community members and leaders were integral participants in the "autodiagnistico" and became immediately involved in awareness and practices regarding sustainable agriculture and natural resource management awareness and practices. This activity has led to a sustained dialogue between the community, non-government organizations and researchers. The Site Coordination Office initiated a "priming" activity that involved all research partners to implement community based workshops on animal husbandry and home gardening. Based on their participatory experience with the SANREM CRSP, community members expressed a strong interest in setting this approach as a precedent for other externally funded activities.

A Monitoring, Continuity and Evaluation Group was created for open discussion and as a venue to discuss concerns, methodologies, project outputs, and facilitate logistical support for the accomplishment of activities on a monthly basis. The program partners have clearly articulation of the roles, aptitudes, and types of support from consortium members that will best benefit the program as a whole has been developed.

The Center for Data Conservation has designed a computer system for data management and sharing among program partners. This will allow all program partners to access research data for the SANREM CRSP/Ecuador site.

Cross Site Linkages

The Ecuador site team has established a mutual working relationship between EARTH University in Costa Rica. A representative from CDC facilitated a workshop in which professors and students of EARTH were trained in GIS. During the the most recent strategic planning workshop in the Philippines, the site coordinator from Ecuador was able to participate and share lessons learned.

Site newsletters in the Philippines and Ecuador have been developed to update projects participants on site activities, as well as available project reports and relative resource materials.

Strengthened partnership with the LGU has enabled SANREM CRSP to make incremental leaps from research to natural resource management policy advocacy. Collaboration and continuous dialogue among projects and policy makers is important to effect a link between research and policy. The LGU plans to undertake a review of policies promulgated by the municipal government council on environment and natural resource management. It is envisioned that this activity would help identify areas where SANREM CRSP research findings can be used to enhance current policies as well as provide directions for the creation of new policies which promote sustainable agriculture and natural resource management. The LGU has initiated steps towards revitalizing the barangay research and development committees (RDCs) which would be responsible for identifying barangay R & D needs.

Potential Benefits

The SCOs are in a unique potion to facilitate spread of research outputs through daily access and a greater familiarity within the local context. Linkages with various sectors and institutions has facilitated the spread of SANREM CRSP results and lessons in implementing a participatory, interdisciplinary, intersectoral and landscape approach to research. These linkages offer the possibility for some sectors and institutions to buy into our research programs. Information exchange among SANREM CRSP researchers has provided opportunities for collaboration.

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September 1996
Program Highlights
BF1-1

Building Community Awareness and Participation in Donsin, Burkina Faso

Rationale

To bridge the time gap between introduction into the community and the beginning of implementation, a series of small projects, that directly addresses the concerns and needs of the local community, as articulated in the participatory appraisal, have been carried out.

Objectives

The main objectives of these "priming" activities were :

■ To assist community members to actively participate in the planning and implementation of research activities to be conducted in the context of the SANREM CRSP.

■ To increase awareness and understanding of natural resource management issues among Donsin farmers and motivate farmers to undertake conservation efforts.

Accomplishments

■ **Establishment of Community Advisory Committee**

A Community Advisory Committee (CAC), composed of eight members, representing all sections of the population (including two women) was established. The CAC's main function is to ensure active participation of the population in the research process and research-related activities. Therefore, the CAC meets regularly and deliberates in all decisions pertaining the research, and sends representatives to the National Coordination Committee meetings in Ouagadougou. The CAC is assisted in its functions by a Wisemen Committee, composed of six members, representing all stakeholders in Donsin. In addition to the village-wide CAC, each village quarter ("section") also has its own lower-level committee. All these committees function and intervene as needed in SANREM CRSP activities undertaken at Donsin. whether they involve the entire population or only a segment of it.

■ **The Bosquet de l'Amitié**

Over 600 tree seedlings of local and imported well adapted species were planted over one hectare surface, in a formerly denuded area at the outskirts of the village, which has been cordoned off and established as a demonstration tree nursery or "Bosquet de l'Amitié" ("Friendship Grove") to encourage farmers to combat erosion and deforestation. This will decrease erosion and provide shade for future underplanting. The community actively participated in the project, including one villager who has been trained for management of the nursery. This project was made possible by the collaboration of local- and national-level institutions such as IRBET (Institute for Research in Tropical Biology and Ecology) and the Provincial Service of the Ministry of Environment.

■ **The "Zai" project**

The "zai" method of planting is a labor intensive practice of soil conservation and fertility enhancement whereby seeds and manure are placed in holes before planting, to increase fertility and moisture retention. It is widely practiced in the north part of Burkina Faso where soil erosion and fertility loss are extreme. SANREM CRSP provided support and funds for the training of four blacksmiths from Donsin village at a center located in the northern province of Yatenga, where they learned to make hoes to dig "zai" holes. Much needed equipment, such as wheelbarrows to carry manure to the fields, has also been provided to farmers, who are able to lease the materials for a small fee, which is paid into an account managed by the SANREM CRSP Community Advisory Council.

Actual and Potential Benefits

■ The establishment of local organizational structures has made it possible for community members to learn about and decide on research being carried out in their village. community. This unprecedented opportunity has enabled them to better articulate and incorporate their priorities into research projects, and to better

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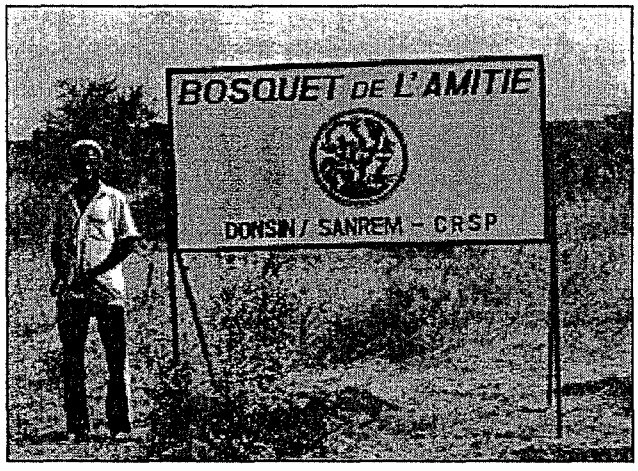
understand what researchers do and what they can expect of them. As a result, researchers are being challenged to keep quality of life issues in the forefront of their agendas and to involve all sectors of the population, including the most marginal groups.

■ Drawing from its experience with the SANREM CRSP process, the CAC has also been successful at negotiating with the SANREM CRSP for additional training activities to address felt needs, such as literacy instruction to enhance the effectiveness of its members, and demonstrations of improved techniques for small livestock production and compost pits building. This will benefit the village as a whole in their future interactions with outside research and development endeavors.

■ The demonstration tree nursery has greatly enhanced local awareness of the relationship between deforestation and soil erosion and committment to sustained conservation efforts. As a result, residents have begun planting trees along paths within the village.

■ The training of the village blacksmiths enabled them to make hoes and sell them to farmers locally, considerably reducing their costs and increasing their availability. Together with the provision of other required equipment, this has contributed to increasing adoption of the "zai" technique which is now practiced by most farmers in Donsin.



A member of the CAC stands by sign at entrance of the Friendship Grove.

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September 1996
Program Highlights
BF2-1

Analysis of Sustainable Livestock Production Systems and Soil Fertility Management in the Donsin Watershed of Central Burkina Faso

Rationale

Livestock is an integrant part of indigenous farming systems in Donsin; livestock health and numbers have been identified as key indicators of the sustainability of natural resource management by the Donsin community. They also plays a central role in the livelihood strategies of farm families; they are the primary source of local cash income. A large herd is also a symbol of status and prestige in the local society. Currently, increasing livestock population is exerting pressure on available land and natural resources, forcing farmers to make critical decisions regarding how much land and resources to allocate to crop and livestock production. The goal of this study is to evaluate the economic impacts of livestock production in terms of food security and soil fertility and to elucidate economic and social trade-offs of fertility management practices and technologies, thereby providing farmers and herders in Donsin with reliable information on which to base their resource allocation decisions.

Objectives

■ Characterize the livestock activities of Donsin with focus on use of communal pastures, crop pastures, and other feeds and on linkages between livestock production and soil fertility recuperation. Evaluate indigenous livestock producation and introduce bush and fallow grazing management strategies.

■ Evaluate alternative least-cost, low risk systems of livestock management, forage production, and manure handling in terms of effects on food supply and income, soil and forest resources, and other community goals.

■ Develop household and aggregate bioeconomic models to evaluate long-term economic and social impacts of nutrient cycling and livestock production on soil fertility enhancement.

Accomplishments

■ Interviews were conducted with four focus groups of livestock producers in Donsin village. These included two groups, one of ten women and one of ten men, from among producers with only small ruminants and two from among producers with cattle. Results were summarized in a report.

■ A survey of all households in the village collected baseline socioeconomic data as well as information about livestock production. The data were analyzed and made available for use by other SANREM CRSP researchers.

■ Plans were prepared for a tracking survey of a selected group of typical Donsin livestock producers.

Outcomes

■ **Characteristics of livestock production.** The focus group interviews revealed clearly the importance of livestock in Donsin. Most households have at least one or two small ruminants. However, only one-half have more than five small ruminants or at least one cow. Only 1 percent have more than twenty head of cattle. Recently, fattening of small ruminants has become a popular and profitable activity, but shortage of capital for purchasing young animals is a major constraint on livestock production. Children provide most of the care of the animals. Local farm families are increasing numbers of livestock that they keep in the Donsin area. In the past, local farmers entrusted much of their livestock to Peulh herders, but the practice has stopped because of concerns about loss of animals during the long transhumant migration. Even for livestock that are kept in the village, losses from stealing and disease or injury are a major problem.

■ **Economic aspects of livestock production.** Livestock sales are the major source of cash income for families in Donsin. This cash in-

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come is used to purchase goods not produced in the village, and to buy supplemental food during the hungry season. Although most of these households have very low incomes and subsist primarily on domestically produced cereals, it is quite common for them to purchase supplemental feeds and veterinary inputs for their livestock. Producers are willing to invest their limited resources for livestock inputs because they expect payback in increased returns from sale of livestock. But scarcity of capital is a major limitation on increasing herds and livestock production. Lack of ready access to an active livestock market is also a problem, although producers were aware of differences in market prices depending on type of animal, season, condition, etc.

■ **Interaction of livestock with natural resources.** Producers are aware of the potential for permanent damage to vegetation and soil from overgrazing. However, the need for increased income from expanded livestock numbers appears to hamper efforts to control the number of animals with access to grazing on common lands and harvested fields. Farmers in Donsin are beginning to take advantage of the soil fertility benefits of livestock manure applied to fields. There are a few farmers experimenting with making compost from animal manure, crop residues, and household waste. Some also confine or herd their livestock so that manure will be dropped on specific fields. However, most livestock are still allowed to wander, therefore causing farmers to lose the benefits of manure.

Potential Benefits

■ Loss of trees and useful plants, degradation of soil, and a chronic problem of drought are seen as threats to quality of life. Increasing populations of both people and livestock are recognized as exerting pressure on resources. But little effort is made to limit livestock numbers to protect resources because livestock remains the main, and in most cases, the only local source of cash available to rural households. When faced with food shortage or other needs, they sell animals to earn money to procure what they need. A better understanding of the economic role of livestock and its potential contribution to sustaining and improving soil fertility and, therefore, food production, will enable the development of improved livestock management practices that are feasible and sustainable in the current economic context wherein Donsin households operate.

Table 1

Distribution of animals in Donsin
(among producers owning each species)

species	*numbers of animals*	*% of producers*
Cattle	1 - 3	53.7
	4 - 10	28.8
n = 554	11 - 20	11.2
	21 - 60	6.3
		(n = 80)
Sheep	1 - 5	48.9
	6 - 10	34.3
n = 862	11 - 24	16.8
		(n = 131)
Goats	1 - 6	52.2
	7 - 10	23.6
n = 1,264	11 - 20	19.9
	21 - 42	4.3
		(n = 161)

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Program Highlights
BF3-1

Conservation and Restoration of Soil Fertility in Cultivated Lands in the Donsin Watershed

Rationale

The soils of Donsin are poor in organic matter and extremely vulnerable to degradation: the condition of the soils is one of the most severe constraints on agricultural productivity. Customary methods of soil restoration, which relied on leaving exhausted land fallow for periods ranging between ten and thirty years, are no longer feasible because cultivation is expanding into all available arable land, to meet the food needs of a growing population.

Increasing pressure from increasing livestock populations also limit the extent to which crop residues can be recycled into the soil, as they are mostly consumed by animals during the dry season, when forage becomes scarce. Livestock husbandry plays a very important role in household economy as the most common, locally available source of cash income, and can also serve soil conservation efforts by providing manure to improve fertility.

There is a need for identifying feasible strategies to maintain soil fertility by introduction of composting techniques and soil-improving crops that can contribute to increasing soil productivity, while also addressing the growing food needs of the local population on a sustainable basis.

Objectives

■ To evaluate local strategies of crop management and crop residue utilization in terms of their effect on soil fertility and nutrient recycling.

■ To evaluate soil and crop responses to improved strategies, including the effect of "zai" on soil fertility and biodiversity restoration.

■ To assess economic feasibility of strategies and demonstrate those that deemed economically feasible and effective in conserving and improving natural resources.

Accomplishments

■ Meetings have been held at Donsin for researchers and villagers to discuss the project objectives and reciprocal expectations: the latter requested SANREM CRSP's assistance in building appropriate compost pits and in developing a research protocol for testing the effectiveness of various types. Participants for this project have been designated and preparations made by the community.

■ Tests on the residual effect of "zai" practices are being conducted in Gampela (originally planned for Donsin, but heavy rainfall hindered access to the site). A fifth-year student from IDR has been chosen to assist researchers in following up the tests, which will provide core data for his thesis. He is expected to complete also a monograph on local agricultural systems.

■ An in-depth survey has been planned on the local systems of plant production, fallow fields management and the related constraints. A preliminary assessment of leguminous crops that are well suited to local conditions in Donsin has been performed, and seeds have been multiplied and distributed to participating farmers.

■ A slide presentation has been conducted in Donsin to illustrate the process of soil degradation and improved techniques for soil conservation and biodiversity restoration and maintenance, generating animated discussion among local farmers, who requested that the program be repeated at a later date to better absorb the material and continue the discussion.

Potential Benefits

■ The village meetings have succeeded in establishing a base of mutual trust and understanding between researchers and farmers that will enable researchers to become better acquainted with farmers' constraints and priorities, and farmers to appreciate the benefits and limitations of research. This better under-

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standing equips them with skills to be assertive and proactive participants in future on-farm research endeavors conducted in their village.

■ The on-farm trials and planned survey will provide a database for better understanding conditions and constraints farmers operate under, and to develop feasible strategies to improve soil fertility and crop productivity.

■ The involvement of a university student in the farm trials provides an example of how local capacity is enhanced by the opportunity to gain experience in hands-on research and interdisciplinary collaboration.

■ The slide presentation and ensuing discussion enhanced farmers' comprehension of the existing interactions between various natural resources in the ecosystem, their awareness of the negative consequences of soil degradation, and their understanding of various practices of soil and biodiversity conservation and restoration.

Sorghum grown using the traditional "zai" method.

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Program Highlights
BF4-1

Process And Impact Of Natural Resource Management On The Quality Of Life In Donsin, Burkina Faso

Rationale

■ To better understand the interrelationship between health and nutrition of the people of the Donsin watershed and natural resource management.

■ To more directly link activities geared towards sustainable agriculture and natural resource management to sustainable health and nutrition of the residents of the watershed.

Objectives

■ Determine and monitor the health and nutritional status of inhabitants of the watershed.

■ Determine the nature of food deficits and ill health among users in the watershed.

■ Determine the links between user's workload and their health and nutritional status.

■ Evaluate the causes and processes that contribute to the annual "hungry and illness period" and chronic undernutrition experienced by users in the watershed.

■ Develop programs and/or strategies which will address and/or mitigate the annual "hungry and illness period" and chronic undernutrition among users in the watershed.

■ Develop a household vulnerability model which will be used as a tool by policy makers and watershed residents in making timely decisions to prevent acute food shortages and malnutrition in the watershed and/or individual households.

Accomplishments

■ Watershed wide thematic PLLA and nutritional survey held to determine the nature of food deficits, ill health, and nutritional status of the population.

■ Thematic PLLA report completed and preliminary analysis of anthropometric data begun.

■ Five Burkinabe trained in anthropometric and dietary survey techniques.

■ Dietary intake of 120 households measured.

■ Frequency of food consumption documented for 120 children.

■ 104 adult males between the ages of 15 and 47 measured and their nutritional status determined.

■ 120 adult females between the ages of 15 and 47 measured and their nutritional status determined.

■ 59 male children between the ages of 6 and 72 months measured and nutritional status determined.

■ 61 female children between the ages of 6 and 72 months measured and nutritional status determined.

Outcomes

■ Hunger is chronic and residents of the watershed experience it every year. It is caused by insufficient food production due to low rainfall, high physical demands of agricultural labor which are contributing factors to health and nutrition.

■ The provision of food to the family in these times is the responsibility of all family members. Men and women work independently but complimentary to keep the family fed.

■ Disinvestment of family assets, primarily livestock sales, is a major means of generating cash to meet the chronic food shortages.

■ Coping mechanisms were found at the level of gender and community. They wanted varied to the extent that they affected livelihoods, potential for future incomes, and ability to recover from food shortages.

1. gathering forest products, borrowing money, borrowing food, living with parents or friends, eating leaves and grass, selling prepared food stuffs, selling shea nuts and nere, working for food;

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2. community cereal bank, cooperative cultivation of additional fields;

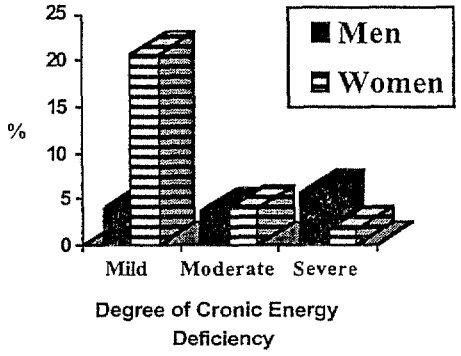
3. premature harvest of crops, out-migration for wage employment;

■ The community in the watershed is highly food insecure: people are affected in all three major dimensions of food insecurity: food availability, food access, and food utilization.

The Nutritional Status of Adults and Children

■ The body mass index (Wt/Ht), presented in the figure below is used as an indicator of chronic energy deficiency in adults, which is defined as a condition where they are in energy balance, but at a cost in terms of their functions being impaired, or their health being at risk.

Nutritional Status of the Adult Population - Body Mass Index



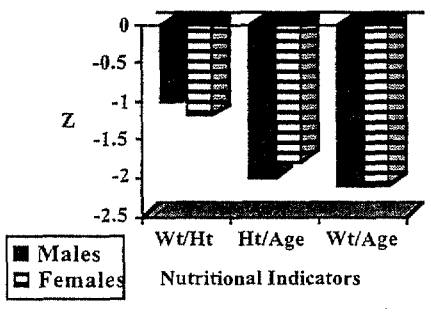
■ About one fourth of the adult population in the Donsin watershed is experiencing chronic energy deficiency.

■ Anthropometric data collected in August 1995, at the peak of the hungry season, were compared with NCHS/WHO international standards of "normal" growth.

■ Z-scores are a way to measure nutritional status in comparison with a reference population. Wt/Ht Z-scores indicate the degree of acute malnutrition (wasting); Ht/Age indicate the degree of chronic malnutrition (stunting); and Wt/Age scores indicate the degree of acute/chronic malnutrition.

Over 44% of the children in the watershed suffer from chronic malnutrition, and 29% are experiencing acute malnutrition.

Mean Z-Scores of Children Average Age 39.2 Months



Potential Benefits

The understanding of the determinants and the effects of an unstable, low quality and quantity food supply is the first step towards developing some action programs and policies to address the food situation in the region. With only a very small fraction of the study completed, we have moved in the following manner towards achieving the goal. We now have:

■ A trained cadre of NGOs and residents of the watershed on the collection and monitoring of the food/nutrition and health situation of the population.

■ A citizenry better informed about the causes of the annual hunger and illness periods and chronic undernutrition, and their relationship to the natural resource management in their watershed.

■ The researchers now have a better understanding of the complex relationship between environment imbalance, agriculture productivity, and human nutrition and health.

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Program Highlights
BF5-1

Training in Holistic Management Decision-Making, Burkina Faso

Rationale

This project was an introductory activity designed to assist the community of Donsin in becoming actively engaged in decision-making processes related to the SANREM CRSP research program being implemented in their watershed. The Holistic Management approach provides individuals, groups, and communities with a systematic method to make decisions in ways that focus their energies and resources on achieving a long-term goal rather than striving to address and resolve short-term problems. This vision is defined in human, economic, and environmental terms. The process enables community members to select the best available means whereby they can achieve a collectively defined goal and then monitor the effects of such choices to ensure they are proceeding towards it.

Objectives

■ To train local facilitators to work in Donsin and the surrounding areas in assisting community members to learn the Holistic Management approach to goal-setting and collective decision-making.

■ To provide a viable methodology for introducing community priorities and concerns in decision-making related to the SANREM CRSP program and other research and development programs that may seek to operate in the area.

Accomplishments

■ Conducted four, ten-day long learning sessions for six potential Holistic Management facilitators who were selected from among field staff of local development and research institutions who are working in Donsin and the surrounding area.

■ Facilitated two community-wide learning sessions in Donsin to introduce the principles of Holistic Management to villagers.

■ Developed a strategy for Phase II to ensure continued learning by the trainees and the application of such learnings in facilitating collective decision-making according to the Holistic Management approach in Donsin.

■ Planned for the development of culturally-appropriate training materials for use by facilitators during training sessions and community mobilization in Donsin as well as in other areas of Burkina Faso.

Outcomes

■ A growing awareness by facilitators and community members of the need to work towards a collectively-defined, long-term vision rather than concentrating energy and resources on short-term problems or symptomatic manifestations of ecological and/or social imbalances.

■ A shift among HR facilitators in their conceptualization of development from an influx of money, tools, and expertise from outside to an active and collective process of engaging all locally available skills and resources towards a common goal that encompasses the welfare of all social groups as well as the sustainability of the local environment.

■ The constitution of a local Holistic Management association was initiated by the trainees themselves to continue support of one another, as well as to reduce their dependence on outside resources in applying the learned methods and skills in their work at the community level.

■ A one-day meeting between HM facilitators and Burkinabè researchers to discuss the principles and methods of Holistic Management and to explore ways of applying them to enhance community participation in and the local relevance of their research projects.

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■ The HM facilitators and trainers assisted the community of Donsin in articulating a collective development goal:

We people from Donsin are for a welfare characterized by food security and water and health resources; methods that help us to conduct various activities such as literacy, trade, health care, religious practices, and solidarity; and any positive actions which could help the village to be respected and keep young people away from exodus.

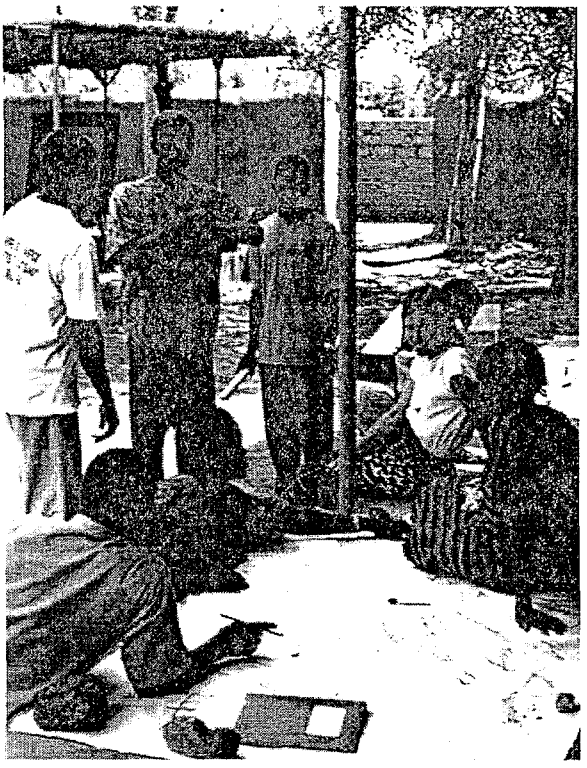
Potential Benefits

■ If the learning is sustained, all social groups in the Donsin community will be in a better position to contribute towards decisions on how and what outside research and expertise they need to assist them in realizing a collectively-defined community of environmental well-being.

■ By training local facilitators and providing community members with a systematic method to ensure their active participation in research and development efforts in Donsin and in the surrounding areas, the project will increase their relevance, effectiveness, and sustainability.

■ The HM facilitators will be able to share their learning with other field workers and provide assistance in training others and in the use of training materials among their own and other institutions and organizations involved in research and development.

■ The newly-established HM association will provide a network that can be used by the Donsin community to extend learnings from this project as well as from all research conducted in the watershed by the SANREM CRSP program to neighboring areas.



Trainers and Trainees work together in composing a map of the resource base of the Donsin Watershed.

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BF6-1

Indigenous Knowledge Systems in Inter-Ethnic Research and Training Programs: Mossi and Fulani Knowledge of Ethnoveterinary Medicine and The Role of Livestock in Nutrient Management. Donsin, Burkina Faso.

Objectives

■ Document Mossi and Fulani indigenous knowledge systems relative to ethnoveterinary medicine and soil nutrient management.

■ Develop appropriate methodologies for conducting cross-ethnic participatory research and training; develop a curriculum that integrates indigenous knowledge relative to ethnoveterinary medicine and soil nutrient management.

■ Examine the impact of agroecological and socioeconomic change on indigenous knowledge systems and predict future developments and implications for indigenous knowledge.

■ Establish a mechanism for using indigenous knowledge systems to set priorities and guide the agenda in research on natural resource management.

Accomplishments

■ A training workshop was carried out in December 1995 for a total of twelve participants, including the work plan team and project collaborators, to develop appropriate methods for data collection, organization, and analysis and to launch field work activities.

■ Identification of appropriate sites, based on semi-structured interviews. Three villages, surrounding the Donsin site, were selected: Guemesgo, Rouangtenga and Guebadin. Research is being conducted on both ethnoveterinary medicine and soil nutrient management in Donsin and Guemesgo, while ethnoveterinary medicine is the focus in Rouangtenga and Guebadin, which are mainly inhabited by Fulani herders.

■ Mossi and Fulani indigenous specialists in ethnoveterinary medicine and soil nutrient management were identified in Donsin and Guemesgo using semi-structured interviews. A village map, historical profile, land use and resource matrixes, and Venn diagram were developed in Guemesgo by the team using rapid rural appraisal techniques. Feces and blood samples were collected for diagnosis and epidemiology of animal diseases in the Donsin watershed.

■ A workshop was carried out by Lin Compton and Jess Reed in April 1996 to assess the status of the research and provide further training on data analysis. The training focused on the iterative process of data collection, transcription/translation, structural analysis, and graphic presentation of analytical results.

■ Research assistant Craig Castro documented the process of interdisciplinary research through participant observation and interviews with team members concerning their perspectives and experience with interdisciplinary research and the methodology they used to document the indigenous knowledge of Mossi and Fulani in the Donsin watershed.

Outcomes

■ **Research**

A report synthesizes information on the physical environment and social organization of the villages in question. The information was obtained through rapid rural appraisal methodologies, including village maps and Venn diagram. A selection process based on semi-structured interviews identified samples of twenty ethnoveterinary medicine specialists in Donsin, Guebadin, Guemesgo, and Rouangtenga and twenty-three soil nutrient management specialists in Donsin.

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■ **Training**

During the December training, two questionnaires were developed that focus on ethnoveterinary medicine and soil nutrient management respectively, both of which include a first part on descriptive and demographic data and a second part on indigenous knowledge. During the April training, appropriate methodologies for eliciting and analyzing indigenous knowledge were developed and tested and are being used by the research team.

■ **Process**

A critical assessment of the process of interdisciplinary research and participatory interaction between researchers and farmers surrounding the elicitation of indigenous knowledge systems shows how such an approach contributed to a better understanding of indigenous knowledge and of the context of daily life of farmers and herders in the Donsin watershed.

■ The approach used by the field team facilitated farmers' participation in the research process. Conducting interviews in the informants' compounds was especially effective in establishing a good rapport and enabling contextual observations. However, there is still a need to develop appropriate techniques that bridge the worldviews and concerns of scientists and farmers so that they can better communicate and collaborate with each others.

Potential Benefits

■ The trainings enabled a better understanding and appreciation for the important role of indigenous knowledge in addressing animal health problems and soil management and in developing culturally appropriate methodologies for documentation and analysis of indigenous knowledge.

■ The analysis of the research process identified strengths and weaknesses of interdisciplinary and participatory approaches which are being used in efforts to improve communication between researchers and farmers and the program's ability to respond to farmer concerns and priorities.

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Participatory Production Of Visual Media For Environmental Conservation

Rationale

Enhancing awareness of and diffusing information on environmental sustainability issues is a key component of the SANREM CRSP mandate. This mandate entails the formulation of a communication strategy that hinges on the cornerstones of collaboration and participation to ensure that the information generated and disseminated represents and addresses the concerns of end-users as well as those of scientists, development workers, and policy makers. The proposed methodology centers around the use of photography as a tool to elicit and exchange information on practices and problems of natural resource management among farmers of Burkina Faso. Participants were given one disposable camera each to take photographs, focusing on one or more of five jointly defined thematic areas (soil fertility, water resources, biodiversity, livestock management, human health and nutrition).

This project draws inspiration from experimental work by visual anthropologists and development media specialists that directly involves minorities and marginal populations in producing images of themselves and their own social and physical landscapes. Placing cameras in the control of indigenous people, for them to render their own representations rather than to serve as photographic subjects, contributes to demystifying a typically foreign technology, while challenging the power it embodies when encountered as the prerogative of privileged outsiders. The quality of permanence that visual media endows also contributes to validating indigenous viewpoints, counteracting the tendency of conventional research and travel photography to undermine them.

Objectives

- To determine the technical feasibility and sociocultural appropriateness of photography as a research and communication tool among Burkina Faso farmers.
- To identify priority concerns and visual indicators relative to environmental sustainability to guide implementation and assess progress of research projects.
- To explore possible applications of farmer-produced visual media for environmental education within and across SANREM CRSP sites and the U.S.
- To pursue support of and opportunities to expand SANREM CRSP activities centering around indigenous production of visual media to promote sustainability.

Accomplishments

- A training for eighteen participants, representing all sections of the community, was held and included: a) gender-based focus groups to fine-tune key issues to be addressed by the photographic exercise; b) ranking exercises to elicit indigenous criteria of visual appreciation; and c) hands-on instruction in photographic technique.
- A community photo album was collectively compiled from a selection of photographs and commentaries by the participants to be used in illustrating problems and practices of natural resource management to visiting researchers, development planners, policy makers, government officials, etc.
- Photo-elicitation interviews with twelve of the project participants, were conducted and yielded six hours of recorded narratives describing agricultural practices, environmental sustainability, and household livelihood strategies. The materials are being analyzed using a mix of social science and visual art techniques.
- Exploratory interviews were held with representatives of development agencies, agricultural extension, and educational institutions to discuss possible applications of visual media for purposes of environmental education among farmers, students, and the general public at the site and in the U.S.
- A report/manual detailing the process of implementation of and participation in the project, outlining thirty-five lessons learned, and including a comprehensive list of references on indigenous visual media production, was written, translated into French, and distributed to relevant agencies.

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■ Two papers on the project were presented at panels on Visual Anthropology and Participatory Methodologies at the 1996 Meetings of the Society for Applied Anthropology (Baltimore, March 26-30, 1996) and will be featured in the Spring 1997 issue of the SfAA's journal, *Practicing Anthropology*.

■ A presentation on the methodology, and its potential applications to the identification of indigenous indicators, was made at a workshop on Indicators of Sustainability, in Ouagadougou, Burkina Faso on May 23-24, 1996.

■ A presentation on research results and a training in photo-elicitation and content analysis methods have been solicited and accepted for a conference on Creativity and Innovation at the Grassroots, Indian Institute of Management, Ahmedabad, India, January 11-14, 1997.

■ A dossier, comprised of a selection of photographs by the farmers, information about the project, and examples of corporate sponsorship in science education, was produced and circulated to solicit support for future initiatives of indigenous visual media production.

Outcomes

■ Project results show that the methodology can provide an invaluable research tool for exploring ethnoecological and ethnohistorical domains of local knowledge as well as an innovative heuristic device for identifying and incorporating indigenous indicators of sustainability and/or quality of life into the assessment of technological innovations and development interventions.

■ Content analysis of the visual material revealed that, while farming still constitutes the main source of livelihood, soil degradation remains the gravest concern for both men and women. Deforestation, and in particular the disappearance of tree species that are useful for medicinal or nutritional purposes, is also a serious concern for both genders. Other issues receive emphasis according to how they come to play in the sexual division of labor, with women, especially, stressing water availability and family nutrition and well-being.

■ Natural discourse analysis of narratives elicited by the photographs shows that visual representations are produced not only to "document/illustrate," but most significantly to "evoke/recall" a story or situation, and/or to express a "judgment/feeling" about actions or conditions. "Contexualization" (the ability to identify details in the image and connect them to the social and spacial world of the viewer) emerged as the most salient criteria of appreciation of the visual medium.

■ Contextual elements can be retrieved only from the narratives surrounding the visual data, which suggests that, where oral/aural modes of representation prevail, as they do among West African societies, meaning emanates from the meeting of word and image rather than from isolated images. Insight must be taken into account in the application of visual media to communication among non-literate rural societies.

Potential Benefits

■ By providing farmers with an avenue for critical reflection and creative expression of their concerns and priorities relative to natural resource management, the project enhances environmental awareness and promotes conservation efforts in the community.

■ By providing scientists with an effective tool to elicit indigenous viewpoints, the project enables them to better integrate these viewpoints into their research agenda and to direct their efforts towards developing more appropriate and feasible technologies.

■ By generating visual and narrative elements to be used in developing culturally-appropriate communication materials, the project enhances the effectiveness of outreach efforts to promote sustainable natural resource management practices among farmers in Burkina Faso and other sites.

■ By pursuing support and opportunities to produce and utilize indigenous visual media for environmental education, the project contributes to improving the quality of science education in schools at the site and in the U.S. and increasing interest in and commitment to environmental conservation among the youth and the public at large.

Outputs

Roncoli, C. and M. Sendze. Visions from the Margins: Indigenous Visual Media Production for Environmental Conservation. A paper prepared for a Conference on Creativity and Innovation at the Grassroots, Indian Institute of Management, Ahmedabad, India, January 11-14, 1997.

Roncoli, C. and M. Sendze. Visions and Voices of Donsin: How Farmers of Burkina Faso Do and Deal with Photography. Paper presented at the Annual Meetings of the Society for Applied Anthropology, Baltimore, March. 27-30, 1996 (in press, *Practicing Anthropology*, Spring 1997).

Sendze, M. and C. Roncoli. Sights and Sounds of Sustainability: Participatory Production of Visual Media for Environmental Conservation. Paper presented at the Annual Meetings of the Society for Applied Anthropology, Baltimore, March. 27-30, 1996.

Roncoli, C. and M. Sendze. Pictures Where People Matter. A Report/Manual on the Use of Photography as a Tool in Farmer-Centered Participatory Research and Information Exchange: Lessons from the Field, Donsin Village, Namantenga Province, Burkina Faso. SANREM CRSP, December 1995.

The Donsin Community, with P. Bandre, S. Boena, Z. Derme, C. Roncoli, and M. Sendze. Notre Environment en Images (Our Environment through Images: a Community Photo Album). Donsin, Burkina Faso, June 1995.

Roncoli, C. and M. Sendze. Our World, Ourselves. A photographic essay by the farmers of Donsin, Burkina Faso. SANREM CRSP, June 1995.

Roncoli, C. and M. Sendze. Our Story. A photographic essay on a training session with the farmers of Donsin, Burkina Faso. SANREM CRSP, June 1995.

Roncoli, C. and M. Sendze. A Proposal for Corporate Sponsors. SANREM CRSP, August 1995.

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BF8-1

A Planning Grant For Gender Training And Research Development, Burkina Faso

Rationale

The goal of this work plan is to assist scientists involved in SANREM CRSP, Burkina Faso, in becoming more aware, sensitive and competent in addressing the needs of the different people in the community of Donsin.

Objectives

- Provide training in gender analysis to SANREM CRSP researchers who are implementing research projects in Donsin, Burkina Faso.
- Plan and implement a training workshop in gender analysis for U.S.-based and Burkinabè researchers in Burkina Faso.
- Develop training materials in support of the training workshop.
- Develop a long term strategy for gender analysis research activities in Burkina Faso.
- Establish an Working Group of researchers interested in Burkina Faso to discuss issues and formulate recommendations for a long term strategy for gender related research in the country.
- Build an interdisciplinary, interinstitutional, and gender diverse team to develop a work plan and implement a long term research activity in the Burkina Faso site.

Accomplishments

- A training manual was developed to facilitate the integration of gender issues into the research program. The manual includes a trainer's guide that explains how to use it in the course of training sessions. It includes a set of interactive exercises to facilitate the understanding of gender issues in general, and in particular those relevant to the SANREM CRSP research in the Donsin watershed.
- The training manual served as the support materials for the development of a workshop on "Gender Integration and Social Stratification" held in Ouagadougou, on October 11-13, 1995 and attended by about fifty participants. As a result participation in the planning and implementation of this workshop, five Burkinabè and two Americans were trained as trainers; forty-four researchers, three Americans and thirty-eight Burkinabè; and six Donsin farmers representing nineteen research and development institutions were trained on gender analysis and social stratification.
- The implementation of the workshop actively engaged a variety of local resources, which facilitated in the demonstration and adaptation of innovative methodologies that will aid the understanding of local complexities and inferences of gender and social stratification relevant to the research issues. As a results, the ten research projects currently under implementation in Donsin watershed have revised research methodologies and instruments to incorporate gender and social class related variability that may affect the issues and processes under investigation.
- An interdisciplinary, interinstitutional team was formed to determine the strategy for continued monitoring and evaluation of the integration of gender and social class issues.

Outcome

- The workshop evaluation indicated that the program was well received by the participants and that the methodological tools presented were useful in integrating gender issues into their research projects. As a result, U.S.-based and Burkinabè researchers have a better understanding of the issues and the importance of gender and social stratification in their research.

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■ Key materials on gender and social stratification were translated into Moré and was made available to the community. Based on the workshop evaluation, and as a results of their participation in the workshop, members of the Donsin community (especially the men) reported to have gained a greater awareness of the need to ensure adequate representation of all social classes and genders in village development meetings.

■ A new research project plan will be developed during Phase II of the SANREM CRSP program to assess the effectiveness of the integration of gender and social stratification variables into the research, and the impact of this emphasis on research outcomes and sustainability.

Potential Benefits

The approach used in the training on gender integration and social stratification appears to be highly transferable across sites. It clearly reflects the SANREM CRSP participatory thrust, enabling researchers, teachers, the community, and other institutions involved to better understand the social heterogeneity and gender-related issues that exit in the communities where they work.

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BF9-1

Indicators of Sustainability: Activities in Burkina Faso

Objectives

■ The overall objectives of this planning grant was to organize a planning workshop on indicators of sustainability in Ouagadougou to meet specific objectives as follows:

■ Assist SANREM CRSP researchers and the Donsin community in developing a common understanding of a conceptual framework for studying changes in sustainability

■ Identify a narrow list of indicators of sustainability most relevant to the Donsin watershed

■ Establish appropriate measurable parameters for the narrow list of identified indicators

■ Develop a practical strategy for implementing participatory research on indicators of sustainability at the site and select a working group on indicators of sustainability to implement the agreed strategy

Accomplishments

■ A conceptual framework focused on the quality of life, consistent with the global SANREM CRSP research, and the pressure-state-response model were identified as useful for generating testable hypotheses concerning changes in sustainability. Critical interacting system components are ecosystems integrity, water quality and quantity, management of landscape and lifescape.

■ Development of measurable parameters for the narrow list of indicators of sustainability by workshop participants with a focus on their relevance and usefulness in monitoring changes in ecosystem sustainability at Donsin.

■ As site working group on indicators of sustainability, with a clear strategy and a time table for integrating indicators work into the approved work plans, has been selected.

■ Leadership within the working group, allocation of responsibility, and coordination with the global SANREM CRSP Indicators of Sustainability working group have been established. It is intended to build on this momentum in work plan implementation.

Outcomes

■ Training of 65+ community leaders, NGO, extension, outreach staff, and researchers in partner institutions in indicators of sustainability research tools.

■ A workshop report entitled "Indicators of Sustainability Planning Workshop," May 23-24, 1996, Ouagadougou, Burkina Faso, A SANREM CRSP Report.

■ A focused policy concept paper for USAID Washington Africa Bureau, Office of Agriculture, entitled "Durability Et Quality De Vie a Donsin-Plan Strategic Pour un Programme de Recherches Integre Sur Les Indicateurs De Durability," May 23, 24, 1996, Ouagadougou, Burkina Faso.

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BF10-1

Traditional Small Ruminant Husbandry in the Donsin Watershed: Productivity and Environmental Impacts

Objectives

■ To improve the contribution of natural pastures to animal feeding.

■ To identify existing pasture types and monitor animal behavior in the pasture.

■ To improve the productivity of small ruminants.

■ To study current strategies of pasture management and of small ruminant husbandry, particularly feeding practices.

■ To identify the conditions of access to animal husbandry by marginalized groups.

■ To predict potential sociological changes of proposed improved practices.

Accomplishments

■ **Data collection and analysis.**
The following activities have been completed and preliminary findings are available: survey of pasture composition and productivity; characterization of natural vegetation species for each soil type; mapping of soil and pasture types prevalent in the watershed; evaluation of crop residues production and storage; collection and analysis of rainfall information relative to the area; identification of potential strategies for improving livestock husbandry; and socioeconomic characterization of households (based on indicators and causes of poverty).

■ **Training activities.**
Research team members participated as trainers and/or resource persons in SANREM CRSP workshops and contributed to the production of materials and documents before or after these events. For instance, a paper entitled "Complexity of the Concept of Sustainability and of Potential Indicators Relative to Livestock Management" was presented during the workshop on Indicators of Sustainability held in Ouagadougou May 23-24, 1996.

■ **Collaborative linkages.**
A strong emphasis on building institutional capacity and links brought together researchers from four Burkinabé institutions (IDR, INERA, IRBET, and the Ministry of Social Affairs), two U.S.-based institutions (Tuskegee University and Heifer Project International), and the Cameroonian branch of HPI. As an outcome of this collaboration, a representative of the Ministry of Social Affairs will visit HPI/Cameroon to learn about its approach to integrating livestock husbandry into household livelihood strategies.

Outcomes

Research findings refer to the climatic conditions and to forage production in natural pastures and crop fields. A preliminary analysis suggests potential strategies for increasing animal productivity during each season and for each animal group, which will be tested in collaboration with farmers to evaluate their potential impacts.

■ **Rainfall patterns.**
In the area around Boulsa, rainfall varies from about 500mm/year to about 1150 mm per year, and does not always reflect the same overall pattern for the entire country.

Lowest annual rainfalls were observed in 1971 (ca 500 mm), 1985 (less than 500 mm) and 1990 (less then 500 mm); these numbers differ from the rest of the country, where drought years are known to have been 1973 and 1984.

Highest rainfalls in Boulsa were observed in 1964 (greater then 1100 mm) and 1994 (greater than 1000 mm). Maximum daily rainfall varies between 50 mm recorded in 1966 to about 110 mm in 1959.

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Table 1. Dominant plant species in different soil types

Soil/Pasture type	Species	Presence (%)
Low land	*Panicum granularis*	13.5
	Paspalum orbiculare	10.1
	Acroceras amplectens	9.9
	Echinachloa colona	8.7
	Setaria palide-fusca	7.1
	Andropogon fastigiatus	7.1
	Brachiaria jubata	6.4
	Alysicarpus glumaceus	5.4
Sandy-rocky to sandy-clay	*Adropogon fastigiatus*	36.1
	Pennicetum pedicellatum	27.1
	Loudetia togoensis	19.6
	Andropogon foveolatus	4.7
Rock-ferruginous to sandy-clay	*Andropogon fastigiatus*	17.5
	Schoenefeldia gacilis	10.8
	Setaria palide-fusca	10.2
	Tripogon minimus	10.2
	Zornia glochidiata	8.5
	Digitaria longiflora	8.0
	Alysicarpus ovalifolius	6.8
	Schizachyrium exile	5.3
Rocky	*Chloris inule I**	35.2
	Loudetia togoensis	31.2
	Schoeneifeldia gracilis	10.5
	Andropogon fastigiatus	4.0
Hills	*Schizachyrium exile*	
	Andropogon ascinodis	
	Pennisetum pedicellatum	——**
	Andropogon fastiglatus	
	Andropogon foveolatus	

* unidentified
** decreasing presence

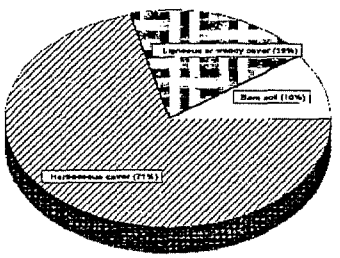

Figure 4a. Soil vegetation cover in low land soils.

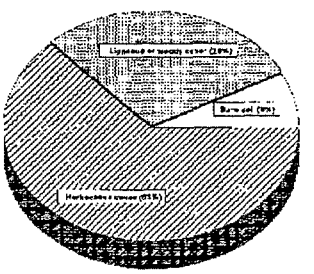

Figure 4c. Soil vegetation cover in rocky-ferruginous to sandy-clay soils.

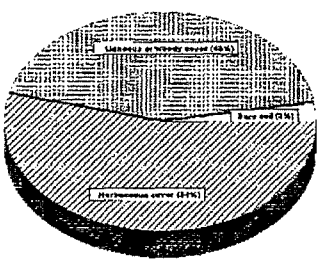

Figure 4b. Soil vegetation cover in sandy-rocky to sandy-clay soils.

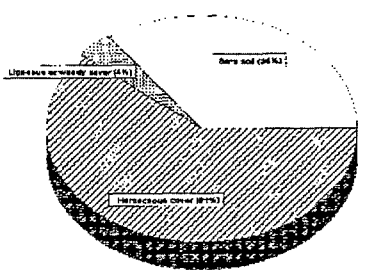

Figure 4d. Soil vegetation cover in rocky soils.

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Water Quality and Environmental Education in the Donsin Watershed, Burkina Faso

Rationale

Shortage of water and water contamination are among the main constraints affecting the wellbeing of farm families in Donsin: decline in water quantity and quality are invariably mentioned by community members in all discussions of environmental trends and development needs. These problems impact most severely those members of households and community that are less privileged and most vulnerable, such as children (who are more at risk of dying from water-born diseases). This project aims at identifying causal factors and effective strategies to improve water resources management in the Donsin watershed. An additional goal is also to assist in the development of an appropriate and feasible plan for environmental education and training centering on water issues in the area.

Objectives

■ to identify agricultural and social practices which adversely impact surface and ground water and the quality of water used for drinking and other uses within the household.

■ to estimate relative costs and benefits of water contamination to the extent possible by source of water contaminants and/or water use practices.

■ to develop a set of biophysical water quality indicators which will allow for water quality monitoring by the community.

■ to develop sustainable practices which could be used to prevent water quality deterioration in the Donsin watershed.

■ to assist in developing a research project on water quality monitoring and environmental education to be implemented in Donsin.

Accomplishments

■ Inventories of major water sources (surface and groundwater) used by the community for drinking and for farming, including drilled and dug wells, were completed at the end of the 1995 rainy season.

■ Samples of groundwater wells and shallow dug wells were taken in October 1995 and analyzed: nitrates, lead, and selected pesticide contamination were tested.

■ Water samples were collected at the beginning and end of the 1995-1996 dry season, and sampled analyzed for nitrate, lead, and pesticides, in addition to inorganic and bacteriological analysis. Water samples were again collected in July 1996.

■ Visits were conducted at facilities dealing with water issues and at government and development agencies at both national and provincial levels to refine an environmental education strategy centered on water resource management.

■ Hydrological and topographic information materials (maps and reports) were collected and utilized to guide a physical survey of the Donsin watershed to assess state of soil and vegetation in relation to water resources.

■ A focus group with community members (12 men and 2 women) was conducted to discuss water related issues and evaluate community needs and priorities.

■ A poster on water-borne diseases has been developed for a Forum of Scientific Research and Technological Innovation held in Ouagadougou.

Outcomes

■ Results from groundwater testing suggest that nitrates are entering the ground water from anthropogenic sources: investigations are concentrating on causal factors to trace the

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practices leading to the increase in nitrate. Results from analysis of surface water testing suggest presence of fecal material: this points to the needs for hygiene education in the village.

■ The watershed survey revealed that the watershed covered a much larger surface area than previously determined in the PLLA, resulting in the recommendation that, for purposes of water resource management, the watershed be divided into three or four sub-sections.

■ The field assessment identified relevant indigenous knowledge and practices concerning water that should be integrated or targetted by environmental education and hygiene promotion, and the important role women and children play in water resource management.

■ Reconnaissance interviews with representatives of government institutions and development agencies highlighted information needs and priorities for the application of research findings to the development of appropriate water resource management and environmental education strategies to be implemented in the watershed.

Potential Benefits

Research results will enable to identify indicators of water quality that can be utilized by local households and to assess causal links in the epidemiology of water-borne diseases that can be removed by appropriate interventions and educational strategies aimed at modifying water related behavior.

Table 1. Chemical and Microbiological Analysis from Dug Wells and Ponds.

Parameter/Code	GIPM	BdM	BdPM	BdPT1	BdPT2	BdPT3	BdPT4	BdPT5	LM	Norm
Temperature (°C)	31.3	34.6	28.3	27.9	28.2	28.8	28.6	29.9	32.1	25.0
pH	8.1	8.4	7.7	7.6	7.7	7.0	6.8	6.9	7.5	6.5-8.5
Conductivity at 25°C (µm)	460.0	75.1	246.0	227.0	164.0	121.7	90.1	44.0	78.3	1100.0
Turbidity (FTU)	4.0	HG	0.0	0.0	0.0	0.0	HG	HG	HG	5.0
Alkalinity (°F)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Carbonates (mg/L CO_3^{2-})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Total Alkalinity (°F)	21.5	1.6	10.3	9.0	8.1	3.2	3.6	1.0	3.4	-
Bicarbonates (mg/L)	262.3	19.5	125.7	109.8	98.8	39.0	43.9	12.2	41.5	-
Carbon Dioxide (mg/L CO_2)	3.7	«1.0	4.1	4.9	3.2	7.0	12.0	2.8	2.2	-
Total Hardness (°F)	18.8	2.2	9.0	8.6	6.8	3.2	5.2	1.6	3.2	-
Calcium (mg/L Ca^{2+})	57.6	5.6	29.6	30.4	24.0	9.6	17.6	4.0	6.0	75.0
Magnesium (mg/L Mg^{2+})	10.6	1.9	3.9	2.4	1.9	1.9	1.9	1.5	3.9	50.0
Total Iron (mg/L Fe)	0.1	8.5	1.8	0.3	0.3	2.3	0.5	7.1	21.6	0.3
Manganese (mg/L Mn)	0.3	0.0	0.2	0.0	0.2	0.1	0.3	1.5	0.0	0.1
Sodium (mg/L Na)	16.7	2.4	5.8	6.2	6.6	5.4	4.6	47.1	1.2	150.0
Potassium (mg/L K)	4.0	6.0	6.0	5.5	5.0	5.5	3.5	127.0	5.0	12.0
Ammonium (mg/L NH_3)	2.5	4.7	1.7	0.2	0.2	2.5	0.1	7.4	5.1	0.5
Nitrite (mg NO_2-)	0.4	0.0	0.1	0.1	0.0	0.0	0.0	0.7	1.2	0.1
Nitrate (mg/L NO_3-)	9.2	3.1	3.1	6.2	2.6	0.0	2.2	0.0	42.2	45.0
Iodine (mg/L Fe)	0.3	0.1	0.0	0.2	0.1	0.0	0.1	0.0	0.2	-
Flourine (mg/L F)	0.3	1.1	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.7
Chlorine (mg/L)	4.6	5.0	5.6	6.2	6.2	10.2	3.2	6.4	6.2	200.0
Phosphorus (mg/L P)	0.3	0.0	0.2	0.2	0.2	0.2	0.1	235.0	0.1	-
Sulfate (mg/L SO_4^{2-})	0.0	10.0	0.0	8.0	6.0	0.0	65.0	0.0	0.0	200.0
Total Coliform (/100 mL)	UR	UR	UR	UR	UR*	UR*	UR*	270.0	UR*	-
Faecal Coliform (/100 mL)	UR*	UR*	UR*	UR*	UR*	UR*	UR*	270.0	UR*	-
Faecal Strepto. (/100 mL)	170.0	254.0	538.0	484.0	370.0	258.0	188.0	152.0	2900.0	-

GIPM = Pond # 6 Boumdoula
BdM = Pond # 7 Boumdoula
BdPM = Pond Boumdoula-Cloa of Donsin
BdPT1 = Pond # 1 Nabitenga
BdPT2 = Pond # 2 in front of Nabitenga chief's house
BdPT3 = Pond # 3 Nabitenga pond of Sopurbarka
BdPT4 = Pond # 4 Nabitenga next to market
BdPT5 = Pond # 5 Nabitenga in front of Catholic Chapel
LM = Shallow Stream

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
funded by U. S. Agency for International Development (USAID)

September 1996
Program Highlights
CV1-1

SANREM CRSP in the Republic of the Cape Verde Islands, West Africa

Rationale

The SANREM CRSP was invited by USAID/Cape Verde to collaborate with the Watershed and Applied Research and Development (WARD) project to provide training, technical assistance, and research planning assistance to the national research institution, INIDA. The overall goal of the SANREM CRSP/INIDA effort was to provide the WARD project with training, technical assistance, and research collaboration, which would strengthen the administrative capabilities of DGASP, INIDA and INERF as semi-autonomous research and development institutions and strengthen their capability in terms of participatory research methodologies which will result in greater short term agricultural productivity, increase income to producers, and long-term agricultural and environmental sustainability. Through attainment of this goal, the project would assist INIDA in making its research products more useful to recipient farmers, thereby increasing the impact and effectiveness of INIDA's research efforts.

Objectives

■ The seven objectives identified to meet this goal were:

1. Strengthen the agricultural research management capabilities of INIDA in the areas of research planning, coordination, and research staff supervision.

2. Develop with INIDA a system for continuous evaluation and monitoring of research management activities to include both the administration and actual research.

3. Provide assistance to INIDA researchers in the areas of information exchange with farmers, research/extension linkages, inter-institutional collaboration and interdisciplinary research.

4. Provide DGASP, INIDA, INERF, other institutions and other groups (i.e., NGOs, user groups) with in-country training in areas of farmer-first, on-farm research and participatory landscape/lifescape approaches to agricultural sustainability and watershed management.

5. Provide DGASP, INIDA, INERF, other institutions, and other groups (i.e., NGOs, user groups) with short term in-country technical training in various areas identified by the respective institutions to include aspects of soil and water conservation, watershed management, forestry, planning, monitoring and evaluation, proposal writing, and priority setting, etc.

6. Provide DGASP, INIDA and INERF staff and other institutions with short term technical training in the United States in the areas of planning, monitoring and evaluation.

7. Supervise the graduate degree programs of 6 candidates in the U.S. and providing the means for the candidates to return to Cape Verde to do research in collaboration with the WARD Project

Accomplishments

■ The SANREM CRSP implemented an eighteen (18) months cooperative agreement with USAID/Praia to work with INIDA in implementing the agricultural research component of the WARD Project.

■ The numbers of persons trained in participatory, collaborative, inter-disciplinary, inter-institutional, inter-sectorial, on-farm research methods met and surpassed the numbers mandate by the agreement.

■ There was a palpable increase in the capability of numerous members of all three principal institutions, as well as of Rural Exten-

Cooperative Agreement

LAG-0017-A-00-5002-00

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sion, INFA, and farmers to work together and collaborate in areas that they have an interest.

■ All short term technical training activities planned were implemented with numbers actually trained surpassing the numbers planned. These activities have increased tremendously the technical capacity of the three principal WARD collaborating institutions and other collaborating institutions (i.e, INC, Rural Extension).

Outcomes

■ SANREM CRSP has left INIDA with an on-farm participatory research program in place, with a total of nine individual projects, some already implemented, and others in the process of implementation in the watershed of "Agua de Gato". These projects were developed by interdisciplinary, intersectoral teams which included farmers and research partners. The research address specific problems identified in the watershed which are responsive to farmers' needs.

■ The WARD Project, through collaboration of SANREM CRSP, has given INIDA the basic "tools" to realize its goals: These basic "tools" include: 1) a strategic plan and a short-term operational plan for the institution; 2) a plan for monitoring and evaluation of ongoing research projects, including the engagement of the clientele into this process; 3) a career development plan; and 4) institutional linkages and collaborative efforts with other important Cape Verdean institutions like the Extension Service.

■ The situation of INIDA today has changed markedly as a result of SANREM/WARD project. INIDA has established an institutional framework for: 1) long-term research planning and for implementing short-term plans; 2) monitoring and evaluation; 3) maintaining and promoting highly trained, quality researchers; 4) inter-institutional collaboration and interdisciplinary research: 5) establishing and maintaining linkages with farmers and the Extension Service; and 6) conducting on-farm research.

Potential Impacts

■ For INIDA to fully realize the benefits of the training and the participatory research activities initiated under WARD, and to meet their goal of self-sufficiency, continued collaboration and support are necessary. Programmatic areas for continuation include the following: 1) additional local training in the areas of farmer participatory methodologies and research management, monitoring, and evaluation through PL480 funds (to continue through December 1997) and through continued monitoring and technical assistance from SANREM CRSP (through support from USAID/W and/or regional activities supported by USAID);2) support for research efforts in the "Agua de Gato" watershed through PL480 funds and through continued collaboration and technical assistance from SANREM CRSP (through support from USAID/W and/or regional activities supported by USAID; 3) Self monitoring and evaluation of ongoing field research by INIDA supported by SANREM CRSP monitoring and evaluation program; 4) continued efforts in environmental education in linking research results with classroom education,and in U.S. and Cape Verdean classroom linkages through continued efforts by INIDA with support from the SANREM CRSP.

■ For a relatively small ongoing investment in time and financial resources, USAID, through SANREM CRSP, could assist INIDA to realize its important goal of becoming self supporting institution whereby it can mature into a professional and productive agricultural institution that is providing technological advances relevant to the agriculture of Cape Verde.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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September 1996
Program Highlights
CV2-1

Agricultural Research Planning, Management, Monitoring, and Evaluation Training for Cape Verde Research, Outreach, and Education Managers

Rationale

Increased competition for scarce resources and the need to carefully target those resources to achieve environmentally sound, economically viable, and socially acceptable outcomes requires that program implementers have both the vision and skills to do this effectively. Increased demands for accountability from international donors and lenders, as well as from local citizen groups, make new demands on government managers and scientists that their traditional training has not prepared them to meet. As part of the SANREM CRSP cooperative agreement with USAID/Cape Verde to help transform the agricultural and natural resource research system in the Republic, an intensive training and apprenticeship in management of participatory research and development projects was provided by Iowa State University and the University of Arizona in collaboration with the Center for PVO/University Collaboration in Development at Western Carolina University. Strategies of agriculture and natural resource management that are not participatory have little chance of providing sustainable outcomes for local people or the nation. However, managing participatory research and development in a competitive international setting requires new tools and new approaches.

Objectives

- Provide a high quality, theoretically sound, practical, and experientially-based learning experience in research planning, management, monitoring, and evaluation for middle and senior management staff of key Cape Verde institutions.
- Make the materials and presentations used in Cape Verde available through translated videotapes.
- Carry out a pre-departure needs assessment of the participants and their institutions.
- Provide hands-on, formal training in all aspects of research and development planning and implementation to increase the understanding of how resources could be best mobilized to reach participatory, sustainable goals.
- Provide individualized, mentored, and practical experience to meet expressed professional needs.
- Link participants with managers in their area of specialty to provide internship experience in day-to-day management activities.
- Collaboratively develop action plans for participants to take back to their own institutions.
- Increase the effectiveness of agriculture and natural resource management activities in Cape Verde through the implementation of the plans.
- Provide continuing follow-up to the program participants.

Accomplishments

- Based on the pre-departure survey and extensive discussions with our partners in the enterprise, an intensive course was designed in response to the expressed needs of the participants which built on the exceptional previous in-country training and planning. The U.S.-based training concentrated on specific management skills and linking those skills to already agreed upon principles of sustainability and participation that had been developed by the institutions involved.
- Developed a set of videotapes and materials which are available for use in Cape Verde.

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■ Participants received an overview of the current international funding situation and on practical ways to compete for that funding, building on their new strengths of participatory research aimed at sustainable development and internal, on-going monitoring and evaluation.

■ Provided specific training in computer-based financial management of research and development.

■ Developed ten specific action plans to implement in Cape Verde research and development agencies.

■ Identified specific low-cost or no-cost follow-ups on opportunities.

Outcomes

■ Because training had to be postponed several times due to political events in Cape Verde, formal follow-up was greatly curtailed. However, informal relationships were established between the trainers and the trainees, as well as between the trainees and internship directors, which will be continued.

■ Increased capability and efficiency in computer-based financial management.

■ Increased capacity to trace grant activity and link to outputs and outcomes.

■ Enhanced capacity for competitiveness in the international funding arena.

■ Strengthened institutional linkages through sharing action plans.

Potential Impacts

■ Although only ten individuals were able to participate in the U.S.-based training, the training materials were copied and the sessions taped in order to facilitate Cape Verde training of managers unable to attend. An understanding of key aspects of internal management, from performance evaluations of employees to monitoring results for continuous improvement, was linked to the knowledge and skills necessary for successful competition for both domestic and international funding. This link could lead to more effective and efficient use of domestic and international resources to meet the needs of the citizens of Cape Verde while enhancing environmental quality.

■ The potential impact of the training includes: more efficient and effective use of resources; building partnerships and reducing turf battles through good strategic planning; and sharing credit and responsibility in partnership situations.

■ The training would not have been effective as a stand-alone activity. It served to reinforce and enhance a process of institutional transformation already underway through governmental and international efforts. The training in the U.S. could serve to encourage research and development managers to initiate participatory, sustainable research, despite the push of inertia to continue in the safe ruts of a top-down, reductionist, controllable activity.

■ Better coordination between those expected to implement the research and development results and those who maintain the environmental practices introduced through those effects should result in increased empowerment, efficiency, productivity, and sustainability at the local level.

SANREM CRSP
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September 1996
Program Highlights
CA1-1

La Escuela de Agricultura de la Region Tropical Humeda (EARTH)

Rationale

La Escuela de Agricultura de la Region Tropical Humeda (EARTH) provides a comprehensive and integrated four-year program in agriculture and natural resource management leading to an Ingeniero Agronomo degree. EARTH offers an international faculty and draws students from throughout Latin American and Caribbean countries. A distinctive feature of the program is its emphasis on the student that is integrated into all facets of the curriculum. Students are required to participate in several community research/development oriented work experience modules, a trimester-long, off campus internship with emphasis on community work, and a final year research program.

Objectives

■ Modify existing Rapid Rural Appraisal and Participatory Landscape/Lifescape Appraisal (PLLA) methodologies to focus on indicators of sustainability.

■ Develop a "tool kit" of indicators of sustainability that is both indigenously and scientifically valid to become part of the project definition, execution, and evaluation for EARTH students.

■ Incorporate indicators of sustainability into the EARTH curriculum through courses such as: food agriculture and natural resources, enterprise course, internship programs, graduation projects, and work experience modules.

Accomplishments

■ A PLLA methodology document was developed for use by EARTH students. This document puts emphasis on the use of the PLLA as a tool to identify indicators of sustainability. The use of this document has helped students to conduct a focused PLLA to determine indicators of sustainability and conduct research on the measurement of these indicators in the field.

■ A baseline data set was developed on indigenous and scientific indicators in social, economic, and environmental areas. A Geographic Information System (GIS) is available for use which incorporates land use patterns, household distribution, natural resource allocation, water quality, and the organizational profile of the community.

■ The SANREM CRSP methodology has been introduced in work experience modules which are carried out in the communities adjacent to EARTH. The methodology also has been an integral part of the community development course taught to third-year students. The students in the internship course have used it as a community diagnostic tool in different countries of Latin America. During EARTH's upcoming curriculum review, the findings of SANREM CRSP/EARTH will be discussed and an attempt will be made to incorporate the focused PLLA techniques and the teaching of indicators of sustainability for natural resource management into the EARTH's curriculum.

Outcomes

■ Over thirty-four students from nine countries have conducted over seventeen research projects on the indicators of sustainability with 150 farmers in La Argentina. Thirteen professors have supervised the students' research projects and participated in SANREM CRSP's on campus advisory committee. The research documents are available in EARTH library.

■ An important outcome of this project has been the development of a "tool kit" to guide the research on indicators of sustainability.

■ A mechanism has been developed to include the SANREM CRSP approach in the curriculum of the institutions of higher learning; this mechanism will ensure the continuation of SANREM CRSP's efforts well beyond the life of the project.

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■ SANREM CRSP/EARTH has received national recognition by the Board of University Rectors of Costa Rica for its excellence in incorporating environmental education and indicators of sustainability into the curriculum.

■ Awareness in natural resource management has increased in the community of La Argentina. More farmers are growing organic medicinal plants, vegetables, and bananas. Community school students have established a "water club" to monitor the water quality.

Potential Benefits

■ La Argentina could serve as a model community to demonstrate the SANREM CRSP approach in action and the benefit that this approach can deliver in a short span of time to community members and researchers.

■ Universities who want to incorporate the SANREM CRSP philosophy into their activities will benefit from EARTH's experience.

■ The methodology developed for this project will enable universities, local communities, governments, and NGOs to monitor their own efforts towards sustainable agriculture, natural resource management, and protection of the environment.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
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Program Highlights
CA2-1

Community Watershed Management and Resource Risk Mapping in the Department of Lempira, Honduras

Objectives

■ To work with a community-based NGO and their beneficiaries to promote the process of sustainable management of the watersheds, the natural resource systems on which their built water supply infrastructure depends for the quality and quantity of water delivered. Initial objectives of this program element included:

■ To identify meaningful and comprehensive means of identifying strategies and measures of sustainable, non-conflicting resource use in the watershed.

■ To develop a starting group of related indicators to track and define sustainable agricultural systems and sustainable water supply systems.

■ Development and testing of standardized field methodologies for objective and meaningful collection of quantitative and qualitative data sets for each starting indicator, as appropriate with baseline collection from selected watersheds.

■ Selection of parameters with the greatest apparent potential and utility for use in future watershed management through two three-day intensive workshops.

Products were to include:

■ An inventory of workable and community-approved indicators of sustainable watershed management that are practical for direct progress evaluation and decision making at the community level.

■ A manual of standard field techniques and data collection methodologies for the assembly of indicator data, developed with and for community watershed and water system management groups and supporting agency field staff (in Spanish and English).

■ A research paper discussing the methodology, results and application of the work described above.

■ Incorporation of the results of the research in Lempira into the watershed management component of four EAP Zamorano courses on the Measurement, Protection, Utilization and Planning of Natural Resources.

Accomplishments

■ A prime accomplishment of this program element was the capacity-building directed at the community-based Comite Central Pro Agua y el Desarrollo Integrado de Lempira (COCEPRADIL), and the participatory training provided to more than ten of its members, executive body and paratechnicians over a twelve month period. The outcome of this process is a draft manual on watershed mapping currently in the final editing stage by EAP Zamorano/SANREM CRSP Honduras investigators following local-level revision in Lempira.

Outcomes

■ The principal outcome of this 1995/96 program element has been the development of a set of field procedures and analytical steps to develop a detailed watershed map of contributing areas to community water supply systems. The field procedures allow the drafting of a precise and detailed map of a watershed area using only basic, relatively low-cost manual field equipment in areas or economic situations where the use of sophisticated electronic or remote sensing procedures are not technically, financially or educationally feasible. The analytical procedures provide either a hand-held calculator and graph paper production of a scaled map and derived geographical data sets, or a computer, spreadsheet and graphics package based approach for situations in which such off-site resources are available. Both sets of procedures are premised on the same set of trigonometric formulae and raw data requirements, the difference being the more labor intensive hand-calculation and drawing required for the former.

■ As indicated, these procedures have been incorporated into a detailed and well illustrated manual in Spanish that will subsequently be translated into English for potential use in other SANREM CRSP sites, for example in mapping distant forest plots in Burkina or ravine vegetation in the Philippines.

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96

■ As part of the capacity-building process, 10 paratechnicians from COCEPRADIL and the beneficiary communities were trained in the mapping process during the participatory development of the locally applicable and transferable field techniques. A complete set of field equipment and 1:50,000 base topographic map coverage was purchased and given to COCEPRADIL by SANREM CRSP Honduras to facilitate the mapping program to be implemented in the various watersheds selected for analysis and management.

■ During the 1995/96 period in which EAP Zamorano/ SANREM CRSP Honduras was associated with COCEPRADIL, they applied for and received a large grant of over $300,000 to finance their integrated development activities in the Lempira Department over the following five years. The money has been granted by the debt-for-nature swap financed clearing house for Honduran NGO funding, FUNDACION-VIDA, created by USAID in 1993. According to officials involved, COCEPRADIL's on-going association with two international NGOs, Catholic Relief Services and EAP Zamorano/SANREM CRSP Honduras, and their dynamic and integrated approach to sustainable development in their region played a major factor in their being awarded this financing. Michael Lee, EAP Zamorano Principal Investigator, was named as site representative to the SANREM CRSP Technical Committee. VIDA is a member of the SANREM CRSP Honduras National Coordinating Committee.

■ A formal list of indicators of sustainable watershed management was not prepared as planned in the original proposal for this project element, rather a detailed discussion of sustainability and runoff productivity and quality risk factors, their identification and management was integrated into the basic guidebook that the watershed mapping manual represents. A research paper based on the SANREM CRSP-funded work was written and presented at an international conference in Honduras in January 1996. Experiences from the research work were incorporated into the newly formulated course structure in the Department of Natural Resources and Conservation Biology at EAP Zamorano as part of the class on "Protection of Natural Resources: Watershed and Water Resources Management". The field mapping objectives and techniques were taught to 31 students as a series of classes and field laboratories as part of this fourth-year course in 1996/97.

Potential Benefits

■ The benefits of this SANREM CRSP research program is the ability of COCEPRADIL and their partner communities to identify actual and potential problems within the various watersheds on which they depend for their water supplies. The mapping process provides a systematic and concrete representation of the resource use issues and potential and actual conflicts between actors within and outside the beneficiary community that must be resolved to maintain adequate water quality and quantity yields from developed systems and a basis for quantifying and prioritizing activities within the 80 watersheds already exploited and 90 or so more watersheds that will be tapped in the future. The potential benefits relate to the maturation of COCEPRADIL as a form of local government, a de facto water utility, which needs to develop its technical capability in the environmental management side of water supply development, as opposed to the more straight-laced system construction, and the personal relations aspect of mobilizing beneficiaries to carry out the necessary protective actions and resolution of conflicts that many of the watersheds present.

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Program Highlights
CA3-1

Community Watershed Management and Resource Risk Mapping in the Department of Lempira, Honduras

Objectives

■ The project was designed to provide a practical opportunity for the screening of indicators of environmental sustainability at the rural landscape level through the carrying out of student research theses into selected, interrelated, and multi-disciplinary topics of basic concern in the landscape/lifescape represented by the La Lima community in the Department of Francisco Morazán, Honduras. The project began with four stated objectives of:

■ Identify and screen indicators of sustainability of rural landscapes/lifescape suitable for the Central American experience.

■ Identify and analyze local agricultural and resource management practices in relation to their ecological, economic and social sustainability.

■ Design and evaluate strategies to integrate criteria for sustainability in development programs (aimed at providing input to Fundación VIDA project evaluation and management).

■ Catalyze a new paradigm for agriculture and natural resource management in Zamorano education.

Accomplishments

■ The objectives were developed in anticipation of the incorporation of student researchers into the project team, a factor which lead to a somewhat different approach and outcomes. Moreover, the shift of emphasis moved from the development of general strategies for NGOs and the development of evaluation criteria for Fundación VIDA, to the development of information usable and pertinent to the community of La Lima itself and some of the organizations working directly with them including EAP Zamorano's own extension service and a FAO/European Community program to improve rural nutrition and health in part due to the training of paratechnicians aware of sustainability issues.

■ The principal accomplishment of the 1995/96 program were five student theses completed as part of the 1995/96 research activities. They are summarized as follows:

■ Flores, J. C. 1996. Characterization of water use in the La Lima Community. (Caracterización del uso del agua en La Lima, Tatumbla, Francisco Morazán, Honduras). Water supply is a critical element for development. The study shows that the La Lima community has a developed water supply system but does not have the corresponding social system to collectively operate and maintain the system. While there is more than enough water to meet all the community's agricultural and domestic needs, the major obstacle to sustainable water supply is the lack of community participation in managing the system. The demand for water is highly varied in the community, dividing individuals because of equity issues.

■ Escolán, R. 1996. The role of women in the management of natural resources in the La Lima community. (La mujer y su papel en el manejo de los recursos naturales en La Lima, Tatumbla). The research looked at women's roles in the community and the limiting factors affecting whether and how they participate in the sustainable management of natural resources. Women's roles are predominantly extractive, especially the collection and sale of wild fruits, and the collection and use of medicinal plants and wild animals. While women were found to be worried about natural resource management issues, few carry out any kind of conservation or protection practices. Limiting factors include their lack of involvement in family and community-level decisions about natural resources management, the large family size and daily household work requirements of women, and the lack of any kind of capacity-building for women interested in adopting a broader role in society.

■ Zeledon, J. J. 1996. Characterization of the farming system and indicators of sustainability in the La Lima Community. (Caracterización del sistema de labranza mediante indicadores de sostenibilidad en La Lima, Tatumbla). Four indicators were used to assess the status of production farming in the La Lima community. Selected farmers, largely maize and bean producers with horticultural production on

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more fertile parcels of land, participated in evaluating field plant diversity at different farming cycles and frequency of pest infestations. The two appeared negatively related, the relatively high plant diversity in the zone inhibiting the generation and spreading of pests in the farming region. Soil fertility was not seen to be a sensitive indicator with little variation. Productivity was seen to be a function of labor availability and the planting of beans in combination with maize.

■ Flores, S. 1996. An evaluation of child nutrition status in the La Lima community. (Evaluación nutricional de los niños de La Lima, Tatumbla). The study was oriented at focusing on good nutritional status as an important element of integrated and sustainable development and raising awareness among agricultural extension workers in the Tatumbla area about this issue. To develop into healthy adults, children require an adequate diet which must be reflected in the type of agricultural production carried out by parents as well as their food preparation customs. The dietary analysis indicated animal and dairy products to be in limited supply, affecting protein intake, the majority of which must come from legume crops such as beans. Maize and beans dominate the diet all year round with an intensive period of vegetable production and consumption every dry season. With this dietary pattern, the study showed over 40% of the children to exhibit nutritional deficiencies leaving them susceptible to infectious diseases, principally those of the respiratory system.

■ Ramírez, V. 1996. Characterization of family gardens in the La Lima community. (Caracterización de los huertos familiares en La Lima, Tatumbla, Francisco Morazán, Honduras). Family gardens are an important element of the rural home. They can also provide a significant proportion of the family diet and provide a source of income through their commercialization. However, out of the 42 households studied, 29 only had gardens, mostly organic. In only one were agrochemicals used. Gardens in the community appear under-utilized with a low diversity of products and limited dietary contribution.

■ Copies (in Spanish) of each theses have been placed on file with the SANREM CRSP Management Entity and a copy has been placed in an archive with the school teacher in the La Lima community along with other research documents and publications relating to the community and its resource situation. A research paper was prepared during the 1995/96 project year in part using information gathered by Principal Investigator, Hans Kammerbauer, during his SANREM CRSP activities and also from the work of student researchers

Potential Benefits

■ Experience from the 1995/96 research program has been used as a basis for the design of six additional research theses scheduled in 1996/97, two of which are designed to operationalize and consolidate findings from the first year of SANREM CRSP Honduras research in the La Lima community (see EAP Zamorano/SANREM CRSP Honduras project for academic year 1996/97 version 4.00). The emphasis of these two efforts, bringing student researchers and PIs together with community members, is to address two significant issues raised in the course of the participatory research in La Lima: the need for greater community participation and collaboration to address collective issues affecting sustainable resource use; and the question of soil fertility and land use management, a key factor underpinning the productivity of the mixed agricultural system on which the community depends for its livelihood. The following outlines the scope of the 1996/97 projects in Honduras:

■ Ixchel Palencia. The development of a participatory extension program to achieve sustainable agriculture and natural resources management within the La Lima community. La Lima reflects many of the rural social conditions found in Honduras and elsewhere in Central America in highly sloping and geomorphologically varied landscapes and lifescapes. The community is fragmented, has grown through patterns of incremental immigration, with piecemeal and ad-hoc land use and natural resource development. The lack of a nucleated and cohesive community with common goals and a high degree of social capital presents a constraint to traditional extension programs. The focus is more on the mechanisms for and difficulties associated with the design of a participatory (in other words, community-based) technical assistance package geared to community needs such as soil fertility, firewood resources, and water quality/quantity and using sustainability indicators to document progress.

■ Alejandro Paniagua. The conservation and management of soil resources as a basis for sustainable production systems with emphasis on communal solutions to common problems. Due to the use of steep slopes for agriculture, the elimination of forest cover through firewood exploitation, and because of the juxtaposition of steep and unstable slopes to flatter production areas and to the transmission route of the communal water pipeline, landslides are a key biophysical issue in the watershed leading to the accumulation of subsoil, boulders, and other material on productive areas and fracturing of water mains among other impacts. This project will compliment that of Palencia and look at the options for communal and individual action designed to promote sustainable land-use patterns.

SANREM CRSP
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September 1996
Program Highlights
E1-1

Domestic Economy, Gender Relations and Community Participation: Potential and Limitation of Productive Strategies for the Sustainable Development of the Alambi Micro-Region

Rationale

In the analysis of production and reproduction strategies within the rural family unit, the role of women often remains invisible. In many cases, their contributions to the subsistence economy have been recognized. These contributions include production for home consumption, activities preparatory to planting and after harvest, storage tasks, etc. Additionally, women are not typically taken into account in the transfer of technology, training, the distribution of resources (tools, inputs, money) destined to improve production, nor the differential participation of men, women, and youth are not referenced. Using gender as a point of entry, this project will try to better understand the logic of internal family organization and of production strategies, to recognize the different kinds of participation and the different responsibilities of men and women, and the value assigned to their respective contributions in the management of resources.

Objectives

■ Establish a typology of peasant family economies in terms of differential access to resources and the management forms applied to resources and production subsystems, taking into account sustainability indicators

■ Analyze the different productive strategies identified in terms of:
1) interrelations among different productive activities engaged in by each family, 2) labor distribution, 3) existing gender roles, 4) variable significance of non-market social relations, and 5) socio-cultural factors conditioning the sustainability of productive systems

■ Identify cultural elements present in production strategies used by families in the zone which have facilitated the formation of collective identities and the composition of communities as territorial and organizational entities.

■ Recognize the specific tendencies and implications of the various farm family economic strategies for the use of natural resources and the possibilities that these strategies offer for the adopting of changes in order to develop sustainable agriculture and livestock raising practices.

Accomplishments

■ A bibliography with of over 200 titles related to peasant economies, productive strategies, and gender has been compiled.

■ Secondary information compiled by the communities and by the Health Care Center (April 1994), for 250 households of the four communities have been processed and analyzed.

■ Land adjudication records for the Alambi river basin and properties affected by the agrarian reform have been revised.

■ A census has been taken that characterizes the families from the communities on the basis of numerous variables has been completed and augmented by the perception of the community, the perception of the field team, and direct observation.

■ Four workshops, one per community, were held on the socialization of the data gathered directly by the members of the communities, project team, and SANREM CRSP field team. These workshops served to motivate the community in implementing the census. Sixteen members from four communities were trained in census collection, including education on the importance of the census, explanation of the census form, practical exercises of the application and elaboration of maps for locating the households during the gathering of the cen-

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sus data.

■ The census was implemented by 16 investigators in conjunction with the Project partners and subsequently, a training workshop to report and analyze census data was held for 16 community investigators.

Outcomes

■ Census information was gathered, processed and analyzed giving insights into the population structure, immigration trends, and land tenure issues in the four communities. The population census provides characteristics of the agrarian structure and the population structure and is presented in the output document with tables and graphics presenting the quantitative distribution of the census data. The census data has been entered in the data base in the SPS system for use by all SANREM CRSP institutions.

■ The census was enhanced with more detailed information based on the 92 families working with other projects.

■ The participatory methodology was utilized in every community meeting and the community members recognized the importance of investigation as a tool to identify problems. Additionally, this approach substantiated the community members' knowledge about the community and its surroundings. Community leaders, the parents-school committee, and the Peasant Social Security Health Care Center were each represented in the activities.

■ The participation of men, women and youth in the census has raised the awareness of the use of such tools to identify problems, recover local knowledge and to motivate community members in community action. Through the participatory methodology, a high level of trust was developed between the field team and the community members. By involving other institutions and projects working in the area, the knowledge gained through the census proved to beneficial to the Ecuador site program as a whole.

Potential Benefits

■ Dissemination of validated census data can further serve as a tool for organizations to advocate change in policies through the bureaucratic process and enable the appropriation of legal representation of their communities.

SANREM CRSP
Sustainable Agriculture and Natural Resource Management
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Program Highlights
E2-1

Comparative Ethnoecology in the Cotacachi-Cayapas Buffer Zone: An Action Research Program For Biodiversity Enhancement Through Use

Objectives

■ Analyze and develop policy initiatives for intellectual and community biodiversity rights at the national, regional, and community levels.

■ Conduct biological monitoring and define culturally relevant indicators of sustainability among select buffer zone human populations.

■ Compare four distinct ethnic groups in lowland and highland Cotacachi-Cayapas communities.

■ Assist interested communities in developing their own natural resource action plans.

Accomplishments

■ A wide range of activities were completed under the biodiversity rights portion of the project, largely through the in-country efforts of EcoCiencia. Among these are: trade secret protocol for protecting community intellectual property rights (IPR) related to plants; legal briefs to advise Ecuadorian government on IPR; a primer on prior informed consent and bioprospection for traditional communities; a symposium at the Society for Applied Anthropology Annual Meetings in the United States (organized by R. Rhoades and V. Nazarea); and two computer-based programs for helping traditional communities protect their knowledge ("Memory Banking" at University of Georgia and the trade secret program developed in Ecuador).

■ Ethnoecological studies focusing on cultural definitions of environment were started with the Chachi, highland indigenous groups (UNORCAC or "Union de Organizaciones Campesinas de Cotacachi"), and Mestizo communities (Cuellaje) located near the reserve. Ethnobotanical research, Thematic Aperception Tests (TATs), folk mapping, and monitoring of agricultural plots and forest areas were conducted with each different ethnic group. In the Cotacachi area, a comparative study of conservationists and local inhabitants' perspectives on the reserve is underway. An ethnomedicinal study under the direction of UNORCAC was conducted in 1995. Collection and photos (identified by local and scientific names) were left in the communities for their own use.

■ A comparative study of the four ethnic groups is in progress. Researchers have been placed among the Chachis and Afro-Ecuadorians in the lowland area, near Cuellaje where Mestizo predominate, and in the communities of Highland Indians. The hypothesis to be tested is: The greater the sense of place (as measured by time, cosmovision, local knowledge, and social regulation), the greater the local protection of the environment. In other words, recent migrants to a community inflict more damage on the surrounding environment than communities which have long been in place and have learned to adapt to the environment. An initial report comparing the four communities will be available in December, 1996. Information on the biological monitoring part of the project will be submitted independently by SUBIR.

■ Direct assistance has been given to UNORCAC in developing two community-led proposals: (1) Memory Banking and medicinal plants and (2) Workshop for Self-Diagnosis of the Environment and Water. Funding is now being sought for these proposals. In addition, a guide to local gene banking ("Yesterday's Ways, Tomorrow's Treasures") was translated into Spanish and tested in schools in Ecuador. Assistance was given to the community of La Loma (Cuellaje) in the establishment of their women's group dealing with biodiversity.

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Outcomes

■ The joint work on biodiversity between EcoCiencia, their Ecuadorian partners, and the Department of Anthropology, University of Georgia is having significant local, national, and global impact. First, the trade secret work of Joseph Vogel (funded in part by this project) has stimulated a global debate among scientists and politicians over the relevancy of this approach (versus patents, open access, and other options). His work, as well as that of the comparative ethnoecology project, has increased awareness in native communities in Ecuador of the value of their own knowledge and genetic resources. Second, the Memory Banking project (and a different computer model related to trade secrets) has stimulated interest in indigenous Ecuadorian communities in preserving their knowledge and plants. A printed guide was received enthusiastically by local groups and is being tested in the schools. Third, an edited volume on local to global articulations in plant genetic resources is being prepared by R. Rhoades and V. Nazarea for publication by the University of Michigan Press.

■ Application of the ethnoecological approach to natural resource management is leading to novel insights about participatory research. Different groups (class, gender, age, and ethnicity) have different perspectives of the environment. This fact is often overlooked in participatory analysis because research teams normally work through the local power structure. The ethnoecology field manual for natural resource research being developed in this project will be useful to development teams interested in the impact of intracultural variations on local management.

Potential Benefits

■ The research on intellectual and community biodiversity rights has global implications. At present, international bodies, national governments, and traditional communities are looking for information and solutions to the issues surrounding control and access to biological resources. This research offers protocols, experiences, and guidelines for different levels of organizations. The comparative research will offer insights on why some groups degrade their environments and why some groups protect theirs. The findings of the project will be globally useful for sustainable land management in buffer zones of nature reserves.

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Program Highlights
E3-1

Ethnoecology of Frontier Settlements in the Alambi-Guayllabamba River Confluence: Environmental History, Migration and Cognition

Objectives

- Research the environmental history of the Alambi-Guayllabamba Confluence.
- Study processes of migration and settlement in recent colonial period.
- Identify different cognitive models of natural resources and agriculture.
- Link cognitive models with behavior in natural resource and agriculture management.

Accomplishments

Environmental History. Historical documents available in Ecuador were compiled and analyzed. A history workshop and oral history day were held in Nanegal during August, 1996. These exercises revealed that the area has been a diversified zone of extractive agricultural and natural products exploitation since Pre-Inca times. Capitalizing on diverse agroecological zonal production and linkages with Indian populations in lower zones, the local inhabitants, Yumbos, specialized in long-distance trade with highland populations. Although the Yumbos largely disappeared in the 19th Century, their descendants continued this strategic trading role into the Colonial and nationalistic periods, when the emphasis shifted from natural products to cane products, mainly sugar cane alcohol. A final history report will be available in January, 1997.

Migration and Settlement Processes. A quantitative and informal survey of a stratified sample of over 200 migrants to the zone was administrated during June, July, and August of 1996. Results are being analyzed by SPSS during August, 1996. Ecuadorian migration literature was reviewed in order to place the zone in a national demographic context. Results reveal that migration does not follow the new zone "colonization" pattern, but rather a branching spin-off migration from historic communication routes as described above. A 1995 study within the project revealed a mosaic of livelihoods, which must be taken into account in natural resource management.

Differential Cognitive Models of Environment. Based on key informant interviewing and photographic elicitation, a typology of livelihood strategies were refined. The livelihood strategies, based on local ethnolinguistic categories, include: Hacendado, Agricultor, Canacultor, Commerciante, Ganadero, and Quehacer Domestica. Scientists and NGOs represent cognitive models from outside the community. Eight different images of the landscape/lifescape were developed and compared between groups. Special attention is given in one subproject to Canacultor because it is the dominate system in the SANREM CRSP region.

Integration of Cognition and Behavior. Each of the different livelihood groups mentioned above have a different relation to the land and agriculture. This linkage was explored through Thematic Aperception Tests, photographic elicitation, and informal interviewing.

Outcomes

An Ethno-Political Ecology Monograph of the Alambi-Guayllabamba River Confluence that is useful for local communities, planners, policy makers, and scientists interested in the development and preservation of this zone. The monograph (written jointly with FLACSO/Ecuador) contains chapters on: (1) Co-Evolution of the Ethnoscape and Landscape; (2) Recent Configurations of Humans and the Landscape

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(1960-96); (3) Livelihood Strategies and the Environment: An Integrated Study of Cognition and Behavior; and (4) Implications for the Future. As part of the project, a community history will be compiled for Nanegal and a detailed study of population movement will be available.

■ **A Political Ecological Study of Sugar Cane Production, Processing, and Marketing, which is useful for understanding problems that exist within this dominant system.** Research has demonstrated that within the four communities in which SANREM CRSP is working, sugar cane is "King." Any attempts to understand, much less improve, the region depends on changes to be made in the sugar cane system.

■ **Eight Comparative Landscape Maps, developed for the purpose of determining which type of image and scale is useful for different objectives.** The spatial images are: geographical flat maps, GIS, remote sensing, aerial photography, community-drawn maps, male and female maps, landscape maps with local terms, and landscape photos with local categories. An early finding revealed that GIS maps at a large scale (1:250,000) have limited use for local community planning; landscape photos are more practical. Systematic comparison continues.

■ **Comparative Ethnoecological Research Manual for Natural Resource Management.** A field manual was developed at the University of Georgia and tested in the field during June, July, and August, 1996. It offers a step-by-step approach to the use of ethnoecology in applied projects such as SANREM CRSP.

Potential Benefits

■ The long-term, comparative benefit of ethnoecological research lies in its potential to bring a human dimension to the more prevalent biophysical approaches to watershed/landscape analysis in natural resource and sustainable agricultural management. This approach shows that different actors in the landscape (the "ethnoscape") actually perceive and understand the "same" physical environment in dramatically different ways. Any homogeneous approach that sees all people as the same is doomed to failure.

Humans do not organize themselves according to watersheds; instead, different human cultures and subcultures are embedded within the same watershed in some instances and in others they crossover. The "watershed" approach can not fully integrate human perspectives into the solutions because the boundaries are fixed biophysically. Any improved management system must understand this basic difference between a people-dominated landscape and one defined by scientists in terms of some biophysical component.

SANREM CRSP
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Program Highlights
E4-1

Rapid Ecological Assessment of the SANREM CRSP/ Ecuador Research Area, Northwestern Pichincha

Rationale

In Ecuador, deforestation has reached unprecedented levels. About 300,000 ha are deforested annually (CAAM, 1995). The scarce remnants of the forests located along the Andean slopes and in the inter-Andean valleys are the most endangered. Subsequently, there is greater emphasis on the conservation of soils and water resources, and of course, on preventing loss of biodiversity. In this context, the SANREM CRSP works in an area where the local agricultural communities are facing related problems. The aim is to find solutions and alternative approaches to resource management with an interdisciplinary research methodology and in close collaboration with the local population.

The participation of the Conservation Data Center (CDC/Ecuador) in this project has two main purposes: 1) to build a pool of geographical and ecological information about the area and 2) to provide the institutions and the local communities involved in SANREM CRSP/Ecuador with this information as a useful tool for research and planning.

Objectives

■ Provide cartographic support to the SANREM CRSP/Ecuador program through the elaboration of maps containing information such as distribution of human settlements, current land use, vegetative cover, geomorphology and soils, and potential land use and use conflicts.

■ Augment this geophysical characterization of the area with information about ecological communities, their distribution, and their current level of conservation.

■ Identify plants and animals as potential ecological indicators for evaluation, monitoring, and research purposes.

Accomplishments

■ Produced a base map containing elevation curves (topography), fluvial system, and human settlements, and two comparative maps of vegetative cover and land use based on the interpretation of aerial photography of 1966 and 1990. This information has been digitalized and is part of the Geographical Information System (GIS).

■ The remnants of ecologicalcommunities have been identified and characterized with the help of local informants and are being incorporated into the GIS for geographical location on the maps.

■ The botanical survey has generated an almost complete inventory of the flora of the zone as well as a list of plants used by the local population. Additionally, identification of potentially useful plants to the communities with alternative resources for management is in process.

■ A completed zoological survey has confirmed that the native ecosystems of the area have been extremely disturbed.

■ Designed an interinstitutional communication system. This network will allow the information generated by each institution to be shared and used by other SANREM CRSP partners.

Outcomes

■ Interdisciplinary work methodology. During the presentation of our maps to the other SANREM CRSP/Ecuador institutions, we identified the need for better methods and procedures to facilitate collaboration. Therefore a new entity called Monitoring Interinstitutional Group (Groupo de Monitoreo y Seguimiento Interinstitucional) formed, with one representative of each institution. This group is working on the design of a methodology for effective interinstitutional participation. Additionally, reports in the field of in-

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96

terdisciplinary work have been advanced for publication.

■ Environmental education is being improved through interaction with local communities. The comparative maps of 1966 and 1990 are being used to analyze the results of the ecological survey and as an environmental educational tool for local community members and students. A map with the location of meaningful sites of the daily activities in the communities will facilitate the use of maps by the local people.

■ Worked on restoration of the former natural landscape and predictive approach of the ecological survey. Given the scarcity of forests remnants, a more useful way to use both the ecological characterization and the GIS would be to analyze biodiversity and soil degradation in light of the progressive exploitation of the forests and other lands. This information is generated by the cross reference of different thematic maps and cartography of different years combined with field information. This approach assists in the explanation of the consequences of non-sustainable use of natural resources, planning restoration on the basis of former distribution of the forest, and using additional socioeconomic information generated by the other SANREM CRSP/Ecuador partners.

Potential Benefit

■ This is the first time in which CDC has taken a participatory approach with the local community in order to present highly technical tools such as the GIS and to use these as an educational resource to visualize potential problems related to natural resources and/or possible solutions. This effort has provided CDC with a unique opportunity to expand its methodologies.

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Program Highlights
E5-1

The Potential of the Forest Extractive Economy for Biodiversity Conservation and Sustainable Land Use in Colonization Areas: A Regional Household Study of the SANREM CRSP Micro-Region, Ecuador

Rationale

The community self-diagnosis during the PLLA process in the SANREM CRSP microregion underlined the importance of forest resources for farm family livelihoods. "The forest extractive economy" refers to the current recognition of the potential of non-timber products as an economically viable, socially equitable, and ecologically sound alternative to the exploitation of forested tropical areas. The range of products that have been documented as extracted from tropical forests is staggering. In most cases, these products have both exchange and use value for the extracting households. Colonizers—such as those near the Nanegal microregion—engage in processes which lead to quick degradation of the landscape. Although agriculture is the base of the economy, forest extraction typically subsidizes farm expansion which, more often than not, leads to household economic decline. Understanding the regional and household perspectives is essential and, in conjunction with, the study of the forest extractive economy will provide key background knowledge to support practical experimentation and community organization.

Objectives

- To obtain a diagnostic or a panoramic view of the use of forest resources by the area's inhabitants.
- To gather the historical context of the mountain by means of statistical analyses and the oral memory of the population, taking into account gender and generational categories.
- To gain an understanding of the economic and social contexts of mountain use, especially in relation to the circulation of products (wood, fire wood, fence poles, rattan for handicrafts) and in relation to the forest zone and agropastoral production. To understand these relationships, it is necessary to take into account the interrelationships between families, the forest products exchange networks, resource access and control, gender relationships, and peasant representations of the mountain and its products.
- To train groups of youth from the four communities in participatory research techniques to bring them into the investigation of the relationships between the inhabitants and the mountain.
- Analyze the policies (laws and regulations) pertaining to mountain areas and/or bordering on ecological reserves.

Accomplishments

- Participation in the design and development of methodologies for interinstitutional monitoring of the research plans in relation to the SANREM CRSP's *cornerstones* and to the evaluation criteria and indicators.
- Training of the SANREM CRSP researchers in participatory research methodologies elaborated with the Local Agricultural Research Committees (CIAL's).
- Participation in the design and data analysis of the Community Census for that which refers to the use of mountain resources, quantity of available mountain hectares, and evergreen forest for each community. Participation in returning of the Census data to the communities.
- Review of secondary literature and a bibliographical synthesis.
- Collection of testimonies of adults and elders (women and men) on the history of the transformation of the mountain in agricultural land (Palmitopamba and Nanegal).
- Interviews conducted with the inhabitants on the use of the mountain, and particularly with the carpenters on their wood supplying strategies, the types of wood used, commercialization of finished products, and other related information.
- Conducted interviews on usage of the forest with farmers and owners of the mountain area (Playa Rica, Bellavista, Libertad, Meridiano, Chacapata and Palmitopamba) and with other users such as rattan women gatherers and artisans (Nanegal),

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with the sons and daughters of farmers (Playa Rica), and carpenters (Palmitopamba).

■ Participation in community meetings in Palmitopamba, Playa Rica and Chacapata to identify research assistants representing peasants from the communities.

■ Training of a group of four persons from the community of Playa Rica (3 young women and 1 male professor) to participate in the research process.

■ Initiation of the environmental education program (in collaboration with other institutions) in the schools of the four communities. Participation in the planting of school gardens in Palmitopamba and Playa Rica with the children of third, fourth, fifth, and sixth grades and the projection of films on the theme of environmental protection in the schools of Chacapata y Palmitopamba.

■ Holding of workshops on the elaboration of conceptual drawings with the children of the fourth, fifth, and sixth grades from the schools of Palmitopamba, Chacapata and Playa Rica on topics related to their view of the mountain, forest, wild animals, and the community.

■ Bibliographical review of forest laws or laws related with protected areas: general and special laws, norms, ministerial agreements, executive decrees of the National Institute for Wildlife and Natural Areas (INEFAN), and other institutions responsible for setting the norms for forest activities and control actions in natural areas.

Outcomes

■ Through the Institutional Committee for Continuity and Evaluation a matrix and format for evaluation and monitoring of the project was defined. Also, we defined the participatory research methodologies and diverse strategies to work with the communities. The committee provides a forum to share information on the activities in the field and to exchange opinions on the most adequate strategies to create relationships with the communities.

■ Information from the Census on the use of forest resources is related to the number of families that use the mountain area and the percentages of each priority uses (fire wood, lumber, fence poles, hunting, etc.). The Census provided information about the quantity of mountain hectares and evergreen forest owned by each community.

■ The interviews with the mountain users and visits to the zone have generated information about the use of 24 species, both timber-yielding and non timber-yielding, considered the most important from the point of view of the population. We also have information about the localization of these plants, not only in the four communities, but also in a wider area that includes Meridiano, Bellavista and Libertad.

■ The four workshops for the training of a group of four people in Playa Rica on a diversity of themes related to investigation and research work have generated 10 interviews with mountain users and 30 environmental representations to present information about timber yielding and fruit trees, fire wood shrubs, etc. A typology of soils and climate as well as wildlife and mountain fauna was produced. The information also refers to the difficulties the mountain represents for farmers (wild life considered damaging for cultures and cattle) and to the concepts, ideas, usage, positive and negative aspects, colors, sounds, and life cycles of the wild animals, birds, insects and snakes.

■ The principal locations for the obtaining wood to supply the six local carpenters and the commercial exchanges the produce from lumber extraction, processing, and sales on the market have been identified.

■ A number of photographs, drawings of the community landscape of Chacapata and La Perla that include cultivated land perspectives, wood, living fences, vegetation on slopes, pasture grounds for horses, cane, fruit gardens, tree and pasture associations, house around the central plaza, roads, slopes, mountains and rivers have been gathered. These drawing are to be compared to those produced by the communities.

■ The environmental education program with 125 children of third, fourth, fifth, and sixth grades from the Palmitopamba, Playa Rica and Chacapata schools has been initiated. The children have drawn some 76 pictures and provided 16 narratives to represent their perceptions of the mountain and its resources.

■ A preliminary analysis of Ecuadorian regulations related to forestry has been conducted.

Potential Benefits

■ The participatory research now being implemented can bring benefits to the SANREM CRSP populations in that the information about the history and present links between the population and natural resources is being returned to the communities. This information gathering is done in parallel to the training of the inhabitants on damage caused to the environment from the unsustainable use of resources and on the economic and environmental potential of good resource management.

■ This information is also oriented towards the establishment of a management plan that includes the reconversion of agricultural landscape and the optimization of forestry resource usage patterns to promote the preservation of resources.

■ Additionally, the study of Ecuadorian laws and regulations related to forest areas will contribute to the development of new management policies for the influence areas of ecological reserves.

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Program Highlights
E6-1

Analysis of Agropastoral Production Systems, Nanegal Ecuador

Rationale

Livestock plays a critical role in peasant agricultural production in the Guayllabamba watershed of Ecuador. It is essential to understand the technical and social elements of these production systems and to characterize those indigenous and non-indigenous management strategies as related to sustainability.

Objectives

■ Evaluate the technical, and economic indicators of the cattle raising activities through monitoring to direct agropastoral activities toward a more sustainable system.

■ Identify and analyze technological and administrative practices utilized by farmers in animal management, evaluating elements that contribute to the sustainability of production systems.

■ Compare these practices with others used in similar zones, and discuss with farmers the possibility for testing these in the micro basin, and enriching local knowledge.

■ Create a practical environment in which farmers and researcher, using the knowledge and experiences of farmers, can develop creative solutions to problems associated with agriculture and livestock practices.

Accomplishments

■ Designed a monitoring system on spread sheets to characterize the agropastoral production system in the project area, related to cattle raising activities.

■ Designed the registers for data collection on fifteen farms from the Chacapata, Playa Rica, La Perla and Palmitopamba communities.

■ Held six training workshops on the design and use of technical and accounting registers related to agropastoral activities on the farm. The workshops were assisted by 16 promoters chosen by their respective communities: Chacapata, La Perla, Palmitopamba, and Playa Rica.

■ Held four theoretical and practical veterinary first aid courses in the four communities to teach farmers basic healing practices and the techniques for providing medication and vaccines.

■ Processed information from four farms and conducted a systematic monthly analysis of the use and management of pastures and cattle exploitation. Collected information on the following parameters:

■ Area, species of forage, biological cycle, grazing time, forage residues, and production of pastures.

■ Monthly analysis of milk production, receptive capacity, animal payload, nutritional content, grazing balance, work force, and forage production costs.

■ Feed systems, hygiene, reproduction, management, labor, and production components related to cattle raising.

■ Monthly analysis of estimated production, animal payload, feed balance, reproduction, hygiene, labor, costs, income, and production profitability.

■ Short and long-term production cycles, diversity, cultural labor, production, sales, consumption on the farm, work force, implements, and prices related to cattle raising.

■ Inventory of porcines, domestic fowl, equipment/implement availability, production,

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sales, prices, location of sales, family consumption, work force, and labor.

Outcomes

■ The peasant agropastoral production systems are clearly more complex than their conventional counterparts. Decision making related to adoption of a given productive strategy requires that farmers find convenient mechanisms for combining many variables. Little information related to this aspect of decision making with multiple options has been studied and even less with economic and environmental perspectives in play.

■ The expectations of peasant producers concerning the agropastoral activities were clearly articulated through the participatory information gathering. It is felt that individual producers do not envision community well being from their activities, but that of personal aspiration and quality of life.

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Program Highlights
E7-1

Characterization of the Biodiversity and Potential Use of Forestry Resources in the Alambi River Basin

Rationale

The natural landscape does not exist in isolation, but, rather is directly impacted by the human landscape. Inhabited since prehispanic times by the Yumbos, the study site has experienced increasing impacts due to colonization since the end of the last century. As a result of human occupation, the original environment of the tropical forest has been transformed into an agricultural landscape with a lower percentage of natural forests, primarily relegated to the steepest hillsides. The effects of colonization—destruction of the natural landscapes and specifically of forestry resources—produce land use process that are typically non-sustainable, and that are manifested in ecological, production, and social problems. A characterization of the vegetation present in the micro-region is necessary for subsequent implementation of an awareness program for adoption of measures to conserve biodiversity and natural resources.

Objectives

■ Characterize the distribution, composition, and flora structure that constitute the natural landscape of the micro-region.

■ Describe the distribution, composition, structure and degree of exploitation and sustainability of forestry resources.

■ Assess the principal environment impacts.

■ Implement, at the local community level, an environmental education program addressing the designated area and that promotes a conscience for the preservation of natural resources and biodiversity.

■ Coordinate environmental education activities with other programs in the SANREM CRSP Project, especially through the Global Committee for Environmental Education.

■ Integrate in this program the information from other SANREM CRSP projects and help in the diffusion of information at the national and international levels.

Accomplishments

■ A reconstitution of the past landscape, using both the local inhabitants and bibliographic descriptions dating from the beginning of the century, was produced. It was found that the area was covered by an evergreen vegetation constituted of Peruvian bark, palm trees, matapalos, rattan and a dense vegetation of shrubs. The agricultural zone was restricted to areas of little slope and close to the few existing roads. Presently, these conditions have radically changed and the zone has been converted into an agricultural landscape with remnants of natural vegetation. Of the areas around the four communities, Palmitopamba, La Perla, Chacapata and Playa Rica, only in the last two are native forests a significant percentage of total cover (approximately 20 percent).

■ The Chacapata forest has been surveyed, with the help of the local community as well as with university students. This was carried out using a 50 X 2 m transect considering only the vegetation with a DBH greater than or equal to 5 cm. Fifty species were identified out of which «logma» (16.7 percent), «borracho» (7.5 percent) and «carachacoco» (5.8 percent) were the most abundant. In the grove forest, (vegetation with a DBH less than 5 cm) there was tendency toward high biodiversity, especially in areas where there a minimum number of large trees. In general, the bio-zone, according to the Holdridge classification system, corresponds to a very humid low mountainous forest.

■ The forestry potential, in terms of bio-volume of lumber, is very low to and can not sus-

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tain a profitable forest exploitation. However, many species are important for the local communities. Some species seem to have a rapid growth rate and natural regeneration that satisfies the local demand for fire wood. Other species produce edible fruits, and more importantly these forests are the refuge for local wildlife.

■ According to the local population, the native tree species of greatest interest for its lumber and multiple uses is the «teme colorado» (Ocotea lauraceae). Preliminary studies of the reforestation potential of this species have been done. Among the advantages for its use in reforestation are that it is a native species from the area, it requires little maintenance, it offers a food supply for the animal population, the seed management is easy through natural and artificial germinating success, and the growth rate relatively high (20 to 30 years).

■ Five schools in the area have been visited with the objective of finding out about the number of children (340) and to establish initial contact with the teachers (9). Meetings in Chacapata and Playa Rica have been held which were attended by more than 60 people from each community were present where the objective was to discuss the importance of the natural surroundings.

■ The main environmental problems in the area are shown to be 1) deforestation and loss of the natural vegetation cover, 2) soil erosion, 3) reduction and contamination of water sources, 4) lost of biodiversity, and 5) health risks for the community. For each these problems, a matrix has been devised with: a) the causes that augment the problem, b) effects on the natural and human landscapes, c) areas where the problem is occurring, d) actors who are contributing to the problem as well as those whom it affects, e) tendencies of the problem: present or potential, and lastly, f) a strategy to address the problem.

Outcomes

■ The study of forest residues (e.g., Chacapata) allows us to consider its potential as a center of seed and plant production for future reforestation of native species (e.g., Teme colorado or Ocotea lauraceae).

■ A general description has been conducted and can be found in the document "Study of the Natural Landscape in the SANREM CRSP Project Area" (1995).

■ Given the fact that deforestation is one of the most serious problems in the study area, the distribution, abundance, morphological structure of the lumber yielding native species for a possible reforestation program is very important. The details can be found in the document "Study of Forest Management Potential of the Teme colorado (Ocotea lauraceae) in North West Pichincha, Ecuador." This study served as a learning experience and a requirement for the graduating USFQ students.

Potential Benefits

■ The participation of the local population in the study of the forest and natural vegetation, as well as the identification of the environmental impacts, will help the communities better view and understand their natural surroundings and relate that information to the protection of the natural resources.

■ The study of the seed and plant potential for native lumber yielding trees, wild fruits, fire wood, and other forest products are of general interest for the local communities, and will set the goal of better natural regeneration management practices to conserve the forest, while reconstituting the natural (historical) landscape and wildlife. In this sense, the residual forest (e.g., Chacapata and Palmitopamba) are at an advantage due to accessibility to local populations.

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Program Highlights
E8-1

Social Capital and Networks of Reciprocity in the Four Communities in the SANREM CRSP Micro-region of Ecuador

Rationale

Social capital, defined as networks of reciprocity and mutual trust based on shared symbols and collective identity, is a necessary ingredient for effective collective action. High levels of social capital may increase community capacity for resolving issues facing the collectivity. However, certain configurations of social capital may also inhibit effective collective action. Social capital can be horizontal, hierarchical or absent. This project seeks to assess levels and patterns of social capital in each of the four communities within the SANREM CRSP/Ecuador site and relate them to contemporary and historical collective action. Through a better understanding of social capital and how it relates to collective action, we can understand its potential to foster more sustainable agricultural and forestry practices in the area. Through the use of participatory research methods jointly with community members, we hope to test whether it is possible for communities to consciously increase or reconfigure their social capital, thereby enabling them to be more effective in natural resource management.

Objectives

■ Develop baseline indicators of social infrastructure, a form of horizontal social capital, which includes acceptance of alternatives, mobilization of diverse resources, and horizontal networks of mutual obligations.

■ Explore deeply certain networks related to production and patterns of information exchange regarding both sustainable and conventional natural resource management.

■ Relate these production/natural resource-oriented networks to typologies of peasant economies being developed by other SANREM CRSP/Ecuador institutions, in order to better identify horizontal and vertical patterns of social capital.

■ Assess changes in the indicators of social infrastructure and relate those changes as well as the initial social capital configurations to the incorporation of sustainable practices and world view in each of the four villages.

Accomplishments

■ Using the minutes of the Community Board meetings of La Perla, we calculated indices of power based on patterns of turnover or duration of individuals in formal community posts. From the minutes, it was possible to delineate three phases of the community's life: (1) the pre-cooperative, (2) the pre-commune, and (3) the period of struggle for legal recognition of the community. The first phase involved greater continuity of leadership and fuller participation of all comuñeros in the governing process. The second period involved less continuity of leadership, declining participation of other residents in meetings of the community board, and large scale in-migration. In the third period, the community's political life enters into a period of crisis, in part because of the difficulty in obtaining services due to its irregular legal status. In the two latter periods there has been a significant decline in social capital.

■ Focus groups were held in all four communities to begin gathering information on social capital. Venn diagramming was used to explain the relative importance of the various community organizations, patterns of interaction among them, and their link with outside organizations. Other information on organized community life relating to the various dimensions of social infrastructure was also obtained. Results from the various subgroups within each focus group were shared with the larger group, and were summarized in the plenary session.

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104

■ Interviews with selected farmers in two communities allowed for the delineation of functional networks related to labor exchange, credit, and other productive activities. A stratification index was developed to demonstrate a predominance of horizontal relations in one community and largely vertical linkages in the other. This promising approach needs to be expanded to include a larger number of residents in each community, and to include the other communities.

Outcomes

■ The analysis of social capital has led the research in new directions; the unofficial status of the communities has stymied the growth of social capital because certain services are difficult to obtain (such as professional police) and others are in jeopardy (as in the case of the health center which serves the four communities). The prospect for success in "legalization," in part stimulated by the presence of SANREM CRSP, may encourage greater organization and strengthen social capital.

■ The historical examination of social capital through the minutes of the Community Board meetings of La Perla has enriched our understanding of changes in community organization and their relationship to shifts in land tenure. We found that participation was greater during the first phase of the community's life when all comuñeros were landholders. The population explosion that began at the end of the 1970s may have reduced social capital, but new organizational forms had to be found in order to incorporate families who earned a living from sharecropping and/or different forms of farm labor. As social capital declined, inclusion, and thus, social infrastructure, grew. This shift needs further exploration; it has huge implications for the communities' capacity to solve their problems, including those related to the environment.

Potential Impacts

■ The understanding of social capital and how different manifestations of it affect the capacity of communities to address issues could contribute to new perspectives on how community development might be done and community sustainability fostered.

■ The social capital optic may be very useful in community collective decision-making regarding the land tenure regime to be pursued. It is not a foregone conclusion that individual titling is a solution which would foster community collaboration. It may be that some combination of formal and informal, and individual and group, ownership would be preferable with respect to the well-being of the community as a whole. Normally, these community impacts are not taken into account.

■ The tracing of production-related networks, particularly those related to how information is exchanged, can provide important insights into how more sustainable approaches to resource use might be encouraged. This tracking will require collaboration of different projects within SANREM CRSP/Ecuador. For instance, if it is determined that ecological principles used in home gardens could be transferred to field situations, it will be extremely important to understand gendered informal networks, as they could be the vehicles for transfer of practices from one ecological niche to another.

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Program Highlights
E9-1

Agroecological Study of the Sustainability of Sugar Cane, Short Cycle Crops, and Agroforestry at the Farm Level in the SANREM CRSP - Ecuador Zone

Rationale

Based on the participatory appraisal of the Guayllabamba River, there was a strong indication that the greatest amount of agriculture was being practiced on steep slopes subject to erosion. Conventional practices of monoculture, high external inputs, and mechanization have only led to further degradation of the soil and build up of crop pests. The dominant long cycle crop is sugarcane where plant residues are often burned rather than utilized. Short cycle crops include beans, cassava, and corn. From an agroecological perspective, a framework integrating colonial and local knowledge to obtain alternative farming practices to improve soil and ecosystem health while providing necessary crop yields.

Objectives

■ Study the way farmers manage the production subsystems existing in the area, related to sugar cane, short cycle crops, and forestry verifying the current level of system integrity.

■ Determine the reasons farmers have adopted the techniques they are using especially related to the perceived soil degradation.

■ Study techniques that would encourage the gradual recover of agro-ecosystem integrity and identify alternative management practices.

■ Generate knowledge with land users on the relationship between agriculture and the landscape as a whole and disseminate these insights to other community members.

Accomplishments

■ Development of a practical guide to gather information about any agroecosystem in the SANREM CRSP area. Materials for short cycle and sugar cane agroecological production guides are in the elaboration stage.

■ Production of a methodological proposal for interinstitutional agroecological research for the SANREM CRSP-Nanegal area.

■ Definition of the indicators of sustainability to measure the actual state of agroecosystems.

■ Characterization of selected farms and a description of existing technologies including problem definition.

■ Investigation of the efficiency of nutrient recycling practices on peasant farms.

■ Identification of local methods for producing corn with emphasis on soil management, seeds, control of weeds, insects and diseases.

■ Identification of appropriate technologies for sugar cane production (or other crops) for a sustainable crop production.

■ Observation and verification of significant local natural resources protection practices including a description of models of ecological succession processes and natural stability. Appraisal of the study of ecological successions as a mechanism for agricultural land stability.

■ Revision of bibliographic references related to subtropic production systems for use in comparisons with the cropping systems in the study site.

Outcomes

■ Through the research, traditional technologies have been identified which are already in place and which are useful for incorporation in a long term productive strategy. This has

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substantiated that there are still agricultural practices that are respectful of the environment and natural resources.

■ Through participatory exercises, there was a strong emphasis on agroecosystem awareness including practical measures related to soil conservation, fruit crop management, small nurseries for forest species and the use of leguminous species in cropping systems management.

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E10-1

Local Knowledge, Social Capital and Community Empowerment: Basic Conditions for a Sustainable Management Plan of SANREM CRSP Project Region of Study

Rationale

It is believed that community control of the sustainable management of the micro-basin is contingent upon the empowerment of local knowledge, the strengthening of community organization, and the ability of residents to control and oversee the entire process. This will assure the creative participation of residents in all stages , and will facilitate the appropriation by the community of all results of interactions produced with institutions working in the area. Another key element in the communities is the resident's social capital, that is , the existence of formal and informal organizations, internal and external networks, social norms, reciprocity, symbolic elements, the skills and trust that exist among neighbors, and community members which facilitates cooperation and mobilization of resources for the mutual benefit of all. There are a variety of skills and techniques which can be transferred to develop social capital and to further empower the local population once the existing social organizations are in place.

Objectives

■ Study local knowledge (knowledge, attitudes, and practices) related to the management of resources, spatial ethnocategories, biodiversity, the way of conceptualizing problems and solutions. The community management plan is to be based on this knowledge.

■ Study the social capital in each of the communities: symbolic diversity, internal and external networks, mobilization of resources, reciprocity relations, markets and policies, for the purpose of identifying organizations and reciprocity relations that can be mobilized to solve problems and reinforce organization.

■ Study formal organizations to explain the reasons for their rise and continued existence; contribute to the development of these organizations so that they will assume, in a participatory fashion, the task of continuous evaluation of the process, building bridges for communication with scientific technical researchers, and transfer skills and techniques for the strengthening of communities; planning, administration, conflict resolution, cultural revitalization, and critical reflection.

Accomplishments

■ Reactivated contacts with the communities to explain the project, to survey the formal organizations to measure their potential, and to coordinate with the field team and other SANREM CRSP institutions.

■ Consulted the population about their most pressing constraints and about the image and expectations of SANREM CRSP, constructed a discourse to relate «the communities' urgent needs and expectations» with «the SANREM CRSP investigation proposal», and supported the legal recognition of the communities as one of the most urgent needs that will help solidify the SANREM CRSP's presence in the area.

■ Surveyed the social networks from participating families to analyze the composition of the social capital. Analyzed the social networks:
a) Classification of the families by social strata with a system of seven indicators
b) Maps of the networks crossing the social strata, good circulation, community work, services and knowledge.

■ Made progress in the design of MASEDES (Continuity and Evaluation Framework for Sustainable Development) to accomplish the start-up evaluation.

■ Designed and held workshops on the application of PAC-ORGANIZATIONAL methodologies. The PAC is a tool for participatory discussions about the statutes and regulations for the Committees for Improvements in each communities. Conducted of 5 PAC-Organizational workshops (organization, structure, internal regulation).

■ **Gained Local Histories:**
a) Agreement with community leaders to investigate the local history.
b) Transcription of the minutes, landed properties transfers, communications, mingas, and accounting documents for the community of La Perla from 1969 to 1996.
c) Survey of two local monographs of La Perla (1969-79 and 1969-82).
Processed the data contained in the meeting minutes of La Perla to interpret local history and to deepen our knowledge of community social organization.

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■ Supported the legalization of the communities into Improvement Committees and elaborated statutes and regulations.

■ Held workshops with focus groups (leaders, representatives of formal organizations and community groups) in La Perla and Palmitopamba to measure the SOCIAL CAPITAL of the COMMUNITIES.

Outcomes

■ The population values community participation and the roles of decision making methodologies as a distinct work modality compared to the more vertical ways of other groups or of the State.

■ The population knows the different organization options permitted in Ecuadorian laws and they chose with full knowledge the Improvement Committee option.

■ There is the strong attitude to discuss a new organizational option that will link together all formal organizations and build upon existing social capital.

■ The existing social capital is known and valued as well as the various types of local, micro-regional and regional networks. The improvement of the social capital is considered necessary.

■ The capacity to reflect on local problems has been improved and the possibility to suggest alternatives has been developed.

■ The work with the communities has shown the necessity to combine the most urgent problems with the SANREM CRSP proposals, or to build intercommunication bridges.

■ Participation is a process that has to do with attitudes, work styles, involvement, and methodologies. The participatory methodologies must be developed and adapted creatively to each particular case.

■ Interinstitutional and multidisciplinary collaboration have produced its first fruit. By confronting "progress" and the points of view of different experts, profound and diverse forms of approximation to the concrete reality of the zone can be seen.

■ Colonization processes have generally been considered negative for deforestation, acculturation, competition with native groups, and the rapid depletion of natural resources. This image is the object of redefinition in this investigation. The Nanegal communities have reestablished their networks, they have an important social capital, although centralized, and they have various formal organizations that catalyze the actions of the families. It may be possible to increase the social capital by strengthening the formal and informal organizations to reach the goal of adequate natural resources management in a sustainable development proposal.

■ The population has gone from a marked disorganization and crisis to one of hope and organization. The community leadership is now working. Families are participating in community activities. New ideas and alternatives have been put forward. People know their social capital, potentials, weaknesses, and are ready to work toward solving their problems.

■ According to the inhabitants of La Perla and to our research, the community organization crisis of the last few years has three origins: a) It is a growth crisis. That is, while the population of the commune increased no other forms of organization that enabled the inhabitants to participate was developed. When the inhabitants were few and known to each other, participation was high and the leadership's control was total. b) It has an identity crisis. They have not been able to find unifying common elements. When the issues of land and services were resolved, peoples did not find motivating elements. All of this was provoked by the massive presence of new colonizers. c) The productive model exhausted possibilities and resources. There were many problems (plagues, sickness, drought) that rendered the zone unattractive. New productive strategies have been elaborated because the existing ones are not adequate for the sustainability of the migrants.

■ Poverty is not the same in all four communities. Poverty is very related to the levels of existing social capital.

■ Household production strategies are defined in the area by land access, cattle, machinery (including sugar mills), relationship with the market, and available social and human capital.

■ There is strong interest to experiment with new technologies that would revalue local products and open new markets.

■ There are three types of networks: local, micro-regional, regional. Each network can be classified by order of importance for the communities (for their quality of relations or intensity): very important, important, not so important. Also, they can be classified according to the types of relationships they generate: solidarity (democratic) or hierarchical.

■ Three new methodological products have been generated: a) The PAC for colonization zones, a tool used in the community auto-diagnostic; b) The PAC-Organizational, a tool that served to analyze the organizational structure of the area; c) The social relations' map, a tool design for the auto-diagnostic of the social capital.

■ The PAC-ORGANIZATIONAL, a small manual has been produced for discussion of the statutes and regulations of the organization. It is accompanied by a graphic elaborated in cloth, that symbolizes the organization in sugar cane, the main crop of the area.

Potential Benefits

■ The work of COMUNIDEC does not directly act on the natural landscape. However, it is considered that an empowered community that can make decisions, have its partners implement them, and has better negotiation capabilities, can manage and improve its local knowledge and will manage more adequately its resources.

■ Therefore, under the premisses of such a thesis, the conditions created in the area mark new signs:
a) The creation of the Improvements Committees with a juridical persona, recognized by the population and the State, will allow to take decisions about natural resources and territorial management that will be mandatory for all partners, and will permit a more adequate control and use of natural resources.
b) The analysis of the social capital realized in a participatory manner has shown the relationships between the solidarity networks and good management practices. The democratization of the networks and the strengthening of the social capital, will improve resource use and management.
c) Community empowerment will allow the communities to negotiate with local, micro-regional and regional powers (State, Haciendas, Merchants) to establish adequate forms of resource management.

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FOR YEAR 4 - ENDING JULY 31, 1996

Prepared by: Jolie Baker, Project Coordinator

COST ELEMENT	(A) USAID Obligations in Year 4	(B) Cumulative USAID Obligations Years 1 - 4	(C) USAID Obligations Encumbered at UGA in Year 4	(D) Cumulative USAID Obligations Encumbered at UGA Years 1 - 4	(E) Actual USAID Expenditures in Year 4	(F) Cumulative Actual USAID Expenditures Years 1 - 4	(G=D-F) Non-Invoiced Balance of Encumbered Funds
MANAGEMENT ENTITY							
SALARIES	$ 176,099	$ 676,876	$ 176,099	$ 676,876	$ 169,048	$ 657,356	$ 19,520
FRINGE BENEFITS	52,329	187,939	52,329	187,939	41,263	171,050	16,889
CONSULTANTS	30,870	50,390	30,870	50,390	8,858	86,289	(35,899)
TRAVEL/TRANSPORTATION							
-DOMESTIC	12,000	46,439	12,000	46,439	14,763	69,966	(23,527)
- INTERNATIONAL	18,000	76,841	18,000	76,841	30,978	83,795	(6,954)
OTHER DIRECT COST	57,518	215,617	57,518	215,617	87,393	323,415	(107,798)
INDIRECT COSTS	138,886	613,332	138,886	613,332	186,044	730,941	(117,609)
SUBTOTAL - MANAGEMENT ENTITY	$ 485,702	$ 1,867,434	$ 485,702	$ 1,867,434	$ 538,347	$ 2,122,811	$ (255,377)
PROJECT SUPPORT & DEVELOPMENT	$ 150,000	$ 395,000	$ 150,000	$ 395,000	$ 42,078	$ 233,597	$ 161,403
RESEARCH SUBCONTRACTS							
DOMESTIC COLLABORATORS							
AUBURN UNIVERSITY	$ 125,576	$ 380,216	$ 138,586	$ 302,682	$ -	$ 151,044	$ 151,638
COLORADO STATE UNIVERSITY	50,000	142,498		135,846	18,978	115,690	20,156
CTR FOR HOLISTIC RESOURCE MGMT	61,000	61,000	-	61,937	25,426	50,380	11,557
IOWA STATE UNIVERSITY	47,200	47,200	103,685	152,472	56,372	101,667	50,805
TUSKEGEE UNIVERSITY	115,000	328,650	147,338	209,313	122,740	183,890	25,423
UNIVERSITY OF GEORGIA	199,400	1,296,442	185,301	1,353,375	344,286	1,226,741	126,634
UNIVERSITY OF WISCONSIN	175,218	444,507	31,513	486,593	281,864	352,900	133,693
USDA-ARS	-	39,938	-	10,620	1,535	2,597	8,023
VIRGINIA POLYTECHNIC INSTITUTE	40,000	274,160	97,612	292,684	37,550	215,858	76,826
WASHINGTON STATE UNIVERSITY	40,000	201,000	148,356	324,889	106,275	280,151	44,738
WESTERN CAROLINA/PVO-UNIVERSITY CTR	45,246	307,877	121,077	343,217	121,078	343,217	-
INTERNATIONAL COLLABORATORS							
AVRDC	33,185	98,050	-	60,252	20,299	40,367	19,885
CARE/ECUADOR	-	-	66,085	66,085	39,163	39,163	26,922
INTL CTR-RESEARCH-AGROFORESTRY(ICRAF)	20,000	57,000	-	37,540	-	-	37,540
INTL POTATO CENTER(CIP)	20,000	20,000	-	34,463	15,323	34,463	-
INTL RICE RESEARCH INSTITUTE(IRRI)	50,125	299,792	112,125	112,125	-	-	112,125
PLAN/BURKINA FASO	100,525	200,525	-	232,452	87,447	230,666	1,786
HOST COUNTRY COLLABORATORS							
CNRST/BURKINA FASO	-	426,560	184,612	184,612	46,153	46,153	138,459
EARTH UNIVERSITY	56,304	76,304	62,560	62,560	52,326	52,326	10,234
HEIFER PROJECT INTERNATIONAL	558,558	1,133,142	501,427	1,824,161	822,967	1,807,977	16,184
PCCARD/PHILIPPINES	-	145,744	-	-	-	-	-
UNIVERSITY OF OUAGADOUGOU-(IDR)	100,000	100,000	22,565	22,565	5,641	5,641	16,924
ZAMORANO UNIVERSITY/HONDURAS	54,961	74,961	61,068	61,068	30,392	30,392	30,676
PROPOSED COLLABORATORS							
FUNDAGRO	-	100,000	-	-	-	-	-
ICRISAT	-	50,000	-	-	-	-	-
INERA	100,000	100,000	-	-	-	-	-
IRBET	100,000	100,000	-	-	-	-	-
SUBTOTAL-RESEARCH SUBCONTRACTS	$ 2,092,298	$ 6,505,566	$ 1,983,910	$ 6,371,511	$ 2,235,814	$ 5,311,283	$ 1,060,228
GRAND TOTAL	$ 2,728,000	$ 8,768,000	$ 2,619,612	$ 8,633,945	$ 2,816,239	$ 7,667,691	$ 966,254