

SANREM CRSP
Annual Report 2001- 2002
On the Path Towards Sustainability

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Annual Report 2001- 2002

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Sustainable Agriculture and Natural Resource Management

Collaborative Research Support Program

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SANREM CRSP ANNUAL REPORT 2001-2002

On the path towards sustainability

The 2001-2002 fiscal year that we are reporting in this document was very productive. Work continued in our seven sites (Ecuador, Peru, the Philippines, Vietnam, Mali, Kenya and the US) with a strong emphasis on synthesizing research, deriving lessons learned and documenting our accomplishments and shortcomings.

We organized one Research Synthesis Conference on November 28 to 30, 2001, in Athens, GA. Researchers from Ecuador, Peru, the Philippines, Vietnam, Mali, Kenya and the US shared research results, methods, training achievements and impacts sponsored under the SANREM program. Topics covered during the conference targeted issues of relevance to the program's audience, i.e. researchers, policy makers and development workers. SANREM researchers also discussed lessons

learned while developing tools and methods, and carrying out institutional strengthening efforts and policy analysis related to sustainable agriculture and natural resource management. The conference papers and discussions allowed SANREM to underscore promising new or on-going research areas that should be included while planning for the next phase of the SANREM CRSP (2003-2008). Power point presentations and papers submitted for this Conference are available online.¹

SANREM researchers summarized years of work in the Andes and Africa respectively, in two books.² They also provided state-of-the-art papers in another book on conservation and development projects around protected areas in Latin America.³ In addition, twelve scientific journal papers were published or approved for publication during this period. Two synthesis studies were tasked to distill SANREM's experience. In the Philippines, a study was carried out on SANREM's experience in linking participatory local-level research with policy making at local, provincial and national levels. Another study was implemented to compare and contrast the citizen-based water quality monitoring efforts in Ecuador and the Philippines.

Communications with broad audiences in the sustainable agriculture and natural resource management community were strengthened through the dynamic and proactive use of electronic media. SANREM's website was completely revamped and provided the structure for storing and accessing news, documents, photographs and maps of SANREM activities worldwide. We launched a "Research Brief" series to scale-out SANREM's reach and make the results of SANREM research available to audiences usually not in direct contact with SANREM researchers.



**Sustainable Agriculture & Natural Resource
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Conservation farming and land use planning are two of SANREM's major project areas

Twelve "Research Briefs" were completed in the period we report and distributed widely. In cooperation with the Philippine Institute for Development Studies (PIDS), the SANREM South East Asia project also launched several Policy Notes specifically designed to target national legislation and policy makers in the Philippines. Copies of the "Research Briefs" and "Policy Notes" can be downloaded from SANREM's website.⁴

In January 2002, SANREM and the Soils Management CRSP jointly launched a "Carbon from Communities" project supported with NASA (National Aeronautics and Space Administration) funds (2001-2003). The project presents a unique opportunity to simultaneously address agricultural productivity, natural resource conservation and carbon sequestration in Mali. NASA data will be used to provide an efficient and rapid means to inferentially assess carbon stock changes attributable to community-based agriculture and natural resource management (NRM) decisions. Specifically, the project will seek to demonstrate remote sensing technology's potential for assessing local and regional carbon stocks by monitoring community land management practices and their subsequent carbon storage capacity, and then scaling up. The project will contribute to increase the precision of identification of carbon sequestration capacities of agro-pastoral managed systems and ridge-till

age systems with differential carbon sequestration capacities using remote sensing.

Project reporting and monitoring was streamlined substantially reducing the time researchers spend in report preparation while increasing the effectiveness of their communication with donors and other stakeholders. Reporting was carried out totally through a Web-based database specifically developed for this purpose. The system considerably reduced the time in report submission and powerfully increased the flexibility in report design for specific audiences and topics.



Carbon from Communities in Mali

On January 15, 2002 a Request for Pre-Proposal (RFP) was issued as part of the process of preparing SANREM's third phase (2003-2008). The RFP sought proposals to support SANREM's focus on the three priority themes selected for SANREM's Phase III, namely:

1. Community-based water and watershed management
2. Agriculture and biodiversity use and conservation linkages
3. Local responses to global climate variation

Within the framework of those priority themes, researchers were asked to tailor proposals addressing the following methodological issues: 1) Ecological-agriculture land use systems and methods; 2) Optimum approaches to local landscape planning and management; 3) Innovative local organizational structures and management for sustainable agriculture and natural resource management; 4) Methods and approaches to link local research to national levels; and 5) Methods to integrate landscape analysis up and down the ecosystem hierarchy.

Our priority in Phase III preparation was to set the conditions to enhance SANREM's overall capacity to carry out high quality research quality and produce extensive benefits. To that effect, we widely opened the request for proposals to allow researchers from universities affiliated or not to SANREM to submit research proposals, and for SANREM to be able to prepare a Phase III proposal on the basis of the best individual research proposals. It was deemed critical to balance to the extent possible the input from social and biophysical sciences, and the focus on sustainable agriculture, on one hand, and management of natural resources, on the other. We also emphasized the need to consider those proposals that are more promising in terms of actual contributions to people and the environment, and the advancement of scientific knowledge in specific fields.



We received more than 60 pre-proposals, which were reviewed by a panel of six external reviewers. The External Advisory Group chose 20 of those submitted pre-proposals, and the principal investigators of those pre-proposals were invited to submit full proposals. In order to remove the potential for a conflict of interest the Management Entity at UGA did not vote in the selection of pre-proposals. On July 15, 2002 16 out of the 20 full proposals received were approved to be included as part of SANREM's Phase III proposal. A SANREM CRSP proposal for Phase III, which incorporates all those proposals, is slated to be completed in late September 2002, and will be submitted to USAID for a review in November this year.

In the following pages we present a report on individual activities within the different SANREM projects. Accomplishments are described for each activity in terms of scientific advances, as well as contributions to capacity building, scaling up, policy impact and improvements in the life of people and natural resource management. At the same time, each project section is prefaced by a summary of SANREM's outcomes over the last four years. The resulting report indeed confirms that the activities at SANREM during the last fiscal year and the preceding years have indeed been very fruitful.

Footnotes

¹ <http://www.sanrem.uga.edu/sanrem/conferences/nov2801/default.cfm>

² Rhoades, R. (Ed.). 2001. *Bridging Human and Ecological Landscapes: Participatory Research and Sustainable Development in an Andean Region*. Dubuque, IA: Kendall/Hunt Publishing Company.; Vitale, J., J. Stuth, T. Butt, P. Dyke, and J. Angerer. (in press). *Implications of Extensification and Intensification for Food Security in 2015: Farm Level Analysis Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali*.

³ Rhoades, R. and J. Stallings. (Eds.). 2001. *Integrated Conservation and Development in Tropical America: Lessons Learned in Linking Communities, Projects, and Policies*. Athens, GA: SANREM-CRSP and CARE-SUBIR.

⁴ <http://www.sanrem.uga.edu/index.cfm?pageID=20>



SANREM Andes Project Overview

1. Introduction

The central accomplishment of the SANREM-Andes project (Phase II) has been the development of an applied research and decision support process called the "sustainable mountain futures methodology" - whereby diverse stakeholder groups in mountainous regions jointly create sustainable land, water, and biodiversity management systems. The research keeps an eye on a globalizing economy in the context of decentralizing community governance. Our accomplishments are directly relevant for a much needed re-thinking of a pervasive global flat-land policy mentality which has worked in negative ways toward mountain environments. The pilot research to develop this process took place in two sites in Ecuador: Nanegal Parish of Pichincha Province and Cotacachi Municipality of Imbarura Province. These sites were chosen since stakeholders (local, national, and international) are faced with unique challenges of managing diverse resources across jurisdictional boundaries, across extremes in topographic relief and poorly accessible terrain, and within a setting of high stakeholder conflict. The research addresses challenges set out in Agenda 21, Chapter 13 (Managing Fragile Ecosystems: Sustainable Mountain Development). The project is actively embedded in the global inter-agency network of organization working on the global mountain agenda, including the 2002 UN International Year of the Mountain. The interdisciplinary research team, involving US scientists and Ecuadorian scientists and NGO's, participated with local communities in addressing both "human drivers" and "environmental impacts" of natural resources and agriculture. Two

projects (AND-02: ethnoecology and AND-03: institutions) examined the role of sociocultural/ demographics factors and social organization drivers while two biological science projects (AND-05: water resources and AND-08: soils) examined direct environmental impacts. The central linking project AND-07 (sustainable mountain future) pulled together data from all projects, filled data gaps such economics and biodiversity, and provided a platform for the creation of scientifically valid future scenarios for community-based planning and action. AND-01 (coordination) and AND-09 (Scaling-up and Training) facilitated and carried out the extension of the methodology to local, national, and international audiences. Year 5 projected accomplishments are clearly stated in the Year 5 work plans found on the SANREM website. The products of each project, which operated both within a team context and individually in its execution of research and transfer activities, are listed below.

2. Highlights of Accomplishments

2a. Publications (June, 1998 - May 2002):

The SANREM-Andes has been most prolific in scientific publication output. Published to date are 10 books and monographs, several by top-rated university and trade presses (e.g., University of Arizona Press, Kendall/Hunt Publishing, and Abya Yala Press). Five of these books were published in both English and Spanish, three in only English, and one in Spanish only. Ten refereed articles have been published in high ranking journals (e.g., Human Organization, Climate Research, Mountain Research and Development). In addition, 21 book chapters and seven SANREM

research briefs have been generated by the project. The books and articles published in more prestigious outlets have been extensively reviewed in the scientific literature.

2b. Professional Presentations:

SANREM-Andes researchers have presented papers on SANREM in over three dozen international and national meetings. In several instances, the SANREM-Andes PI was the keynote speaker (e.g., Rhoades before Cornell's international conference on Communities Watersheds) thereby reaching diverse decision-maker audiences. Project PI's organized three E-conferences and satellite presentations. The most recent (2002) on "Rural Municipalities and Participatory Local Management in Mountain Areas" with Mountain Forum-Andes/Condesan involved over 350 participants. In 1999, the project organized jointly with CARE (Cooperative for American Relief Everywhere) and USAID-Ecuador an international gathering of 200 individuals throughout Latin America on the topic of "Integrated Conservation and Development: Lessons Learned in Linking Projects and People". SANREM was also a co-sponsor of a 1999 conference "Third International Symposium on Sustainable Mountain Development" held in Quito, Ecuador, and attended by several hundred international participants. In addition, nine smaller workshops and coordination meetings were held in Ecuador and the US.

2c. Methods, Data, Information-Knowledge:

Several innovative methods for sustainable agriculture and natural resource management have been generated by the project. Memory banking, although originally developed in the Philippines with UPWARD/CIP, was refined in Ecuador through the SANREM-Andes project. This method of rescuing both genetic resources and indigenous knowledge of culturally significant plants has been adopted by international organizations (IPGRI, CIP) and national groups (e.g., Native Seed Search, USDA Vietnamese germplasm project, In Situ agrobiodiversity project in Peru). Future visioning, the central team method of SANREM-Andes II, has been successfully applied in the Nanegal site, Quilcas in Peru, as well as in land use planning for the Georgia (USA) Piedmont. The institutions team AND-03 has refined and adapted the advocacy coalition approach to conflict and natural resource management. A step-by-step methodology for summarizing information on tools needed by institutional actors, as well as desired

future states and mental causal models by institution and by coalitions, has been developed on three key issues in Cotacachi. SANREM-Andes has collaborated with the International Centre for Integrated Mountain Development in the creation of an extrapolation tool whereby regions of similar techno-environmental needs can be identified for technology transfer and training.

A combined integrated data-visual database has been established at three project nodes (UGA, Catholic-Quito, and Cotacachi). This massive database currently includes GIS-based soil, topographic, political boundaries, climate, hydrology, demographic, and project-specific information on both Nanegal and Cotacachi. The database includes, for example, a 10% sample of migrants in three SANREM study areas (N=771) as well as a 10% participatory census of Nanegal Parish. In addition, over 75 cognitive landscape maps, 50 environmentally relevant folktales, and dozens of culturally relevant plants and their accompanying indigenous knowledge have been collected. Two advocacy coalition databases in N-Vivo (text analysis program) have been completed along with two nested data bases consisting of 20 interviews at the Secondary Level Organization level and 100 interviews at the community level on social capital and organizational capacity in 4 indigenous SLO's in Ecuador. A Global Water Quality Database has been developed with links community-based, water quality monitoring programs in various parts of the work, including Ecuador. A series of 3,258 bacterial samples have been taken from water sources in Cotacachi at 222 sites and analyzed. Detailed characterization and geo-referencing of soils with respect to soil development, soil fertility, and erodibility has been completed. Land use change models projecting future scenarios based on 30 years of trend data have been completed for Nanegal while similar historic land use trends for Cotacachi have been completed. Land use trend data over 30 years for Quilcas, Peru, has been collected and analyzed in participatory scenario building workshops.

2d. Training:

Twelve Ph.D. (Doctor of Philosophy) and eight Masters students received full or partial dissertation support (9 US, 7 Ecuadorian, 2 Peruvian, 1 Philipino, 1 European) for SANREM-Andes research. Over 300 individuals received training and information in SANREM-Andes courses, training workshops, and biodiversity fairs. Seventy-six citizens in Ecuador and 11 in Peru have become certified water quality monitors. Twelve

community leaders and project staff have been trained in various skills, including advocacy coalition and youth-led memory banking. Scholarship support has been given to 16 indigenous children for participation in memory banking. One indigenous project staff was provided assistance for matriculation at a local technical university.

Four Ecuadorian scientists provided on-site training in the US and at CIAT (Centro Internacional de Agricultura Tropical) in GIS and other spatial-information tools for NRM research.

3. Impacts

3a. Impacts at Local, Regional, and Global Levels:

Local: Impact study at the Nanegal site showed that three-fourths of participants used SANREM information and that 84% of those passed on this information to neighbors. Sustainable cropping systems (bean and sugar cane) gave adopters a net increase in family income of 11% leading to a doubling of area planted. Two Nanegal communities obtained legal status due to SANREM which stimulated better conservation practices. Over a dozen endangered culturally relevant plants as well as associated indigenous cultural practices identified and rescued. Creation of awareness of water quality importance to human health leading to improvement of community water systems by citizens. Water monitoring helped leverage German financial assistance to build water distribution systems in six Cotacachi communities. Water monitoring data was vital to election of SANREM project indigenous collaborators to political office who are implementing plans to discharge city water with minimum environmental and health impacts on approximately 20,000 inhabitants. Agronomic and soils research in Cotacachi has demonstrated means to improve soil fertility and increase yields. Future visioning in Nanegal and Quilcas, Peru, has led to local initiatives to push for infrastructure improvements and compensation for disenfranchise lands. The advocacy coalition research in



Ecuador and Peru has led to increased awareness and effective action of local decision makers in terms of their rights and laws affecting land use, land ownership, and water regulations.

Regional: Project biodiversity data and land use maps were utilized to design and execute the Choco-Andean biodiversity corridor stretching from Nanegal into Colombia (Global Biodiversity Hotspot). Through participation in e-conferences, publishing, and presentations, the research results of SANREM-Andes has stimulated discussion, and hopefully impact on policy, of participatory research and natural resource management in the Andean region. The joint conference on integrated conservation and development reached over 200 practitioners and policy makers while the e-conference on local institutions had over 350 participants.

International: Project has directly influenced global policies on mountain areas, especially the Andes - by incorporating ideas, plans, and laws which are sensitive to mountain realities. Participation in the global inter-agency initiative on mountains and the International Year of the Mountain has brought SANREM decision support tools to mountain policy makers globally. Robert Rhoades participated in the Mountain Forum, a networking organization that reaches policy makers around the world. Through participation of SANREM researchers in the US Genetic Resources Council (advisory to the U.S. Secretary of Agriculture) new policies on intellectual property rights developed. Novel approaches to legally protecting indigenous knowledge impacted Ecuadorian external trade policy negotiations. Drs. Jan and Cornelia Flora's work on social capital and advocacy coalitions impacted thinking within the Poverty Section of the World Bank. Global water monitoring database and methods have been adopted in Asia, U.S., and Latin America.

3b. Return to the United States:

All of the SANREM US PI's have parallel projects in the U.S. in which

An impact study at the Nanegal site showed that three-fourths of participants used SANREM information - 84% of those passed this information on to neighbors.

the lessons learned, technologies, and methods have been applied to improve the livelihoods or protect the environment in the U.S. Water monitoring equipment and supplies are purchased from 2 U.S. companies, in one case to our project specifications. Discussions with these companies have spearheaded establishment of distributorships in several countries where SANREM has worked.

The advocacy coalition focus group methodology has been applied to the planning process of four Regional Sustainable Development Partnerships in Minnesota, including training for a citizen-led watershed organization in Iowa. In rural Iowa, the SANREM work has informed a leadership program for new Hispanic immigrants. Knowledge of fertility and erosion of volcanic ash soils can be useful to similar situations in the U.S. Methodologies for low-tech assessment of hydrologic processes, such as climate monitoring involving local collaborators, may be used in the US. Low-tech stream flow monitoring devices and runoff and sediment collectors may be used in domestic community-based watershed monitoring activities. The memory banking methodology has been adopted and applied in saving endangered landraces and wild species among southwestern Native American groups (Arizona) and in the south with various ethnic groups (Southern Seed Legacy). The USDA is now asking that the memory banking method be applied to a study of germplasm acquisition among Vietnamese immigrants and refugees. The memory banking method's originator, Dr. Virginia Nazarea, received the national Praxis Award in anthropology for her work. The future visioning methodology has been applied to the land use planning process of Oglethorpe County, Georgia. Finally, the SANREM-Andes project has contributed to the international curriculum and programs at three US universities: Iowa State University, Auburn University, and University of Georgia. In the case of Georgia, it has led to the signing of memorandum of agreement between two Ecuadorian universities and UGA (University of Georgia).

3b. Tracking Impact:

In Ecuador an independent evaluation was made of the local impacts at the Nanegal site (103 participants surveyed). In the US, each PI keeps a record of their involvement of parallel projects in water, biodiversity, advocacy coalitions. Also, we have an integrated database at three nodes (Athens, Quito, and Cotacachi)

in which all information, including impact information, is available.

4. Dissemination

SANREM-Andes disseminates its findings and outputs through publications, presentations, e-conferences, research briefs, participatory hand-on workshops, professional organizations, formal and informal training and PI involvement with international organizations, boards, as well as in the classroom in the US and abroad. SANREM PI's are in high demand as keynote speakers. The long list of critically reviewed publications listed above testify to the tremendous outreach of the SANREM team. The significant number of research briefs written about the Andean project is empirical evidence of interest. Other groups, such as the Asian Watershed Network, reprinted R. Rhoades "lessons learned" article about participatory watershed research and distributed to 7000 readers. Novel approaches have been developed. For example, future visioning and advocacy coalition was part of a graduate course at the National Agrarian University conducted jointly with the Grupo Yanapai and the Association of Livestock Raisers of Quilcas, Peru, and attended by national NGO's and policy makers. We developed our own bilingual website which has now been taken over by the ME (Management Entity). The numerous conferences (including electronic) reach hundreds of interested individuals. An article in Southern Living Magazine about the Southern Seed Legacy, the US parallel project to memory banking, reached over 2 million US readers. Evidence of the effectiveness of the Andean outreach is the high number of requests for publication and invitation to keynote addresses. SANREM-Andes co-sponsorship of biodiversity fairs, women's days, visioning workshops, and so on guarantee a local spread of results.

5. Training and Institutional Strengthening

The SANREM-Andes has been one of the most aggressive CRSP projects in training of graduate students, both from the US and host countries (see figures above). Former US students are now employed by Heifer Project International, USAID, and CGIAR (Consultative Group on International Agriculture Research) centers. One Peruvian student at ISU (Iowa State University) is being groomed for a possible position at the University of La Molina. Ecuadorian students have taken up posts with international NGO's, Ministry of Agriculture, and Ministry of Environment. Local

indigenous participants have moved into higher positions of political decision making. Ecologist Auki Tituana, recipient of an international prize for making Cotacachi an ecological canton, is now respected as a potential candidate for the Presidency of Ecuador. Rafael Guitarra, co-PI in the ethnoecology project, is the President of UNORCAC (Union of Organizations of the Peasants of Cotacachi). Galo Ramon and Segundo Andrango headed up a major World Bank project for indigenous people throughout Ecuador (over 2 million participants) in which SANREM methods and approaches were used. Magdalena Fueres, Co-PI on the up-scaling project AND-09 is now council woman in Cotacachi, the first indigenous woman ever elected to the Canton Council.

Regarding institutional strengthening, the project has impacted community-level organization in Nanegal and Cotacachi. Nanegal, a frontier, is a difficult place to institutionalize but legalization is one example of how SANREM-Andes helped. Cotacachi, however, is open to the need for second degree organizations (UNORCAC) articulating between the international and national levels in terms of development. In this case, SANREM's impact has been tremendous and might well be the seed from which a new participatory development paradigm springs in the Andes. Four Ecuadorian universities, 5 NGO's, 3 ministries, and 48 communities have been engaged by SANREM in some capacity. At the international level, R. Rhoades has contributed to the development of the Mountain Forum. The Floras (AND-03) have been particularly effective in building research capacity among NGO's. Working with Grupo Yanapai, Heifer International-Ecuador, and Terranueva, they have deepened the NGO's relationship with the grassroots organizations with which they work and trained the personnel in research methods. Contacts arising from the SANREM project have contributed to an exchange program between University of La Molina and ISU that will substantially strengthen graduate programs in Sustainable Agriculture at both institutions. The GIS work on future visioning and land use change has benefitted from a close collaboration with the Direccion de Informacion sobre Recursos Naturales y Ordenamiento Rural (DINAREN) of the Ministerio de Agricultura y Ganaderia (MAG) in Quito, Ecuador.

6. Collaborative Relationships

i. Role of US-based scientists and HC scientists: More than 50 researchers (NO, universities, ministries, local communities) have participated as PI's, Co-PI's, and

collaborators. Approximately, 20% have been U.S. citizens while the remainder are Ecuadorians (majority) or Peruvians. All Andean activities are jointly planned, written, and executed. For management and budgeting purposes, the main PIs are U.S.-based (ISU, Auburn, and UA). More than half of the budget has been spent on behalf of the host country. Research carried out in the communities of Cotacachi must pass through a local approval process. All proposals must be presented to the communities in an assembly and the community decides on the relevance and approval of the project. The project participates with both UNORCAC which has 45 communities in its secondary level organization. The indigenous secondary organization in Ecuador is a para-statal organization which carries out development in their regions. At the same time, we have a strong working relationship with the Mayor of Cotacachi who is the official government representative in the region. The SANREM-Andes project has been strong on NGO's, especially HPI (Heifer Project International), Terra Nueva, Communidec, EcoCiencia, CARE, Grupo Yanapai, and others. The NGO's have mainly been in charge of extension and application of technologies, research findings, and information within the communities. We have had a strong linkage with three International Agricultural Research Centers (IARC's): CIP (International Potato Center), CIAT, and ICIMOD. These international centers have helped in training (CIAT in GIS and modeling), germplasm and methods (CIP in Andean tubers), and methods development (ICIMOD (International Center for Integrated Mountain Development) in ecoregional approaches). Joint activities have been planned and are being planned with all three. As mentioned above the water team works with monitoring suppliers to market materials in the area where SANREM works. In Ecuador, a private producer of quinoa has worked through SANREM to start farmers in the production of organic quinoa for niche markets in the US. SANREM has assisted with a private agro-tourism company (linked to UNORCAC) in attracting tourists to the area.

7. Leveraged Funding External to USAID

Several recent grants should assist in the process. These are separate and complementary funds and are not funds going to the SANREM project per se (an important distinction for government funding and the Contracts and Grants office of UA). R. Rhoades received a Fulbright grant valued at \$13,000 for research in Ecuador (Spring 2003). The University of Georgia will



Students learn about plant diversity

provide salary support for research for both Virginia Nazarea and Robert Rhoades during their spring, 2003, research leave in Ecuador. R. Rhoades is a co-PI on an international Ecoregional grant (Dutch funded) of \$500,000 to ICIMOD for methods development. Jan and Cornelia Flora received a grant through the Association Liaison Office from USAID-Peru for an exchange program between ISU and the National Agrarian University. The Assembly of Cotacachi has provided funds for publication of citizens guides.

8. Accomplishments Related to Original "Five Year Indicators" and Notes on Year 5 Plans

The EEP requested that all SANREM programs develop Five-Year Indicators as specific markers with which to measure progress. Although not requested as part of this report, the SANREM-Andes team is proud to indicate that we have more than addressed the 12 original indicators.

8a. Scientific and Indigenous Multimedia Decision Support Platforms:

Among the many decision support tools developed are: 1) models (USLE, EPIC, LUC model, and future visioning); 2) social science approaches such as advocacy coalition, social capital, and mental causal models; 3) ethnoecological methods such as comparative mapping, participatory mapping; 4) Photo-simulation tools using digital cameras and Photoshop; 5) Canton Atlas for natural resource planning will be finished in year 5. Most of these methods or products have already been written up or are being written up for general application. A final SANREM-Andes conference of all scientists and participants will be held with the local communities in March, 2003. Year 5 will also be dedicated to final publication efforts.

8b. Case Studies of Landscape Level Decision Support Tools and Experiences:

Two major books published in both English and Spanish on the SANREM field experience (Nanegal and ICDP book with CARE). Seven research briefs on SANREM-Andes produced and distributed by SANREM Memory banking protocol published in Spanish by Abya Yala Press. Also, see full publication list of SANREM-Andes.

8c. Landuse Change/Hydrology Model (See indicator 8a. above):

Three models near completion or in progress are Future Visioning LUC model for Nanegal and Cotacachi, EPIC model in AND-08 and USLE model in AND-07 as a master's thesis at Catholic University. Social science models include advocacy coalition/mental causal models in AND-03 A book on soils and soil fertility geared toward local uses in Cotacachi by Dr. William Miller and Franz Zehetner in Spanish will be released in year 5. Mr. Zehetner will also receive his Ph.D. in soils from UA in 2003 based on his research in Ecuador.

8d. On-site Databases Established:

Databases are 75% complete and stored in three database nodes at Catholic-Quito, Cotacachi (Jambi Mascaric) and UA. Database management led by Catholic University-Quito (Monsarrath Mejia) who is also producing a decision makers Atlas for Cotacachi. Longitudinal data on both Nanegal and Cotacachi include 40 years of landuse and biodiversity change in addition to socio-cultural and historical information. The databases represent unique information sources for long-term analysis of environmental change.

The long-term study of Cotacachi biodiversity by Marcia Penafiel and her students will be published in 2002 as well as a series of smaller reports. A policy brief will be prepared for the managers of the Cotacachi Ecological Reserve.

8e. Interactive Searchable Database Warehousing of SANREM-Andes Data:

The bilingual website established by SANREM-Andes has been moved to the ME and is under management of Robert Phares, information manager for SANREM.

8f. Case Study:

Ethno-Geomatics and Ethnoecological Methods-Comparative analysis of stakeholder interpretations of 17 images of the Nanegal and Cotacachi Landscapes completed. Mapping of sacred areas with environmental significance completed for Cotacachi and linked to dynamic indigenous cosmological interpretation. Working documents on use of future visioning for Nanegal and Oglethorpe County, Georgia completed.

8g. NGO and Scientific Personnel Trained in Future Visioning Methodology:

SANREM-Andes has worked intensely with 6 Latin American NGO's (HPI, Terranueva, Communidec, EcoCiencia, Yanapai, and CDC (Centro de Dalos para la Conservacion (Ecuador)) training over a dozen host country nationals. In addition, many host country and US students have received opportunity for field training leading to higher degrees (Masters and Ph.D.'s.). The data is more complete in the above section on training. Training of indigenous technicians has been a central part of the work in Cotacachi.



8h. Community Training in Water Quality/Quantity:

Seventy-six citizens in Ecuador and 11 in Peru have become certified water monitors. In Cotacachi, a time series of 3,258 bacterial samples have been taken at 222 sites in almost all of the 45 communities. A global water quality database is being developed and, finally, a synthesis monograph entitled "Laying the Foundation for a Global Network of Citizen Volunteer, Water Monitors: A Decade of Community-based Watershed Assessments," 1992-2002 will be produced in year 5. A Ph.D. economics thesis by an Ecuadorian student at Ohio State University has begun and should be complete in 2003.

8i. Training Manual on DSS Tools for Mountains:

During Year 5 the joint project with ICIMOD will come to an end and a series of publications are planned based on this joint activity.

8j. Case Study of Future Visions Scenarios:

In addition to the 4 articles already written, an additional series in various formats will be produced in Year 5. Final testing will take place in Cotacachi during the fall, 2002, and spring, 2003.

8k. Memory Banking Methodology:

This methodology has been translated and will be published in Spanish for Latin American distribution by Abya Yala Press of Quito. The method will be applied on a wider scale in the Andes in Year 5 through the in situ project of the Peruvian government.

8l. UN Year of the Mountain:

SANREM-Andes participated (R. Rhoades, V. Nazarea, and 3 members of Cotacachi) participated in the international conference on mountains sponsored by the government of Peru (June, 2002). We will play a major role in the Mountain People Conference (one of 3 official world conference for UN Year of the Mountain) to be held at end of September, 2002, in Quito. We have also been a part of the Mountain Forum, including sponsoring an e-conference for the Andes.

SANREM Andes played a major role in the Mountain People Conference, September 2002, Quito.

Finally, the SANREM-Andes team will publish a book on Cotacachi similar to the well received Nanegal book. This book will close out Phase II for the SANREM-Andes and the longer-term research in both sites.

SANREM CRSP

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

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Andes Coordination and Networking

OBJECTIVE 1

Provide timely administration and coordination support to Principal Investigators of Andean projects; link with Management Entity and other regional projects.

Annual Achievements

In May, 2001, a full-time Field Coordinator (Natalia Parra) was hired and stationed in Cotacachi, Ecuador, to oversee and coordinate SANREM-Andes activities. Natalia, a US citizen and fully bilingual in English and Spanish, performed her duties with professional excellence and dedication. Through UNORCAC, our Cotacachi host institution, a field vehicle dedicated strictly for SANREM field activity was arranged. The vehicle will remain under SANREM control until May, 2003, when Phase II ends. Each activity project using the vehicle must provide minimum upkeep funds of \$300 which cover costs of maintenance and fees associated with the vehicle. Recent changes in SANREM reporting mechanisms (e.g., online semiannual progress reporting) has reduced tremendously administrative transaction costs. The SANREM-Andean team has met as a group 4 times in "coordination tables" since June, 2001.

All aspects of coordination, administration, and financial management have improved significantly during year 4 (2001-2002). These advances are due to better knowledge of international requirements by the Institute for Behavioral Research (IBR) at UGA, stronger coordination between the subcontracting universities (Auburn, ISU, and UGA's Anthropology and Crop and Soils). In addition, flow of funds and support to field projects has been enhanced by increasing sophistication on the

part of UNORCAC in management and reporting of field expenditures. The UNORCAC vehicle assigned to SANREM has been a major improvement in the project since researchers can easily get to the field instead of having to wait on other UNORCAC vehicles which are often not available.

OBJECTIVE 2

Manage an organized central database and facilitate communication and information exchange among Andean SANREM researchers as well as among other partners and collaborators in the Andean region.

Annual Achievements

On July 16, 2001, a coordination meeting was held at Catholic University-Quito where a set of guidelines was developed as to the responsibilities and roles in developing the "databank" for the SANREM-Andes project. The "databank" is maintained at Catholic University by the Department of Geography under the direction of Juan Hidalgo (advisor), Nelson Gomez (Head), and Monsarrath Mejia (database manager). It was agreed that a separate computer would be obtained and maintained by Ms. Mejia for quality input and distribution. All P.I.'s are required to submit research results for data entry. Assuming sufficient data entry, we agreed that every six months a CD (Compact Disc) will be prepared for distribution among researchers. The plan to send Rakesh Malhotra for future GIS training at Catholic did not occur due to changes in Mr. Malhotra's career plans. Follow-up to the SANREM-Andes data coordination meeting at Catholic University-Quito has been excellent. All projects have directly

Principal Investigator
Robert Rhoades

Co-Principal Investigator
Juan Hidalgo
Rafael Guitarra

supplied to Monsarrath Mejia (Catholic University SANREM database manager) relevant data from their project and more is in the preparation stage. A beta-version of the database CD has been distributed.

During February, 2002, Monsarrath Mejia presented to Drs. Nelson Gomez and Juan Hidlago (Professors of Geography) a progress report outlining the framework of the database as well as the content of the Natural Resource Atlas being prepared for Cotacachi. She presented 10 finished maps (base map, administrative/political, physical, geomorphological, geological, watershed, soils, landuse, climate and irrigation). Additional information for the Atlas is being sought for 32 other relevant categories ranging from human demographics to flora and fauna. Health and women have been added as important themes based on feedback from UNORCAC and the mayor's office. A decision was reached that the Atlas should be geared for local use/decision making and not for scientific or highly sophisticated analysis purposes.

A paper was presented by Monsarrath at the conference "Symposium on Integrated Management of Watersheds and Human Settlements" organized by INSTRUCT (sister project at Catholic University) in Otavalo, Ecuador, during May 28-31, 2002.

OBJECTIVE 3

Link the SANREM Andean project with the global interagency initiative for Chapter 13, Agenda 21 (Sustainable Mountain Development).

Annual Achievements

SANREM-Andes has continued to play a visible role in the UN International Year of the Mountain and in fostering the objectives of Chapter 13 (Sustainable Mountain Development) of Agenda 21.

Although 9/11 disrupted Robert Rhoades planned travel to the Mountain Forum Board meeting (R. Rhoades represents North American) and World Mountain Conference in Switzerland, other opportunities were capitalized on during the year. Fausto Sarmiento of UGA geography organized a conference on montology comparing Andes and Appalachia. "Montology", or the study of mountains, was accepted by the Oxford dictionary as a new word in 2001 thanks to the efforts of Robert Rhoades.

In addition, a seminar in celebration of the Year of the Mountain was organized by R. Rhoades and M. Shrestha in March, 2002, during the 62nd Annual Meet-

ing of the Society of Applied Anthropology, Atlanta, Georgia. Plans are being developed to have SANREM-Andes play a significant role in the upcoming international Year of the Mountain meetings in Huaraz, Peru (June 10-15) and Quito, Ecuador (September 17-22).

Advances

in Research - As witnessed by update achievements of the three objectives (see this annual report), it is clear that coordination and management of the integrated database is on target. Full-time coordination is in place, the database is organized and progressing, and - finally - SANREM Andes continues to play a visible role in advancing the objectives of Chapter 13 (Sustainable Mountain Development), Agenda 21.

in Capacity Buildup - In the host country, capacity building in research and database management at UNORCAC and Catholic University is progressing. Students have been trained on SANREM data at Catholic through classes, field visits, data retrieval, and building of the Atlas. At UNORCAC, our field assistants have been trained as well as indigenous youth in the process of research and data entry.

in Scaling Up - The lessons learned from SANREM have been scaled-up through publications (see individual projects) and participation in e-conferences and international events organized under the International Year of the Mountain. Evidence of scaling up can be seen in number of request for information and guidance from other integrated watershed projects.

in Policy Impact - While this project is primarily coordination, it is widely known that SANREM-Andes databases have been applied in the ongoing process of constructing the Choco-Andean Corridor (funded by GEF) as well as other projects in the Nanegal area.

in Improved Environment and Natural Resource Management - By providing case studies, publications, technologies, and methodologies on sustainable mountain development, the SANREM-Andes project plays a concrete role in advancing improved highland environment and natural resource management on a local, national, and global scale.

Other Major Outputs in this Period

* This is primarily a coordination project. See individual activities for specific research outputs.

Theses and Dissertations

Jones, E. 2002. *The Role of Wealth and Cultural Heterogeneity in the Emergence of Social Networks and Agricultural Cooperatives in an Ecuadorian Colonization Zone*. PhD Dissertation (Department of Anthropology) submitted to the Graduate School, University of Georgia, Athens, GA.

Training Degree

Name, Level, Start Date, Completion Date

Karla Vasquez, Ph.D, 2000

Aurelio Vicuna, M.S., 2001

Shiloh Moats, Ph.D., 2001

Lincoln Novilos, Ph.D., 2001

Carlos Guitarra, M.S., 2001

SANREM CRSP

Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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June 2002
Annual Report
AND-02

Ethnoecology: Stakeholder Perceptions and Use of Andean Landscape Maps and Models

Principal Investigator
Virginia Nazarea

Co-Principal Investigator
Rocio Alarcon
Magdalena Furies

Collaborators
Communities of Nanegal
& Cotacachi

OBJECTIVE 1

To map local realities and stakeholder perceptions as input to "future scenarios" planning exercise.

Annual Achievements

As a general introduction to the annual report of achievements and progress towards objectives, it needs to be stated that the September 11 terrorist attack on the United States upset much of our plans and considerably slowed down our progress. That said, a number of accomplishments can still be reported. The first part of the year under review was devoted to investigating the intimate-animate landscape from the perspective of the local people. This initial research highlighted a dynamism that we did not anticipate, with meanings and attributions of sacredness constantly shifting, and practical considerations and strategic alliances often heavily weighing in on people's conceptions of the landscape and their decision making pertaining to land use. We also noted the interplay of ethnicity, class, and religion in shaping people's stakes and positions, via the land, in global trends and movements. One such notable trend is ecotourism based on traditional agriculture and cuisine. In Cotacachi, the motto that has been adopted is "rural tourism with indigenous identity". We have documented that, whether principally motivated by ecotourism or by a deeper search for this identity, there has been a resurgence in the practice of traditional rituals such as; 1) "burying the chicha", a ceremony of "giving back to the earth" the fruits of its generosity, including a sample of all grains produced and a ves-

sel of the traditional fermented drink, 2) "calling the rain", an activity that can be participated in exclusively by innocent children to ask mother rain for relief from drought, and 3) making an offering to the waterhole, a ritual of thanks for the continuous provision of one of the most vital elements in people's lives. Older people see this recuperation of their traditional beliefs as key to the persistence and transmission of their indigenous identity.

With renewed interest, and in keeping with local priorities, we have pursued the collection of local representations of characters of folktales, mainly by school children. Maricel Piniero, Rafael Guitarra and Rocio Alarcon, have assembled a collection of these representations of spirits, heroes, and tricksters that animate the Cotacachi landscape. Natalia Parra, with our field assistants, has documented the ritual calendars of both the indigenous and mestizo populations of Cotacachi.

OBJECTIVE 2

To "groundtruth" scientific models, rules, and predictions regarding land use change.

Annual Achievements

The Ethnoecology/Biodiversity Laboratory co-sponsored the book launching for Bridging Human and Ecological Landscapes. A synopsis of research findings in Nanegal was presented by Robert Rhoades, Virginia Nazarea, Maricel Piniero, and Eric Jones.

In her dissertation on Women and Biodiversity in Nanegal and Cotacachi, Piniero compared researchers' maps and local maps at a much more micro level than previously investigated by focusing on women's homegardens. She also added a diachronic dimension by looking at women's representations of their homegardens in the past, present, and future.

A paper on "cultural envisioning" based on story completion tests for both past and future scenarios will be submitted to Human Organization. The Journal of Human Biology has invited Nazarea to review a relevant newly-published book entitled Human Ecology in the New Millennium.

SANREM research experiences and ideas have invaded the classroom and inspired student research. Based on work comparing scientific and folk models of land use change in Ecuador, Nazarea developed and taught a seminar on Landscapes and Memories where students did firsthand research examining the different "lenses" through which the landscape is viewed. Undergraduate and graduate students in another course, Anthropology of Development, applied principles of participatory research to construct in-depth "profiles of development" that contributed insights to how development is perceived and responded to at a personal level. Much of the research analyzed changing patterns of resource management and urban and rural land use change from varying perspectives.

In addition, a special component focused on SANREM research participants and came up with interesting results, evaluations, and recommendations (research output provided to SANREM ME).

OBJECTIVE 3

To put Decision Support Information to use by supporting local initiatives in biodiversity conservation emphasizing the role of local youth and of women

Annual Achievements

We claim at least partial credit for the resurgence of interest in traditional plants, farming practices, food preparation, and rituals in Cotacachi. The 'becarios', or young memory bankers, have contributed to the "memory bank" and seed accessions in Jambi Mascaric and along with their parents have expanded the communal in situ garden.

The women, supported by the indigenous leaders, are continuing the tradition of the annual Biodiversity Fair and plans for 2002 were discussed by the PI and Co-PI

with Magdalena Fueres and Rafael Guitarra in Huaraz, Peru during the Year of the Mountain Conference.

In terms of scaling up, Nazarea and Rhoades also met with Maria Scurrah (CIP plant breeder and NGO president) and Miguel Hole (CIP Horticulturist and Program Leader for In Situ Conservation of Andean Crops) in Athens, GA to plan for a research project on in situ conservation that spans Bolivia, Peru, and Ecuador.

Two book manuscripts are in preparation. One is on the role of seed savers in biodiversity conservation, Marginalities of the Mind: Countermemory in the Persistence Of Biodiversity, is being considered for inclusion in the Duke University Press series co-edited by Diane Rochealou and Arturo Escobar. An article on the subject was recently submitted by Nazarea to American Anthropologist for review. The second is on the cultural/legal interface of intellectual property rights and plant genetic resources, entitled Culture and Law in Biodiversity Conservation and Use: An Uneasy Interface. Nazarea's commentary on Ronald Nigh's article on bioprospecting was published in the June issue of Current Anthropology.

Publications

Rhoades, R. V. Nazarea, M. Piniero. 2001. Contrasting scientific and local valuations of land use change: The future visioning methodology. Pp. 333- 349 in R. Rhoades, editor. *Bridging Human and Ecological Landscapes: Participatory Research and Sustainable Development in an Andean Frontier*. Dubuque, Iowa: Kendall/Hunt Publishing Company.

Other Major Outputs in this Period

Conference Presentations

Nazarea, V. 2001. *Seedsavers and Jumping Genes: Blessed are the Unseen*. Annual Meetings of the American Society of Agronomy, Crop and Soil Science of America, and Soil Science of America. Charlotte, NC.

Nazarea, V. 2001. *Tenuous Times and Transient Gardens in a Globalizing World*. In-situ Conservation of Agrobiodiversity. Biodiversity and Genetic Resources Workshop. Lima, Peru.

Nazarea, V. 2001. *Women and Homegardens in Ecuador: The Forgotten Question*. Conference Paper. Society of Ethnobiology Conference. Durango, CO.

Thesis and Dissertations

Piniero, M. 2002. *Biodiversity and Marginality: Dilemma of Economic Development Ethnoecology/ Biodiversity Laboratory, SANREM CRSP ANDES Project, Department of Anthropology, University of Georgia, Athens, GA.*

Tools

Nazarea, V., R. Alarcon, E. Tison, and M. Piniero. 2001. *Costumbres del Ayer, Tesoros de Manana. Quito, Ecuador: Abya-Yala.* Memory banking protocol and teaching packet in Spanish for local students.

Training Degree

Name, Level, Start Date-Completion Date
Maricel Piniero, Ph.D. 9/1995- 5/2002

Training Non Degree

Workshop

International Day of Women: Indigenous People and Biodiversity was attended by 30 person(s) and lasted 1 day(s).

Women's Health, Tourism, and Folklore was attended by 40 person(s) and lasted 7 day(s).

Biodiversity and Water Training Given to Children was attended by 258 person(s) and lasted 7 day(s).

Biodiversity Fair and Workshop was attended by 415 person(s) and lasted 2 day(s).

Biodiversity Gardens for Children was attended by 16 person(s) and lasted 2 day(s).

Planting Field Day of Mashua was attended by 16 person(s) and lasted 1 day(s).

Research Methods and Computer Database Management was attended by 2 person(s) and lasted 7 day(s).

SANREM CRSP

Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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June 2002
Annual Report
AND-03

Integrated Institutional Management: Social Capital, Institutional Capacity and Environmental Capital in the Andes

Principal Investigator
Jan Flora

Co-Principal
Investigator
Cornelia Flora

OBJECTIVE 1

Identify and analyze Sustainable Natural Resource Management (SNRM) issues and decision points within local regional, national and international context

Annual Achievements

Completed two advocacy coalition data bases in N-Vivo (text analysis program). Edith Fernandez-Baca then developed a step-by-step methodology for summarizing information on tools needed by institutional actors, as well as desired future states and mental causal models by institution and by coalition for the three issues studied. In Ecuador, data base with 27 interviews and 5 focus group interviews was transcribed, coded and entered in program. In Peru, a team of community members and of Grupo Yanapai (NGO) completed 17 individual interviews and 1 focus group interview, transcribed, coded, and entered them in N-Vivo data base. [Three or four interviews at the national level remain to be done in year 5.]

OBJECTIVE 2

Develop Decision Support tools for encouraging sustainable natural resource management (SNRM) that are appropriate for different institutional levels and different institutional actors.

Annual Achievements

Regional Level - Peru:

In Peru, the active participation of community leaders in the advocacy coalition in-

terviews and their reporting back to community assemblies on a regular basis resulted in their becoming aware of CONACAMI (Consortio de Comunidades Afectadas Por la Minería; the Consortium of Communities Affected by Mining), participating in their meetings, and applying for membership in the Consortium. They also learned about the Defensoría del Pueblo, the National Government's ombudsman office, by interviewing the head of their regional office. They were able to call upon that organization when the mining company executives failed to show up for a scheduled meeting with the Community of Quilcas and other communities.

Further, the land study carried out by Grupo Yanapai along with community members, provided a sound knowledge base for the Community President to negotiate with adjacent communities regarding boundary disputes. Although neither the boundary issue nor the mining issue has been resolved, community members and leaders have acquired a feeling of efficacy.

Local Level - Ecuador:

Regarding work in the Pitzambitze sub-watershed, the inventory of cultural resources in the watershed that was carried out by the young people was related to the development of a committee of stakeholders to deal with the obstruction of the river bank and pollution of the water by animals and humans in violation of the laws regulating stream bank protection.

OBJECTIVE 3

Disseminate SNRM Decision Support tools and publications to appropriate actors at appropriate levels throughout the Andes and beyond; train people to implement and evaluate efficiency and effectiveness of Decision Support (DS) tools.

Annual Achievements

Papers have been given at conferences sponsored by the United Nations' Economic Commission for Latin America and the Caribbean and at the Inauguration of Robert A. and Ruth E. Polson Institute for Global Development at Cornell University.

Publications

Book Chapters

Flora, C. 2001. *The creation of social incentives for the conservation of biodiversity*. Pp. 135-144 in R. Rhoades and J. Stallings (Eds.) *Integrated Conservation and Development in Tropical America: Experiences and Lessons in Linking Communities, Projects, and Policies*. Athens, Georgia: SANREM CRSP and CARE-SUBIR.

Flora, C., F. Larrea, M. Ordonez, S. Chancay, S. Baez, F. Guerrero. 2001. *Production strategy typology for sustainable agriculture and natural resource management*. Pp. 193-213 in R. Rhoades (Ed.) *Bridging Human and Ecological Landscapes: Participatory Research and Eco-Development in an Andean Region*. Dubuque, IA: Kendall/Hunt Publishing Company.

Flora, J. 2001. *Creating local and national capacity for the integration of conservation and development projects*. Pp. 193-206 in R. Rhoades and J. (Eds.) *Integrated Conservation and Development in Tropical America: Experiences and Lessons in Linking Communities, Projects and Policies*. Athens, GA: SANREM CRSP and CARE-SUBIR.

Flora, J., M. Bravo, C. Flora and S. Andrango. 2001. *Community sustainability in an Ecuadorian landscape: the role of economic, human, environmental and social capital*. Pp. 291-313 in R. Rhoades (Ed.) *Bridging Human and Ecological Landscapes: Participatory Research and Sustainable Development in an Andean Agricultural Frontier*. Dubuque, IA: Kendall/Hunt. Publishing Company.

Gasteyer, S. and C. Flora. 2001. *A Common Source: Comparing Community Water Quality Protection Initiatives*. Pp. 10-25 in *Rising Tide: Community Development Tools, Models, and Processes*. Sackville, NB: Rural and Small Town Programme Press.

Larrea, F., C. Flora, M. Ordonez, S. Chancay, S. Baez and F. Guerrero. 2001. *A typology of family production strategies for sustainable agriculture and natural resource management*. In: Robert Rhoades (Ed.) *Bridging Landscapes and Lifescapes: Participatory Research and Sustainability in an Andean Region*. Dubuque, IA: Kendall Hunt Publishing Company.

Ordonez, M. and C. Flora. 2001. *Production strategies and gender*. Pp. 215-230 in R. Rhoades (Ed.) *Bridging Human and Ecological Landscapes: Participatory Research and Eco-Development in an Andean Region*. Dubuque, IA: Kendall/Hunt Publishing Company.

Books

Flora, C. (Ed.). 2001. *Between Agroecosystems and Rural Communities*. Boca Raton, FL: CRC Press.

Journal Articles

Gasteyer, S., C. Flora, E. Fernandez-Baca, D. Banerji, S. Bastian, S. Aleman, M. Kroma, and A. Mears. 2002. *Community participation for conservation and development of natural resources: A summary of literature and report of research findings*. *Delta Development Journal*. 1(2): 57-84.

Other Major Outputs in this Period

Briefs

Flora, C. 2002. *Typologies of Production and Power: Household Livelihood Strategies and Gender Roles in an Andean Frontier Economy*. SANREM CRSP Research Brief No. 8.

Flora, J. 2002. *Capital, Community and Collective Action: Social Foundations of Sustainability in an Andean Buffer Zone (Ecuador)*. SANREM CRSP Research Brief No. 9.

Conference Presentations

Flora, J. 2001. *Advocacy Coalitions and Natural Resource Management at the Local Level: Examples from the Andes*. Invited presentation at Global Developments in the 21st Century, Inauguration of Robert A. and Ruth E. Polson Institute for Global Development, Cornell University, Ithaca, NY. September 21-22.

Flora, J. and C. Flora. 2001. *Construyendo Comunidad en Zonas Rurales de los Andes y de los Estados Unidos*. Presentation at International Invitational Conference entitled "Social Capital and Poverty Reduction in Latin America and the Caribbean: Toward a New Paradigm." Michigan State University and the Economic Commission for Latin America and the Caribbean (ECLAC): Santiago, Chile. Sept. 24-26.

Research Reports

Nunez M., E. Olivera, R. Canto, and M.M. de Scurrah. 2001. *Estudio de Uso de la Tierra en la Comunidad Campesina de Quilcas*. Grupo Yanapai, Huancayo, Peru.

Training Degree

Name, Level, Start Date-Completion Date
Edith Fernandez-Baca, Ph.D. 1999-

SANREM CRSP

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Collaborative Research Support Program
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June 2002
Annual Report
AND-05

Water Resources and Environmental Education in Two Andean Watersheds

Principal Investigator
Bryan Duncan

Co-Principal Investigator
William Deutsch

OBJECTIVE 1

Provide technical support to citizen monitoring groups for collection of data on water quantity and quality at Nanegal and Cotacachi sites.

Annual Achievements

Mr. Ruiz Cordova conducted 3 bacteriological surveys of surface and drinking water with members of UNORCAC communities in Cotacachi Canton. Sampling was conducted with the help of volunteers and UNORCAC Water Monitoring Coordinator Nicolas Gomez. About 1275 bacterial samples were collected from about 200 sites in 50 communities. Most communities were affiliated with UNORCAC in Canton Cotacachi, and the cities of Imantag, Quiroga and Cotacachi. Analysis of those samples indicated the presence of coliform bacteria in 69% with 34% indicating presence of E. coli. Analyses of water from the cities of Quiroga and Cotacachi indicated no coliforms.

One hundred and seventeen records of physical-chemical data from 83 sites were collected from June 2001 to May 2002. Forty-three percent of these records come from streams, 24% from springs, 13% from irrigation canals and 20% from reservoirs, Lake Cuicocha and other surface sources. Most physical-chemical analyses were within desired limits.

Bacterial and physical-chemical data were entered into the computer database at PUCE-Q (Pontificia Universidad Catolica del Ecuador-Quito) and the SANREM computer at Jambi Mascaric in Cotacachi. The municipality of Cotacachi last year had requested

SANREM to introduce an inexpensive method for BOD (Biological Oxygen Demand) testing. The tests would be used to monitor stream water quality at 24 sites where the municipality discharged waste. This activity was put on hold due to municipality financial constraints.

Substantial progress has been made developing the Global Water Quality Database that will link Ecuador, Philippines, Alabama Water Watch, and other developing community-based water quality-monitoring projects. A conservative goal is for the database to be functioning for online data entry well before the end of Year 5.

OBJECTIVE 2

Establish partnerships and linkages for research, outreach & training/education activities in Andean region

Annual Achievements

Two certification Workshops on Water Quality Monitoring were conducted, in Ecuador, with participation of 16 volunteers. Environmental education talks have been extended to several schools and communities by UNORCAC after a successful beginning with elementary school children in La Calera. On January 24th, 2002 Rafael Guitarra President of UNORCAC and Auki Tituana, mayor of Cotacachi, signed a cooperation agreement to conduct water quality monitoring in the watersheds of the Canton as part of a general plan for natural resources management.

Strengthening institutional partnerships and linkages was done through joint activities, including training, workshops, technical support, and database development. The Director of Eco-Development for the Ecuadorian Amazon Region (ECORAE) has approached SANREM partners to explore the possibility of starting water quality monitoring activities in this region that covers 50% of the country and from where 90% of Ecuador oil is extracted. Over the past decade poverty and environmental degradation have worsened. ECORAE is seeking SANREM assistance for water quality monitoring and environmental management. The presence of headwaters of the Amazon river system give this region considerable importance. Auburn University personnel participated in a two-day tour of the region by ECORAE, and the director has made plans to travel to Auburn University for discussions. Leveraging of oil company funding is a possible source of support.

OBJECTIVE 3

Assist Andean program leader with overall coordination of Andean project as well as backstop efforts at assessing the impact of water monitoring research.

Annual Achievements

A well-qualified social scientist and development specialist has been engaged to conduct a research activity on institutional change related to community-based water quality monitoring. This activity will be conducted in Year five.

OBJECTIVE 4

Write a monograph on the topic of developing community capacity for bacteriological assessment of water, and protection and restoration of aquatic resources.

Annual Achievements

This objective has been strengthened and broadened. A detailed outline for the synthesis document (Laying the Foundation...) was finalized at a second meeting of the writing team, and writing of sections initiated. Bacteriological assessment of water will be written separately. A major revision of the technical manual for bacteriological monitoring has not yet been completed.

Advances

in Research - Two training courses (Basic Certification Workshops) were conducted, kit refills provided, and data submission formats completed in association with development of the Global Water Quality Monitor-

ing Database. A multiple-country Training-of-Trainers course was planned for this year, but due to difficulties in obtaining visas among others, the course was cancelled.

in Capacity Buildup - Several individuals of the Andean region continue to monitor, train and develop skills. However, upon reassessment institutionalization and the ability of partners to take over monitoring and data management has come into question. It is suspected that lack of financial resources on the part of our principal partner, and a low priority for water activities are in part responsible. An assessment will be conducted by a collaborating social scientist in year 5.

in Scaling Up - No further assistance to Peru this year. Scaling-up to communities in the Intag River Watershed was accomplished. These communities, which are not affiliated with UNORCAC, had requested training and assistance establishing water-monitoring groups. SANREM was invited to assist with community-based water quality monitoring and environmental management in the Amazon region of Ecuador. Discussions are taking place with the Director of Eco-Development for the Ecuadorian Amazon Region (ECORAE) to define possible relationships.

in Policy Impact - With SANREM participation an agreement was developed and signed between Cotacachi Municipality and UNORCAC to conduct water quality monitoring in the watersheds of the Canton as part of a general plan for natural resources management. In interviews with the mayor of Cotacachi he has declared his intentions to use this information to elaborate water policy for the municipality. A member of the Cantonal Assembly has a strong interest in water quality monitoring. He has provided entry into several communities, transportation for the UNORCAC monitor, and funds to print a manual. It is hoped that this relationship will lead to stronger partnering by local government.

in Improved Environment and Natural Resource Management - Bacterial surveys identified problems with surface and drinking water in several communities. Results were presented to leaders in each community who are taking actions to solve the problems. As a result of water monitoring in the Cambugan System that provides water to six large communities affiliated with UNORCAC, a distribution tank is being constructed with funds leveraged from German assistance. Fencing is also being erected to exclude animals from critical points in the system.

Other Major Outputs in this Period

* Training was conducted in Ecuador for basic certification of water quality monitors. Sixteen persons, including two women, received this training.

* Water quality data was moved from Excel to Access software in preparation for inclusion in the Global Water Quality Database.

SANREM CRSP

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

June 2002
Annual Report
AND-07

Sustainable Mountain Futures: Linking People and Information for Effective Landscape Decision-Making in the Andes

Principal Investigator
Robert Rhoades

Co-Principal Investigator
Marcia Penafiel Cevallos
Monsarrath Mejia
Hernan Velasquez
Jose Iquicio Sanz
Juan Hidalgo

Collaborators
Communities of Nanegal and Cotacachi

OBJECTIVE 1

Integrate data from the SANREM-Andes activities (land use/biodiversity, hydrology, ethnoecology, institutions) into a "Futures Scenario" modeling process at two Ecuadorian test sites (Nanegal and Cotacachi).

Annual Achievements

During 2001-2002, the SANREM-Andes team identified data requirements for completion of testing of the future visioning methodology at the Nanegal site while simultaneously advancing data integration for Cotacachi.

By completing the Nanegal exercise, and publishing and/or presenting the results in several venues, we were able to identify weakness and strengths in the process and attempt to overcome them in Cotacachi where we expect richer data. Central to data integration is the multi-temporal landuse change study of the Ministry of Agriculture (Hernan Velasquez) and central database bank directed by Catholic University (Monsarrath Mejia). The thirty year trend study of landuse change has been completed (see AND-08) and approximately 75% of the data gathered in the SANREM-Andes project is now in the central database with Catholic. The team is now identifying missing components of the modelling process.

One addition to the database has been the commencement of the economics Ph.D. dissertation of Fabian Rodriquez at Ohio State University ("Local Resolution of the local natural management issues: The case of wa-

ter allocation and management in Cotacachi, Ecuador").

Three biodiversity reports written by Marcia Penafiel of Jatun Sacha/CDC-Ecuador and her students were completed in 2001-2002 and submitted for publication. These reports are: (1) Flora and Vegetation of Cuicocha; (2) Multitemporal study of vegetation change in the Canton Cotacachi and Surroundings; and (3) Ecological Diversity of the Canton Cotacachi.

These studies, which are the most detailed of those conducted in the region, provide scientific data on distribution and change of flora and fauna of the region. The results are being published in a forthcoming book by Abya Yala Press sponsored by SANREM. Finally, the results are being used by the government authorities of the Cotacachi Cayapas Ecological Reserve for establishment of new management policies and practices. Bibliographic research on future visioning methodology has been complete and the SANREM-Andes is prepared to cooperate with the ME in its preparation of a "white paper".

OBJECTIVE 2

Test and refine the participatory future scenarios modeling exercise with a hierarchy of decision-makers (internal and external) connected with the landscapes around Cotacachi and Nanegal.

Annual Achievements

In July, 2001, the first formal "future visioning" activity was conducted with the com-

munity of Palmitopamba, Nanegal Parish, Ecuador. Twenty-five key community members participated (15 males and 10 women). Scientific generated images of past, present, and future photo-simulated landscapes (1950-2030) were presented and debated by the full community. Community-generated future 2030 images of the same landscape were then created based on age and gender categories. In the months following the Nanegal testing, significant progress has been made on refining the methodology tested first in Nanegal. We designed a method to capture quantitative indicators of different stakeholder groups visions of the future. Further testing of landscape presentation verified that the photographic panorama was still the most useful instrument and ways of improving both the scale, detail, and readability of the changing panorama has been sought. Digital cameras and improved Photoshop manipulation has aided improvement in the process. In testing the method with "outside" stakeholders (foreign conservationists, government officials, scientists unfamiliar with the area) we have found they tend to interpret the changing landscape as a result of deforestation and land degradation. This contrasts sharply to local people who envision land use change as a progressive community driven process.

This drives home the point that there are significant differences in the way the different stakeholders (planners/scientists and local people) understand land use change. We have also learned that it is not necessary to do future visioning with computers and cameras but that group interaction and historic drawings and projects can serve just as well. The best evidence from this comes from the test case of Quilcas in the Mantaro Valley, Peru, where SANREM-Andes has funded future visioning work as community planning and policy formation process (see AND-03).

Facilitated by Maria Scurrah (President of Yanapai), different groups of community members conducted a land use study and constructed 6 maps during 8 workshops. Using a map (1:25000) of the Peruvian Ministry of Agriculture, locally generated information was superimposed. For historic data, aerial photographs from 1960 were used to stimulate memory as were older soil maps, community documents, and other data. GIS, computers, and other modern instruments were not used. The community gleaned that it has lost over half of its land through privatization and illegal land claims. The traditional agriculture systems of "turnos" had been disrupted and losses in biodiversity and animals had occurred in all production areas as well as loss of irri-

gated areas. The community is using the future visioning study to negotiate with the mining industry and the government to get compensation for lost land as well as reclaim as much as possible.

The important point is that future visioning is potentially a methodology which can take many forms as long as it helps community understand the past and potential scenarios in the future.

OBJECTIVE 3

Extrapolate the Future Scenarios methodology to other global mountainous landscape/watershed projects as a contribution to Agenda 21, Chapter 13.

Annual Achievements

Based on future visioning activity in year 4, three articles and two reports have been published and four conference presentations were made. These publications and presentations have fostered a demand by development organizations for information on the future visioning methodology.

One example of potential scaling up comes through the interest of the Cornell International Institute for Food, Agriculture, and Development (CIIFAD) which has programs in Central America, the Andes, Indonesia, Philippines, Southwest China, Madagascar and Ghana. R. Rhoades was invited to give a keynote presentation in an "International Workshop on Watersheds and Communities" (May 5-14, 2002) to an experienced group of researchers and practitioners from many of these countries. Other invitations were received from North Carolina State University and within the state of Georgia. The programmed conference with CIAT continues in a planning stage. Progress was made through an e-conferencing chat room but stronger effort needs to be forthcoming if the envisioning workshop is to become a reality in 2002. Changes in leadership and staffing a CIAT has not been conducive to accomplishment of this joint activity although funding was provided directly to CIAT to make the collaboration happen.

Advances

in Research - 1. Integrated database 75% complete with 10 maps ready for the hard copy and computerized Atlas; 2. Multi-temporal land use change study (1963-1990) completed with thematic overlays and efforts are underway to extrapolate to 2030; 3. Ph.D. dissertation on economics on efficient water allocation and rights continues with a 2003 completion date; 4. Call for papers for the SANREM-Andes monograph on Cotacachi sent to PI's and other researchers; 5.

Three biodiversity reports completed and the Abya Yala book on the "Flora and Vegetation of Cuicocha" is now in press. 6/7. Three methods papers completed on the future visioning methodology; papers being prepared as academic journal articles to be submitted in 2002-2003.

in Capacity Buildup - 1. One US SANREM Ph.D. graduated in May, 2002 (Eric Jones on colonization and natural resources); three masters in Ecuador completed (Marco Tipan, Karla Vasquez, and Lincoln Nolivos) at Central University; four undergraduate research projects supported and one indigenous researcher (Carlos Guitarra) completed one year of technical agriculture college. 2. One conference and training session on database management provided by Catholic University to UNORCAC and Municipality of Cotacachi as part of the Atlas building process.

in Scaling Up - 1. "Ten Lessons Learned" based on the Nanegal experience is the concluding chapter of the book by Kendall/Hunt Publishers (R. Rhoades, editor) and an expanded version will be developed during Year 5 of SANREM; 2. The joint workshop with CIAT continues on the planning calendar but, since CIAT controls the funds, SANREM can do little to guarantee that this happens. 3. During the year, SANREM-Andes set the ground work to sponsor a international e-conference with the Mountain Forum (Andes-Condesan), an international conference in Huaraz, Peru, with the foreign ministry of Peru, and in September, 2002, one of the main international conferences of the Year of the Mountain in Quito, Ecuador. Cotacachi will be showcased in this conference. 4. The documentary film is in the planning stage for Year 5.

in Policy Impact - Reports of the biodiversity work of Marcia Penafiel has impacted the new policies of the Cotacachi Cayapas Ecological Reserve by identifying areas and species endangered. The economics research is still in an early stage to have impact. The series of envisioning exercises planned for Year 5 will help define the policies of UNORCAC as well as the municipality of Cotacachi.

in Improved Environment and Natural Resource Management - 1. Development agency demands for the future visioning methodology is increasing due to its innovative qualities; 2. The Nanegal and Cotacachi cases will serve as beacons or models which can be replicated in other cases; 3. Actual management plan for the Pitzimbizi in Cotacachi will lead to improved NRM.

Publications

Books

Rhoades, R. 2001. *Tendiendo Puentes Entre Los Paisajes Humanos y Naturales*. Abya-Yala, Quito.

Other Major Outputs in this Period

Briefs

Diamond, B. 2002. *Pasture Preferences: The Ecology and Economics of Andean Farmers' Decisions*. SANREM CRSP Research Brief No. 10.

Nazarea, V. 2001. *Looking at the Landscape Through Local Lenses: Integrating Community Values and Variation in Indicators of Sustainability*. SANREM CRSP Research Brief No. 6.

Conference Presentations

Nazarea, V. and R. Rhoades. 2001. *Cultural Invisioning of Land Use Change in Nanegal, Ecuador*.

Training Degree

Name, Level, Start Date-Completion Date

Lincoln Nolivos, Ph.D. 9/1/99- 5/15/02

Karla Vasquez, M.S. 9/15/99- 5/15/02

Brian Campbell, Ph.D. 2000-

Eric Jones, Ph.D. 1999-

Training Non Degree

Workshop

Database Management was attended by 38 person(s) and lasted 1 day(s).

SANREM CRSP

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

June 2002
Annual Report
AND-08

Effects of Land Use Change on Long-term Soil Fertility, Crop Productivity and Water Quality in Cotacachi

Principal Investigator
William (Bill) Miller

Co-Principal
Investigator
Franz Zehetner

OBJECTIVE 1

Select with local community guidance a representative first-order watershed to which the model developed in this activity will be implemented

OBJECTIVE 2

On a field-scale, assess long-term changes in soil fertility, crop productivity, as well as nutrient export by erosion and runoff using an erosion / nutrient cycling / crop growth model (EPIC = Erosion-Productivity Impact Calculator).

Annual Achievements

The samples of the soil fertility monitoring activity have been analyzed for pH, organic matter content, soil test values for micro and macro nutrients, cation exchange capacity and base saturation, electrolytic conductivity, soil texture and water holding capacity.

A geo-referenced soil database was created, and the areas between the sampling locations were spatially interpolated in a GIS. Maps covering the entire Andean study area were generated for each soil parameter, and soil fertility characteristics were statistically analyzed as a function of soil parent material, elevation, and land management. The obtained soil database and maps will serve as a basis to extrapolate model predictions from the communities studied in depth to the entire area pertaining to UNORCAC.

The crop growth modeling will be conducted using the DSSAT crop growth models rather than the EPIC model. The DSSAT models are more mechanistic and have been used in northern Ecuador by our collaborators from

CIP. They have studied the crop specific DSSAT input parameters for the local crop varieties, which will be utilized in this activity and thus improve the quality of the model predictions. All soil and climate related model input parameters collected for the EPIC model will be used, with minor adjustments, as inputs for the DSSAT models. The input databases have been completed, and first DSSAT model runs are being performed.

OBJECTIVE 3

Evaluate the impact of land use and land management on biodiversity of flora and fauna in the study area.

Annual Achievements

The analysis of past land use change and the elaboration of future land use change scenarios conducted under Objective 4 of AND-08 is being linked to the biodiversity study performed under AND-07.

OBJECTIVE 4

Scale up the field-scale modeling outputs to the watershed level using raster GIS.

Annual Achievements

Rainfall-runoff studies using a rainfall simulator, infiltration tests to estimate saturated hydraulic conductivity and other soil analyses showed that the soils in the study area are generally very stable and thus not very susceptible to sheet erosion. However, in the presence of amorphous volcanic minerals, the soils tend to get supersaturated, and in many parts of the study area, the recent soils are underlain by very compacted paleosols with re-

stricted water infiltration. This favors mass-wasting, the downhill flow (solifluction) or slide of soil material on steep slopes. Evidence of this type of soil erosion is found throughout the study area. In light of these findings, the work under Objective 4 has been adapted to capture the impact of land use change on mass-wasting phenomena rather than on sheet erosion. For the second study area in the subtropical part of Cotacachi (see Year 5 workplan), aerial photographs from the years 1966, 1977, 1990, and a satellite image from the year 2000 have been interpreted, on the basis of which multi-temporal land use maps will be prepared. For both the Andean and the subtropical study area, past and present mass-wasting phenomena will be identified and quantified using aerial photography, and correlated with land use history.

OBJECTIVE 5

Route sediment and runoff through the landscape and evaluate nutrient export and water quality changes. Plan for this period: This objective will be achieved by the activities proposed under the modified Objective 4.

OBJECTIVE 6

Incorporate the model into the "Future Visioning Methodology" and case study as well as show local people how to interpret and use the model results as a decision support tool.

Annual Achievements

Due to changes in both the field-scale crop growth modeling as well as the watershed-scale analysis of land use impacts on soil degradation, the seminar originally planned for the second half of year 4 was postponed to Year 5.

Advances

in Research - 1. Multi-temporal land use maps are ready for the Andean study area, and under construction for the subtropical area; 2. The soil fertility database covering all the UNORCAC communities is ready; 3. One manuscript (soil formation) is written and will soon be submitted to a peer-reviewed journal.

in Capacity Buildup - 1. Nicolas Gomez, our local activity coordinator, has been trained in the interpretation of soil testing results with respect to land management and fertilizer recommendations. Further training is planned for Year 5; 2. The workshops as well as the publication of the book are planned for Year 5.

in Scaling Up - 1. The geo-referenced soil database and GIS coverages of individual soil properties, which are the basis for the extrapolation of modeling results to the entire Andean region of UNORCAC, are completed; 2. The expansion of the land use change analysis to the subtropical region of Cotacachi is in progress (photo interpretation is already completed); 3. Collaboration with our Belgian colleagues is planned to be initiated at an international geomorphology conference in Dec. 2002 in Quito, Ecuador, which is organized by the Belgian researchers.

in Policy Impact - These results are expected towards the end of Year 5, after the outputs of this activity will have been disseminated to local decision makers through workshops.

in Improved Environment and Natural Resource Management - These results are expected towards the end of Year 5, after the outputs of this activity will have been disseminated to local and regional decision makers and the general public through workshops and the publication of a book.

Publications

Journal Articles

Zehetner, F., W. Miller, and L. West. 2002. *Pedogenesis of volcanic ash soils in Andean Ecuador*. Soil Science Society of American Journal.

Zehetner, F., L. West, and W. Miller 2002. *The effect of sample grinding on the estimation of allophane contents in volcanic ash soils*. European Journal of Soil Science.

Other Major Outputs in this Period

Conference Presentations

Zehetner, F., W. Miller, and L. West. 2002. *Weathering and soil formation on the slopes of volcano Cotacachi in Northern Ecuador*. Annual Meeting of the Soil Science Society of American in Indianapolis, IN.

Working Paper

Zehetner, F. and W. Miller. 2002. *Soil fertility and crop growth in Andean communities of northern Ecuador*. Manuscript in preparation.

Zehetner, F. and W. Miller 2002. *Erodibility of volcanic ash in the Andes of northern Ecuador*. Manuscript in preparation.

Zehetner, F. and W. Miller. 2002. *Suelos Volcanicos en la Sierra Norte del Ecuador*. Manuscript in preparation. Abya Yala, Quito, Ecuador.

Training Degree

Name, Level, Start Date-Completion Date

Franz Zehetner, Ph.D. 06/2000-

Training Non Degree

On the job training

Stream flow monitoring, runoff monitoring, interpretation of soil test results was attended by 1 person(s) and lasted ? day(s).

SANREM CRSP

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

June 2002
Annual Report
AND-09

Regional Node for Training and Upscaling of Community-Based Natural Resource Decision-Making

Principal
Investigator
Robert Rhoades

Co-Principal
Investigator
Magdalena Furies

OBJECTIVE 1

Establish a training and up-scaling node within Jambi Masc'ric (UNORCAC) which will serve as the center of scaling up activities for landscape level work (especially the sustainable futures visioning methodology, memory banking, water quality and quantity, leadership training in NRM) within the Andean region and for other mountainous areas.

Annual Achievements

The training and up-scaling node in Jambi ascaric has continued to serve as the central field office of the SANREM project. Since the center is already established no new equipment or facilities have been added in 2001-2002, although the memory banking garden (see AND-02) continues to serve its training and educational function. Increasingly, geotourists have visited the garden to learn about indigenous plants. SANREM has three indigenous research assistants who continue to learn how to do research and manage data.

One assistant, Carlos Guitarra, is attending agricultural college with SANREM support in nearby Ibarra. Exchange visits between Andean communities (e.g., Vicos in Peru and Cotacachi, Ecuador) have continued with positive outcomes in the transfer of SANREM methodologies.

The Atlas project of Catholic University will be finalized in the Jambi node with a training course on its use.

OBJECTIVE 2

Establish a functional data center at Jambi Masc'ric headquarters with dynamic linkages to comparable facilities at UGA (USA) and Catholic university (Quito) to house case studies and summaries of Phase I/II findings for use at Cotacachi and other sites in the Andes.

Annual Achievements

Research on the Pitzimbizi watershed plan is well advanced (see AND-03) and data from the water, soils, biodiversity, and ethnoecology projects have been integral to this effort.

Two planning meetings were held with key stakeholders in Cotacachi (including with the new president of UNORCAC, Rafael Guitarra) to determine locally relevant geographical areas of interest, key natural resource issues, and data requirements for various planning activities.

In 2002-2003 there will be a stepped up plan of action in the implementation of the Pitzimbizi plan. UNORCAC, along with the municipality, hopes to integrate better its various development activities and is asking for SANREM assistance. One aspect will be integration of the agrotourism enterprise into the watershed and biodiversity work (See AND-02) Catholic University will install the interactive Atlas by October, 2002, and test its usefulness with the communities.

OBJECTIVE 3

Conduct training on site in methodologies, technologies, land use and water systems for interested individuals and organizations that

have the ability to further scale up the findings of SANREM.

Annual Achievements

In conjunction with UNORCAC, SANREM led or participated in nine training workshops on biodiversity, water, and gender. The office supported the research activities of 7 graduate students (3 Ecuadorian, 4 US) by providing space, transportation, computer facilities and communications. The Nanegal book in English and Spanish (Bridging Human and Ecological Landscapes), along with a series of reports, have outlined very clearly the methodologies being developed.

Three leaders from Cotacachi were invited to participate in an Andean International Year of the Mountain meeting in Huaraz, Peru, in early June, 2002. At the same time, UNORCAC is preparing to serve as one of the model field sites for visitors participating in the official International Year of the Mountain meeting to be held in late September, 2002 (Second Global Encounter of Mountain Peoples). SANREM will assist UNORCAC and the municipality demonstrate the results of the project to visitors from all over the world.

To facilitate this process and finalization of SANREM Phase II, Robert Rhoades and Virginia Nazarea will be living in Cotacachi during the fall, 2002. Rhoades will be officially affiliated with Catholic University and UNORCAC under a Fulbright Scholars program.

Advances

in Research - This project does not conduct research per se. It is a support and outreach project of the local indigenous communities. The project houses and facilitates the efforts of Ecuadorian and US-based SANREM researchers. The field coordinator is headquartered in the Jambi SANREM office. The research assistants, computers, and information files are found here. All training occurs in the Jambi Mascaric compound under this project.

in Capacity Buildup - During the year, 9 training workshops on biodiversity, water, and women were held. The office supported the research activities of 7 graduate students (3 Ecuadorian, 4 US).

in Scaling Up - Cotacachi is an ideal laboratory for scaling up of SANREM research. It has gained international acclaim for its participatory approaches to natural resource planning. The indigenous leaders who are involved in SANREM are widely respected in the Andes. Mayor Auki Tituana is a possible presidential candidate

in Ecuador's upcoming elections. He has adopted several SANREM projects as his own and promoted them throughout the Canton (e.g., memory banking). Finally, with one of the three official International Year of the Mountain Conferences coming to Quito (with an official trip to Nanegal and Cotacachi) SANREM will be globally highlighted.

in Policy Impact - With the addition of an economics project on water rights in the zone, we can expect the formulation of policy briefs which can foster more rational water and land use planning in the zone. One expected impact of the International Year of the Mountain will be the integration of mountain perspectives into national policies of countries such as Ecuador.

in Improved Environment and Natural Resource Management - The formation and implementation of the Pitzimbizi watershed plan will lead to improved environment and MRM. More significantly, however, will be the utilization of both Nanegal and Cotacachi as case studies and inspiration for other communities and project engaged in NRM planning.

Publications

Book Chapters

Rhoades, R. 2001. *Bringing sustainability down-to-earth: reflections and guidelines for policy makers and practitioners*. Pp. 353-368 in Robert Rhoades (Ed.) Bridging Human and Ecological Landscapes. Participatory Research and sustainable Development in an Andean Agricultural Frontier. Dubuque, IA: Kendall/Hunt Publishing Company.

Rhoades, R. and A. Martinez. 2001. *Environmental history of the Nanegal area during the first fifty years of the Twentieth Century*. Pp. 57-83 in Robert Rhoades (Ed.) Bridging Human and Ecological Landscapes. Participatory Research and sustainable Development in an Andean Agricultural Frontier. Dubuque, IA: Kendall/Hunt Publishing Company.

Rhoades, R. and N. Vedwan. 2001. *Breaking new ground: Linking research, participation, and sustainable development*. Pp. 3-21 in Robert Rhoades (Ed.) Bridging Human and Ecological Landscapes. Participatory Research and sustainable Development in an Andean Agricultural Frontier. Dubuque, IA: Kendall/Hunt Publishing Company.

Rhoades, R., A. Martinez and E. Jones 2001. *Migration and the landscape of Nanegal*. Pp. 353-

368 in Robert Rhoades (Ed.) *Bridging Human and Ecological Landscapes. Participatory Research and sustainable Development in an Andean Agricultural Frontier*. Dubuque, IA: Kendall/Hunt Publishing Company.

Rhoades, R., V. Nazarea, and M. Piniero. 2001. *Contrasting scientific and local valuations of land use change: The future visioning methodology*. Pp 333-349 in R. Rhoades (Ed.) *Bridging Human and Ecological Landscapes. Participatory Research and Sustainable Development in an Andean Agricultural Frontier*. Dubuque, IA: Kendall/Hunt Publishing Company.

Books

Rhoades, R. (Ed.). 2001. *Bridging Human and Ecological Landscapes: Participatory Research and Sustainable Development in an Andean Agricultural Frontier*. Dubuque, IA: Kendall/Hunt Publishing Company.

Rhoades, R. and J. Stallings (Eds.). 2001. *Integrated Conservation and Development in Tropical America: Lessons Learned in Linking Communities, Projects, and Policies*. SANREM CRSP and CARE-SUBIR, Athens, GA.

Other Major Outputs in this Period

Proceeding

CONDESAN. 2002. *Municipios Rurales y Gestación Local Participativa en Zonas de Montana*. E-conference supported by SDC, SANREM-Andes and Comisión Interministerial de Empleo, Comité Asesor Ecuador.

Training Degree

Name, Level, Start Date-Completion Date

Eric Jones, Ph.D.

Aurelio Vicuna, M.A.

Shiloh Moats, M.A.

Training Non Degree

Workshop

Biodiversity Fair and Workshop was attended by 303 person(s) and lasted 2 day(s).

Children's Camp was attended by 250 person(s) and lasted 7 day(s).

Children Scholars Workshops and Training was attended by 16 person(s) and lasted 3 day(s).

Children's Scholars Workshop on Andean Tubers was attended by 16 person(s) and lasted 1 day(s).

EcoTourism Workshop was attended by 5 person(s) and lasted 2 day(s).

World Water Day was attended by 256 person(s) and lasted 1 day(s).



SANREM Southeast Asia Project Overview

1. Introduction

In Phase II, the SANREM Southeast Asia project set itself the ambitious goal of "enabling better natural resource management decisions by upland communities". This was to be achieved through collaborative partnerships among researchers, government organizations and civil society in research, information dissemination, capacity-building and policy advocacy as means to support natural resource management for sustainable development by communities, local administrations, agencies of national government.

Within rural areas of Southeast Asia, concerns about unsustainable development are keenest "at the margin" - that is, in areas close to the cultivated frontier, where poor households farm sloping lands that are frequently poorly suited to intensive cultivation. The "margin" thus represents a constellation of ecological, economic and political conditions in which stress is endemic and the security of human welfare, soil and water resources, and biological diversity is under constant threat.

In the recent past, settlement and cultivation at the frontier was driven primarily by demographic change - rapid population growth and internal migration - in poor agrarian economies. Upland populations relied almost exclusively on agricultural production and gathering of forest products, and were largely subsistence-oriented. The influences of government and markets were relatively weak and indirect. Deforestation, land use decisions, and agricultural technology were, therefore, largely driven by local demographic, economic and biophysical conditions.

In very many areas of Southeast Asia these conditions have changed fundamentally within just two decades. The region as a whole is experiencing economic growth at an unprecedented pace. In addition to raising average income, growth has been accompanied by improvement and expansion of infrastructure, financial systems, educational opportunities, and the power of government. Internal and international labor mobility is increasing. 'Globalization', or the opening to international trade and capital flows, is transforming the structure of production and consumption, and the valuation of domestic endowments of labor, land and natural resources.

In the course of this change, upland communities find themselves increasingly closely integrated into rapidly expanding and developing national and global markets, through which resource managers receive signals that play major roles in determining land use, technology adoption, and investment. Markets thus exert a powerful influence over long-term environmental health and economic welfare. In Southeast Asia, deforestation and land use change is now driven much more by globalization and the transformation of domestic governance systems than by 'traditional' influences, namely population growth and poverty.

Unfortunately, economic growth alone does not resolve the problem of unsustainable upland land management practices in developing countries. The new forms of agricultural development place relatively fragile upland ecosystems under great stress. Land-degrading patterns of agricultural growth are promoted by adverse economic incentives and institutional failures. Tenure

insecurity and failures of property rights are primary among these problems, and introduce an incentive bias in favor of short-term land uses. Rates of return to long-term investments in perennial crops and soil-conserving structures are also reduced by high capital costs in 'thin' local credit markets. For these and related reasons, farmers in steeply sloping upland areas are frequently observed to engage in land-degrading agricultural practices, even when they are clearly aware of the long-term consequences of their actions.

The expansion and intensification of upland agriculture also has important policy 'drivers'. Most Southeast Asian governments support domestic cereal production by special policy measures, and the expansion of temperate climate vegetable crops in steep lands is similarly stimulated by import restrictions, input subsidies and special R&D allocations (all of these policies are especially prominent in the Philippines). Accumulated evidence suggests that while overall economic growth rates are important predictors of declines in poverty-related migration and land degradation, crop-specific and sector-specific policies (or policy failures) exert substantial influence over land resource allocation and soil management, even in apparently remote upland areas.

Importantly, the policy aspect of environmental degradation is not limited to those agencies of government with direct responsibility for the management of agriculture or natural resources. In 'globalized' economies, trade and investment policies in



particular are important determinants of the input and output prices that influence land use decisions. And increasingly, the devolution of fiscal and administrative responsibilities to local governments, rendering them simultaneously dependent on transfers from central government and on the participation of communities, is introducing new complexities to environmental policy-making and implementation. Thus every economic policy or administrative regulation that affects resource allocation in the uplands, whether directly or not, is a *de facto* environmental policy, and the creation of a supportive policy environment for sustainable development requires engagement and collaboration with *all* agencies whose actions have such effects.

SANREM's main Southeast Asia research site is the municipality of Lantapan, located in the province of Bukidnon in the southern Philippines. Our continuous presence in Lantapan since the inception of the project in 1993 has enabled researchers to make long term observations on the dynamic interaction of economy, environment and policy, to accumulate a vast amount of information, and to establish and develop partnerships with community-based groups, local government, and other key actors in environmental and natural resource management. With Lantapan as our 'laboratory' we have been able to scale up and out to other municipalities and provinces in the Philippines, and to comparable research sites in Vietnam, thereby extending the research base and potential impacts of the project far beyond the boundaries of our initial research site. Similarities with Lantapan are defined not merely by common geographic characteristics, but the fact that economies in the region share certain experiences that are instrumental in shaping the direction of resource use and the logic of local natural resource management strategies. These experiences include dynamic economic growth, which tends to slow the rate of net migration to upland areas; expansion of commercial opportunities for local upland farmers, including intensive vegetable cultivation for urban markets; increased presence of highly capitalized agribusiness ventures in previously remote rural areas; and above all, rapid devolution of powers to sub-national jurisdictions.

In Phase II, we designed a project that brought together local and outside experts to combine community-level data gathering and analysis and local government capacity-building with the search for policies, at local as well as national level, that would achieve environmental targets through incentive-compatible

means rather than through the application of regulatory formulae; through participation rather than command-and-control; and through local design rather than 'one size fits all' central plans. The methods adopted, and models developed, took account of the prevailing economic, social and institutional context, in particular on-going rapid economic growth, the presence of economic policies affecting agriculture, and the decentralization of administrative and some policy responsibilities from central to local government.

Our outputs included decisions support tools (methodologies, technologies, research findings and simulation models) to enable the formulation and answering of questions that link economic and social development goals with the long-term viability of the environment and natural resource base. We helped build analytical and decision-making capacity at local levels; and to promote structured discussion of NRM and sustainable development through information exchange and policy advocacy across levels (local, sub-national and national) and among institutions at each level. Capacity building activities supported our research by helping ensure that decision support tools could be used efficiently in NRM planning by communities, provincial and national governments and other local organizations. Information exchange and policy advocacy activities followed through on SANREM research with the aim that research findings and their implications should reach the right influence makers and decision-makers, take appropriate forms for different audiences, and ultimately contribute to broader debates on the question of sustainable development.

2. Highlights of Accomplishments

The project has enjoyed substantial success in meeting its Phase II objectives. Our own quantitative self-assessments have indicated tangible links from the projects to community-level and household-level changes in environmental awareness, attitudes and actions.¹ And an external review in 1999 described the project as "one of the few research programs with a rich base of data and experience . . . [it] mobilizes information, research and participatory processes to achieve well-conceived and implementable plans that contribute to economic development as well as natural resource conservation"².

The following are some of our accomplishment highlights, selected to emphasize the range as well as

the depth of SANREM activities. More complete documentation of our activities is available from <http://www.aae.wisc.edu/SANREM-sea>.

2a. Tools for sustainable agriculture and NRM policy planning and implementation

The project's partners have developed and adapted a suite of tools for NRM. These range from data intensive economic and environmental models, to participatory monitoring of environmental quality and methodologies for the design and implementation of NRM strategies, to on-farm technologies produced through collaborative research at the project site (24, 25, 34, 42, 44³). The successful development of these tools supports our goal of enabling better natural resource management decisions by upland communities. By making these tools available to a wide range of users, we steer away from making decisions *for* natural resource managers. Instead we work with them to develop and test an array of options to evaluate choices, develop a plan to conserve community resources, monitor the health of the environment, and select agricultural livelihood and NRM technologies which best fit their needs and capacity.

Our achievements in economy-environment modeling include the following. (A) Insights about the operation of markets, and about farmers' land use responses to prices and policies, based on monitoring of farm decisions and market trends in the site since 1994. This information contributes to a deeper and more detailed understanding of the dynamics of the upland economy. (B) The 'Manupali model', a user-friendly, intuitive, flexible, and highly portable computer-based tool for understanding the important linkages between economic policies, agricultural resource use decisions, and environmental outcomes. This computer model is based on data gathered at the research site and collaborative

¹ Buenavista, G., I. Coxhead, and K. Kim. 2001. *Assessing SANREM's Impacts in Lantapan: Results of a Survey*. Pp. 232-257 in Coxhead, I. and G. Buenavista (Eds.) *Seeking Sustainability: Challenges of Natural Resource Management in a Philippine Watershed*. Los Banos, Philippine Council on Agricultural Research, Natural Resources and Development.

² Scherr, S. 1999. *Report of the EEP visit to Sanrem-Southeast Asia*. (<http://www.aae.wisc.edu/sanrem-sea/DocumentArchive/EEP99.doc>).

³ These numbers refer to the project's component work plans as provided in SANREM workplans, Year 5, 2002-2003.

research with host country university researchers, host country NARS, and IARC's. To date, the Manupali model has been 'road-tested' with local government, agencies of the national government, representatives of NGO's, and university research groups. It has gone through several stages of development and has been presented at international research conferences in the Philippines and Thailand, and at offices of the Department of Agriculture and the Department of Environment and Natural Resources of the Philippines. The Manupali model is a substantive improvement over existing watershed model in that it incorporates a realistic representation of farmer decision-making in response to economic and environmental information. It is being now adapted for further use in SANREM Phase III, both at the Lantapan site and in Vietnam, and is guiding methodological work on watershed modeling in the US. The model has been widely disseminated on CD-ROM (Compact Disc - Read Only Memory) and the world-wide-web at <http://www.agecon.purdue.edu/staff/shively/manupali>.

Participatory environmental monitoring is spearheaded by our collaboration on water quality monitoring with the *Tigbantay Wahig*, a local NGO in whose formation the project was a catalytic force. The TW undertakes water quality and quantity monitoring in Lantapan, and its documentation of environmental trends over six years of continuous monitoring has generated a comprehensive and unique database. This is a unique accomplishment also in that the data have been collected (and increasingly analyzed) by a community-based group with minimal supervision foreign or external scientists; and that the activity is a collaboration between US and Philippine universities, an international NGO, and a community-based organization. The rich information from water monitoring has enabled us to draw connections on the effects of population and economy on the environment and to study the role of local organizations and institutions in sustainable natural resource management. The TW (*Tigbantay Wahig*), meanwhile, are increasing the list of their own accomplishments by providing training and advisory services to other community-based water quality monitoring efforts in several locations in the southern Philippines.

Another important 'process' accomplishment has been the development and application of methodologies for participatory natural resource management (NRM) planning. There have been several of these in the project, differing slightly in approach and outcome. The

ICRAF (International Center for Research in Agroforestry)-led NRM planning process worked with municipal level governments to articulate their environmental visions and develop action plans. In a separate activity, SEARCA led a collaboration with CMU-BIDANI (Central Mindanao University, The Philippines - *Birangay Integrated Development Approach for Nutrition Improvement*) working directly with village level (*barangay*) governments in NRM and sustainable land use planning. Both approaches involved capacity building, used local level data generated by community members themselves (or in collaboration with other groups) and required stakeholders, especially municipal and village governments, to commit time, human and financial resources to support the planning process.

Finally, our accomplishments in the area of agronomic research and experimentation have been significant, whether measured by conventional indicators such as academic output, or by influence on local practices. Our vegetable and agroforestry research initiatives test and evaluate alternative land management options; the agroforestry initiatives in particular have led to the formation of a financially and organizationally strong local tree seed producers' group. Data from the field experiments have also been incorporated into the watershed modeling efforts described above.



IBC 13 TV crew interviewing Mr. Alfonso Sagayan, a member of the Agroforestry, Trees, Seeds Association of Lantapan (ATSAL), an NGO that was born out of ICRAF-SANREM partnership in the implementation of the tree domestication work plan. (Photo by: Vel J. Suminguit)

2b. Capacity for NRM Planning and Policy Analysis:

Building capacity for analysis, action and evaluation is an essential component of any effort to promote better natural resource management decisions in upland communities. The project has been very active in this area, and our accomplishments extend from training and analysis for farmers and natural resource managers to communities, local policy makers, community based organizations, and researchers. All are aimed at building capacity to analyze NRM challenges and opportunities, the conduct of policy analysis, and the use of specialized information to support policy action and advocacy (SEA-23, -24, -25, -32, -34, -42, -44). It is significant that our capacity building activities, initially aimed at supporting the implementation of specific research activities, led to the establishment of viable community organizations, such as the *Tigbantay Wahig*, the Agroforestry Tree Seeds Association of Lantapan (ATSAL), and Landcare groups, all at the community level. These groups are increasingly recognized in mainstream local and national environmental forums and by development-oriented projects. In some municipalities in the Philippines, parallel organizations have been formed locally to undertake similar activities.

Strengthened capacity for NRM planning and policy analysis is a key component in the Philippine transition to decentralized environmental and natural resource management. As such we focused our efforts not only on strengthening capacity within civil society, but more importantly enhanced local government NRM capacity through the acquisition of skills in NRM planning and policy analysis (SEA-23, -34, -42). This has been a major thrust of the project, and has paid off in diverse ways: in facilitating civil society participation with local government, inter-agency collaboration, appreciation for the value of research, and recognition of local initiatives. These improvements in the policy making environment are notable in the Municipality of Lantapan, where many have achieved concrete expression in the project-supported municipal Natural Resource and Development Plan.

2c. Research to Support Policy Advocacy at Local and National Levels:

Local and national policies have been shown to exert significant influence over natural resource management decisions in upland areas. Projects aiming to achieve

sustainable development in such areas must not only provide support for building local policy making capacity, but also engage in policy analysis and advocacy to maximize their chances of success. Policy studies and advisory activities have been conducted by the project to assist the local government address emerging NRM issues in the municipality (SEA-23). As an example, we conducted a study to evaluate residents' willingness to pay for clean water, as an input to future legislation aimed at preventing further degradation of local water resources. Assistance was provided to the local government in preparing several ordinances, including a ban of aerial spraying by banana plantations, and the setting of user charges for water used by agro-based industries. The first of these has been approved, the second is awaiting further evaluation by the local officials of the provisions of the Water Code of the Philippines. Advocacy activities at the local level have also been conducted by other work plans and have produced concrete results such as the creation of Lantapan Water Task Force, legislation supporting NRM planning and implementation and ordinance for adoption of sustainable farming practices. Furthermore, the local government has provided financial resources to fully implement these legislations. In other municipalities where the project sponsored capacity building activities for NRM planning, legislation was passed to support both the planning process and implementation.

Our policy advocacy activity has also reached the national level. In previous years, this was done through attendance of researchers in national level forums. More recently, we strategically included the Philippine Institute of Development Studies (PIDS) as an institutional partner to enable us to reach national level policy makers (SEA-53). PIDS leads in the preparation and dissemination of policy briefs and research notes, featuring results of our research in the Manupali watershed. These documents are distributed in key policy making branches and agencies of national government. PIDS also heads the organization of a national level policy forum on watershed and water management. This forum, which will be held in August 2002, will feature research papers by national leaders in their fields on competing uses of water, environmental governance and water resource management, watershed development programs and policies, and the role of grassroots organizations in water resource and watershed management. National level policy makers and their advisors are expected to attend this activity.

2d. Information Exchange at Various Scales:

Information exchange has been facilitated at the local level through site visits, training programs and workshops as well as a wide range of less formal programs. At the national and international level the exchange of information has been achieved through participation by SANREM researchers in a range of conferences and workshops. We have also sponsored an international workshop on NRM (in Chiang Mai, Thailand, in 1999, and an international conference on Sustaining Upland Development in Southeast Asia. Held in Manila in May 2001, the latter conference showcased the breadth and depth of SANREM activities, established the project as one with Southeast Asia-wide relevance and cemented its position as a key resource of research and policy advice on the management of natural resources in the upland agricultural areas of the Philippines.

Three publications released at the conference provide further documentation of SANREM-SEA progress. These are the research monograph *Seeking Sustainability* edited by I. Coxhead and G. Buenavista and published by PCARRD; the SANREM-SEA multimedia CD-ROM; and a SANREM-sponsored IRR publication, *Enhancing Participation in Local Governance: Experiences from the Philippines*.

Through an institutional relationship with the Philippine Institute for Development Studies, a national government economic think-tank, SANREM researchers now contribute to the publication and dissemination of policy-relevant research tools and findings on environment and natural resource management. We are also poised, in late 2002, to embark on a similar venture with a counterpart national agency in Vietnam, the Information Center for Agricultural and Rural Development in the Ministry of Agriculture.

Complementing our information dissemination strategy, we maintain and regularly update a web site containing research activities, publications, and other pertinent documents. The site is linked into by leading Southeast Asian NRM research networks, such as Mekonginfo (www.mekonginfo.org). In the final 12 months of the project we will be drawing on the expertise of communication specialists to assist in translating research papers into popular media for wider dissemination of research outputs beyond the Philippine scientific community. At the site level, PCARRD in

collaboration with the local government provides leadership in the organization of a technical working group to coordinate research and outreach activities implemented by various projects (other than SANREM) in the Municipality of Lantapan.

2e. External Linkages Through Environmental Research Grants:

Beginning our fourth year, we implemented a competition for small research projects designed to address issues related to promoting sustainable agriculture and natural resource management in the region (SEA-50). Funded research in 2001-2002 include activities testing environmental models at the Manupali watershed, institutional analysis, testing of the Lantapan watershed model in Vietnam, and enhancing research and policy linkages in Vietnam. For the current year (2002-2003), we have provided funds through the environmental grant scheme to translate research outputs in popular format; review research on the linkages between forest resources and poverty alleviation in Vietnam; and examine the role of social capital and natural resource management in Bukidnon. Also in Year 4, the project added a GIS research activity to update site maps that were generated during Phase I and to use related outputs for integrated watershed analysis (SEA-52).

Our work in Philippines and Vietnam clearly shows the transferability of the tools we have developed in the Manupali Watershed to other areas undergoing similar economic transformations. As an example of the strong research contributions being made by SANREM researchers, Dr. Gerald Shively, a member of the SANREM SE Asia team, recently won a three-year NSF grant to continue his research on economy-environment interactions in the Philippines. His research uses household survey data to study how technical change in agriculture affects rates of tropical deforestation. This theme has been an important one for SANREM researchers in the Philippines, and Shively's research provides an opportunity to study the direct and indirect effects of irrigation development on agricultural production and labor allocation, while controlling for a number of agronomic features of the sample farms and important social factors such as tenure security. His results will provide an empirical foundation for assessing competing theories regarding poverty and the environment, and will also inform broader debates regarding the distributional effects of growth and development and their implications for important aspects of household behavior. Results should

have implications for a range of social and environmental outcomes including economic development, poverty reduction, biodiversity protection and carbon sequestration.

3. Impacts

SANREM is a research project, and as such its impacts are considerably more difficult to identify than is the case with projects having explicit development or technology transfer components. Moreover, because we lack a laboratory 'control', it is very difficult to draw precise causal links from project initiatives to impacts. In addition, the impacts of a research project of this kind are often frustratingly intangible, consisting in the main of changes in awareness and attitudes, perhaps leading to changes in actions, whose *physical* effects (in terms of environmental indicators) may not be observable for years or even decades. Nevertheless, our sustained presence in the Lantapan site has helped generate a number of local impacts that we feel confident in claiming to have caused. These in turn are generating increasing momentum for impacts at national and even regional (Southeast Asian) levels.

3a. Sustained NRM Planning and Implementation and Strengthened Institutional Capacity:

SANREM's NRM planning activity in Lantapan has altered governance in the municipality, with environmental concerns now high on the legislative agenda, and consultation with the community an accepted procedural mode, as demonstrated by the project-sponsored natural resource management and development (NRMD) planning process.

The same process has since been implemented successfully in four more of the municipalities bordering the Mt. Kitanglad Range Nature Park. There, local governments have sustained NRM planning activities over a year after its initiation, even with no direct technical assistance from SANREM. A follow-up survey conducted by project researchers in 2002 revealed 5 critical elements key to ensuring the NRM plans are put into action: the presence of local champions; continued budgetary allocations; a balance of power and responsibility; integration of the NRM plan with municipal environment and economic development plans; and a cohesive NRM council. The spread of NRMD planning has clearly led to immediate impacts in local governance. Local governments have become responsive in providing support to environment related projects in the community, such as those

pertaining to soil conservation and protection of water resources. In the long-term, we expect that sustained NRM planning and implementation will lead to a better managed natural resource base in Bukidnon province.

3b. Improved Human and Organizational Capacity:

Our research and capacity-building activities have undoubtedly enriched local skills in the application of tools for natural resource management. The community groups that have become partners of the project have no less become advocates, trainers, and resource persons. The spread of their work is notable nationally and even internationally. Increased awareness and knowledge of local environmental issues have inspired these community groups to advocate for sound environmental projects and to participate in local policy dialogues. This also comes with their ability and ease to use information based on research. The *Tigbantay Wahig* members, for example, used data that they themselves collected to warn municipal officials of the gradual degradation of the river systems.

Improved human capacity has led to the creation or strengthening of local organizations and institutions. In the case of Lantapan and other municipalities in the country, members involved in water quality monitoring, agroforestry research and other NRM related activities have organized themselves as formal groups. We have observed the institutionalization of SANREM methodologies (by which we mean adoption of tools and principles as part of an organization's regular activities) among the various local organizations and institutions with which the project works. The BIDANI (Birangay Integrated Development Approach for Nutrition Improvement) group at Central Mindanao University, for example, has incorporated NRM as part of its research and extension agenda in promoting integrated development at the village level. Local governments in and around the project site have established multi-stakeholder natural resource management councils in their respective municipalities to ensure the continuation of NRM planning activities.

3c. Diversified Land Management Practices and Increased Incomes:

The introduction, through the project, of alternative land management practices in Lantapan, including low-cost conservation structures and integrated vegetable and agroforestry systems, has resulted in agricultural diversification and the conservation of soil resources.

In Lantapan, for example, one can now observe greater diversity of tree species across the landscape than a decade ago. With the guidance and support of agroforestry experts, there has been a shift away from plantation-type establishments using single tree species, as introduced by previous projects. Diversifying tree species provides farmers with a hedge against disease and price risks associated with monoculture, and enables them to respond to market demands for specific species. There is now widespread appreciation for tree farming as an income-generating activity. Information obtained from the agroforestry association (an organization created with SANREM assistance) revealed that members made substantial additional earnings from sale of tree seeds. Income opportunities of local farmers could be enhanced even further with better knowledge of the timber and tree seed market.

3d. Better Policy Environment:

Increased capacity for policy analysis among municipal officials has improved the environment for local policy analysis, design and implementation. This is demonstrated by increased consultation and transparency in decision-making (especially as policy formulation depends increasingly on data from community-based research), adoption of consultative processes, and the increased reliance on relatively formal tools for evaluating and deciding on policy alternatives.

At the national level, inputs to policy debates by SANREM researchers through our partnership with the Philippine Institute for Development Studies are paying early dividends. Our policy briefs distributed through PIDS have been documented to be the catalysts for a review of policies and procedures at the National Water Resources Board (and we expect more progress following the August 2002 national water policy forum). Also through PIDS, SANREM research is now reaching legislators in the national parliament through the PIDS' legislative monitoring data base, which provides lawmakers and their staff with information (including background research) pertaining to current legislative initiatives.

Finally, SANREM has also helped national researchers to package and present research results for policy makers. In the Philippines, this has been an important impact of our partnership with PIDS. In Vietnam, the same process has just begun, with two workshops in 2001-2002 bringing researchers together with

communications experts and senior officials of the Ministry of Agriculture and Rural Development for the purpose of refining and targeting the policy implications of academic research.

4. Dissemination

SANREM is first and foremost a research project, and the primary means for dissemination of findings are the standard outlets for such research: peer-reviewed journal articles, books, acceptance of papers for presentation at national and international conferences, and publication of findings in numerous less formal and more popular outlets. Our achievements in these areas are documented in our annual reports and on the project web site.

The project has also made good on its promise to feed back research results to the Lantapan community. Numerous informal gatherings, called *kapihan* ('coffee meetings') and *pulong-pulong* (dialogues), have been organized to facilitate local level reporting and sharing of research results and to provide a venue for researchers to interact with a municipal level audience, including many participants not directly involved in project activities. The *kapihan* were also held at the provincial level, bringing in a geographically and politically broader audience, such as municipal planners and other provincial and in some cases regional (sub-national) level policy makers. SANREM researchers, including community members, have also participated in government-sponsored conferences and technical working groups addressing provincial environmental issues. These face-to-face strategies for information dissemination and exchange not only facilitated understanding on the project's mission, but more importantly have helped create awareness on pressing local environmental issues. The successful spread of SANREM research outputs are documented in an impact study conducted at the research site, in which Lantapan local government officials ranked SANREM as primary source of information on environmental and natural resource issues.⁴

Clear and systematic presentation of research outputs at the community level has made it easier for the Lantapan government and SANREM to define environmental issues affecting the municipality. This paved the way for the proactive utilization of research-based information in the formulation of the municipal natural resource management plan ñ a concrete policy action undertaken by the local government.

Policy advocacy at the national level is led by national level institutions such as the ISPPS, the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and the Philippine Institute of Development Studies (PIDS) - each of which has its own established networks within the central government. Activities include dissemination of policy briefs to the executive and legislative branches, and presentation of research results in national level dialogues. To cite an example, a recent SANREM policy brief on water management has been forwarded to the National Economic Development Authority (NEDA) to be used as an input for the forthcoming national water summit. Recommendations presented in this policy brief are also being used as input in a paper prepared by NEDA for the president of the Philippines. A more direct approach undertaken by the project through PIDS and ISPPS (Institute for Strategic Policy and Planning Studies) is the organization of a water policy forum, which brings together key policy research experts in water and watershed management. Participants to the forum will include representatives from national line agencies and policy makers.

The strategies that we have employed help ensure that our findings and their implications reach the right audience, in particular influence-makers and decision-makers, and provide opportunities for replication of SANREM-like activities in other parts of the country and region.

5. Training and Institutional Atrengthening

5a. Contributions to Human Capacity Development:

Our capacity building activities cover a wide range of topics, but have one thematic focus: to enable better natural resource management decision in upland communities in Southeast Asia. Topics include application of integrated watershed model for policy simulations, water quality monitoring, natural resource management planning, land use planning, policy analysis, agroforestry management practices and participatory landscape/lifescape appraisal. The project site office has also hosted study tours for groups from as far away as Ethiopia, and with the provincial government has jointly sponsored a regional watershed workshop and symposium. Capacity building has been provided to community-based organizations on group strengthening, and organizational administration and management.

The project also sponsored researchers and staff to participate in national and international conferences, training programs, and workshops. These activities present opportunities for the participants to share project experiences, research methodologies and findings as well as to learn from other researchers. A number of graduate students in the U.S. and the Philippines were also funded by SANREM through research/project assistant ships. Inclusive of graduate students in the U.S. funded in Phase I, they now occupy research and teaching positions in U.S. universities or are employed in the private sector.

Those in the teaching and research position in the U.S. are still involved in SANREM research and have published widely the results of their research. A sample profile of former U.S. based students is presented in Appendix 2.

Two Philippine-based students are actively involved in SANREM research and pursuing their doctoral degree at the University of the Philippines in Los Banos.

5b. Institutional Strengthening:

Our institutional strengthening efforts have been focused on enabling local governments undertake their devolved functions in environment and natural resource management. Governmental units both at municipality and provincial levels comprise our main capacity building clients.

6. Collaborative Relationships

6a. Research Administration and Management:

At the University of Wisconsin, Ian Coxhead, John Rowe and Gladys Buenavista (postdoctoral) take charge of research administration and management. Both Buenavista and Coxhead also have research responsibilities. Our counterpart host institution in the Philippines is represented by the PCARRD (Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development). PCARRD is responsible for administration and site coordination. PCARRD-based staff includes Dr. Rogelio Serrano (SANREM SEA Co-Principal Investigator). A staff of three assists him. Dr. Vel Suminguit is our Site Coordinator and is assisted by a staff of two (one is site-based and also serves as research assistant for the policy analysis work

¹ Buenavista et al., op. cit.

plan). The Site Coordination Office is located in Malaybalay, Bukidnon. The Philippine Agriculture and Resources Research Foundation, Inc. (PARFFI) handles our financial administration. PARFFI is housed at PCARRD.

7. Leveraged Funding External to USAID

Leveraged funding as a result of SANREM programming in Southeast Asia continued to grow during Years 4 and 5 of the project. The funds are estimated at \$151,596 and \$182,660 for Years 4 and 5, respectively. Specifically, the funding came from the following sources and is being used for the reported purposes:

- * PCARRD contributes approximately \$10,000 per year in staff salaries, transportation and other in-kind benefits in support of the SANREM administration in Southeast Asia.

- * The International Fund for Agricultural Development (IFAD) is providing complementary support to work plan SEA-34 by implementing a countywide case study on the eleven Local Government Units that have introduced NRM plans. Estimated leveraged funds equal \$10,000.

- * For work plan SEA-42, the BIDANI Institute has a MOA for this project with the city of Valencia and Municipality of Lantapan. BIDANI and Central Mindanao University have provided approximately \$11,000 over the two years for capability building, micro-finance and community based enterprise activities in these localities.

- * ICRAF continues to build the Landcare program in the Lantapan and Calveria municipalities. Total support from ICRAF, the Australian Center for International Agricultural Research (ACIAR) and the Agencia Espanola de Cooperacion Internacional (AECI) now totals approximately \$50,000 per year.

- * The Swedish International Development Cooperation Agency (SIDA) is funding a study through the Southeast Asian Network for Agroforestry Education (SEANAFE) and ICRAF-Philippines Agroforestry Thesis Research Support Program for the Philippines at the cost of approximately \$15,000.

- * Gerald Shively received a \$40,000 grant from the National Science Foundation to support a postdoctoral students' research on Southeast Asian natural resource management issues.

- * The Australian National University has supported Ian Coxhead's SANREM activities while he has been there on sabbatical (\$5,600). The UW-Madison Graduate School has also provided Coxhead a grant of \$18,500 to work on decentralization and natural resource management ideas arising from SANREM research.

- * Heifer Project International continues its strong support of the water quality monitoring work in Lantapan and other municipalities at the rate of approximately \$12,000 per year.

- * Victoria Espaldon and Agnes Rola received grants of \$7,000 each to attend the Sustainable Environmental Management course at UC-(University of California) Berkeley. Espaldon also received a grant of \$2,500 to attend the International Human Dimension Program in Brazil.

- * University of Philippines-Los Banos, SEARCA, Central Queensland University, Auburn University, Purdue University and UW-Madison contribute leveraged funds each year in support of the SANREM researchers based on their campuses. The annual value of this support for 2001-2002 is estimated as follows: UPLB (Institute of Strategic Planning and Policy Studies) (\$2,500), SEARCA (\$4,960), Central Queensland University (\$5,000), Auburn University (\$7,500), Purdue University (\$1,500), and UW-Madison (\$27,600).

8. Complementarity with Bilateral Programs and Benefits to the U.S.

The work of SANREM CRSP-Southeast Asia addresses the strategic objectives of USAID's bilateral program in the Philippines, and also has benefits to the US directly.

The goals and methods of the project over the past 5 years have address strategic objectives of the Manila USAID mission on governance, natural resource management, trade liberalization and food security, as well as some of its specific programs such as the recently completed Growth with Equity in Mindanao (GEM) project (for the mission's current SOS, visit their site at <http://www.usaid-ph.gov/>).

- * The core of SANREM's Philippine activities in Phase II was a partnership with municipal and provincial governments to engage in natural resource management (NRM) planning. This was carried out in a way that deliberately integrated NRM planning into the broader

strategy of building local government capacity for fiscal and development policy formation in the wake of the devolution mandated by the revised Local Government Code of 1992.

* The integration of environmental and economic-social analysis in Phase II directly addressed both growth and equity for a key province in Northern Mindanao. Our work with commercial corn and vegetable growers complements the small-business orientation of GEM.

* The project's close research attention to NRM and biodiversity conservation issues at the margin of agricultural cultivation in the buffer zone of the Mt. Kitanglad Range National Park addresses crucial problems raised by continuing economic and demographic pressures for the conversion of forested lands to commercial agricultural production.

* SANREM research has demonstrated and quantified the linkages between Philippine agricultural trade policies and the use of natural resources in upland agriculture. These operate both directly - through import restrictions on corn and certain temperate-climate vegetable crops' - and indirectly, through the effects of trade and exchange rate policies on overall economic growth, rural poverty and the generation of non-agricultural employment.

* Finally, it hardly needs to be emphasized that our research on the NRM activities of a relatively poor upland population in control of a fragile resource base has direct implications for the understanding of food security issues, both at the local level and - through the distillation of local and national policy implications ñ for the broader Philippine agricultural economy. SANREM's Philippine counterparts include nationally prominent researchers and policy advisors concerned with the integration of environmental policies and economic development strategies.

SANREM's work in Southeast Asia also continues to strengthen links between U.S. research institutions and their counterparts and clients in the region. This benefits the U.S. institutions through student training, faculty involvement in international experiences and opportunities for policy-relevant applied research. The research site serves as a research laboratory for U.S. based graduate students to gain experience in environment and natural resource management. Graduate students conduct on-site research or work on research activities led by U.S. and Philippine-based researchers

affiliated with the project. They gain valuable knowledge and skills in addressing environmental issues in the U.S. and abroad through the development of innovative research methodologies.

In addition to graduate training, we have enhanced capacity for conducting multi-disciplinary research using the landscape as a unit of analysis. The dynamic simulation modeling method, for example, is applicable to a wide range of topics.

U.S. based project researchers have served as resource persons in various international research and development courses and programs.

We keep track of our progress and impacts through our annual reporting process and mid-year meetings conducted on site. These meetings offer researchers the opportunity to interact and share research outcomes and outputs. We also use these meetings to address management issues. Towards the end of Phase I, the project conducted an impact evaluation. A similar activity will be conducted before the conclusion of Phase II.

SANREM CRSP

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

June 2002
Annual Report
SEA-01

Administration and Research Management for SANREM-Southeast Asia

Principal Investigator
Ian Coxhead

Co-Principal
Investigator
John Rowe

OBJECTIVE 1

To manage and coordinate research and related activities conducted by PI's and work plan holders of the Southeast Asia project.

Annual Achievements

Project annual planning meeting held in Baguio City, Philippines. Work plan principal investigators reported progress of research and outreach activities. ERGP (Environment Research Grants Program) grantees were also invited to present their research and progress to date. The workshop portion of the meeting identified issues and set of activities that the project need to address before the end of Phase II. These include institutionalization, impact evaluation, and strategies for information dissemination to various audiences: community, host country, extension agency, and international organizations. A timeline was set for delivery of outputs.

OBJECTIVE 2

To provide administrative guidance for the research programs of the Southeast Asia project.

Annual Achievements

Administration procedures were discussed at the meetings in Makati (May 2001) and Baguio (May 2002). John Rowe visited Malaybalay and Los Banos during May 2001 to discuss administrative procedures for Year 4 with SCO (Site Coordination Office (officer)), PCARRD and PARRFI officials. During Year 4, monthly financial reports were prepared by PARRFI and reviewed by PCARRD and UW. Rowe also reviewed PARRFI and PCARRD procedures at Los Banos in May 2002 and found all activities and procedures

to in order. Throughout Year 4 invoices were received, reviewed and reimbursed for the other SEA subcontractors

OBJECTIVE 3

To coordinate documentation and communication of SANREM-SEA procedures and results.

Annual Achievements

SANREM SEA project website is regularly updated. Research outputs are archived in the project's website and CD-ROM. During our annual planning work plan holders developed a list of communication materials that they plan to produce for distribution to various audiences. To facilitate in the preparation of these materials, a short-term communication specialist will be hired by PCARRD to lead in the design of communication strategy and publications. Briefings on the project and distribution project documents were also done this year at the University of Wisconsin and in the Philippines. Follow up visit to institutions that participated in SANREM capacity building activities and/or cross site visits was also conducted.

OBJECTIVE 4

To facilitate project monitoring and evaluation

Annual Achievements

Annual planning meeting conducted in Baguio City last May 2002. Visits with institutional partners have also been conducted to monitor progress and provide management support as needed. Synthesis study completed in Year 4. Output re-

ported separately. GIS, national level policy advocacy and ERGP are in place and implemented on schedule.

Advances

in Research - For FY 2002-2003, ERGP proposal competition was announced through international channels. A total of 35 proposals from various countries in Asia were received. Small grants were awarded to four proposals which met among others the following evaluation criteria: relevance to SANREM goals and research needs, ability to complete research project by May 2003, and clarity of research methodology. These were:

1. Translation of SANREM technology briefs into Tagalog and Cebuano comics format Principal investigator: Eliseo M. Baltazar Technology Development Division Ecosystems Research and Development Bureau College, Laguna 4031, Philippines

2. Packaging streamflow and soil erosion prediction technology based on the WEPP model for the Manupali subwatersheds Principal investigator: Victor B. Ella University of the Philippines Los Banos College, Laguna 4031, Philippines

3. Social capital and natural resource management: A study of communities with varying levels of economic development in Bukidnon, Philippines Principal investigators: Merlyne M. Paunlagui and Miriam R. Nguyen Institute of Strategic Planning and Policy Studies College of Public Affairs University of the Philippines Los Banos College, Laguna 4031, Philippines

4. A literature review and bibliography on the link between forest resources and poverty alleviation in Vietnam Principal investigator: William Sunderlin Center for International Forestry Research P.O. Box 6596 JK-PWB Jakarta 10065, Indonesia

in Scaling Up - National level water policy advocacy continued to second year. Implementation of this work plan is aimed at enhancing local-national policy dialogues on key NRM issues, such as water resource management.

in Policy Impact - Collaboration with community-based institutions, in particular the local government, has been maintained to strengthen policy linkage at the local level. Outcomes and lessons of local level linkage are reported in the revised synthesis paper by Buenavista and Sumbalan. Likewise, the project has established alliances with national level institutions, such as the Philippine Institute of Development Stud-

ies, the Institute of Strategic Planning and Policy Studies and PCARRD to facilitate local-national policy dialogues on natural resource management. It is envisioned that these strategic alliances with policy making institutions will enhance the uptake of research information.

Other Major Outputs in this Period

* Participation and paper presentation by SANREM Southeast Asia researchers at the SANREM Synthesis Conference in Athens, Georgia.

* GIS research activity is in progress. This is led by Dr. Steve Ventura, UW professor, and Mr. Gregg Clark, UW graduate student in remote sensing.

* Activities for the national level policy activity have been initiated and led by the (UPLB, Philippine Institute of Development Studies and the University of Wisconsin. These activities are designed to make available SANREM's research outputs to national policy makers.

Conference Presentations

Buenavista, G. 2002. *Participatory Approach to Research and Development: The SANREM CRSP Southeast Asia Experience*. Paper presented at the Workshop on Biodiversity Conservation and Sustainable Development. Kunming, Yunnan, China. August 8-18.

SANREM CRSP

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

June 2002
Annual Report
SEA-02

Administration and Coordination of the SANREM CRSP Southeast Asian Program (PCARRD)

**Principal
Investigator**
Rogelio Serrano

**Co-Principal
Investigator**
Vel Suminguit

OBJECTIVE 1

To provide timely administrative and coordination support to regional principal investigators and work plan holders.

Annual Achievements

The SCO coordinated and assisted data collection efforts of two ERGP grantees, Dr. Ed Paningbatan who is working on PCARES (Predicting Catchment Runoff and Soil Erosion) and Dr. Victor Ella who is working on WEPP (Water Erosion Prediction Project). Likewise, Mr. Gregg Clark from the University of Wisconsin was also assisted in his collection of data on GPS positions in the Manupali watershed. The SCO provided logistic support to two policy analysis workshops conducted by Dr. Agnes Rola and her team members. The first workshop entitled: "Natural Resource Management Awareness and Workshop in Support to Mt. Kitanglad Management Plan" was conducted on September 11-13, 2001 at Cannosa Youth Formation Center, Malaybalay City. This was followed by a second workshop conducted on May 2-3, 2002 at Haus Malibu.

OBJECTIVE 2

To build linkages with other agencies and institutions that are implementing similar programs.

Annual Achievements

On 27-28 May 2002, SANREM SCO conducted a meeting with the Provincial Planning and Development Officials of Bohol

and with the officials of Ramon Aboitiz Foundation, Inc. (RAFI), Cebu City concerning their application and adoption of water quality and quantity monitoring and evaluation learned from the Water Monitoring workplan of SANREM.

OBJECTIVE 3

To support scaling and outreach activities at the community, provincial, national and regional levels.

Annual Achievements

On February 21, 2002, SANREM sponsored the forum entitled "Lantapan Farmers' Technology Forum" held at the Mt. Kitanglad Agri-Venture, Inc. (MKAVI), Lantapan, Bukidnon. Five technologies were presented to farmers by different institutions that include the CMU, ATSAL, ICRAF, KIN (Kitanglad Integrated Non-Governmental Organizations) and MKAVI. About 110 people attended the forum. This included 54 farmers, 20 government officials and 36 researchers and research administrators. The forum served as a venue for constructive dialogue between farmers and scientists for harmonious collaboration in the R&D process and for dissemination of mature sustainable agriculture and NRM technologies to farmers.

OBJECTIVE 4

To support program capacity building activities, especially for community-based partners

Annual Achievements

During this period, SANREM co-sponsored a workshop on policy formulation entitled "The 1st Policy Forum on NRM". The activity was held on November 8-9, 2001 at Valencia City, Bukidnon. Participants to the Forum were different LGU's coming from various municipalities in Bukidnon, Saranggani, Zamboanga, Baguio and Jolo. Also a training on AWS operation and maintenance was conducted for PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) staff in Bukidnon.

OBJECTIVE 5

To organize and coordinate the annual conference of SANREM CRSP-Southeast Asia partners

Annual Achievements

The Year 5 planning workshop was held on May 7-10, 2002 at The Golden Pines Hotel, Baguio City. It was attended by the SANREM CRSP/SEA workplan holders, ERGP principal investigators, ME members, UW-Madison and PCARRD. All in all, there were 26 participants. The workshop tackled the planned activities, targets and output for year 5 as well as the final assessment of impacts. The publications to be produced were also identified. Plans for acceptance and screening of ERGP Proposals were also explained including guidelines for financial and administrative closing of the program.

On June 5-6, 2002, the Technical Working Group of all Lantapan-based R&D projects conducted a field visit to different SANREM workplan sites and other R&D and community-based projects/partners in Lantapan, Bukidnon. Among the sites/institutions visited were MSEC's soil erosion monitoring site, Abarques Farm, Alfonso Sagayan Farm, Binahon Farm, KIN's Non-Destructive Livelihood Project, SANREM soil erosion monitoring site, ATSAL seedbank, SANREM Automatic Weather Station (AWS) and MAKAVI.

Presentations were also held at the MKAVI by the LGU on Natural Resource Management and Development Plan (NRMDP) formulation and implementation in the province of Bukidnon, NRMDP replication in municipalities surrounding Mt. Kitanglad and NRMDP implementation at the Barangay level back to back with the field visit was the conduct of all SANREM CRSP/SEA workplan finance officers meeting with PCARRD-PARRFI for the financial audit and physical inventory of all SANREM-purchased equipment.

OBJECTIVE 6

To improve public dissemination of research outputs.

Annual Achievements

Digitized SANREM video entitled "Verdant Hills." Twelve high resolutions video clips in MPEG format are now integrated in the CD-ROM. The SANREM CRSP/SEA Update Newsletter Vol. 2 No. 1 and 2 were released and distributed to partners and LGU's around Bukidnon while Vol. 2 No. 3 is in press. The next issue (Vol. 3 No. 1) is currently in its writing stage and will come out in July 2002. The draft proceedings for the First Bukidnon NRM Policy Forum will come out in August 2002. SANREM CRSP Research Brief No. 1 and No. 6 were already printed and ready for distribution. Four are in press. Updated and distributed a new version of the SANREM CRSP/SEA Multimedia CD-ROM. SANREM CRSP/SEA was also featured in local newspaper "Central Mindanao Newswatch" dated April 9, 2002 during the SANREM presentation on media companies (Manila Bulletin, We Forum and Philippine Daily Inquirer). A Press release entitled "Agroforestry experiment changing landscape, lifescape in Upland Bukidnon" was published by Today newspaper on April 25, 2002. To date, The SCO and PCARRD multiplied and distributed 22 SANREM and SANREM derived research reports to concerned institutions and libraries in Bukidnon and Luzon.

OBJECTIVE 7

To facilitate access and sharing of primary data.

Annual Achievements

Four SCO and SANREM-PCARRD personnel were trained on "Relational Database and Modeling Design" and "Microsoft SQL" last September 2001 in Mandaluyong City. The SCO had also shared the AWS (Automatic Weather Stations) data to LGU - Lantapan, Dr. Paningbatan and Dr. Ella; and soil data to Dr. Conrado Duque of MSEC. The Site Coordinator attended a two week training on GIS, GPS, and remote sensing.

Advances

in Research - 1. Sponsored a forum entitled "Lantapan Farmers' Technology Forum" on February 21, 2002 at the Mt. Kitanglad Agri-Venture, Inc. The activity was designed to support the promotion and application of technologies generated from SANREM CRSP and other Lantapan-based R&D projects.

in Capacity Buildup - 1. The SCO sponsored and participated a training on AWS Data Analysis, Consolidation and Processing on August 2001 at the Computer Laboratory of Central Mindanao University, Bukidnon; 2. SCO organized and participated a symposium on Community Organization for Sustainable Development on September 7, 2001 at ICRAF office in Lantapan, Bukidnon; 3. Four SCO and SANREM-PCARRD personnel were trained on "Relational Database and Modeling Design" and "Microsoft SQL" (industry-standard language for creating, updating and, querying relational database management systems) last September 2001 in Mandaluyong City.

in Scaling Up - 1. SCO presented a paper on Ancestral Domain Recognition and Management in Mt. Kitanglad Range Natural Park on November 12-14, 2001 at Davao City; 2. Conducted meeting on May 27-28, 2002 with the Provincial Planning and Development Officials of Bohol and officials of Ramon Aboitiz Foundation, Inc. (RAFI) on how they applied and adopted SANREM's water quantity and quality monitoring and evaluation; 3. The Regional Program Co-Director participated the International Conference on Sustainable Land Use Mosaic last 12-17 November, 2001 in Chiang Mai, Thailand. He presented the paper on the SANREM CRSP/SEA experience on Landscape-Lifescape Approach to Natural Resources Management and the impacts of said approach.

in Policy Impact - 4. Provided logistic support to policy analysis workshops entitled "Natural Resource Management Awareness" and "Workshop in Support to Mt. Kitanglad Management Plan" conducted by Dr. Agnes Rola on September 11-13, 2001. SANREM co-organized the 5th Multi-sectoral Forum on Watershed Management with the Forestry Development Center, the Philippine House of Representatives Committee on Natural Resources, and Bureau of Soils and Water Management among others. The forum was held on November 15-16, 2001 at the Congressional Building in Quezon City.

in Improved Environment and Natural Resource Management - 1. A press release entitled "Agroforestry experiment changing landscape, lifescape in Upland Bukidnon" was published by Today Newspaper on April 25, 2001. SANREM CRSP/SEA was featured in local newspaper "Central Mindanao Newswatch" on April 9, 2002 during the SANREM presentation for media companies (Manila Bulletin, We Forum and Philippine Daily Inquirer).

Other Major Outputs in this Period

- * Relational Database Modeling and Design
- * Database Development using SQL 7.0 Sept. 17-21, 2001, Shangri-La Plaza, Mandaluyong City Participants: Dr. Vel Suminguit, Mr. Edgar Romuar, Mr. Jeffrey Caidic, Mr. Sherwin R. delos Reyes 1st Philippine Workshop on Ecological Rainwater Harvesting, Nov 7-8, 2001, Punta Villa Resort, Sto. NiOo Sur, Arevalo, Iloilo City Participant: Mr. Edgar S. Romuar
- * Regional Workshop on Managing Tensions and Conflicts in Natural Resource Management in Indonesia, Thailand, and the Philippines, Nov 26-28, 2001, Cebu Midtown Hotel, Cebu City Participant: Mr. Edgar S. Romuar
- * Production of SEA Multimedia CD-ROM *SANREM CRSP for Southeast Asia*
- * Production of videocassette *Verdant Hills: Healing Nature, Sustaining Life*. 1998.

Popular Media

- Serrano, R. and R. Baltazar. (Eds.). 2002. *SANREM CRSP SEA Update Vol. 3, No. 1*. SANREM CRSP/SEA Workplans.
- Serrano, R. and R. Baltazar. (Eds.). 2001. *SANREM CRSP SEA Update Vol. 2, Nos. 1, 2 & 3*. SANREM CRSP/SEA Workplans.

Training Non Degree

On the job training

Database Modeling and Database Development was attended by 4 person(s) and lasted 5 day(s).

Workshop

Ecological Rainwater Harvesting was attended by 1 person(s) and lasted 2 day(s).

Managing Tensions and Conflicts in Natural Resource Management was attended by 1 person(s) and lasted 3 day(s).

SANREM CRSP

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

June 2002
Annual Report
SEA-23

Policy Analysis for Environmental Management Planning

Principal Investigator
Ian Coxhead

Co-Principal
Investigator
Agnes Rola

OBJECTIVE 1

To develop a monitoring and evaluation system for NRMDP impacts and other national policy impacts on farm households and the community's natural resource endowments.

Annual Achievements

1. Temporal analysis of land use data as influenced by the changing local policy environment. Report is in form of an ISPPS (UPLB) working paper; 2. Weekly price data (1995-2001) trends analysis to determine the impact of Philippines' compliance to WTO agreements. Rough drafts of case studies done for corn (yellow and white), cabbage, potatoes, tomatoes, selected fertilizers and selected pesticides are available; 3. Initial analysis of effect of farm, off farm and non farm wages as they influence farmers' decisions on soil conservation practices; 4. Draft of a paper that is an update of the book chapter (Rola and Coxhead 2001) available.

OBJECTIVE 2

To strengthen policy analysis and policy advocacy skills at the municipal and the provincial levels

Annual Achievements

1. Policy analysis workshop attended by newly elected provincial board members and selected municipal vice mayors; and the CMU faculty (May 2-3, 2002). Kapihan sa Malaybalay (May 2, 2002) with the regional representative of the Department of Interior and Local Governments (DILG) as

resource person; 2. Policy Research Presentation to Bukidnon Provincial Board (Sept. 9, 2001); 3. Workshop on the Operationalization of the Mt. Kitanglad Management Plan (MKMP) attended by barangay captains in the buffer zone areas (Sept. 10-12, 2002); 4. Three case studies have been prepared to understand constraining and facilitating factors towards LGU's responses to interventions by SANREM. These are:

* a case study of the responses of the barangay captains on their commitments to implement doable programs in support of the Mt. Kitanglad Management Plan

* a case study on the progress of the Lantapan Task Force on Watershed Management and Development, as a response to the policy advocacy done by the HPI partner

* a case study on the progress of the activities of the Bukidnon Watershed Council, in response to the policy advocacy done by the SANREM CRSP SEA policy group during a presentation of study results to the provincial board. A fourth case study determined the pattern of IRA expenditures and the proportion of these expenditures devoted to environmental management, by the Bukidnon municipal LGU's.

OBJECTIVE 3

To distill lessons learned from Lantapan at the national level

Annual Achievements

The proposed policy advocacy activities with the DILG were not pushed through because there were changes in the leadership of the Bureau of Local Government and Development. The retirement of the Director meant that we need to acquaint ourselves with the new leadership again. We tried to invite the retired head in a meeting in Malaybalay, due to ill health, the regional representative came over. It was learned that there are no initiatives yet to propose some provisions in the local government code, for environmental management. It was also learned that an endorsement by the regional office of the DILG could help in the advocacy activities. In the meantime, the third item of the proposed amendment as written in our policy brief, which is to give a share of the revenues of water related industries to host communities, will be tackled in a national water policy forum this coming July 2002. Other activities for this objective are the following: *Visit with four national agencies to introduce the SANREM project; participated in national meetings on water. The national agencies included the National Economic and Development Authority (NEDA); the National Water Resources Board (NWRB), the water regulatory agency under the Dept. of Public Works and Highways, the DILG's Local Government Academy and the DILG's Bureau of Local Government and Development. *From the policy briefs in year 3, we prepared (with PIDS) two Policy Notes and two Economic Issues of the Day all related to water. An article in the MARID Agribusiness digest was also published.

Advances

in Research - These policy discussion papers will be available by the middle of July for a policy forum in July 31, 2002. The four policy briefs will be prepared from the 4 policy discussion papers. A book of proceedings will also be ready by the end of year 5. The 4 discussion papers and the 4 policy briefs are now complete and in the process of being edited for publication. Contents of the book of proceedings are now with the reviewers.

in Capacity Buildup - Policy analysis training of 10 barangay captains; and also policy analysis training of provincial, municipal, elective and appointive officials. forum with the NGO sector in Malaybalay.

in Scaling Up - We have published with PIDS two policy notes and two economic issue of the day articles.

We also sent out SANREM publications and other briefs to two other national agencies.

in Policy Impact - 1. Five out of 28 barangays in the buffer zone of Mt. Kitanglad passed ordinances in support of the Mt. Kitanglad Plan. About 60% of the barangays planted the river banks with bamboos; 5 barangays established nurseries; 2. BENRO and other institutions concerned with the province's water supply are doing its best to prevent water disaster. It was also reported in the case study that as long as the people and the multi-sectoral institutions and agencies will lend their full cooperation to the endeavor, Bukidnon will continue to enjoy life, because water is life; 3. Current programs in Lantapan includes planting of 2000 bamboo seedlings along Kulasihan, Alanib, Tugasan river banks last Feb. 2002; and planting of 500 mahogany seedlings along the Maгнаo river. Lantapan LGU allotted 200,000 pesos for the establishment of nurseries.

Publications

Book Chapters

Buenavista, G. and I. Coxhead. 2001. *Conclusions*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Buenavista, G., I. Coxhead and K. Kim. 2001. *Assessing the impact of a participatory, research-oriented project: Results of a survey*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Coxhead, I. and G. Buenavista. 2001. *Implementing a participatory natural resources research program*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Coxhead, I. and G. Buenavista. 2001. *Seeking sustainability*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental

Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Paunlagui, M. and V. Suminguit. 2001. *Demographic development of Lantapan*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Serrano, R. and B. del Rosario. 2001. *Impact of SANREM CRSP/Southeast Asia on PCARRD and the Philippine NARRS*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. Los Banos, Laguna, Philippines: PCARRD.

Books

Coxhead, I. and G. Buenavista. 2001. *Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed*. Los Banos, Laguna, Philippines: PCARRD. 267 pp.

Journal Articles

Coxhead, I., A. Rola and K. Kim. 2001. *How do national markets and price policies affect land use at the forest margin? Evidence from the Philippines*. Land Economics. 77(2): 250-267.

Other Major Outputs in this Period

Briefs

Buenavista, G. 2001. *From Awareness to Attitude to Action: An Iterative Approach to Evaluating Impacts of NRM Projects*. SANREM CRSP Research Brief No. 2.

Coxhead, I. and A. Rola. 2001. *Reconciling Livelihoods and Landscapes: Trade Policies, Labor Markets, and Land Use in the Philippines*. SANREM CRSP Research Brief No. 3.

Elazegui, D. 2002. *Setting Quality Standards for Environmental Management Policy: How Effective Is It?* PIDS Policy Notes, No. 2002-3.

Elazegui, D. 2002. *A "Law of Nature": The Command and Control Approach*. PIDS Economic Issue of the Day. 3(1).

Theses and Dissertations

Bayacag, P. 2001. *Economic and Environmental Impacts of Market Incentives Among Upland Corn Farms of Manupali Sub-Watershed in Bukidnon, Philippines*.

Working Paper

Buenavista, G., A. Sumbalan, and I. Coxhead. 2002. *How do research projects inform the design of local policies for environment and natural resource management?*

Training Degree

Name, Level, Start Date-Completion Date

Haidy Ear Depuy, Ph.D. 2000-

Gregg Clark, M.S. 2001-

Brian Wiley, Ph.D. 2001-

Demeke Bayou, Ph.D. 2001-

Training Non Degree

Workshop

Policy Analysis was attended by 14 person(s) and lasted 2.5 day(s).

Policy Analysis was attended by 20 person(s) and lasted 2 day(s).

SANREM CRSP

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

June 2002
Annual Report
SEA-24

Integrated Watershed Modeling for Decision Support and Policy Planning

Principal Investigator
Gerald Shively

OBJECTIVE 1

To disseminate a computer-based tool for policy research and planning at the watershed scale to serve researchers, government agencies, and NGO's for whom natural resources management is a programming priority.

Annual Achievements

New achievements include the modeling of carbon uptake in forest systems consisting of pure stands of *P. Falcataria* and agroforestry systems consisting of *P. Falcataria* and vegetable intercrops. Results have been presented in conferences and workshops and are currently in review in a professional journal. New results on labor allocation at forest margins have also been prepared as part of SANREM-related research in Palawan (Philippines) and Southern Malawi. These findings have been reported and are in peer-review. One of the difficulties faced in the latest visit to the site in Lantapan is the reluctance by our cooperators to allow us to harvest some of the trees to determine allometric relationships, and timber density, necessary for accurate calculations of timber yield and C sequestration. We have instructed our staff to make measurements on timber of the same species known to have been felled elsewhere in the watershed.

OBJECTIVE 2

Relate rate of eroded soil and decline in soil fertility to loss of yield potential in annual crops.

Annual Achievements

A third experiment with Cabbage as the planted species will follow re-liming of the plots that were assigned the liming treatment. A fourth experiment will be undertaken in the Autumn season of 2002, and that will finalize this set of experiments.

Pesticide sampling has been undertaken in each of the major rivers in the watershed, on three occasions, and will continue in year 5.

Some data are presented in Table I (next page), and suggest that spikes of pesticide may be present in the waterways, due to spray activities or to washing of application apparatus/disposal of containers. Produce purchased in the market was also contaminated with pesticides.

Although in the first season after removal of topsoil - the tomato crop - there was an apparent response to the treatment, with greater removal leading to lower yield and liming raising yield (Table II), such an effect was not observed in the following Chinese cabbage crop. In neither season were the treatment differences significant at $p=0.05$. Soil parameters measured at the beginning of the trial did not pick up major trends between treatments.

Table II. Effects of removing soil, and or liming, on tomato and Chinese cabbage yields (kg/plot) and some soil properties

<i>Treatment</i>	Tomato	Chinese cabbage	Total	N	pH	Ca
No Lime	2.62	16.3	0.75	5.36		6.4
With lime	3.35	16.4	0.60	5.47		7.1
Non-removal	13.27	17.6	0.67	ab	5.45	7.4
3 cm removal	2.96	14.0	0.54	b	5.34	6.2
6 cm removal	2.73	17.3	0.81	a	5.45	6.7

Table I. Pesticide test results from sampling in rivers, runoff and vegetable produce, August 2001

Sample No.	Cholinesterase	Synthetic Pyrethroid	Cyclodiene
S 1 (Kulasihan river)	(-)	(-)	(-)
2	(-)	(-)	(-)
3	(-)		(-)
S 4 (Alanib river)	(-)		(-)
5	(+)	(-)	(-)
6	(+)	(-)	
S 7 (Maagnao river)	(+)		(-)
8	(+)	(-)	1.2 ppb
9	(+)		1.1 ppb
S 10 (Tugasan river)	(+)	(-)	1.9 ppb
11	(+)		1.5 ppb
12	(+)		1.4 ppb
S 13 (canal)	(+)	5.1 ppb	2.5 ppb
S 14 (canal)	(+)	6.2 ppb	2.5 ppb
S 15 (highland cabbage)	(+)	(-)	(-)
S 16 (lowland cabbage)	(+)	2.6 ppb	(-)
S 17 (Chinese cabbage)		(-)	(-)
S 18 (pechay)	(-)	(-)	(-)
S 19 (tomato, surface)	(+)	1.9 ppb	1.0 ; 2.9 ppb
S 20 (tomato, juice)			2.0 ppb
S 21 (chili)	(-)		
S 22 (runoff plot)		5.2 ppb	0.9 ppb
S 23 (plot 2)			(-)
S 24 (tomato leaf)			4.6 ppb
S 25 (beans)			2.9 ppb

Note: 1) (+) indicates presence of pesticide. No quantification was made, as interpretation procedure for cholinesterase is not clear. Page 5 of handout (Pesticide Control) states, "These controls are not intended to be used in the analysis of sample extracts. In order to properly analyze sample extracts, pesticide standards, both negative and positive must be prepared using negative extracts of the matrix to be tested". Also, except for Tomato, Low cabbage, Sample 7 & 9, the other samples have CV greater than 15%. 2) For synthetic pyrethroid, in the first run, only rep. 2 was considered as rep. 1 has an over value. 3) For cyclodiene, in the second set/run, only 1.737 of rep. 2 (NC) was considered, as rep. 1 value of 1.324 is too low. Value of 1 ppb in rep. 1 is 1.459.

Our efforts to acquire data on the costs associated with the harvesting of trees for timber in the watershed were without reward, for the cooperators are keen to keep their trees growing, believing that they are still in the logarithmic phase of growth (compound interest returns!).

Our approach to the development of a multivariate analysis to explain the relative contributions of the many factors that explain variation in yields over time, including changes in soil parameters, was strengthened by a visit by David Midmore to Durga Poudel, to put all of the available data into a large spreadsheet. This was completed, and the overall analysis will soon be forthcoming.

A visit to the USA by David Midmore in May 2001 (funded by non-SANREM sources) also allowed for a meeting between Todd Nissen, Jerry Shively and David Midmore, to discuss further cooperative activities for year 5.

OBJECTIVE 3

To evaluate and measure the potential economic and environmental impacts of changes in economic policy variables and corresponding changes in land use in a prototype watershed economy.

Annual Achievements

Achievements on this objective include the specification of conceptual linkages between land use changes and environmental outcomes. Data from field experiments on vegetable and agroforestry systems have been incorporated in systems models to measure the on-farm economic impacts of the systems and the potential carbon uptake of these systems. Policy simulations have been conducted and reported to the scientific community and national-level stakeholders.

OBJECTIVE 4

Provide evidence for or against the thesis that full and/or partial conversion of vegetable farms to agroforestry will lead to sustainable use of soil and water resources, and satisfy the income demand by upland farming families.

Annual Achievements

The data from two seasons of vegetable production following incorporation of wild sunflower have been collected (Table III), as have data on the effects of the sunflower on soil physical and chemical properties (Table IV).

Yields were favored in most treatment combinations by the fallow period with sunflower, and erosion was marginally better in the fallowed plots too. The least beneficial effects of the sunflower were on the up-down cultivated plots, a result that requires more confirmation in the following two seasons of data collection before the trial is terminated.

Table III. Effect of previous and current management on CS-15 tomato yields (kg/plot) and erosion (t/ha) and CS-16 unshelled maize (kg/plot)

<i>Treatment</i>	Yield	Erosion	Maize
Contour (new)	78.8	0.41	62.7
Contour (contin.)	66.4	6.10	29.2
Hedgerow (new)	80.1	4.92	53.9
Hedgerow (contin.)	17.6	4.19	2.8
Strip (new)	14.3	9.58	23.7
Strip (contin.)	6.9	14.26	11.8
Up-down (new)	89.9	17.75	34.1
Up-down (contin.)	95.7	14.96	36.9

The major differences between the soil properties following fallow or continuous cultivation were in relation to pH (less acid after fallow), K (more in the continuous plots due to routine application to each crop), and C and MG ((both increased with fallow). We also have data on infiltration, and will compare these with those collected seven seasons prior to the data collected in May 2001.

Table IV. Some effects of three years fallow with wild sunflower on soil properties in the Victory plots

<i>Treatment</i>	pH	N(%)	Kppm	C(%)	Mg meq/100g
	bott	top	top	bott.	bott.
Contour	5.01	0.496	5.48	5.48a	0.976
Hedgerow	4.99	0.569	4.59	4.59b	1.178
Strip	5.00	0.372	5.12	5.12ab	0.823
Up-down	4.84	0.604	4.76	4.76b	0.668
Contin.	4.72a	0.399a	280	4.32x	0.447a
New	5.20b	0.621b	175	5.61y	0.376b

OBJECTIVE 5

Further incorporate biophysical parameters into the watershed model.

Annual Achievements

This is an ongoing activity. Considerable progress has been made, especially in the area of forestry and agroforestry.

Model parameters have been updated based on new knowledge regarding pest control and erosion runoff.

OBJECTIVE 6

Quantify pesticide loading on eroded soil, runoff and stream flow.

Annual Achievements

Based on water sampling undertaken in 2001 and 2002 we have been able to identify specific groups of pesticides, including organochlorines, organocarbonates, and synthetic pyrethroids in some of the water samples tested.

OBJECTIVE 7

To assess the potential transferability of the computer modeling strategy to other sites in the Philippines and elsewhere in Southeast Asia.

Annual Achievements

We have enjoyed excellent progress and several important research achievements as a result of Dr. Ha's visit to Purdue and Dr. Shively's exchange visit to UAF in March/April 2002. Staff training of scientists at the University of Agriculture and Forestry (Ho Chi Minh City) was undertaken for one week with a multidisciplinary group (agronomy, economics, forestry, hydrology, fisheries) of 12 individuals. Solid groundwork for Phase III activities in Vietnam has been established. A strategy for transferring economy-environment modeling activities from the Philippines to Vietnam have been completed.

OBJECTIVE 8

Provide model parameters for inclusion of such evidence into a watershed model.

Annual Achievements

Tree growth has not been favored by the intercropping with vegetables (Table V). No benefit had been recorded since the start of the experiment, and possible reasons for this were speculated upon in the previous annual report.

We have taken soil samples from under the trees, and will compare with samples from the continuously cropped plots, to determine whether the trees have recycled nutrients from lower in the soil profile and unavailable to sole vegetable plots.

Table V. Some effects of original and new treatment on tree (*E. robusta*) growth in Victory plots (measured three years after planting trees)

Treatment	Diameter at breast height (cm)
Contour	12.02
Hedgerow	11.60
Strip	11.57
Up-down	11.21
Trees only	11.27
Trees + vegetables	11.93

We continue to monitor the growth on a biannual basis of trees planted in 1995, and have related the performance of *Paraserianthes falcataria* to that predicted in a published simulation model. The correspondence is excellent, and our research on this topic has been published extensively. We note (Table VI) that the benefits of very high population noted in earlier years is less marked now, and that correctly pruned trees outperform control trees and those planted at a higher population and then with the poorer trees culled out. The benefits of higher populations over the range 500 to 2000 trees per hectare is still notable (Table VII).

Table VI. Effects of planting density (trees/ha) and management on 5.5 years growth of *E. torrelliana* at Minas'

Treatment	Stand basal area (m ² ha ⁻¹)
1331	34.94b
2604	49.35a
5101	49.36a
Pruning	50.75a
Thinning	38.35c
Control	44.55b

Table VII. Effects of planting density (trees/ha) and management on 5.5 year growth of *E. deglupta* at Ricacho's

Treatment	Stand basal area (m ² ha ⁻¹)
500	13.70a
1000	23.79b
2000	30.78c
Short crop	21.14
Tall crop	24.38ns

OBJECTIVE 9

Understand harvest and associated costs of tree production, and effects of trees and sunflower on soil properties and subsequent annual crop performance.

Annual Achievements

New information and knowledge were generated regarding the functioning of the wholesale and retail timber market in the study area, and price data from earlier sample periods were confirmed. These data provide an opportunity to strengthen our analysis and prediction of economic forces operating in the area with respect to market incentives for forest and agroforest production in the area.

Prices monitored, but no realistic harvest data acquired. A visit in September/October may allow for the collection of some data.

OBJECTIVE 10

To monitor the changes in the practice of vegetable production, and the adoption of participatory-led research-substantiated innovations.

Annual Achievements

Responses from 40 persons to 200 questions are summarized as follows:

- * Yields and soil quality are getting worse, pest and disease not so
- * Standard of living of best farmers going down
- * Irrigation quantity not going down (pre-MKAVI?)
- * 37% using powdered lime
- * 18% with sole tree plots, 6% with intercrop trees and 76% with trees on field edges
- * Although tree planting is mainly around the field edge, respondents indicated a preference for the close 3m x 3m spacing over wider spacings
- * 60% will sell 5-10 years old, rest older
- * 89% say apply organic manure to improve soil fertility,
- * 11% say burn

* Less than 10% know about natural parasites to control diamondback moth

* Contour farming was more favoured than other practices for erosion control

* 50% with non-farm activity

Close analysis comparing responses to those collected in 1994 will take place in year 5. Additionally, we will differentiate between the responses given the degree of involvement with SANREM or not.

OBJECTIVE 11

Interpret relationships between off-plot and in-stream sediment loadings.

Annual Achievements

Conceptual linkages between off-plot and in-stream sediment loadings have been outlined. Empirical confirmation awaits future data analysis.

OBJECTIVE 12

To provide a robust model for prediction of impacts due to changes in upland vegetable production practices on farm scale income generation and resource management (in year 3/4).

Annual Achievements

We have developed a computer (spreadsheet-based) optimization model to predict short-run and long-run changes in incomes and land uses in response to changes in vegetable prices and production practices.

Advances

in Research - Results as expected. New findings incorporated in the model with respect to carbon sequestration in forest and agroforest systems. Meeting with biophysical team at the University of Illinois in May 2002 resulted in a number of new insights that have been incorporated in version II of the Manupali model. The new model includes an interface for user-defined input of up to four general agricultural or non-agricultural activities for purposes of simulation.

in Capacity Buildup - Progress better than expected. Solid participation by a multidisciplinary group (12) UAF researchers at a week-long training held at UAF in April 2002. This was a follow-up to training of Prof. Ha at Purdue in December 2001.

in Scaling Up - Progress better than expected. Strong linkages established in Vietnam at UAF and also at Ministry of Agriuculture and Forestry and the NGO Terre des Hommes. Multidisciplinary group established for Phase III SANREM research.

in Policy Impact - Progress as expected. Policy Brief based on results from modeling carbon sequestration in forestry and agroforestry (in progress, expected completion in 3rd quarter of 2002).

in Improved Environment and Natural Resource Management - Progress as expected. New modeling tools made available for the policy research community in the Philippines.

Publications

Journal Articles

Coxhead, I., G. Shively, and X. Shuai. 2002. *Development policies, resource constraints, and agricultural expansion on the Philippine land frontier*. Environment and Development Economics. 7(2): 341-364.

Hogset, H., W. Masters, G. Shively. 2002. *Policy Changes, input supply liberalization, and missing markets: evidence from smallholder farms in Malawi*. Journal of Policy Modeling/ EconModels.com.

Nissen, T. and D. Midmore. 2002. *Stand basal area as an index of competitiveness in timber intercropping*. Agroforestry Systems. 54(1): 51-60.

Nissen, T. and D. Midmore. 2002. *A bioeconomic rationale for the expansion of tree planting by upland farmers in the Philippines*. Philippine Journal of Development. 34.

Shively, G. 2001. *Price Thresholds, Price Volatility, and the Private Costs of Investment in a Developing Country Grain Market*. Economic Modeling. 18(3): 399-414.

Shively, G. and I. Coxhead. 2002. *Conducting economic policy analysis at the landscape scale: examples from a dynamic model of a Philippine watershed*. Agriculture, Ecosystems, and the Environment.

Shively, G. and C. Zelek. 2002. *Economic policies and environmental outcomes at a watershed scale*.

Philippine Journal of Development.

Shively, G., and I. Coxhead. 2003. *(in press)*. *Conducting economic policy analysis at a landscape scale: examples from a Philippine watershed*. Agriculture, Ecosystems and the Environment.

Shively, G. and S. Pagiola. 2003. *(in press)*. *The Microeconomic Dynamics of Agricultural Development and Deforestation: Evidence from a Frontier Region of the Philippines*. Environment and Development Economics.

Shively, G., E. Martinez, and W. Masters. 2002. *Testing the link between public intervention and food price variability: evidence from rice markets in the Philippines*. Pacific Economic Review. 7(2): 545-554.

Shively, G., C. Zelek, D. Midmore, and T. Nissen. 2002. *Carbon sequestration in a tropical agroforestry system*. Agroforestry Systems.

Zelek, C. and G. Shively. 2003. *Measuring the Opportunity Cost of Carbon Sequestration in Tropical Agriculture*. Land Economics.

Other Major Outputs in this Period

* A new version of the Manupali simulation model was released (on disk and on the web at www.agecon.purdue.edu/staff/shively/manupali). The new version incorporates new biophysical findings from the watershed and also adds a new user interface that allows up to four user-defined agricultural or non-agricultural packages to be used in the simulation.

Briefs

Midmore, D. 2001. *Saving Soil: Integrating Erosion Control in Upland Agricultural Systems (Mindanao Island, Philippines)*. SANREM CRSP Research Brief No. 5.

Conference Presentations

Shively, G. and S. Pagiola. 2001. *Poverty, Agricultural Development, and the Environment: Evidence from a Frontier Region of the Philippines*. Paper Prepared for selected paper session of the AAEA. Chicago, IL. August 5-8.

Zelek, C. and G. Shively. 2001. *Technical Change, Factor Bias, and Input Adjustments: Panel Data*

Evidence from the Philippines. Paper prepared for selected paper session of the AAEA. Chicago, IL. August 5-8.

Research Reports

Fisher, M., G. Shively, and S. Buccola. 2002. *An empirical investigation of activity choice, labor allocation, and forest use in southern Malawi*. Dept. of Agricultural Economics. Purdue University Staff Paper #02-01. Midmore, D., D. Poudel, T. Nissen, and G. Shively. 2001. *Searching for least-cost methods of erosion control: policy changes versus technological options in SE Asia*.

Mwakabolo, A. and G. Shively. 2001. *Food Security and Natural Resource Management in Developing Countries*. Purdue University Department of Agricultural Economics, Staff Paper No 01-12.

Shively, G. E. 2001. *Conducting economic policy analysis at a landscape scale: A Stella-based approach to dynamic simulation with examples from the agricultural economy of a Philippine watershed*. Draft manuscript. Purdue University, West Lafayette, IN. 70 pp.

Theses and Dissertations

Zelek, C. 2002. *Measuring the Opportunity Cost of Carbon Sequestration in Tropical Agriculture*. PhD dissertation, Department of Agricultural Economics, Purdue University, West Lafayette, IN.

Training Degree

Name, Level, Start Date-Completion Date

Charles Zelek, Ph.D. 9/1997-

Training Non Degree

Workshop

Economy-Environment Modeling was attended by 11 person(s) and lasted 5 day(s).

Modeling was attended by 1 person(s) and lasted 5 day(s).

SANREM CRSP

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

June 2002
Annual Report
SEA-25

Water Resource Management and Education Work Plan

Principal Investigator
William Deutsch

Co-Principal Investigator
Jim Orprecio

Collaborators
Estella Cequiña
Vincent Molina

OBJECTIVE 1

To support the growth and capability of the Tigbantay Wahig as a viable and sustainable people's organization in Lantapan, and extend community-based monitoring to other parts of Mindanao (Sarangani Province).

Annual Achievements

* Sarangani Province, Southern Mindanao: To assist Munong El in their organizational development, HPI conducted two trainings on organizational management last November 27-29, 2001 and December 11-13, 2001, in Maitum, Sarangani. The two trainings were entitled "Structural and Organizational Management" and "Human Value Formation Training". Both trainings were participated by 23 participants (15 male & 8 female).

* Bohol Province, in the Visayas: Last December 8-19, 2001, a series of reconnaissance surveys and trainings in TSS (Total Suspended Solids) and Water Chemistry monitoring was conducted in Bohol. During the reconnaissance surveys, rivers and tributaries of the six municipalities of Bohol were visited to select the sample sites for the water monitoring. Three series of trainings then followed held in Antequera, Catigbian and Sevilla. A total of 49 graduates (42 male and 7 female) became water monitors in the six municipalities of Bohol. These monitors started collecting TSS and water chemistry samples last February 2002.

* Asia/South Pacific Region of HPI: On April 22 to 26, 2002, Mr. Jim L. Orprecio along with key staffs of the HPI/Thailand office, conducted a series of reconnaissance surveys of rivers in Chiang Rai province. The survey was to select sample sites that will be used in the water monitoring activities.

The reconnaissance survey was followed by a water monitoring training in Chiang Rai, Thailand. This was conducted last May 14-19, 2002 by Mr. Jim L. Orprecio and Dr. Bill Deutsch.

Other related activities during the reporting period:

January 15 - 7, 2002 - Water Monitoring Training: HPI and Tigbantay Wahig hosted 22 people from Davao City for a 3-day exposure trip cum water monitoring training in Lantapan, Bukidnon. The activity was sponsored by DRCCC (Davao River Conservation Coordinating Committee) or Davao River Conservation Coordinating Committee, an LGU sponsored organization. The participants of the training were representatives from the Upland Development Programme in Southern Mindanao, City Planning and Development Office, Barangay Officials, City Health Office, CENRO (Community Environment and Natural Resource Office), DENR (Department of Environment and Natural Resources), Holy Cross College, VSO and the Movement for Clean and Green Mountain Forest, Inc.

February 15, 2002 - A Training of Trainer Workshop for Basic Trainers This TOT (Training of Trainers) workshop was conducted in Lantapan, Bukidnon by Dr. Bill Deutsch and Mr. Jim L. Orprecio for members of water monitors from Bohol, Sarangani and Lantapan. The trainers training was conducted in preparation for the expansion of the water monitoring program. The TOT graduates will help in the conduct of basic certification trainings in the expansion areas.

February 16 & 18, 2002 - Bacteriological Monitoring Workshop and Survey Headed by the Tigbantay Wahig members, the Bohol and Sarangani water monitors have an exposure and training on bacteriological monitoring and survey for two days. This was being supervised by Dr. Bill Deutsch.

February 19, 2002 - Workshop on Use of colorimeters. Twelve Tigbantay Wahig members have undergone a workshop on identifying the presence of phosphate, nitrite and nitrate in water. The group has started monitoring the four main rivers in Lantapan last March 2002 with these additional parameters.

February 20, 2002 - Symposium on "Community-Based Environmental Monitoring." The symposium was conducted through the request of the Vice Mayor of Valencia City in Bukidnon. About 100 people came to participate in the symposium. Participants were Science teachers of the National High School of Valencia, members of the Bikers Association of Bukidnon, Military reserves, representatives from the Governors office, the City Mayor, Vice Mayor, SANREM/PCARRD representatives, Dr. Bill Deutsch, Mr. Jim L. Orprecio, HPI staffs and Tigbantay Wahig members.

April 4, 2002 - HPI and Tigbantay presented the accomplishments of the workplan to media persons coming from Manila and Malaybalay.

April 26, 2002 - Water Monitoring presentation to the Local Government of Baungon. The presentation was headed by Mr. Jim L. Orprecio, and assisted by Janeth B. Labis, Jhonie Sumampong and Vincent Molina. The presentation stirred interest and support from the LGU officials. Water monitoring activity will soon start in Baungon, Bukidnon, hopefully by September 2002.

May 2, 2002 - Water monitoring data presentation at Malaybalay City. The presentation was attended by the Sangguniang Panlalawigan Members (Provincial Board Members) and five Municipal Vice Mayors from the different towns of Bukidnon province.

OBJECTIVE 2

To collect water quality and quantity data for addition to a six-year database. This information will be useful for local water management and as model for other communities.

Annual Achievements

Updated number of collected samples for the period (June 2001 to June 2002)

Tigbantay Wahig - Lantapan, Bukidnon Province

* Total Suspended Solids - 276 samples (June 2001 to April 2002)

* Water Chemistry - 52 samples (June 2001 to June 2002)

* Stream Discharge/Soil Export - 90 (June 2001 to June 2002)

* Bacteriological Survey - 90 samples (February 2002)

Munong El ñ Maitum, Sarangani Province

* Total Suspended Solids - 81 samples (June 2001 to Jan 2002)

* Water Chemistry - 21 samples (June 2001 to Jan 2002)

* Stream Discharge/Soil Export - 12 samples (June 2001 to Jan 2002)

* Bacteriological Survey - 50 samples

Bohol Water Monitoring - Province of Bohol

* Total Suspended Solids - 57 samples (February 2002 to April 2002)

* Water Chemistry - 31 samples (Jan 2002 to April 2002)

* Total TSS (Lantapan, Sarangani & Bohol) - 414

* Total Water Chemistry Samples (Lantapan, Sarangani & Bohol) - 104

* Total Stream Discharge Samples (Lantapan, Sarangani & Bohol) - 102

* Total Bacteriological Survey (Lantapan & Sarangani) - 104

* Total Samples = 760

OBJECTIVE 3

To organize the water database for use in watershed model to be developed by the SANREM Southeast Asia Program.

Advances

in Research - 1) Last August 23, 2001, the Tigbantay Wahig members and HPI met with governmental offi-

cials and representatives of other community sectors to present a data set that indicated probable degradation of water quality in all subwatersheds over the last few years. The quantitative data of the monitors was taken seriously by the group and was also substantiated by others' observations about deforestation and development along streams. The data presentation and resulted in the creation of the Lantapan Watershed Management Council; 2) Part of the HPI/Tigbantay Wahig's role in the Lantapan Watershed Management Council is Information Education Campaign. This includes visits to schools where the Tigbantay Wahig will speak with school children ages 7 to 12 years old about environmental degradation, preservation and management. From September 2001 to December 2001, a series of IEC's were conducted by the Tigbantay Wahig members. Seven schools (elementary schools) were visited; they were attended by an estimated 3,649 people comprised of children, teachers and municipal officials of Lantapan. The workplan results and data gathered from the water monitoring activities in Lantapan are also now being used by the following: a) Rosemary Morales Fernholz - Working on a research project with a grant from SANREM entitled "Innovations from the Long-Term: Institutional Support for Sustaining SANREM Technologies in the Philippines"; b) Dr. Victor B. Ella - Working on a SANREM ERDP Project on Soil Erosion Modelling of the Manupali River Subwatersheds; c) Maureen M. Cuevas - working on her thesis entitled "Assessment of the Impacts of Extreme Climate Events on Soil Erosion at Lantapan, Bukidnon using Modified Watershed Model"; d) Mr. Gaudencio Ramos, Sr. Superintendent, National Irrigation Administration (NIA is using the water monitoring data for NIA project proposals)

in Capacity Buildup - To assist Munong El in their organizational development, HPI conducted two trainings on organizational management last November 27-29, 2001 and December 11-13, 2001, in Maitum, Sarangani. The two trainings were entitled "Structural and Organizational Management" and "Human Value Formation Training". Both training were participated by 23 participants (15 male & 8 female). Also, on February 15, 2002 - A Training of Trainer Workshop for Basic Trainers. This TOT workshop was conducted in Lantapan, Bukidnon by Dr. Bill Deutsch and Mr. Jim L. Orprecio for members of water monitors from Bohol, Sarangani and Lantapan. The trainers training was conducted in preparation for the expansion of the water monitoring program. The TOT graduates will help in the conduct of basic certification trainings in the expansion areas.

in Scaling Up - 1) Last December 8-19, 2001, a series of reconnaissance surveys and trainings in TSS and Water Chemistry monitoring was conducted in Bohol. During the reconnaissance surveys, rivers and tributaries of the six municipalities of Bohol were visited to select the sample sites for the water monitoring. Three series of trainings then followed held in Antequera, Catigbian and Sevilla. A total of 49 graduates (42 male and 7 female) became water monitors in the six municipalities of Bohol. These monitors started collecting TSS and water chemistry samples last February 2002; 2) April 26, 2002, Water Monitoring presentation to the Local Government of Baungon. The presentation was headed by Mr. Jim L. Orprecio, and assisted by Janeth B. Labis, Jhonie Sumampong and Vincent Molina. The presentation stirred interest and support from the LGU officials. Water monitoring activity will soon start in Baungon, Bukidnon, hopefully by September 2002. 3) Asia/South Pacific Region of HPI On April 22 to 26, 2002, Mr. Jim L. Orprecio along with key staffs of the HPI/Thailand office, conducted a series of reconnaissance surveys of rivers in Chiang Rai province. The survey was to select sample sites that will be used in the water monitoring activities. The reconnaissance survey was followed by a water monitoring training in Chiang Rai, Thailand. This was conducted last May 14-19, 2002 by Mr. Jim L. Orprecio and Dr. Bill Deutsch.

in Policy Impact - A Memorandum Order was issued to all Barangay Captains to initiate a streambank restoration project under the Lantapan Watershed Management Council. A prominent member of the Tigbantay Wahig and associate of HPI was designated to oversee the planting of 2,100 bamboo seedlings to protect the riparian zone and reduce erosion. The Council is currently considering the expansion of the riparian zone from 20 to 40 meters as a Municipal ordinance. Such a riparian zone would be larger than most that are created by ordinance in the U.S. and would probably provide significantly more protection for streams.

Other Major Outputs in this Period

* Emily Mills and Allison Busby of Auburn University have worked out with Mr. Jim L. Orprecio in getting some TSS and bacteriology sampling supplies to the Philippines

* Dr. Bill Deutsch attended a two-day planning session in Watkinsville for compiling a water monitoring book/manual. He also attended the Annual Meeting and

Research Conference of SANREM in Athens, GA on Nov 28-30 and gave a talk which entitled, "Watershed data from the Grassroots...Is it enough to Capture the Trends and Turn the Tide?"

* Last August 23, 2001, the Tigbantay Wahig members and HPI met with governmental officials and representatives of other community sectors to present a data set that indicated probable degradation of water quality in all subwatersheds over the last few years. The quantitative data of the monitors was taken seriously by the group and was also substantiated by others' observations about deforestation and development along streams. The data presentation, resulted to the creation of the Lantapan Watershed Management Council. A Memorandum Order was issued to all Barangay Captains to initiate a streambank restoration project under the Lantapan Watershed Management Council (see below). A prominent member of the Tigbantay Wahig and associate of HPI was designated to oversee the planting of 2,100 bamboo seedlings to protect the riparian zone and reduce erosion. The Council is currently considering the expansion of the riparian zone from 20 to 40 meters as a Municipal ordinance. Such a riparian zone would be larger than most that are created by ordinance in the U.S. and would probably provide significantly more protection for streams.

Briefs

Deutsch, W. 2001. *Water Spirits and Citizens' Action: Community-Based Water Quality Monitoring in the Philippines*. SANREM CRSP Research Brief No. 1.

Popular Media

Deutsch, W. 2001. *Role of Citizen in Watershed Management*.

Deutsch, W. 2001. *Sinatia ang Imong Watershed. (Know your Watershed)*.

Gambe, R. 2001. *Bukidnon Water Quality Project gets Heifer-USAID Support*.

Gambe, R. 2001. *Bukidnon Town Tries to Save its Four Rivers*. Manila Standard.

Gambe, Rey 2002. *Expansion of Bukidnon Water Monitoring Project On*. Manila Standard.

Research Reports

Deutsch, W. 2001. *Citizen Volunteer Water Quality Monitoring on Alabama's Coasts Weeks Bay*.

Training Non Degree

Workshop

Organizational Management was attended by 23 person(s) and lasted 3 day(s).

Organizational Management was attended by 23 person(s) and lasted 3 day(s).

Training of Trainers on water monitoring and teaching was attended by 0 person(s) and lasted 1 day(s).

Community-Based Environmental Monitoring was attended by 100 person(s) and lasted 1 day(s).

On the job training

Water Monitoring was attended by 22 person(s) and lasted 3 day(s).

Training

TSS and Water Chemistry Monitoring was attended by 49 person(s) and lasted 12 day(s).

SANREM CRSP

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

June 2002
Annual Report
SEA-32

Adapting and Transferring Lessons Learned from Manupali Watershed to Other Critical Watersheds in Southeast Asia

Principal Investigator
Victoria O. Espaldon

Co-Principal Investigator
Annielyn Magsino
Dang Thanh Ha

OBJECTIVE 1

Determine suitability of the SANREM Phase 1 tools and processes in a different socio-economic and political context.

Annual Achievements

In Year 4, a policy workshop on sustainable agriculture and natural resource management was conducted on October 23-26, 2001 at University of Agriculture and Forestry (UAF) in order to link research and policy on SA and NRM. This was aimed to strengthen the capacity of the Vietnam collaborators in preparing policy papers and briefs based on the agricultural research activities/findings under the SANREM project. This activity served as an avenue for exchanging experiences between Philippines and Vietnam on how research is being linked with policy making processes. This workshop highlighted the complex notion of research and policy making. Linking them thus becomes a doubly difficult and complicated process. Participants agreed that it is important to find and initiate ways by which the process can be facilitated. One of the agreed solutions is through communication process via repackaging of agricultural research results into consumable form like policy briefs and policy papers. Through this, research findings can be brought to the level of policy making bodies and can be used as a basis in policy formulation on NRM and SA (Sustainable Agriculture).

This consensus also opened an opportunity for UAF, Vietnam collaborator, to disseminate other agricultural research findings that they have, which are relevant to the promo-

tion of sustainable agriculture for the uplands. The Philippine Institute for Development Studies (PIDS) was tapped to assist in this activity.

It also drew about 15 UAF researchers, including SANREM Vietnam team, from different units of the university that shared highlights of their research work and potential policy implications. Highlight of the workshop was a hands-on exercise on policy/research notes writing. The participants agreed that through this, research findings can be brought to the level of policy making bodies and can be used as a basis in policy formulation on NRM and SA.

As a results of these undertakings, there are different types of draft policy notes/briefs being developed. These are developed from out of the research results/findings. Policy notes/brief being developed will be distributed to all concerns public or private institutions, policy-making bodies, researchers and other concerned groups.

OBJECTIVE 2

Examine the dynamics of resources management in the uplands of South Vietnam using a case study approach.

Annual Achievements

Two papers were developed from out of the previous research activities conducted in the upland of Vietnam and presented in international conferences. The

first paper is "Changes In Policy And Market Conditions and Land Use, Land Management And Livelihood Among Upland Farmers In Central Highlands Of Vietnam: Integration of Macro-Micro Processes" This was presented during 2001 Open Meeting of the Human Dimensions of Global Environmental Change Research Community at the Hotel Gloria in Rio de Janeiro, Brazil on October 6-8, 2001. The other paper is entitled "Land use changes, environmental consequences and the need for improving policy and institutional framework for sustainable agriculture and natural resource management in the Central highland of Vietnam" presented during SANREM Research Synthesis Conference on November 28-30, 2001 held in Georgia, U.S.A.

At the last quarter of the workplan implementation, the main focus of this research is to come up with a monograph from out of the full Participatory Landscape Lifescape Appraisal (PLLA) results. Assistance from SANREM CRSP SEA or SANREM/Global editors was planned to tap, however, there are many comments and suggestions that need to be considered that contributed in the delay of completing the monograph. Considerations from different comments and suggestion needs adequate time to complete the monograph. In Year 5, completion of this monograph will be one of the main foci of this research. In spite of that, this research was able to come up with three papers that were presented at the SANREM International Conference in May 2001 and were included in the monograph entitled "Sustaining Natural Resource Management in Southeast Asia" published by SEARCA on August 2001. Acknowledgment to SANREM was included.

OBJECTIVE 3

Examine the interlocking influences of economic, cultural and biophysical factors as they influence upland agriculture and its environment

Annual Achievements

One paper was developed and presented in SANREM Research Synthesis Conference on held in Georgia, U.S.A. on November 28-30, 2001. The title of the paper is "Land use changes, environmental consequences and the need for improving policy and institutional framework for sustainable agriculture and natural resource management in the Central highland of Vietnam." This was presented by Dr. Dang Than Ha of University of Agriculture and Forestry (UAF) from Vietnam.

This paper summarized the results of a case study of the SANREM's research project and two other UAF

case studies in the Central Highland of Vietnam. This paper discussed the approaches used to generate empirical evidences to patterns of land use change as these are influenced by multidimensional factors. Environmental consequences associated with these land changes were also reported. It showed that changes in economic policies, institutions and market access led to a large transformation of forestland into agriculture. The rapid expansion and intensification of agricultural production, driven in part by expanding population, places high pressure on the natural resource base and causes high negative externalities in the uplands, particularly in marginal lands. In all case studies presented, rates of degradation of forests, soils, and water remain high and threaten agricultural sustainability. Recently, national and local government took some efforts to overcome negative environmental consequences of agricultural development in the uplands, but their impacts are still limited. Balancing agricultural development and environmental protection is currently a major challenge for upland development. For meeting this challenge, the paper emphasized the need for setting enabling policies and institutional framework that better promote sustainable agriculture and natural resource management practices in the uplands.

OBJECTIVE 4

Determine policy implications of the changing agricultural practices among farmers in Southern Vietnam.

Annual Achievements

A policy workshop on sustainable agriculture and natural resource management was conducted in order to link research and policy on SA and NRM last October 2001. Assistance of a policy expert, Ms. Jennifer P.T. Liguton of the Philippine Institute for Development Studies (PIDS), was tapped. This activity served as an avenue for exchanging experiences between Philippines and Vietnam on how research is being linked with policy making processes.

This workshop provided an opportunity to view in detail the relationship between research and policy and to identify entry points for establishing the links between the two. It presented various approaches that may help set up and strengthen said links, including a number of communication instruments like the policy notes/briefs.

Based on the output of the workshop conducted, it was suggested that a small meeting with MRD people can be organized. This will facilitate the identification of what

they already have and what are their needs in relation to sustainable agriculture and natural resources management. UAF, as collaborator, agreed to assess their agricultural researches, determine the policy implications, and seek commitment and support from the administration regarding these undertakings. The resources of each institution that have been identified will serve as a take off point for a more productive endeavors that will lead to better accomplishment of the target goals. This can be done through series of meetings or policy workshops and constant communication with those concerned people/institution. Through this, work plan policy activities will link to the level of policy makers - local, district, and national level.

Dr. Tam, a new member of SANREM-Vietnam, has initiated discussion with policy makers of the Ministry of Agriculture and Forestry based in Hanoi. A meeting was set in Ho Chi Minh to discuss in detail some activities related to strengthening link between policy makers and research community based in UAF.

With the aim of linking agricultural research institution like UAF with policy-making bodies like MARD, meeting of SANREM members from SEARCA and UAF and SANREM CRSP SEA Program Director with Dr. Son of the Ministry of Agriculture and Rural Development (MARD) based in Hanoi was initiated on April 12, 2002 in Hanoi, Vietnam. This was an initial step to start the discussion between MARD and UAF and to strengthening link between policy makers and research community based in UAF.

OBJECTIVE 5

Promote a community-based and research-based natural resource planning and management at the farm and community level

Annual Achievements

At the first quarter of the workplan implementation, preparation for the conduct of a short orientation on participatory natural resources management was done. This was an expressed need by the collaborators. Target participants of the said orientation are from academes, researchers and extension workers. The local experts aimed to conduct training at the farmer/community level but this training, Farm/Community level training cannot be done within Year 4 and this will form part of Year 5 activities.

During the orientation on PLLA, the Vietnam collaborators also expressed interest in the "Participatory Pro-

cess in Natural Resource Management: Politics of Empowerment", an article published in "Sustaining Natural Resources Management in Southeast Asia" and is based on the SANREM CRSP SEA 0042 Workplan "Capability Building for NRM at the Local Level." As a result of the discussion during the orientation workshop, a draft proposal for Vietnam focused on environmental rehabilitation using Philippine SANREM Model was developed and was submitted to other local funding agency. This is considered by the team as an offshoot of Philippine-Vietnam SANREM collaborations.

Another activity was a planning meeting conducted on April 7-11, 2002 at University of Agriculture and Forestry (UAF), Ho Chi Minh City, Vietnam. This meeting was attended by SANREM team. The objectives of this meeting are to: a) update the researchers on SANREM activities and progress; and b) review and prepare for the policy meeting with Ministry of Agriculture and Rural Development.

OBJECTIVE 6

Determine a range of sustainable land management options locally found in the area as models for farmers, resource managers and concerned policy makers.

Annual Achievements

Initial identification of sustainable land management options was done, but no detailed documentation yet. Identification of socioeconomic data to be collected was done for each Sustainable Agriculture options. Aside from administrative problems, difficulties in entering the research sites is the another problems being encountered by the workplan due to political issues. This hampered the conduct of activities in the research site. We just completed the SEARCA-UAF administrative arrangement this December, so resources were not fully mobilized and the political problems/issues has just normalized early this year. This objective is expected to be fully accomplished before the end of Year 5 workplan implementation.

Advances

in Research - 1. Workplan provided an avenue for agricultural research results to be used and linked to policy formulation and other policy related activities at different levels.

in Capacity buildup - 1. Workplan helped to developed a core of trainers for SA/NRM, and helped in the promotion of tools such as PLLA. This also provided the collaborating institutions such as UAF, MARD an

opportunity to developed a core of academics and extensionists that is committed to link research results with policy making activies at various levels. It also served as foundation of SA/NRM policy group at the collaborating institutions. Based on the results it shows assurance that there will be continuity of the activities even without the support of SANREM in the future.

in Scaling Up - 1. This work plan was sucessful in scaling up of experiences in the Manupali Watershed, Philippines in Vietnam with similar environmental problems. This workplan was able to promote participatory approaches to SA/NRM planning. This is parallel to the activities being conducted at CMU/BIDANI in the Philippines. Policy analysis capacity is also being conducted, parallel to another workplan with UPLB/LGU partnership in Lantapan, Bukidnon.

in Policy Impact - 1. Workplan was able to develop a policy notes/briefs from out of the research results that can be used and discussed in meetings with policy makers at the national level.

in Improved Environment and Natural Resource Management - 1. Promote SA/NRM to different sectors such as farmers, researhers, decision/policy-makers at various levels.

Conference Presentations

Garcia, A. 2001. *Sustaining Natural Resources Management in Southeast Asia*. SEARCA.

Ha, D.T. and V. Espaldon. 2001. *Changes In Policy And Market Conditions and Land Use, Land Management And Livelihood Among Upland Farmers In Central Highlands Of Vietnam: Integration of Macro-Micro Processes*. SEARCA.

Ha, D. and V. Espaldon. 2001. *Land Use Changes, Environmental Consequences and the Need for Improving Policy and Institutional Framework for Sustainable Agriculture and Natural Resource Management in the Central Highland of Vietnam*. SEARCA.

Training Non Degree

Workshop

Sustainable Environmental Management was attended by 2 person(s) and lasted 23 day(s).

Open Meeting of the Human Dimensions of Environmental Change Program was attended by 1 person(s) and lasted 6 day(s).

SANREM CRSP

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Replicating Models of Institutional Innovation for Devolved, Participatory Watershed Management

Principal Investigator
Eduardo Queblatin

Co-Principal
Investigator
Antonio T. Sumbalan

OBJECTIVE 1

Scale-up the Lantapan model to other municipalities surrounding MKRNP in Bukidnon. This means directly assisting and coaching LGUs in developing their own NRM plans.

Annual Achievements

Local Governance and NRM:

The Local Governments of Manolo Fortich, Libona, Baungon and Impasug-ong are in the process of finalizing the Implementing Rules and Regulations (IRR) of their respective NRMDPs. One institutional innovation stipulated in the IRR is the creation of a Project Management Office (PMO), which will serve as the "defacto" Municipal Environment and Natural Resources Office (MENRO) for the implementation of the Plan. A team approach will be used involving key staff from local agencies: Agriculture, Planning and Environment Office.

In the case of Baungon, a Non-Government Organization-based farmer-manager will be heading the PMO supported by key local line offices. This structure, and the strategic influence at the grassroots level of the non-partisan farmer-manager are expected to ensure successful implementation of the LGU's Plan. Legitimization of the Baungon Plan will be done through public hearings in all villages after the July 15 Barangay elections.

In Manolo Fortich, the MENRO shall be established as soon as the implementation of

NRMDP shall be put into a municipal ordinance. The proposed MENRO structure is guided by the Plan's IRR. On the other hand, the IRRs of Libona and Impasug-ong are being deliberated on at the Legislative Councils. Moreover, Manolo Fortich and Impasug-ong recently concluded their Investment Forums and were able to draw investment pledges for the implementations of their NRMDPs.

Despite the delays in finalizing municipal ordinances that would give legal framework for NRMDPs, some of the activities identified in the Plans were already executed incrementally. For instance, Manolo Fortich started its Landcare Program shortly after the completion of its NRM plan. Just recently, initial Landcare activities started in Libona with a training on upland technologies in a pilot barangay. Plans for initial activities in Impasug-ong in July have already been finalized. These activities are in support to the Province Government's irrigation systems project in buffer zone communities through the ADB-funded Bukidnon Integrated Area Development Project (BIADP).

For its part, Baungon has started a Live-stock Project as well as tree planting activities in identified denuded watersheds. These developments demonstrate the nature of LGU interest in implementing doable activities even in the absence of a local ordinance. The NRMDPs

have already served as guides in implementing environmental projects and programs.

Although the Plans went through a hiatus for a certain period of time following the May 2001 elections, they maintained a strong stand at the legislative level after having been adopted by the previous Legislative Councils. The virtue gained from this planning experience is that of overcoming institutional and financial constraints in initiating local NRM. The assisted LGUs were able to harness their own financial and human resources for this purpose. This demonstrated that a locally driven process can work, without having to follow certain bureaucratic orders.

Local NRM Supportive to BWPDC's Watershed Project:

The Province recently availed of a grant from the LGSP-CIDA for a Capacity-Building Program for Watershed Management, building on the innovations started by the USAID-GOLD Project, as well as the initial experiences of the NRM planning activities in the SANREM-ICRAF assisted LGUs. The Bukidnon Watershed Protection and Development Council (BWPDC), which carries the provincial program, has recognized the completed NRMDPs and the planning teams as foundation blocks for accelerated work on local watershed management planning.

All Technical Working Groups (TWGs) of LGUs in Bukidnon are undergoing the 6 seminar modules on Watershed Management. The expected outputs are municipal Watershed Management Plans, which will be further integrated into an inter-local Watershed Management Plan (where several LGUs fall in one watershed boundary). The training courses, particularly the Technology of Participations I and II on Facilitation and Training Designs, respectively, further enhanced the technical and managerial skills of TWG members. LGUs with completed NRMDPs have used these in further identifying doable activities towards complementing the Watershed Management Plans.

OBJECTIVE 2

Analyze, evaluate and compare the performance of the NRM model in these different municipalities, and develop this knowledge into modules/decision-support guidelines to local governments for NRM planning and implementation

Annual Achievements

Factors Influencing Sustainable Local NRM:

An initial review of the experience on local NRM initiatives in 4 municipalities in northern Bukidnon revealed that there are at least 4 important factors for sustainability as perceived by these LGUs to wit: clear local financial investment, enhanced local technical capacity, sound political culture conducive to NRM, and a supporting national mandate.

The conditions to which local NRM sustainability is predisposed are firming from these factors namely: a) Local governments must ensure a continuous flow of NRM funds, and should be incorporated in the Annual Investment Plan; b) Local governments must install an institutional infrastructure, that is ENRO; c) Local governments must endeavor to create a political culture that is proactive, catalytic and inclusive of paradigm shifts in development and government systems; d) Local governments must be clarified with 'conflict-generating' national policies.

The first draft report was developed into a paper entitled "Governance and NRM: Key Sustainability Factors and Policy Implications, Emerging Lessons from ICRAF-SANREM Collaboration in the Philippines," and was presented in the First Bukidnon NRM Policy Forum and in the SANREM-CRSP Research Synthesis Conference in UGA.

Synthesis Report of 11 Practicing Local Government Units on NRM:

A countrywide case study of 11 practicing local governments in the area of NRM was conducted to determine if the four sustainability factors cited above were true in other places represented by 11 LGUs in various parts of the country. The synthesis revealed substantial similarity as to the sustainability factors identified in study sites in Bukidnon, which are: a) Successful local governments are those that have allocated local funds for NRM programs, as part of Annual Investment Plans; b) These local governments have created their local ENROs as regular division with staffing support and annual budget allocation; c) Local policies were promulgated to support local implementation of environmental programs; d) The main driver of NRM emanates from strong political will and leadership of local leaders, usually the municipal/city mayors and provincial governors.

This implies that LGUs recognized that their own financial and human resource investments within a sound political culture and supported by a clear national mandate sustains the success of local NRM. The crosscutting factor is the leadership and political will of local leaders. A case-study report was developed and circulated as a working document to the participants during the NRM Policy Forum. Three of these LGUs participated in the forum and shared their respective experiences.

NRM Policy Forum:

The First Bukidnon Policy Forum on NRM was convened on November 8-9, 2001 in Valencia City. This was jointly organized with SANREM-SCO, the Provincial Government of Bukidnon through the Bukidnon Environment and Natural Resources Office (BENRO), and International Fund for Agricultural Development (IFAD), co-organized by the Provincial Office of the Department of the Interior and Local Government (DILG), BWPDC-Technical Advisory Committee (TAC) and the Institute of Strategic Planning and Policy Studies (ISPPS), University of the Philippines Los Banos (UPLB). Participants coming primarily from LGUs within Bukidnon and Western Mindanao attended it. The forum resulted in the identification of policy recommendations namely: Advocacy Program and Capacity-Building for NRM implementers at the local level. It also became the venue for sharing research results to policymakers and future environmental policy directions of the provincial and municipal governments.

Participants signified interest on a continuous dialogue to facilitate knowledge-exchange. The policy recommendations are presently developed into policy briefs. The Proceedings of the Forum is currently in progress, and is aimed for circulation in July. This activity will be concluded by translating the sustainability indicators identified earlier and the policy issues into policy statements. These will be communicated to the policy-makers at the national level for wider impact and possible input in the revision of the Philippine Local Government Code.

NRM Planning and Implementation Comparative Assessment:

Process documentation is currently done, collating and integrating of data and documents on the planning process, and so with the results of the completed Self-Assessment Workshops in each of the Municipality. Initial points of comparison were identified to include: Level of Participation and Innovations during the

planning process, LGUs' Financial Support, Human Resource Support and indirect effects on inter-local initiatives such as protected area management. A survey form will be circulated to determine first generation impacts of the Plans' implementation at the LGU level.

OBJECTIVE 3

Communicate significant results of the work plan through the production of popular print media such as the quarterly NRM Notes that we've started to produce, paper presentations in related conferences and self-sponsored workshops or fora.

Annual Achievements

For scaling-up/out the outputs, the Project employed two strategies. First, the indirect strategy that involved networking and building collaborative relationship with the Provincial Government's BWPDC by being a member to its Technical Advisory Committee. The Committee served as the decision-making body for the direction of the Council. The BWPDC provided regular guidance and technical assistance to municipal NRM initiatives that may be partly based on the experience of ICRAF-SANREM's participating LGUs.

Second is the direct strategy, which is the production and circulation of laymanized NRM Notes for wider communication and knowledge sharing, as well as organizing and hosting site visits with government functionaries and their constituents.

For this year, the Project has produced the 4th issue entitled "Factors affecting NRM at the municipal level." NRM Notes is a technical paper that comes in a newsletter format released quarterly. This is made to popularize strategies, approaches and lessons learned from the Project.

The Project has also produced booklet on "The Preventive Systems Approach (PSA) to Protected Area Management: The Case of Mt. Kitanglad Range Nature Park, Bukidnon, Philippines," which was jointly published with the Integrated Protected Area Systems (IPAS)-Mt. Kitanglad. The PSA booklet features the model of protected area management that unifies the efforts of different management regimes encompassing the protected area to the buffer zone down to the privately held agricultural land in an integrated ecosystem. Another booklet was produced entitled, "Managing Natural Resources Locally: An Overview of Inno-

ventions and Ten Initial Steps for Local Governments" co-published by IFAD. It features the Lantapan experience on NRM planning process and implementation, as well as some nationally recognized best local NRM practices in the country.

Circulations of these have already been expanded, particularly to the 11 LGUs involved in the conduct of this research and those that are requesting for information network to the new publications. A series of Research Feedback Sessions in the four municipalities were also conducted to communicate study results and gain useful insights from our research respondents on improving research processes and the results itself. Issues and constraints on localized environmental protection and management were discussed, and possible solutions were discussed, hence improving the understanding on the dynamics of local NRM. The sessions also served as a follow up feedbacking action planning for the recently concluded NRM planning activities with information feedbacking and planning for future actions focused on the final take-off for the implementation of the NRMDPs.

Advances

in Research - Submitted and presented a research report on the sustainability factors affecting local NRM, which will further be developed as ICRAF-SANREM working paper - Developed and presented a synthesis report of the 11 practicing LGUs in the area of NRM in the Philippines - Research results shared to NRMCS through Research Feedback Sessions

in Capacity Buildup - Guided LGUs in developing their IRRs that included creation of PMOs, institutionalization of NRMCS and budget allocations. IRRs' are being subjected to deliberations at the Legislative Councils and Public hearings at the community level, and after which implementation of the plans will follow. - Facilitated the implementation of some activities identified in the plans even without IRRs (e.g. Landcare Program) - Local planning teams underwent 6 courses on Watershed Management provided by the Provincial Government of Bukidnon (with ICRAF staff and LGU staff trained on NRMDP serving as on-call resource persons)

in Scaling Up - Produced and circulated 4th issue of NRM Notes - Produced and Circulated PSA booklet - Produced and circulated NRM caselet - Submitted NRM 5-Year Accomplishment Report - Organized the

First Bukidnon Policy on NRM where research results were communicated to participants

in Policy Impact - Development of NRM Policy Briefs in progress

in Improved Environment and Natural Resource Management - LGUs have developed and completed their NRMDPs utilizing local financial and human resources - LGUs identified environment and NRM as one of the basic social services that have to be delivered effectively and efficiently - LGUs have become more appreciative of the need to create PMOs/ENROs that would spearhead the implementation of their environmental programs - LGUs created PMOs/ENROs utilizing available human and financial resources, even building partnership with private partners to move on with the plan's implementation

Publications

Book Chapters

Sumbalan, A. 2001. *Conservation and management of watershed and natural resources: Issues in the Philippines, the Bukidnon experience*. In Coxhead, I. and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. PCARRD. Los Banos, Laguna, Philippines.

Journal Articles

Catacutan, D. A. Mercado and M. Patindol. 2001. *Scaling up the Landcare and NRM planning process in Mindanao, Philippines*. In "Lessons in scaling-up," Low External Input and Sustainable Agriculture Magazine. Netherlands. 17(3): 31-34.

Garrity, D., V. Amoroso, S. Koffa, D. Catacutan, G. Buenavista, C. Fay and W. Dar. 2002. *Landcare on the Poverty-Protection Interface in an Asian Watershed*. Conservation Ecology Journal No. 6. Special Feature on Integrated Natural Resources Management.

Briefs

Garrity, D. 2001. *A Social Contract for Biodiversity: Institutional Solutions to Environmental Conservation in the Philippines*. SANREM CRSP Research Brief No. 4.

Conference Presentations

Catacutan, D. 2001. *Modalities of Scaling-up Landcare and NRM in the Philippines: Creating space for private-public partnerships at the local level*. Case study presented to the Technical Workshop on Methodologies, Organizations and Management of Global Partnership Programmes. Rome, Italy.

Catacutan, D., C. Duque and D. Garrity. 2001. *Replicating Models of Institutional Innovations for Devolved, Participatory Watershed Management*. Paper presented to the R&D Review of Lantapan-based Activities. NOMCARRD-PCARRD and SANREM CRSP/SEA, Lantapan, Bukidnon. March 25.

Catacutan, D., D. Garrity and C. Duque. 2001. *Local Natural Resources Management: Sustaining Factors and Policy Imperatives, A synthesis of countrywide case studies of eleven practicing LGUs in local natural resources management*. Paper presented to the First Bukidnon Policy Forum on Natural Resources Management, Valencia City, Bukidnon. November 8-9.

Catacutan, D., D. Garrity and C. Duque. 2001. *Governance and Natural Resources Management: Key Factors and Policy Implications, Emerging Lessons from ICRAF-SANREM Collaboration in the Philippines*. Paper presented to the First Bukidnon Policy Forum on NRM, Valencia City. November 8-9.; and to the SANREM CRSP Research Synthesis Conference, Athens, GA. November 28-30.

Garrity, D., et. al. 2001. *Integrated Natural Resources Management on the Poverty-Protection in an Asian Watershed*. Paper presented to the Integrated Natural Resources Management Workshop, Cali, Colombia.

Popular Media

ICRAF. 2002. *Managing Natural Resources Locally: An Overview of Innovations and Ten Initial Steps for Local Governments*. Bukidnon, Philippines: ICRAF.

Research Reports

Catacutan, D. and C. Duque. 2001. *Factors affecting Natural Resources Management implementation at the local level*. NRM Technical Notes (4th issue). Bukidnon, Philippines: ICRAF.

Catacutan, D., D. Garrity and C. Duque. 2001. *Governance and Natural Resources Management: Key Factors and Policy Implications*. Bukidnon, Philippines: ICRAF.

Tools

Catacutan, D., C. Duque, D. Garrity and F. Mirasol. 2001. *The Preventive Systems Approach to Protected Area Management: The case of Mt. Kitanglad Range Natural Park, Bukidnon, Philippines*. ICRAF and IPAS-Mt. Kitanglad.

Queblatin, E., D. Catacutan and D. Garrity. 2002. *Managing Natural Resources Locally: An Overview of Innovations and Ten Initial Steps for Local Governments*. NRM booklet. ICRAF and IFAD.

SANREM CRSP

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Capability Building for Natural Resource Management at the Local Level

Principal Investigator
Victoria O. Espaldon

Co-Principal Investigator
Jose Arances
Annielyn Magsino

OBJECTIVE 1

Develop and strengthen the skills of trainers on Participatory Landscape-Lifescape Appraisal (PLLA).

Annual Achievements

During the first quarter, a Training of Trainers on PLLA was conducted. Four participants were from Central Mindanao University (CMU) while nine represented the barangays and the Municipal Technical Working Group. A total of 13 participants attended the said training.

The skills of PLLA trainers specifically the staff of the CMU-BIDANI Institute were strengthened by: 1) reading about natural resource management in collected materials found in the university; 2) attended lectures on experiential learning and on farm planning; 3) attended seminar sponsored by other agencies like the Policy Analysis Workshop on NRM in SANREM; 4) developed modules using the experiential learning approach; 5) conducted on-site trainings for PLLA team in six barangays; and 6) assisted the PLLA teams in the six barangays to prepare a barangay profile using PLLA data.

OBJECTIVE 2

To develop the ability of the community for participatory planning.

Annual Achievements

Training on the PLLA was conducted in five barangays. These barangays conducted their PLLA and validated their findings. Of these five barangays two had their Initial Training using the BIDANI approach where the findings of the PLLA were used in the preparation of their barangay development/supplemental plans.

Another Training on PLLA was conducted in additional barangays namely: Barangay Lourdes, Mt. Nebo and Guinoyoran in Valencia and Barangays Baclayon, Basac and Victory in Lantapan. All these barangays conducted the PLLA and validated their findings.

The initial training on the BIDANI Program was conducted in all barangays except Mt. Nebo. In this initial training the findings of the PLLA were used in the preparation of a Barangay Integrated Development Plan (BIDP). Mt. Nebo was a BIDANI covered barangay before this workplan was implemented. As such, a Reinforcement Training (RT) was conducted in order that NRM activities could be incorporated in the barangay's supplemental plan.

The BIDP was legitimized at the Barangay Council and the Barangay Development Committee (BDC) and validated by the people in a General Assembly.

The three barangays in Lantapan together with Barangays Kulasihan, Songco and Alanib which were covered in Year 3 presented their BIDs to the Municipal Technical Working Group (MTWG) for commitment-setting and investment consideration. For Lantapan, the MTWG suggested that plans should be classified according to what households could do on their own, what the barangays could implement on their own and what the barangays could implement with LGU assistance. Each of the barangays was instructed by the MTWG to prioritize projects which could be implemented with LGU assistance. Each had to choose three projects which would be funded in the last quarter of CY 2002. If there will be funding constraints in the last quarter, these priorities will be for CY 2003.

Meanwhile, the BIDANI has to backstop technically these six barangays in Lantapan as they prioritize the projects. This has to finish before the date of Barangay elections.

Each line agency in Valencia City gave its financial commitment to activities in the plans presented by Barangays Colonia, Lilingayon and Lurugan in Year 3 and Barangays Mt. Nebo, Guinoyoran and Lourdes in Year 4 as long as the needed budget is within the released allocation or budget savings.

There are Barangay plans which cannot be implemented at once due to funding constraints. However, a household on its own and it level can make and implement plans related to natural resource management. Thus, the BIDANI Institute has gone a step further from the barangay level. It continues to assist households to frame individual farm plans which they can implement on their own.

The BIDANI Foundation, Inc. (BFI), the NGO-arm of the Institute started to conduct training on business planning as part of its commitment to the barangays. The total number of trainers is 298, 135 in Valencia and 163 in Lantapan.

OBJECTIVE 3

To establish a mechanism for collaboration with other work plans/organizations in the area in the planning and implementation of activities.

Annual Achievements

The BIDANI Institute has a MOA for this project with the city of Valencia and Municipality of Lantapan. Expenses for the training in the barangays are cost-shared by the barangays, the LGUs and the BIDANI with funds from SANREM and CMU.

The municipality of Lantapan has set aside P50,000 for capability building while the city of Valencia has funds for capability building (P50,000), micro-finance (P200,000) and community based enterprise activities (P250,000) for every barangay. The BIDANI Institute is still preparing proposals and guidelines on how funds for micro-finance and community-based enterprise activities will be tapped.

The CMU BIDANI Foundation, Inc. conducted a "Training in Entrepreneurship for Agri-Business and Micro-Finance Project in the Upland Communities" in Barangay Baclayon. Trainers include staff from BFI and BIDANI Institute. This training will be conducted in other barangays along the Manupali watershed during the Year 5 workplan implementation.

OBJECTIVE 4

To publish a manual on Participatory Landscape-Landscape Appraisal (PLLA).

Annual Achievements

The NRM team of the BIDANI Institute has prepared second draft of a training manual using the experiential learning approach based on the PLLA manual. Meanwhile, a farm planning manual is still undergoing revisions.

Advances

in Research - The experiential learning approach was used by faculty members involved to be able to write and teach modules on NRM for adult learners and translate the PLLA manual to local dialect.

The training on organizing and participatory planning enable the barangays to incorporate SA/NRM principles and translated these into projects in their respective supplemental plans with all other prioritized components of Barangay development

in Capacity Buildup - Trained people are now capable of conducting the PLLA in their local area. They found PLLA interesting and easy to learn and implement. Moreover, they found that the data generated were very important in their future activities.

in Scaling Up - The community plans developed from out the results of the PLLA per barangays are being used to develop the municipal development plans.

in Policy Impact - The community plans developed from out the results of the PLLA per barangays are being used to develop the municipal development plans.

in Improved Environment and Natural Resource Management - Implementation of community plans that integrates environmental considerations, improved environmental consciousness among local community members.

Other Major Outputs in this Period

Please take note of the following changes: Principal Investigator: Dr. Jose B. Arances; Co-Principal Investigator: Dr. Victoria O. Espaldon, Ms. Annielyn O. Magsino

SANREM CRSP

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Technical and Institutional Innovations to Evolve Agroforestry Systems for Sustainable Agriculture and the Management of Protected Ecosystems in the Framework of a Watershed Model

Principal Investigator
James Rochetko

Co-Principal Investigator
Gliceto O. Dagondon

OBJECTIVE 1

Design, test and scale up community-operated agroforestry seed collection/production, processing and management systems in two municipalities in Bukidnon.

Annual Achievements

Activities in support of this objective included a series of capacity building events including seed technology and nursery management training for ATSAL, as well as other nursery groups in Lantapan and other municipalities Manolo Fortich and Malaybalay City. These municipalities benefited most from the various sharing events.

Facilitation of ATSAL's strengthening and knowledge-sharing:

Members of ATSAL participated in the following training: Farmers' Training of Trainers (Cagayan de Oro City, October 2001) and Training on Epicotyl and Hypocotyl of Fruit Trees (Bunawan, Agusan del Sur, October 2001). A field visit was also facilitated among tree farm-cooperators in ICRAF-Claveria Site in Misamis Oriental to learn the value of tree thinning (December 2001). These activities broadened the knowledge base of the members on modern and indigenous seed technology practices. They enhanced their perspective based on their learning experience and aspirations in the management of trees on farms. With their enhanced capabilities, they have been invited as resource speakers in a number of training on nursery

establishment and management, as well as on seed collection and asexual propagation for fellow farmers within and outside Lantapan, covering areas in Bukidnon. Their training engagements extended to the provinces of Misamis Oriental, Bohol, Leyte, and Antique. Just recently, ATSAL members shared their expertise on seed propagation during the visit in Lantapan of farmer-leaders and Agricultural Technicians (ATs) representing four LGUs of Iloilo Province. Alongside, they were also able to sell seeds and seedlings, and more importantly, established new linkages for future collaborations related to tree farming.

Three ATSAL and Landcare representatives have been identified to participate in the 2nd National Tree farmers' Congress which will be held in Butuan City on July 11-13, 2002. Concerns and issues on tree farming, including marketing will be discussed during the congress. The participation of the three members will be funded by AECI.

Two meetings of the Association were conducted this month (June) to discuss issues concerning group strengthening. The issues included training needs, seed production areas, and registration with the Security and Exchange Commission.

A survey form was initially developed to document the Association's organi-

zational, physical and financial growth, and its contributions to the environment since its establishment in 1998. A more detailed survey form was developed jointly and pre-tested by SANREM and ICRAF. The survey will be conducted during the next meeting of the Association.

Linking Farmers to Market:

Tree farmers joined a field trip to wood processing plants and in Tagoloan, Misamis Oriental and Cagayan de Oro City in December 2001, primarily to determine potential markets for their timber. As an offshoot of the field trip, representatives of VICMAR Development Corporation and Resin-Philippines visited Lantapan in May and surveyed potential species that can be tested for veneer production, particularly on their peelability and recovery qualities. Discussions with ATSAL officers and members led to the initial testing of three species namely: *Eucalyptus torelliana* (Torelliana), *Mesopsis eminii* (Musizi) and *Eucalyptus robusta* (Robusta) by VICMAR. Results of the test showed that all three species passed the quality requirements with *M. eminii* emerging as the most outstanding. This June, arrangements were made with Vision Manufacturing Enterprise and Asiatic Wood Industries, Inc. in Cagayan de Oro City for the initial testing of species for the quality requirements of wood furniture manufacturers.

With these initial activities, market networks and/or weak market information were incrementally addressed. Indications for high demand for these species encouraged the farmers, who witnessed the actual testing of their trees, to plant more of them. Testing of other species included in the species trials will follow as soon as they reach the minimum size required for veneer testing.

OBJECTIVE 2

Build and nurture an enabling environment for the establishment development, and management of small-holder tree-based production systems as viable enterprises and as a vehicle for rehabilitating deforested upper watersheds and to utilize idle and marginal lands.

Annual Achievements

Scaling-up of agroforestry activities to CBFM areas:

This objective was not fully met since the Bukidnon Environment and Natural Resources Office (BENRO), ICRAF's partner, was affected by the change of politi-

cal leadership in the Province. The situation has stabilized recently and the BENRO has resumed proactive leadership of technical support actions for municipalities in the arena of watershed management and agroforestry practices.

The Site hosted a series of cross visits (5) with the Department of Environment and Natural Resources - Community-Based Forest Management (DENR-CBFM) partners all over Bukidnon to Lantapan. However, some usual DENR problems impeded the progress of the partnership.

With the on going watershed management project of the Province, it is hoped that agroforestry technologies will be scaled-up to CBFM areas in partnership with BENRO.

Maintaining on-farm species diversity trials:

Species trial evaluations were established during Phase I of SANREM on sites across altitudes of 400-1400 meters above sea level (masl) to test adaptability and growth performance of 14 promising agroforestry tree species. Data on its growth performance were collected in June, July and August (2001) for the annual measurement.

During SANREM's Phase II, another set of trials was established involving five species, namely: *Acacia aulacocarpa*, *A. crassicarpa*, *Eucalyptus grandis*, *E. pellita* and *Grevillea robusta*). Growth performance is measured semi-annually. The latest was conducted March (2002).

Statistical data have been gathered from both sets of trials and will be analyzed, specifically those collected during Phase II. The upcoming hiring of an agroforestry specialist is expected to facilitate the analysis and interpretation of results.

Supporting projects from ICRAF's Tree Domestication Program in the Philippines:

ICRAF and its partners continue to expand research activities in support to the Tree Domestication and Technical Innovations Program for agroforestry systems development.

Through fund leveraging with other funding agencies, ICRAF was able to implement the following activities:

Knowledge Base of Indigenous Tree Species in Northern Mindanao:

A survey was conducted with the Environmental Research and Development Services (ERDS) of DENR X to provide basic information regarding indigenous tree species in Northern Mindanao. A total of 193 tree species under 51 families were identified with Meliaceae and Euphorbiaceae families having the most number of species. Identified constraints on adopting indigenous tree plantations as agroforestry species included long maturity period (harvest), policy issues involved in marketing wood products, insufficient information on growth, yield and technologies on production and management, and information on the not-so-known indigenous species. Survey results were shared through a seminar-workshop held June 2001 in Malaybalay City. Discussions were initiated to initiate a subsequent activity, which is a short study to be conducted by ERDS. This study will determine the feasibility of extrapolating and verifying the results of the species evaluation trials in Lantapan in the Province focusing at existing tree plantations and/or agroforestry practices in different agroecological zones, elevations and local conditions. Further discussions on this proposal are still going on.

Weeding Management Research:

ICRAF is presently implementing a research on different weeding management regimes of an indigenous species (*Pterocarpus indicus*) and an exotic species (*Eucalyptus robusta*). This study, which is managed by the Central Mindanao University, aims to provide information on weeding regimes and planting density in relation to growth performance. The research is supported by EURU.

Marketing of Eucalyptus wood products :

The thesis of an MS in Agricultural Economics student from Leyte State University is for implementation this June and is expected to be completed in December of this year. It aims to study the marketing of Eucalyptus trees and its products in selected municipalities in Bukidnon.

In the absence of a well-established marketing structure specifically for Eucalyptus, the study shall also analyze established systems and structures for other species and use the resulting information to identify potential marketing structures that are most efficient and most rewarding for Eucalyptus tree growers. The study is supported by SEANAFE.

OBJECTIVE 3

Establish and foster the adoption of a range of agroforestry systems and component technologies in CBFM and other land areas, using the Landcare approach.

Annual Achievements

Soil and Water Conservation:

As of May 2002, 62 Landcare groups with 830 members were operating in 12 barangays of Lantapan. A total of 86 IEC activities were conducted by Landcare Facilitators for various audiences. Seventeen cross-visits were facilitated, exposing farmers to Landcare group activities such as nursery establishment and management, and adoption of agroforestry and soil and water conservation (SWC) technologies. As a result, adoption of agroforestry component technologies and SWC practices by 849 farmers was reported. This includes the adoption of the Natural Vegetative Strips (NVS) by 404 farmers.

Concurrent training implementation of nursery establishment and management:

There were 64 training conducted on nursery establishment and management resulting to the establishment of 65 communal and individual nurseries in Lantapan. All in all, the nurseries propagated a combined total of 160,000 seedlings of various tree species. A total of 156,020 were planted in farmers' fields and in open areas of Lantapan. Of the total number, 152,532 were timber trees, while 3,488 were fruit trees. The ranges of timber species continue to grow from exotic (Eucalyptus, Acacia, etc.) to endemic and indigenous premium wood species such as lauan, narra and mahogany. Fruit trees planted include durian, lanzones, rambutan, jackfruit and other orange species. This was the result of a survey conducted earlier to identify the kinds of trees that farmers are willing to test and grow in their farms.

Two private high schools and three public schools have already put up their own nurseries. The other public elementary schools in Lantapan are still to put up their nurseries as agreed upon with the Department of Education public school system in Lantapan. Agroforestry activities in Lantapan have been scaled-up in the municipality of Manolo Fortich and Malaybalay City. The training on nursery establishment for Manolo Fortich Landcare yielded 15 nurseries, mostly at the barangay level. These nurseries have already propagated 9,687 seedlings of various species. On the other hand,

Malaybalay Landcare has already established five nurseries (trees propagated and planted still to be monitored). A funding of PhP 250,000 from the City Government was allocated for Upland Development with the Municipal Agriculture Office and Landcare at the forefront.

Advances

in Research - 6 years data of the first generation trials in - Phase I, and the 3 years of the second generation trials in Phase are encoded ready for performance growth analysis - Indigenous species in Region X surveyed with the production of the Knowledge-base of Indigenous Tree Species in Northern Mindanao document

in Capacity Buildup - Training Manual developed and tested in CBFM sites in Claveria, Misamis Oriental. Part of the training manual was also used to orient 5 batches of DENR-CBFM groups on agroforestry innovations. Actual training in watershed project areas of BENRO will be implemented hopefully during the implementation of cluster watershed management plans in Bukidnon

in Scaling Up - Farming guides produced and updated. Farming guides for the propagation of indigenous tree species will be produced based on existing literatures.

in Improved Environment and Natural Resource Management - Identified ATSAL's SPA's for both fruit and timber tree species - Established network with processing plants (VICMAR). 3 species (E. torillana, E. robusta & M. eminii) were initially tested. - Marketing study on Eucalyptus trees and products on-going.

Publications

Book Chapters

Garrity, D., V. Amoroso, S. Koffa and D. Catacutan. 2001. *Innovations in Participatory Watershed Resource Management to Conserve Tropical Biodiversity*. Pp. 112-137 In Coxhead, I and G. Buenavista (Eds.) Seeking Sustainability: Challenges of Agricultural Development and Environmental Management in a Philippine Watershed. PCARRD: Laguna, Philippines.

Journal Articles

Garrity, D., S. Koffa, D. Catacutan, G. Buenavista, P. Fay and W. Dar. 2002. *Landcare on the Poverty-*

Protection Interface in an Asian Watershed. Conservation Ecology Journal, No. 6. Special Feature on Integrated Natural Resources Management.

Other Major Outputs in this Period

* 65 decentralized nurseries facilitated and monitored monthly

* 3 major training facilitated for ATSAL members

* 3 field visits facilitated for ATSAL members (thinning management & 2 visits to processing plants)

* 156 020 seedlings outplanted on field in Lantapan alone

* Linkage with VICMAR Development Corporation, Resins-Philippines, and Vision Manufacturing Enterprises/Asiatic Wood Industries, Inc.

Conference Presentations

Catacutan, D., L. Arbes and G. Boy. 2001. *Enhancing Farmer Adoption of Simple Conservation Practices: Landcare in the Philippines*. Paper presented to the R&D Review of Lantapan-Based Activities. NOMCARRD-PCARRD & SANREM CRSP/SEA, Lantapan, Bukidnon. March 25.

Garrity, D., et.al. 2001. *Integrated Natural Resources Management on the Poverty-Protection in an Asian Watershed*. Paper presented to the Integrated Natural Resources Management Workshop, Cali, Colombia.

Scherr, S., J. Amornsanguansin, M. Chiong-Javier, D. Garrity, S. Sunito and Saharudding. 2001. *Local Organizations in Natural Resources Management in the Uplands of Southeast Asia: Policy context and institutional landscape*. Paper presented to the Sustaining Upland Development in Southeast Asia: issues, tools and institutions for local natural resources management, Makati City, Philippines. May 27-30.

Popular Media

ICRAF. 2002. *ATSAL, Seed is Life*. Bukidnon, Philippines: ICRAF.

Tools

Ngugi, M., S. Koffa, and D. Garrity. 2001. *A Guide for Agroforestry Tree Species Selection for Landcare*. Bukidnon, Philippines: ICRAF.

SANREM CRSP

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SANREM-SEA Environmental Research Grants Program

Principal Investigator
Ian Coxhead

Co-Principal Investigator
Gladys Buenavista
John Rowe
Rogelio Serrano

OBJECTIVE 1

To provide opportunities to export SANREM methodologies, import methodologies from non-SANREM projects, or capitalize on synergies and collaborations with high potential productivity in terms of the overall goals of SANREM SEA.

Annual Achievements

Substantial progress is made in all activities under the 2001-2002 Environmental Grants Research Projects. Grantees attended the project's annual meeting in May 2002 and gave an update of their individual research. Cross linkages between ERGP activities and on-going SANREM work plans in the region were also identified. ERGP progress to date include the following:

On-site data collected and secondary data analysis conducted to examine institutional factors that impact on the sustainability of the water monitoring work plan. Preparation of final report in progress.

Research in progress to use the Water Erosion Prediction Project (WEPP) model to simulate soil erosion and sediment yield at the SANREM project site in Lantapan, Bukidnon, Philippines. Activities completed included selection of test sub-watersheds (Kulasihan, Alanib, Maagnao and Tugasan). Secondary data from SANREM sources and geographic maps from relevant Philippine agencies retrieved and evaluated. WEPP model from the National Soil Erosion Research Laboratory of the USDA-ARS and other relevant programs for inclusion in the

model accessed. Test run of WEPP model using trial data conducted.

Research in progress for testing of the Predicting Catchment Runoff and Soil Erosion (PCARES) model. Coordinated with existing SANREM work plans for retrieval of maps and ground truthing.

Consultation with researchers from the University of Agriculture and Forestry in Viet Nam conducted to organize three-day training workshop. The purpose of this workshop was introduce researchers at UAF to theoretical concepts for building models of economy-environment linkages within a watershed, and to present a set of modeling tools, including Excel Solver, Stella 6, and the Manupali model developed by the project for the Philippine site. Data needs were identified to support the economy-environment model that will be developed for Vietnam.

Preparations are underway for the conduct of a policy workshop in Vietnam. The purpose of this workshop is to disseminate research findings and create a venue for policy dialogue between researchers and policy makers on issues related to sustainable natural resource management. (Individual mid-year reports of the research projects are found in the SANREM Southeast Asia website: <http://aae.wisc.edu/sanrem-sea>)

Advances

in Research - Collaboration among U.S., Philippine and Vietnamese researchers in the creation of decision support tools for

integrated watershed management is underway. Two models, WEPP and PCARES, are currently being tested in the Manupali watershed. The economy and environment model developed by SANREM in the Manupali watershed will be adapted for use in Vietnam. Complementing our model development activities are sets of research and consultation activities to understand institutional arrangements needed to sustain participatory action research projects, e.g., water monitoring and develop strategies linking research and policy.

in Capacity Buildup - Training workshop conducted to introduce researchers at UAF to theoretical concepts for building models of economy-environment linkages within a watershed, and to present a set of modeling tools, including Excel Solver, Stella 6, and the Manupali model developed by the project for the Philippine site. Twelve participants, representing multidisciplinary fields of specialization attended the training workshop. Workshop lays the groundwork for adapting the Manupali model to Vietnamese context.

in Scaling Up - Complementing research and capacity building activities, consultations were conducted with host country institutions, in particular the Ministry of Agriculture and Rural Development (MARD) in Vietnam, to map out strategies to enhance the uptake of research information for policy making and action. An outcome of these consultations is the organization of a policy workshop that will be jointly sponsored by SANREM and UAF together with MARD. Part of the workshop will highlight research results from extensive research conducted in the Philippines that could be applied in Vietnam.

Other Major Outputs in this Period

Training Non Degree

Workshop

Economic and Environmental Modeling was attended by 12 person(s) and lasted 3 day(s).

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From Research to Policy in NRM: Synthesis Activity

OBJECTIVE 1

Synthesize SANREM's experience in bringing NRM research results into the development policy arena in all of SANREM's three regional sites.

Annual Achievements

Field work conducted in Bukidnon as part of documentation and analysis of strategies undertaken by project researchers to link research with policy. Secondary literature review was also conducted to study how research results are being used to inform policy dialogues on environmental management and conservation of similar experiences projects in Asia. First draft of final report is written and currently peer reviewed.

Link established with SEA-23 to complement our research activities. Buenavista and Sumbalan will expand synthesis research to include an in-depth analysis of local government expenditures on environment and natural resource management and if these investments support earlier activities jointly undertaking by the local government and SANREM work plans. Such analysis will enable us to obtain lessons on sustaining research and policy linkage/partnership.

Advances

in Research - 1. policy papers presented in a national policy forum on water; 2. Arguments about a watershed based water policy in the Philippines is now inserted in the draft of the Clean Water Act; 3. 4 policy briefs are also now available.

Other Major Outputs in this Period

Principal Investigator
Gladys
Buenavista

Training Degree

Name, Level, Start Date-Completion Date

Joanna Becker , Ph.D. 1998-

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Development of a Spatial Information Management System

Principal Investigator
Steven Ventura

Co-Principal Investigator
Gregg Clark

OBJECTIVE 1

Identify and locate data series that can be used to create GIS layers that will support natural resource management decision-making in the Manupali watershed

Annual Achievements

A comprehensive list of paper and digital spatial data has been compiled. This list is on paper and is being transferred to the SANREM/SEA website. Digital data that is held by SANREM-SEA is being placed onto an ftp server with links to the website. The metadata for these files is currently being created or updated.

OBJECTIVE 2

Create a spatial information management system (SIMS) with an interactive website to facilitate data sharing among SANREM personnel and its partners

Annual Achievements

Limited data connectivity is the largest obstacle regarding the development of an interactive GIS website. Recently the Philippine Institute for Development (PIDS) replaced a test interactive GIS website with a static GIS website due to problems with connection rates. The GIS division at the International Rice Research Institute, Los Banos, Philippines is currently investigating an interactive GIS website. SANREM-SEA data will be available to partners through the SANREM/SEA website and through a mirror site at the Site Coordination Office in Malaybalay, Philippines.

OBJECTIVE 3

Develop protocols to create a land suitability index for the Manupali watershed and create the land cover classification. Provide training during this process to promote capacity building and the sustainability of GIS in the region.

Annual Achievements

Protocols for the land cover classification are being completed. They will be tested and updated accordingly during a visit to the site in July, 2002. A Memorandum of Agreement between SANREM-SEA and Bukidnon Environment and Natural Resources Office to work together to complete the land cover classification has been drafted and is waiting to be signed by local officials. The remote sensing images have been obtained and an updated and more detailed digital elevation model is in the process of being completed.

Advances

in Research - SANREM/SEA is completing the process to create a base map and digital elevation model that will use DGPS ground control points to improve accuracy. The increased accuracy will enhance the incorporation of data from other research being conducted in the study area.

in Scaling Up - Working on MOA with BENRO. Will conduct training on the use of spatial information with BENRO and other interested agencies within the Manupali watershed.

in Policy Impact - Development of data into a useful form is still in progress

in Improved Environment and Natural Resource Management - Development of data into a useful form is still in progress

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Water Policy Research

Principal
Investigator
Christina David

Co-Principal
Investigator
Agnew Rola
Ian Coxhead

OBJECTIVE 1

Contribute to the understanding of policy issues in the area of water resources management in the Philippines and conduct policy advocacy at the national level

Annual Achievements

Commissioned four papers for presentation at the water policy forum July 30, 2002. These papers are:

Malayang III, B.S. *A Model of Water Resource Governance in the Philippines.*

Tabios III, G.Q. *Competing Water Uses: Cases of Laguna Lake, Angat Reservoir and Batangas City Groundwater System.*

Francisco, H. and R. Acosta. *Watershed-based Water Management Approach: How Can We Explore its Potential in the Philippines?*

Coxhead, I., B. Deutsch, A.C. Rola, and A. Sumbalan. *Economic Development and the Use of Water Resources: Lessons from Lantapan, Bukidnon, Philippines.*

Advances

in Research - Four papers are now ready for presentation in a policy forum

in Policy Impact - Lower house (of the Philippines legislative branch) secretary general has instructed the chair of House Committee on Public Works and Highways to act upon recommendations contained in the Policy Notes regarding institutional issues on water. Other media contacted SANREM researchers regarding outputs of project.

Other Major Outputs in this Period

Briefs

Elazegui, D. 2002. *Setting Quality Standards for Environmental Management Policy: How Effective Is It?*. SANREM CRSP SEA Policy Brief No. 2002-3.

Elazegui, D. 2002. *Law of Nature: The Command and Control Approach.* SANREM CRSP SEA Policy Brief No. 2002-2.

Popular Media

Elazegui D. and J. Liguton. 2002. *Setting Quality Standards for Environmental Management Policy: How Effective Is It?*. The Philippine Star. 1: 13.

Elazegui, D. and J. Liguton. 2002. *Law of Nature: The Command and Control Approach.* The Philippine Star. 23: 9.

Tools

De Guzman, P. 2001. "Polluter Pays" Principle. PIDS Economic Issue of the Day. 11(5).

Working Paper

Rola, A., I. Coxhead, W. Deutsch, and A. Sumbalan. 2002. *Economic development and the use of water resources: lessons from Lantapan.* Manuscript. University of the Philippines, Los Banos.



SANREM West Africa Project Overview

1. Introduction

Northern Mali and the Inland Delta Region of the Niger River, like many natural resource systems throughout the world, are in transition to more intensified agriculture and animal husbandry systems. Although open range, opportunistic grazing management by transhumant herders has been a sustainable way of life for centuries in this region, increasing population pressure, declining and erratic rainfall, and degrading natural resources have forced both agricultural and livestock communities to transform their production systems and the social relations on which they are based.

Unfortunately, this transformation has historically come about through conflicting processes and serious natural resource-based conflicts have become increasingly common over the last decades. Furthermore, these conflicts and related natural resource degradation are occurring simultaneously with far-reaching transformations in governance in the region. Decentralization, while holding out the potential for improving natural resource management (NRM), has created a new class of local level decision makers who have little experience, training, or access to NRM decision-support infrastructure.

In 1998, the SANREM CRSP-West Africa (WA) Project was asked to develop a research-based approach to assist in managing these transformations and associated conflicts in northern Mali. In response, the SANREM CRSP-WA Research Project began a participatory program to build science-based solutions while promoting a holistic approach for sustainable

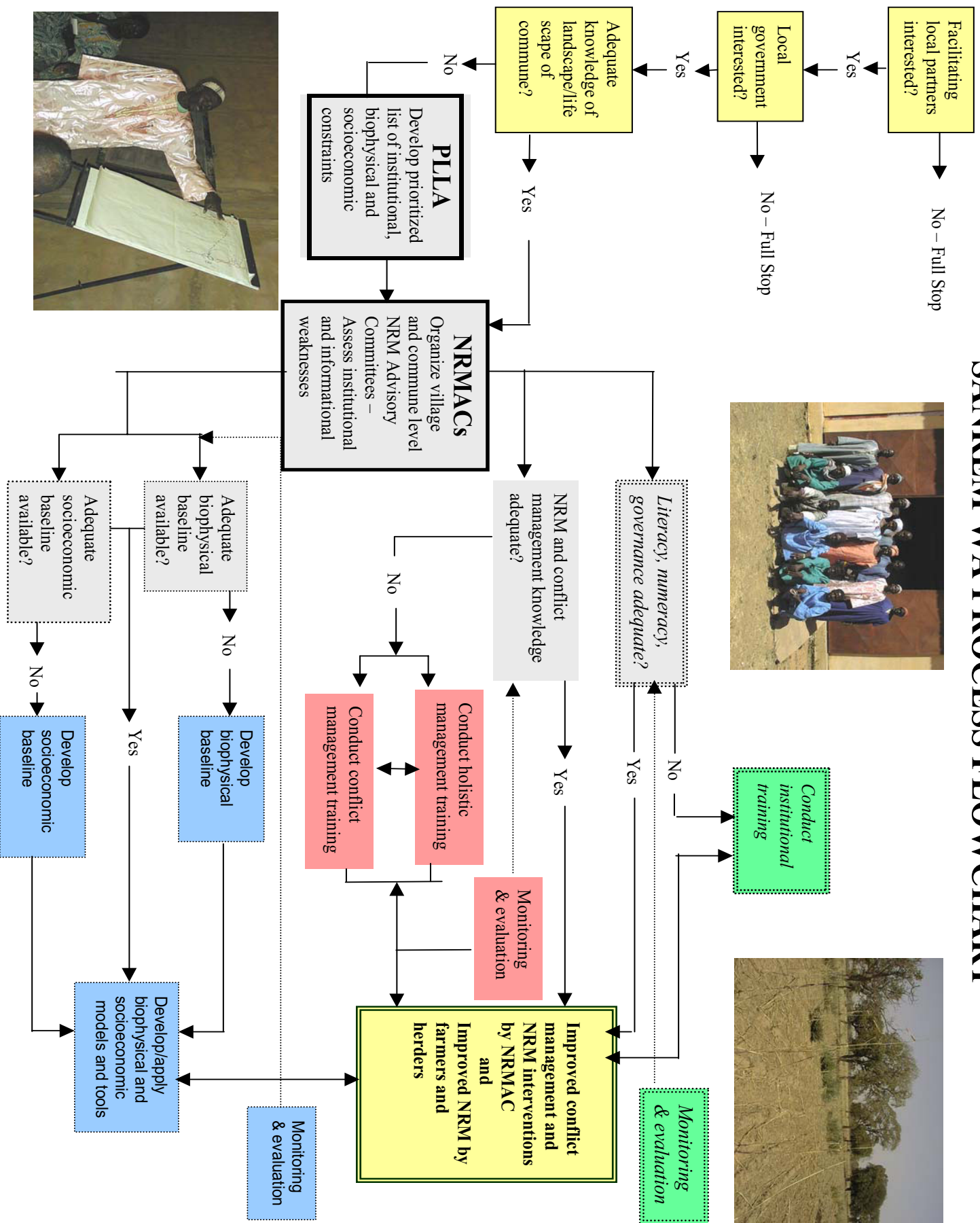
agriculture and NRM in the Madiama Commune in the Mopti Region of Northern Mali. This approach consists of institution building activities supported by an integrated package of databases and decision support systems. SANREM CRSP-WA databases include data on the socioeconomic characteristics of the populations, soil, land use, cropping systems, and water points that provide the basis for an integrating geographic information system (GIS) for the commune. SANREM CRSP-WA decision support systems form a holistic framework which local, regional and national decision makers can use to sustainably address complex agronomic, livestock, economic, and institutional problems.

The SANREM CRSP-WA process being used in Madiama is replicable in other communes of Mali and throughout West Africa. A schematic presentation of the process is presented below.

1a. Overview of Project Coordination:

The SANREM WA Project is organized simply around six integrated work plans. WAF-06 (Creation and Support of a Commune-Level NRM Advisory Committee) is the heart of the project with all other work plans contributing to and receiving direction from the target of this work plan: the NRMAC. The NRMAC is the NRM decision support institutional infrastructure established by SANREM at the newly decentralized commune level in Mali. WAF-06 provides the NRMAC with institution-building support (literacy, numeracy, and institution management training through Care-Mali) and NRM planning support (holistic management and

SANREM WA PROCESS FLOWCHART



conflict management training from trainers associated with the Center for Holistic Management). The NRMAC provides an organizational and coordination bridge for the project to the 10 villages of the commune, where village level NRMAC's function.

The NRMAC uses the training and planning tools provided to implement, monitor, and evaluate project activities for improving soil fertility (WAF-08) and improving pasture management (WAF-09) within the commune. The subjects of these two work plans were identified as priorities during the PLLA in 1999. The information provided by the biophysical and socioeconomic tools work plan (WAF-07) is used in the first instance by the NRMAC to inform their decisions regarding WAF-08 and -09. Data and methods developed in WAF-07 are also shared with the Texas A&M SANREM project, which targets decision makers at higher levels.

The significant results of all work plans are scaled-up to, and informed by, regional stakeholders through participation in regional meetings through WAF-05 (workshops on conflict and NRM). These meetings involve regional project partners INSAH (Institut du Sahel) and the NRM Research Pole. Researchers of the Institut d'Economie Rurale (IER) are fully integrated into all work plans. Finally, management and coordination of the overall project is assured through WAF-01.

2. Highlights of Accomplishments

SANREM CRSP-WA has developed a research program to address both the NRM conflict issues and the need for more accurate data and tools for agricultural and natural resource management and policy dialog. The project has established a multi-year, geo-referenced database of weather, soil, cropping system, land use, and water point data. This database is used for the construction of maps and modeling at the commune level. Agronomic decision-making can now be informed by the calibrated CropSyst Model that simulates the long-run viability of potential new technologies. The Social Accounting Matrix (SAM) developed for the Madiama Commune provides further guidance to researchers and the commune concerning the potential impact of new technologies and how these impacts are distributed between different groups within the community.

Recognizing that technical problems are not divorced from day-to-day community life, SANREM CRSP-WA

has introduced a new community-based institutional structure: the Natural Resource Management Advisory Committee (NRMAC). The entry of the SANREM CRSP-WA coincided with the devolution of authority for NRM to the newly decentralized government structures, the Rural Communes, which have thereby become the focal unit for project interventions. The NRMAC bridges the rural knowledge divide by linking civil society with local government. Local leaders have been trained and in turn have become trainers in livestock and soil management decision making through the introduction of Holistic Management as a farmer/herder diagnostic and management tool, and the adaptive research approach. On the basis of this training, the NRMAC has defined a holistic vision for development of their community. They have also been trained in conflict resolution and community consensus building to assist in managing transformations of the production systems and mobilizing community action for an improved environment and NRM. We hope to soon demonstrate a method for community controlled open range rotational grazing. The NRMAC also bridges the gap between technical specialists and the community and serves as a mechanism for community consensus building, conflict resolution, mobilization, and information exchange. Technical insights gained through data collection and modeling efforts are shared with the community through the NRMAC.

3. Impacts

Despite its short history, SANREM-WA can point with pride to significant project impacts. Impacts are monitored during routine visits to the Commune of Madiama as well as through follow-up household and leadership surveys at the end of Phase II. The most important impacts of SANREM-WA have been social and institutional. The NRMAC is building social capital within the community and the region. In one of its first initiatives, the committee organized and implemented the Mayor's campaign for protection of the *acacia albida*, a nitrogen-fixing tree native to the Sahel, thereby directly impacting soil fertility and productivity. More importantly, the NRMAC has improved social relations between villages and ethnic groups within the commune. There have been no conflicts in the commune since the committee has been established and on the one occasion where a herd entered the commune before the prearranged date, a flare up was averted through an extensive negotiation process learned in the project training and workshop sessions. The Sous-Prefet, responsible for several communes in the region is quite pleased

that he no longer has to concern himself with problems in Madiama because the community appears to have developed the skills necessary to resolve their own conflicts. The NRMAC is also orchestrating the establishment of inter-village accords for management of wetlands (bourgoutiere) and for open-range rotational grazing.

The database and modeling efforts have also been very important to the success of the project. The CropSyst Model and the Social Accounting Matrix (SAM) are providing decision-making information to researchers at the regional level as well as local leaders at the commune level. For example, the results of the SAM have indicated the relatively disadvantaged nature of the transhumant group, and the need to consider their welfare separately in policy planning and economic development activities.

There are several benefits to the U.S. from this project. Most generally, the increase in nutrition and income levels and the reduction in conflict that this project is designed to bring about, will contribute to a more prosperous and peaceful world that will benefit every nation - the U.S., not least among them. More directly, the Holistic Management and conflict management trainers who work in West Africa also work toward the same ends here in the United States, among ranchers and Native Americans, for example. There are important common elements in natural resource and conflict management around the world and as the trainers refine their techniques in Mali, they also become more effective in the U.S. Professionally, the U.S. based researchers are learning about social and environmental conditions in other parts of the world and the ways in which people

adapt to them. The broader result is that they are more informed citizens themselves and better able to educate others back home, particularly in the classroom. The more specific outcome is that the researchers' technical knowledge and experience becomes stronger when also applied to solving problems outside the U.S., thereby maintaining the high level of professional capacity for which U.S. universities are known.

4. Dissemination

There are several mechanisms by which SANREM CRSP-WA research accomplishments are shared with host country partners and beyond. The primary mechanism is the NRMAC which is composed of representatives from all 10 villages of Madiama. Meetings and workshops held with the NRMAC to communicate and discuss findings, transfer skills, or plan interventions are retransmitted to each village in the commune. Results from adaptive research in the community are quickly disseminated among villagers long before findings are fully analyzed and documented by researchers. Committee members have also shared their experiences with the wider region through participation in local radio programs that discuss natural resource management issues. The use of the NRMAC as both implementing partner and disseminator of research accomplishments is the surest and most effective mechanism for disseminating SANREM CRSP-WA information. This mechanism ensures information gets to those who need it and is presented in a language that is fully understood and trusted by the user.

Our collaborators at the *Institut d'economie Rurale* (IER) transfer our research accomplishments to the broader host country user community through annual regional and national user group meetings (involving other government services, NGO's and farmer representatives) where research activities are reported and discussed. CARE/Djenne also shares our research accomplishments within their office as well as with other CARE/Mali sites around the country.

During routine visits to Mali and Madiama, U.S. scientists meet with local authorities, IER, the Institut du Sahel (INSAH) and USAID to share SANREM CRSP-WA research accomplishments as well as learn about what they have heard of the project. In addition, each year, SANREM CRSP-WA collaborators participate in a regional workshop to share research



accomplishments with counterparts throughout West Africa.

5. Training and Institutional Strengthening

Perhaps the most significant contribution to human capacity development during Phase II has been the development of conflict management skills among NRMAC members, IER researchers, and CARE/Mali collaborators. This has certainly been the showcased component of the institutional strengthening of the NRMAC, but committee members have also benefited from training in functional literacy and numeracy, financial management, democratization and decentralization, and NRM legislation. This training has developed a cadre of confident community leaders prepared to address NRM issues affecting the commune. NRMAC and community members, local officials, and service providers have been trained in Holistic Management which has helped them to diagnose NRM problems and plan for changes in management practices. This training has targeted the development of management principles and skills for conducting a community-wide program of open range rotational grazing.

Our long-term training program has contributed to the pool of trained African agriculture and NRM researchers. We have placed an agricultural economist with a Masters' Degree (Virginia Tech, 2000) in Burkina Faso's national agricultural research institute (INERA). He is currently applying to a Ph.D. program at the University of Wageningen in The Netherlands where he plans to continue his work in Madiama. In addition, we currently have a North African Ph.D. student engaged in pasture management research within the commune. The agro-economist at IER is enrolling in a Ph.D. program at the University of Mali and SANREM CRSP-WA



carbon-sequestration project, IER personnel are also receiving training in GIS methods and applications at Agrhymet. SANREM CRSP-WA has also helped in the reinforcement of the CRRA (Regional Agriculture Research Center)/Mopti in the transparent management of a complex, inter-institutional collaborative research projects. This has been assisted by the introduction of email connectivity for center researchers.

6. Collaborative Relationships

The SANREM CRSP-WA Project is a collaborative effort between U.S. based scientists, Malian researchers and NGO staff, and the Commune of Madiama. After a regional level survey of NRM and conflict resolution stakeholders led by Virginia Tech. These collaborative relationships developed following the PLLA that was conducted in early 1999 by researchers from Virginia Tech and Washington State with assistance from SANREM colleagues at the University of Georgia. The PLLA Teams included 4 U.S. scientists, 5 Malian scientists from IER, a USAID representative and a representative of the NGO community.

By October 1999, the newly elected Mayor of Madiama Commune and his staff, and the newly formed NRMAC joined in these collaborative relations. IER scientists played a major role in facilitating the formation of the NRMAC. Once the NRMAC was formed, trainers from the U.S. based Center for Holistic Management became collaborators and assisted U.S. scientists, IER researchers, CARE/Djenne staff, local officials and service providers in developing a holistic vision for natural resource management and decision tools to achieve this vision. This led to the formulation and approbation by the NRMAC of a holistic goal for natural resource management in the Commune of Madiama.

The detailed research agenda addressing technology testing and transfer was initiated by the NRMAC (at the request of IER and VT (Virginia Polytechnic and State University)) through their prioritization of village level concerns. All collaborating partners joined in January 2000 to define the SANREM CRSP-WA research program and institutional development program. CARE/Mali, through its local office in Djenne, joined the team in May 2000 as the lead partner in the

SANREM PI Dr. Ozzie Abaye discusses grazing experiment with collaborators



provision of training for the institutional development of the NRMAC.

Annual project planning is initiated by IER and CARE/Djenne in collaboration with the NRMAC. U.S. scientists then translate these plans and transform them into a finalized Annual Work Plan. Activity implementation occurs most often in joint activities between U.S. and Malian scientists, with IER scientists and technicians conducting the monitoring and follow-up. After design work is completed, surveys are implemented by IER scientists. Initial data analyses and report drafts are prepared by IER scientists and then reviewed and revised in collaboration with U.S. scientists. Detailed model construction and testing has been initiated by U.S. based scientists and shared with Malian researchers through hands-on working sessions. Malian scientists and US scientists jointly present research results to the NRMAC.

Links between the NRMAC and regional government are also maintained through SANREM-WA. The newly elected Mayor and Madiama Commune Council have not only been an important target and beneficiary of SANREM CRSP-WA activities, but intimately involved in the development and evolution of the NRMAC. The NRMAC has kept them duly informed of their activities and been assigned a leadership role in the NRM initiatives by the Mayor and Council.

INSAH and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) have followed SANREM CRSP-WA activities with interest, as have researchers and NGO's from other West African

countries through annual reporting at NRM Inter-CRSP meetings and other regional venues.

7. Leveraged funding external to USAID

SANREM CRSP-WA has leveraged additional funding for research at the Madiama site through the NASA Carbon from Communities Project which has supported additional research in Years 4 and 5 and will extend into

Phase III. The Carbon from Communities Project will examine the potential of holistic management of rangeland strategies to sequester carbon in the soils of West Africa.

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WAF-01

Coordination and Management of West Africa Regional SANREM Project

Principal
Investigator
S. K. DeDatta

Co-Principal
Investigator
Michael Bertelsen

OBJECTIVE 1

Provide leadership for regional project development and implementation.

Annual Achievements

The study tour of 4 NRMAC members and 2 CRRA/Mopti researchers to Chad in September has resulted in PPPOA training activities in October and March in preparation for the open-range rotational grazing program to begin during the coming year. This activity integrates NRMAC appropriation of the Holistic Management with applied research on village and inter-village level management of their open-range resources.

In addition, we drafted and shared with USAID and our partners in Mali a briefing paper on expanding decentralized participatory NRM decision making. Data exchanges with Texas A&M are being arranged. The SANREM CRSP-West Africa Project Co-Manager has made three site visits to Mali (June, October, March) assuring the fully integrated development and implementation of project activities.

The complementary NASA-funded Carbon for Communities project in collaboration with the Soil Management CRSP has been initiated and will monitor the open-range grazing rotational study.

OBJECTIVE 2

Coordinate program development among U.S. and international collaborators.

Annual Achievements

Program activities are being increasingly integrated. Data on water points through the Commune of Madiama have been collected and geo-referenced in conjunction with research on soil fertility perceptions.

Pasture use studies of herding practices are being integrated with geo-referenced land use/cover mapping and improved forage experimentation. Soil fertility mapping is being integrated with climatic models. Much of this work was presented during the SANREM Research Synthesis Conference. Program activities are increasingly integrated across activities and a re-budgeting of program funds is being made to streamline implementation.

OBJECTIVE 3

Coordinate financial and programmatic reporting of regional activities.

Annual Achievements

The SANREM CRSP-West Africa Project Manager and Co-Manager have provided leadership and routine backstopping as well as conducted three site visits to SANREM CRSP-West Africa partners in Mali during June, October, and March. During these visits, Moore met with USAID officials to apprise them of project progress and provide SANREM CRSP-West Africa inputs for the development of USAID/Mali's Country Strategic Plan for 2003-2012.

Stress on timely and complete financial reporting is improving the timeliness of programmed activities.

The SANREM CRSP-West Africa bibliographic data base has been updated and its web site promoted to a wide clientele of West African development specialists and researchers. All reports have been submitted in a timely fashion.

Advances

in Capacity Buildup - Through the study tour to visit the PPPOA site in Chad and subsequent training sessions on open-range rotational grazing, NRMAC members, CRRRA/Mopti researchers, and village level monitors are learning more about their resources and their mutually supportive roles in the sustainable management of their natural resources.

in Scaling Up - NRMAC members have been spreading the word about Holistic Management and their roles at the Commune level to improve NRM through region-wide radio emissions.

in Improved Environment and Natural Resource Management - Increased local knowledge and understanding of biophysical and socioeconomic processes are assisting the NRMAC to provide leadership throughout the commune in promoting NRM activities.

Other Major Outputs in this Period

Working Paper

Ampagoomian, C. and K. Moore. *Linking with SANREM CRSP-West Africa Annotated Bibliographic Database Users*. Office of International Research and Development, Virginia Polytechnic Institute and State University. Working Paper No. 01-05.

Tools

Bertelsen, M., P. Wyeth, and K. Moore. 2002. *Sustainable Agriculture and Natural Resource Management (SANREM) at the Commune Level: A Briefing Paper for Expanding Decentralized Participatory Natural Resource Management Decision Making*. Briefing Paper.

Training Degree

Name, Level, Start Date-Completion Date

Todd Crane, Ph.D. 2001-

SANREM CRSP

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

June 2002
Annual Report
WAF-05

Workshop on Conflict and NRM: Emerging Lessons and Directions from West Africa

Principal Investigator
Michael Bertelsen

Co-Principal Investigator
Keith Moore

OBJECTIVE 1

Review the present (annual) state and progress of strategies to deal with conflict and NRM in agro-pastoral systems in order to coordinate research with other related ongoing activities in the region.

Annual Achievements

During the past year, two presentations on SANREM-West Africa progress were made to the NRM Research Pole Coordinating Committee. An August meeting was held in Banjul, The Gambia, and a March meeting in Nouakchott, Mauritania. The meetings included national NRM coordinators from all nine Sahelian countries, CIRAD (Centre de cooperation internationale en recherche agronomique pour le developement), ICRI-SAT, ICRAF, and INSAH.

Advances

in Research - We are maintaining contact with research partners in the West Africa Region and will take the opportunity to assure maximum exposure for SANREM CRSP West Africa research and policy achievements at all convenient fora in the region.

in Scaling Up - The carbon sequestration focus of the project in the next phase has generated a great deal of interest among the Pole countries. In particular, the synergy between the pasture management component of the SANREM WAF/NASA carbon project and a potentially new Pole thematic thrust in carbon sequestration in parklands agriculture was discussed. It was decided

to form a study group to investigate the possibility of supporting such a new thematic program under the regional coordination of the Pole.

in Policy Impact - Although each country in the Sahel has its own particular platform to facilitate NRM policy dialog with national decision makers, the individual NARS play a crucial role in every country. Because the NRM Research Pole reports directly to the regional organization of the NARS Directors General and its representatives are national NRM coordinators, the Pole is well placed to support policy dialog at both the national and regional levels.

Other Major Outputs this Period

Publications

Book Chapters

Cisse, S. 2002. *Apercu sur les systemes de production du delta interieur du Niger*. Gestion des ressources et aménagement du fleuve Niger: Des connaissances scientifiques pour la decisions publiques. IRD, Paris.

Conference Presentations

Bingham, S. 2001. *Holistic Management: The Promise and Prejudice of a Paradigm*. In Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA.

Cisse, S. 2002. *Le Joros: une institution de gestion de ressources naturelles renouvelables: histoire, status et role.*

Cisse, S., A. Toure, and K. Moore 2001. *Village Dialogues in the Process of Planning for the Management of Bourgoutiere Regeneration: Lessons and Challenges.* In Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA.

Goebel, J. 2001. *From Conflict to Consensus: A Catalyst for Healthy Human, Economic and Ecologic Conditions.* In Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA.

SANREM CRSP

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

June 2002
Annual Report
WAF-06

Creation and Support of a Commune-Level NRM Advisory Committee

Principal Investigator
Salmana Cisse

Co-Principal Investigator
Abdoulaye Toure

OBJECTIVE 1

Reinforcement of the institutional capacity of the NRMAC through training in functional literacy and numeracy, financial management and strategic planning.

Annual Achievements

The NRMAC has drafted and approved its by-laws and obtained administrative recognition of the Governmental Delegate (Prefet) for the Cercle of Djenne. CARE/Djenne has provided training to the committee members in the codes, laws, and practices necessary to implement decentralization in Mali. This material has had a particular emphasis on NRM codes and laws. The NRMAC has also begun mobilizing internal resources through membership cards and fees, and external resources through project design and preparation assistance targeting the new PASAOP (World Bank). On the basis of CARE's Democracy and Governance scale of indicators, the NRMAC has made marked improvement since last year, particularly concerning women's leadership, partnership development, and self-governance.

OBJECTIVE 2

Reinforcement of the NRMAC capacities in Holistic Management of natural resources.

Annual Achievements

Local agreements on the principles and practices necessary for bourgoutiere regeneration, conservation and management were established for two bourgoutieres. Bourgou regeneration did not progress as well as planned due to the force of the initial rains which washed the seeds into the depths of the ponds. Sprouting was weak. Replanting will

be necessary, possibly using animal impact. Soil fertility monitoring and evaluation has been advanced with the research on local soil fertility perceptions. NRMAC members have communicated with their constituents not only through village meetings, but also through radio programs where men and women members discussed NRM, Holistic Management, the formation and role of the NRMAC, conflict resolution, and the experience of the team who visited the PPPOA range management site in Chad.

OBJECTIVE 3

Increasing member's capacities to manage conflict situations involving natural resources.

Annual Achievements

Additional training in conflict management has increased and disseminated skills in the management of conflict situations. One training workshop focused on the management of power targeting NRMAC members and some of the Mayor's staff. More importantly, committee members organized and conducted a training program in conflict resolution pertaining to bourgoutiere management in one of the targeted villages under the supervision of the conflict management and holistic management training experts. To date a total of 4 villages have received a training module in conflict resolution. In addition, a potential conflict due to the early entry of herds into Madiama pasturelands was averted through intervention of NRMAC members.

Advances

in Research - Few results have been formally documented to date. The NRMAC is still early in its learning curve and survey data to mea-

sure skills and impact will not be collected until the coming year.

in Capacity Buildup - NRMAC members and villagers with whom they work have applied their skills in consensus building through the negotiation of two bourgoutiere management agreements. Several members also helped avert a conflict due to the early entry of herds into Madiama pasturelands. NRMAC leaders are developing skills as conflict resolution trainers and have conducted conflict resolution training workshops in four villages.

in Scaling Up - Work still needs to be done to further improve the inclusion of transhumant stakeholders in bourgoutiere and open-range management. Nevertheless, NRMAC members are communicating with a multi-commune audience during their radio emissions and promoting the lessons they have learned through Holistic Management and Conflict Resolution training and the negotiation of local agreements concerning the management of specific resources.

in Policy Impact - The NRMAC has drafted and approved its by-laws and obtained administrative recognition of the Governmental Delegate (Prefet) for the Cercle of Djenne.

in Improved Environment and Natural Resource Management - The partnership between the NRMAC and the Rural Council has re-dynamized and strengthened protection for the acacia albida. The knowledge of NRM codes and laws and their network of members throughout the villages has allowed the NRMAC to increase information flow and to monitor the protection of the acacia albida. Locals have remarked about the lower levels of NRM conflict during the past year.

Publications

Book Chapters

Cisse, S. 2002. *Aperçu sur les systemes de production du delta interieur du Niger*. Gestion des ressources et aménagement du fleuve Niger: Des connaissances scientifiques pour la decisions publiques. IRD, Paris.

Other Major Outputs in this Period

Conference Presentations

Bingham, S. 2001. *Holistic Management: The Promise and Prejudice of a Paradigm*. Proc.

Research Synthesis Conference, SANREM CRSP, Athens, GA. November 28-30.

Cisse, S. 2002. *Le Joros: une institution de gestion de ressources naturelles renouvelables: histoire, status et role*.

Cisse, S., A. Toure, and K. Moore 2001. *Village Dialogues in the Process of Planning for the Management of Bourgoutiere Regeneration: Lessons and Challenges*. Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA. Noveber 28-30.

Goebel, J. 2001. *From Conflict to Consensus: A Catalyst for Healthy Human, Economic and Ecologic Conditions*. Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA. November 28-30.

Training Non Degree

Workshop

Decentralization was attended by 22 person(s) and lasted 5 days day(s).

Managing Power was attended by 20 person(s) and lasted 2 days day(s).

Conflict Resolution was attended by 44 person(s) and lasted 3 days day(s).

NRM Legislation was attended by 28 person(s) and lasted 2 day(s).

Open-Range Rotational Grazing was attended by 24 person(s) and lasted 8 day(s).

SANREM CRSP

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

June 2002
Annual Report
WAF-07

Development of Methods and Tools for Evaluation and Decision Making

Principal Investigator
Oumarou Badini

Co-Principal Investigator
Charlene Brewster

OBJECTIVE 1

Establish a multi-year database for crops, soils, weather and management technologies for modeling and evaluating the impacts of NRM practices on productivity and the environmental sustainability.

Annual Achievements

Data entry for the 2001-02 rainy season has been completed and integrated in the multi-year database (1999-00 & 2000-0). For the past year data were collected at 55 sites (including 18 soil fertility management tests sites). The database covers 2 millet local cultivars (Boanin growth cycle about 120 days and Tassoumani with a cycle of about 70 days), 3 sorghum cultivars (N'guegne-fin about 95 days, N'guegne-blen about 120 days, and Tassoumani with a cycle of about 70 days). A total of 5 rice cultivars are cultivated. They are Kaou (160 days), DM-16 and BG (140 days), Gambiaka (120 days) and Aliba (90 days).

Parameters were derived for biophysical modeling and characterization activities. Also, a report on existing cropping and management systems is in preparation.

Total rainfall for the past year for most of the commune was one of the highest for the last 10 years. It varied from 466 mm in 28 days at Teguegne to 793 mm in 49 days at Torokoro. The average of the year 2001 for the whole commune is 636 mm in 35 days. The average for the previous three decades was around 480 mm. Data for a total of 145 water points were collected throughout the commune. Included in this database are geographical co-

ordinates, type of water source, depth, quality, accessibility, utility, etc.).

Work is proceeding to integrate the identified 145 water points into a GIS system together with other biophysical and socio-economic infrastructures of the commune.

This database, combined with figures on population and spatial distribution of villages in the commune, will help ensure better planning and management of water resources in the commune.

OBJECTIVE 2

Create cartographic and geographic information systems (GIS) for the commune of Madiama from remotely sensed data for more refined planning and a geographic representation of natural resources.

Annual Achievements

A final soil map has been produced and will be published together with the soil survey once results from the local knowledge of soils have been integrated. A technical soil survey report has been produced. Preliminary land use survey and mapping has taken place under the leadership of Virginia Tech. The GIS support integrating soils, land uses and socio-economic infrastructures is being constructed. The thematic maps from this GIS work together with the simulation outputs will facilitate discussions with stakeholders. A planned GIS training of nationals from Mali is imminent. This training is related to the recently

awarded NASA grant to assess carbon sequestration and land use management technologies. The thematic maps from this GIS work together with the simulation outputs will facilitate discussions with stakeholders.

OBJECTIVE 3

Development of biophysical modeling techniques to monitor and evaluate the biophysical performance of existing and alternative natural resource management technologies and practices.

Annual Achievements

Analysis of rainfall records and predictive information combined with GIS and biophysical modeling of soil water balance and crop production functions allowed us to assess the growth potential of some crops and management systems in Madiama commune. Crop water stress, crop yields as well as overall stress indices in reference to yield potential permitted by different soils under low and optimum nitrogen input levels have been simulated and mapped to illustrate how this approach could improve advisors and managers' decision making in the study area. Simulation work is also underway to evaluate the sustainability and suitability of main crops and technologies to the environment in Madiama.

OBJECTIVE 4

Development of tools to monitor and evaluate the social and economic viability of current and alternative soil and pasture management practices.

Annual Achievements

Additional market data from the commune was collected and the SAM methodology was refined further (with additional work on multiplier decomposition by Daniel Kabore). The initial results from compiling a Social Accounting Matrix (SAM) were reported earlier and these clearly demonstrated that transhumants are the least favored of the occupational groups, so that any development interventions should address this group separately. For the new analysis, the SAM was disaggregated further and decomposed multipliers computed. Three groups of decomposed multipliers are computed - direct effect, open loop and closed loop multipliers. The process of decomposition separates the impact of interactions among production activities from that due to interactions among socio-economic groups. These latter interdependencies are important to understand in a commune where rivalry among groups for resources is strong.

An analysis of production and sales activity demonstrated the relatively closed nature of the commune i.e. the tradable sector is relatively small compared to the non-tradable sector. Impacts from exogenous changes in demand for the commune's agricultural and livestock production, as measured by multipliers, will be shared differentially among socioeconomic groups with the transhumant group always benefiting least. This reinforces earlier conclusions that interventions need to specifically target this group. Decomposing multipliers provides decision makers with additional information on the potential impact of measures taken to stimulate economic growth. Direct effect, open loop, and closed loop multipliers enable the tracing of impact information throughout the entire economy. The analysis has demonstrated the importance of stimulating the tradable sectors within both agriculture and livestock. Interventions stimulating growth in the livestock sector are especially important. Such growth will directly provide the largest impact for all socioeconomic groups, especially the diversified agropastoralist and sedentary pastoralist groups. Growth strategies directed solely toward microenterprise development are possibly misguided: there appears to be little potential to stimulate broader growth within the commune since most microenterprise activities are non-tradable.

OBJECTIVE 5

Transfer evaluation tools including models, methods and skills to IER and other regional partners.

Annual Achievements

Training of field agents in data collection and field area measurement and monitoring has taken place. Training in the construction and implementation of CropSyst model planned for the current period has not taken place and has been rescheduled for the next period. Integration of database, modeling outputs, maps and GIS is underway and will be used as training and transfer materials for the biophysical work. Hands-on training of the agro-economist at IER in development and use of SAM models for community policy analysis has taken place through informal sessions between VT and WSU (Washington State University) economists and the economics personnel at IER/Mopti. Data is being collected by IER/Mopti for continuous updating of the SAM model, thereby ensuring sustainability of economics efforts in this realm.

In June 2002, meetings were held with IER personnel (the Director-General and Scientific director) to discuss the results of the SAM analysis. Similar meetings

were held with IER researchers and the SAM methodology and implications of the results discussed. After this, researchers (VT/WSU/IER) met with the NRM Advisory Committee in Madiama to talk about the findings of the study and the implications for community economic development.

Advances

in Research - Knowledge of weather characteristics, soils, crops and cropping systems of the study region has been improved as a consequence of the biophysical database and modeling and survey work. Field measurement, modeling and mapping allowed the analysis of soil potential and erosion rates products and increased the people awareness about the limitations and potential of their natural resources. Collaborative Research approaches and outputs fostered the capacity of local research partners to generate information from data and facilitated discussions with community members. GIS is being developed and colored maps produced to facilitate discussions and linkage with farmers. The SAM analysis demonstrated the importance of stimulating growth in the tradable sectors within both agriculture and livestock. Growth strategies directed solely toward microenterprise development are possibly misguided: there appears to be little potential to stimulate broader growth within the commune since most microenterprise activities are non-tradable. The process of multiplier decomposition permits an understanding of interactions among production activities and among socio-economic groups. These latter interdependencies are important to understand in a commune such as where rivalry among groups for resources is strong.

in Capacity Buildup - IER researchers have a fuller understanding and ability to use economic modeling tools such as the SAM through our collaborative efforts. Community members through the NRMAC, have an increased understanding of the economic interactions between various occupational groups, and how income changes can trickle through the entire community and affect all members beneficially, in addition to those receiving direct benefits.

in Scaling Up - Meetings were held with IER researchers and national level administrators on the use of and implications of results of the Social Accounting Matrices developed for Madiama.

in Policy Impact - The SAM results suggest directions for future research and policy interventions. For example, research efforts may need to be targeted spe-

cifically towards transhumants for them to achieve the potential benefits of other groups.

Other Major Outputs this Period

Annual Report

Badini O., P. Wyeth, M. Toure, D. Lassana and M. Bertelsen. 2001. *Pps 86-90 in Innovative Research for Sustainable Agriculture and Natural Resources. SANREM CRSP 2000-2001 Annual Report. Development of Methods and Tools for Evaluation and Decision Making.*

Badini O., C. Brewster, P. Wyeth, M. Toure and M. Bertelsen. 2002. *Pps. 104-107 in On the Path Towards Sustainability SANREM CRSP Annual Report 2001-2002. Development of Methods and Tools for Evaluation and Decision Making.*

Briefs

Badini, O. 2002. *Rainfall Risk and "Response Farming": Using Rainfall Analysis, Simulation Modeling and GIS to Improve Agricultural Decisions in Mali.* SANREM CRSP Research Brief No. 12.

Conference Presentations

Badini, O. and L. Dioni. 2001. *Application of Rainfall Analysis, Biophysical Modeling and GIS to Agroclimatic Decision Support in Madiama Commune, Mali.* SANREM Scientific Conference. Athens, GA. November 28-30.

Brewster, C., D. Kabore, M. Bertelsen, and P. Wyeth. 2001. *Economic Interdependence Among Socio-Economic Groups in Madiama Commune of the Niger Delta of Mali.* SANREM CRSP, University of Georgia, Athens, GA. November 28-30.

Heatwole C., M. Bertelsen, K. Moore, and O. Badini. 2001. *Multi-temporal classification of land cover using Landsat7 imagery in Madiama, Mali.* Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA. November 28-30.

Rupp, R., B. Frazier, O. Badini and L. Dioni. 2001. *Landsat 7 Imagery for Community-Based Soil Mapping in Madiama Commune, MALI.* Soil Science Society Meeting in Charlotte, NC. October 21-25.

Research Reports

Badini, O. and L. Dioni. 2001. *Etude Morpho-Pedologique et Cartographie de la Commune de Madiama, Cercle de Djenne, Mali*. Working Paper No.01-04. Office of International Research and Development, Virginia Tech, Blacksburg, VA.

Brewster, C., D. Kabore, M. Bertelsen, and P. Wyeth. 2001. *Economic Interdependence Among Socio-Economic Groups in Madiama Commune of the Niger Delta of Mali*. SANREM CRSP, University of Georgia, Athens, GA.

Working Paper

Badini, O. 2001. *Agro-Climatic Assessment (Description and Analysis) of Madiama Commune in Mopti Region, Mali (West Africa)*.

Badini, O. 2001. *Biophysical Research Highlights and Preliminary Simulation Modeling Runs in Madiama Commune*. In Contribution to the Evaluation and Planning Meeting of SANREM West Africa - February 2001. Mopti, Mali (West Africa).

Badini, O. and L. Dioni. 2001. *Etude Morpho-Pedologique et cartographie de la Commune de Madiama, Cercle de Djenne, Mali*. Working Paper No.01-04. Office of Internatioanl Research and Development. Virginia Tech, Blacksburg, VA.

SANREM CRSP

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

June 2002
Annual Report
WAF-08

Farmers' Decision Making Aides for Improved Soil Fertility Management

Principal Investigator
Boureima Traore

Co-Principal Investigator
Oumarou Badini

OBJECTIVE 1

Document the state of the art concerning existing and newly introduced cultural practices

Annual Achievements

The bibliographic synthesis of the state of the art of soil and water conservation technologies documented for Mali and the Sahel has been completed.

OBJECTIVE 2

Development of improved technologies for improvement in soil fertility.

Annual Achievements

Results of the farmer field tests (on millet and sorghum) for improved soil fertility management demonstrated that stabling of livestock is a potential holistic solution to increasing soil fertility. Optimum benefits can be achieved at about five tons/hectare. Use of inorganic fertilizers (rock phosphate (PNT) and microdoses of 15/15/15) and crop rotations to increase land productivity were also significant and a good substitute for livestock stabling. The tests with microdoses and the PNT will be continued over three years for a larger number of farmers with the application of the DAP.

OBJECTIVE 3

Reinforce local capacity to apply the Holistic Management model in the monitoring and evaluation of soil fertility improving technologies.

Annual Achievements

Initial discussions on Holistic Management monitoring and evaluation of soil fertility were conducted with NRMAC members before the

growing season began and a number of evaluation criteria identified. When the field trials were established, farmer collaborators participated in a two-day training program on the various soil fertility enhancing techniques. At the outset of the on-farm trials, farmers and researchers discussed each field test and demonstration so that farmers would understand what the experiment was supposed to demonstrate and how progress is measured (development of indicators). As the season progressed, farmers and technicians monitored both crop and demonstration developments in anticipation of a review and evaluation of each experiment at the end of the season. At the end of the season, farmers, researchers and NRMAC members evaluated the experiments and decided on a plan for next year.

Advances

in Research - Use of inorganic fertilizers (rock phosphate (PNT) and microdoses of 15/15/15) and crop rotations to increase land productivity were also significant and a good substitute for livestock stabling. The tests with microdoses and the PNT will be continued over three years for a larger number of farmers with the application of the DAP.

in Capacity Buildup - Farmers are becoming familiar with fertilizer application alternatives (including PNT, micro-dosing, organic fertilizer interactions) and, based on their monitoring of the on-farm trials, have contributed to the design of the coming years on-farm trials.

in Scaling Up - Another year or two of data will need to be collected before the NRMAC will push the expansion of a particular soil fertility technology.

in Improved Environment and Natural Resource Management - These on-farm trials are providing a range of alternatives to farmers to improve the fertility of their soil.

Other Major Outputs in this Period

Annual Report

Badini, O., B. Traore and O. Samake 2001. *Farmers' Decision Making Aides for Improved Soil Fertility Management*. Innovative Research for Sustainable Agriculture and Natural Resources. SANREM CRSP 2000 Annual Report.

Briefs

Crane, T. 2002. *Ethnopedology in the Malian Sahel: Soil Classifications and Conceptions of Fertility*. SANREM CRSP Research Brief No. 11.

Conference Presentations

Traore, B., O. Samake, and O. Badini. 2001. *Combining Regional Experience and Holistic Management to Search for Alternatives for Improving Soil Fertility in the Commune of Madiama*. In Proc. Research Synthesis Conference, SANREM CRSP, Athens, GA. November 28-30.

Research Reports

Traore, B. 2002. *Amelioration des rendements mil et sorgho avec reduction de la quantite d' engrais mineraux dans le commune rurale de madiama (microdose)*.

Traore, B. 2002. *Parcage de petits ruminants au champ et amendements des sols dans le Delta du fleuve Niger au Mali*.

Traore, B. 2002. *Parcage de bovins au champ et amendements des sols dans le Delta du fleuve Niger au Mali*.

Traore, B. 2002. *Amendements des sols sableux par le fumier de parc et le phosphate naturel (PNT) de Tilemsi dans la Commune Rurale de Madiama*.

Traore, B. 2002. *Conditionnement des sols sableux par la fumure organique sur la culture de mil dans la Commune Rurale de Madiama*.

Traore, B. 2002. *Contribution des Niebe et du phosphate naturel de Tilemsi dans les systemes de rotation avec le mil sur les sols sableux du delta central du fleuve Niger au Mali*.

Traore, B. 2002. *Le Niebe dans les systemes de rotation et d'association des cultures a base de mil dans la commune rurale de Madiama en zone Sahelienne au Mali*.

Traore, B. 2002. *Techniques de conservation et d'amelioration de la fertilité des terres cultivees en zone sahelienne au Mali*.

Technical Guides

Samake, O. 2002. *Technique de lutte contre le striga hermonthica par l'association des culture mil/sorgho avec le niebe*.

Working Paper

Traore, B. 2002. *Techniques de conservation et d'amelioration de la fertilité des terres cultivees en zone sahelienne au Mali*.

Training Non Degree

Workshop

Monitoring was attended by 19 person(s) and lasted 1 day day(s).

SANREM CRSP

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

June 2002
Annual Report
WAF-09

Community Decision Making Aides for Improved Pasture Lands

Principal Investigator
Ozzie Abaye

Co-Principal Investigator
Amadou Kodio

OBJECTIVE 1

Determine the quantity and quality of forage resources in the Commune of Madiama

Annual Achievements

In 2001, botanical composition, forage biomass and ground cover were evaluated at two locations (within the fenced and non fenced areas) within the Madiama commune. The area outside of fence was grazed both by local and transhumant animals. Generally, this preliminary study showed fewer legume components compared with grasses and other weedy forbs. In the fenced area, the percentage of grasses was 72%, with a dominance of *Panicum laetum* and *Schoenfeldia gracilis*, while legumes accounted for 27%. In the non-fenced areas, the percentage of grasses was slightly higher than the fenced areas, while percentage of legumes was lower (18%). This suggests that there is a high probability that through controlled grazing the relative abundance of legumes can be improved. In 2002 and 2003, these preliminary findings will be further evaluated by both the local researchers and their USA collaborators.

Additional ground truthing data have been collected and areal photographs from EROS (Earth Resources Observation Systems) Data Center are being used as a basis for satellite image classification. This is yielding a rich database. More ground truthing is needed to classify the nine primary pockets of pastureland in the commune with respect to distinguishing between recoverable and unrecoverable barren lands.

OBJECTIVE 2

Describe and analyze the socioeconomic characteristics of pastoral and agro-pastoral systems of the commune.

Annual Achievements

The preliminary studies in the Madiama commune showed that livestock management plays an important role in both forage species diversity and biomass, which in turn affects livestock production. The survival of the local population, during the various transitional periods of agricultural practices (row cropping, pasturing, transhumance. . .), is a function of the availability of feed resources for the livestock. This is especially crucial during row crop establishment, which is roughly in June/July depending on the arrival of the first rainfall, and the beginning of the crop harvest, sometime the end of October/early November. The conflicts among the villagers within the commune are mainly due to lack of forages (the carrying capacity of the pastures is only 0.3 AU/ha/an), as well as land and institutional problems in the use of shared natural resources. Our initial data indicated that only a fraction of the livestock (bovine, sheep and goats) are kept all year in the Madiama commune. The majority of the herd travels (transhumance) a few to several hundred kilometers away from the commune. The primary purpose of the animal movement being the opportunistic optimization of pasture/forage resources over the course the year in dryland pasture systems. The practice of transhumance is a solution as it offers a rational management of both herd and forage resources.

OBJECTIVE 3

Develop mechanisms for community-based management of Madiama's pastoral resources using the Holistic Management model.

Annual Achievements

Negotiations between stakeholders at two bourgou regeneration sites and training programs in the proper techniques for bourgou regeneration and management were conducted. As a consequence, bourgoutiere conservation and use agreements have been established by local committees for two sites. Bourgou establishment has not progressed as hoped for this year due to heavy early rains drowning the seed. A potential need for more holistic modification of the bourgou management sites to recreate the conditions for sustainable production is envisioned for the coming year.

Four NRMAC members and two IER researchers visited the World Bank-supported West African Pastoral Pilot Project (PPPOA) in Chad where they learned from project agents and community members how they had managed to improve their pasture grazing resources through Holistic Management practices. The tour participants held meetings with the full NRMAC, the Mayors Office, and other interested members of the Commune of Madiama after their return to describe what they had learned. They have identified and parceled off two village open-range sites to replicate rotational grazing in their own territories. Local monitors have been trained and this experiment in community-based pasture management will begin this year.

Preparations have also been made for the establishment of a dryland controlled grazing experiment at two locations within Madiama commune during the summer of 2002. The pasture sites were identified by villagers, IER Mopti researchers and U.S. cooperators after consultation with the NRMAC.

Advances

in Research - The working paper on the quantity and quality of forage resources and herd management practices was presented at the SANREM Conference (November 2001). The land use map is still being refined. More ground truthing is needed to properly distinguish fallow from currently cropped land and recoverable from unrecoverable barren lands.

in Capacity Buildup - Capacity of the NRMAC and villagers to sustainably manage their bourgou resources

has advanced with the negotiation and establishment of bourgoutiere management agreements. Furthermore, the committee has lined up stakeholder support throughout the commune for an open-range rotational grazing program which is being tested.

in Scaling Up - Bourgoutiere establishment did not occur this past year, so there is no basis at this time for scaling up. Re-establishment of the bourgou is on the agenda for this year.

in Policy Impact - No progress, see above

in Improved Environment and Natural Resource Management - The institutional components to support improved environment and NRM are being established. We are now awaiting biophysical successes to demonstrate the utility of the NRMAC.

Other Major Outputs in this Period

Publications

Book Chapters

Kodio, A. 2002. *Gestion des bourgoutieres dans la Delta Centrale du Niger*. Gestion des ressources et aménagement du fleuve Niger: Des connaissances scientifiques pour la decisions publiques. IRD, Paris.

Conference Presentations

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Training Degree

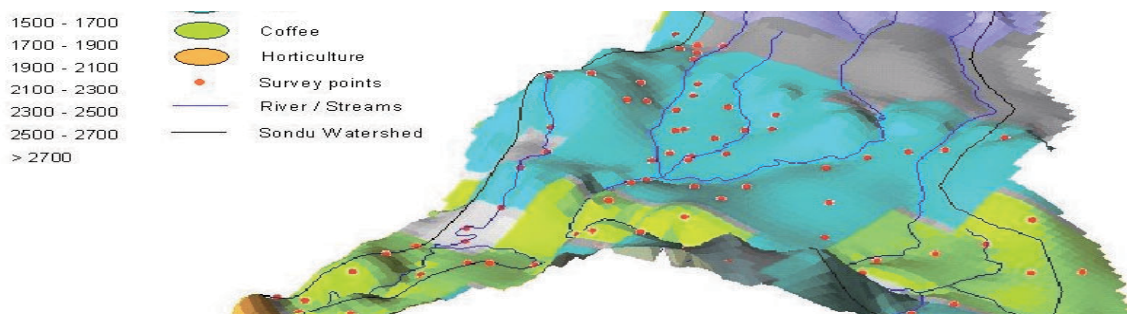
Name, Level, Start Date-Completion Date

Meriem El Hadj, Ph.D. 08/2001-

Training Non Degree

Workshop

Holistic Management of Pasture Lands was attended by 6 person(s) and lasted 10 days day(s).



SANREM Decision Support System Project Overview

1. Introduction

This section of the report provides a description of the most important products of the Decision Support System Project. The section is divided into two major parts. The first deals with methodological accomplishments. The second deals with the applications of these methods to a series of specific issues and questions that were identified by senior decision makers and research collaborators in the host countries where we worked. In this report, some of the accomplishments are listed by title only; a description of them may be found in the more complete report which is found at <http://cnrit.tamu.edu>. In this longer report, there are also appendices which further describe the dissemination and technology transfer that have occurred in this project.

2. Highlights of Accomplishments

2a. Protocol for the integrated decision support system methodology:

The integrated and interactive suite of models and related databases embodied in the DSS methodology required that special attention be devoted to the initial design of the protocol to have a fully functional final product. The protocol was instrumental in the development of the integrated suite of models. The approach has allowed us to extend the use of GIS methods coupled with a variety of analytical methods and has increased the utility of resulting models in conducting assessment of policy and technology options. We include the details of the protocol as an attachment to this report, because of its length. However, we have used the basic building blocks in the protocol as the organizational framework for the part of this report dealing with methodology as it appears to provide a logical framework and flow.

2b. Impact Assessment Definition:

- * Methods for acquisition of primary and secondary data to support biophysical and economic analysis
- * Databases acquired, developed, and/or modified as national and regional resources

One of the most important products being delivered as a result of this project is the set of calibrated, current, and organized information and data needed to use the DSS or to apply to many other analytic methods. The wide array of model runs and associated support data created during the analysis of cropping systems in the INSORMIL CRSP, PEANUT CRSP, small holder dairy technology, Sikasso intensification/extensification, and Rift Valley agricultural intensification technologies has allowed delivery of a comprehensive set of analytical tools and data. These are organized in a manner that allows analysis to be pursued by analysts interested in assessing the impact of agricultural and natural resource technologies and policies in the future. Data were also repackaged in spreadsheets interfaces where the large number of model runs were condensed into mathematical metamodels which were linked to pre-parameterized agricultural sector model (ASM) and farm level analysis model (FLAM) for Mali and Kenya reflecting the analysis for the intensification studies in Sikasso and Rift Valley, respectively.

2c. Spatial Characterization of Landscapes and Lifescapes (Livelihoods):

- * The Almanac Characterization Tool (ACT): Capturing spatial and tabular data for non-GIS users

The SANREM CRSP contributed to the continued development and deployment of the Almanac Character-

ization Tool (ACT) in partnership with USAID Office of Foreign Disaster Assistance, CIMMYT and the Global Livestock CRSP. This collaboration resulted in a comprehensive suite of GIS shapefiles of spatial and tabular data used in the impact analyses for Mali and the surrounding West Africa Sahelian countries as well as Kenya, Tanzania and Uganda and other countries in the Greater Horn of Africa. The software, data and training were provided to our partners in each country where impact analysis was conducted to allow them to explore the wide array of spatial relationships between biophysical and socio-economic data provided in each country's ACT. Design plans were implemented to determine how best to integrate the spatial nature of ACT with the model analytical capacity via the Common Modeling Environment.

* Geo-corrected weather data for systems analysis

* Methods for establishing the spatial framework for integrated analysis of impact

A spatially coherent sampling frame is needed in the DSS to allow for a representative sampling of villages and/or farms across a region, and to allow scaling to the appropriate levels. Sampling frames were developed that emphasized biophysical traits of the region such as soils, climate, and human population density rather than arbitrary political boundaries. This insured that the range of spatial differences that might influence farm yields and natural resource management across these regions was captured for both the economic and environmental components of the impact assessment. The primary steps in developing the spatial sampling frames are as follows:

1) Unique zones of similar climate and soils are defined for biophysical model simulations (simulation zones)

2) Simulation zones are weighted according to human population density with those having the highest population density receiving the greater weights.

3) Representative farms or villages are selected based on the proportional weights of population within the simulation zones.

4) Surveys and data gathering occur at each of the selected villages and/or farms.

5) Climate, soils, crop and livestock management data are catalogued and entered into the biophysical models for simulations

Simulation zones are developed using interpolated climate surface layer for the region of interest and the available soil data layer. A cluster analysis is performed on the climate grid to determine areas of similar climate (climatic clusters). A spatial cross-tabulation of the climatic cluster layer and the soil layer allows the identification of spatially explicit zones of similar soils and climatology (simulation zones).

Simulation zones can then be spatially cross-tabulated with population densities for the region to assist in selection of representative farms. This insures that selection is weighted more to areas having greater population density. Other spatial layers such as distance to primary roads, infrastructure, and land use also can be added into the cross-tabulation to refine farm selection. For example, in the impact assessment conducted in the Sikasso region of Mali, 56 simulation zones were identified. This spatial layer was then merged with the 1990 population density grid for the region (Figure 1). This allowed the delineation of 10 unique (or "best") simulation zones that represented 76% of the total land area and 80% of the population in the Sikasso region (Figure 1). These 10 simulation zones then served as the primary areas for selection of villages and farms to collect data for economic and biophysical modeling. Other spatial information was then introduced into the GIS to aid in village/farm selection to insure that villages selected were representative of rural agriculture villages. Characteristics such as infrastructure (schools, hospitals, markets) distance to roads, and distance to primary markets were included in the analysis. Villages having characteristics of a rural agriculture village were clustered, and two villages for each of the 10 simulation zones were randomly selected from the subset. These villages served as the areas where rapid appraisal surveys were conducted

This method provides an integrated and spatially referenced approach for a spatial framework to analyze new technology introductions and other agricultural policies. It spans multiple dimensions of natural resource management including watersheds, soils, and rangelands. It also has a varied scope that ranges from firm level analyses (farms) to higher levels such as the watershed, national, and global levels.

2d. Surveys and Data Gathering:

* Rapid Appraisal and Intensive Surveys

As part of the impact assessments conducted in both Mali and Kenya, a series of rapid appraisals and farm surveys were conducted to gather data for the DSS. Data obtained from these surveys provided baseline information for use in the subsequent case studies and provided the basis for further development and integration of the suite of models in the DSS. Rapid appraisal surveys were used to gather data from a large enough sample size to determine farm characteristics and modality (or representativeness). For example, in both the Sikasso region of Mali and the central Rift Valley in Kenya, approximately 100 farms were surveyed.

After rapid appraisal surveys are completed, a cluster analysis is conducted on a set of summarized variables to define farm types and locations of representative farms. For example, in the Sikasso region of Mali, cropland hectares, cotton hectares, cereal grain hectares, and number of bullocks were used in the cluster analysis. This resulted in the delineation of four farm types (clusters) (Figure 2). Within each farm type, farms having variables closest to the cluster mean were selected for intensive surveys.

Intensive surveys are conducted at representative farms to collect information on crop management, livestock management and economic information. This information is then used in parameterization of biophysical and farm-level economic models, as well as for budget information to supplement the agriculture sector analysis.

* Methods for Modeling Missing Data to Provide Inputs for Further Analysis

Modern analytic methods and models often have substantial data requirements to run. In many instances, data for biophysical models from secondary sources is either incomplete or missing. They may be either unavailable or prohibitively expensive to acquire. Methods were developed to produce credible estimates for these missing data. In the case of incomplete or missing weather data, the WXGEN weather generator program was used. WXGEN can be used to fill incomplete weather data sets and can also be used to generate weather based on statistics of a weather station. For the majority of impact assessment studies, the weather generator is used for the latter.

Soil is another example of data that many times has missing parameters or incomplete data sets. Soil parameter estimators are used to fill in these gaps. Since soil texture is usually collected on a regular basis, the soil hydraulic properties calculator (<http://www.bsyse.wsu.edu/saxton/soilwater/>) is particularly useful. The EPIC model also has built in algorithms for estimating several soil properties.

2e. Biophysical Analysis of Croplands, Rangelands and Livestock:

* Estimating yields as a function of simulation zones in regional analysis

The simulation zones are used as the basic unit for determining yields within the spatial sampling frame. Information on soil properties within each zone are catalogued and input into the biophysical models. Information on various crop mixes, rangeland plant communities, and future crop and rangeland technology options are gathered from rapid appraisal surveys, intensive farm surveys, secondary data sources, and expert opinion. This information is entered into the biophysical models to reflect specific scenarios to be modeled. Crop and rangeland management information (e.g., planting dates, fertilization methods, livestock movement) are gathered during surveys and interviews or from secondary data sources so that biophysical models reflect the farmer's decision-making process.

Once specific biophysical modeling scenarios are determined, the biophysical models are run for a series of weather conditions. The weather can be historical data or generated data. In the case of the studies conducted in the Sikasso region of Mali and the central Rift Valley of Kenya, generated weather data was used in order to capture more robust states of nature. Once model runs are completed, yield information is summarized into formats for use in both farm level and sector level economic analysis. Yield information transferred to farm level economic models (FLAM, FLIPSIM - Farm Level Income and Policy Simulation Model)) is generally simulation zone specific. However, sector level economic models (ASM) generally require that yield information be area weighted to a political or administrative boundary (Figure 3).

Area weighting methods provide a framework for scaling yield, runoff, erosions estimates and other biophysical model output to watershed, regional or sector level analyses. Because the simulation zone is

the basic aggregation unit, differences in the biophysical model output at each of the varying soil types, climates, and land uses can be properly accounted for in the aggregate yields for the region of interest

Another technique that has been used to assess yields over large landscapes is to use cokriging to create surface maps. Cokriging is a geostatistical interpolation technique that takes advantage of the cross-correlation between a spatially sparse and a spatially rich dataset. In the DSS, biophysical model simulations can be done for a minimal number of points, and then, if a correlation exists between the output and NDVI satellite imagery (a spatially rich greenness index), a surface map of forage production can be created for a region (Figure 4). These surface maps can then be used in any type of analysis that requires spatially explicit vegetation production for a region.

* Linkages between individual elements of the decision support system ñ biophysical, environmental and watershed models

2f. Farm Level Economic Analysis:

* Farm Level Analysis Model (FLAM)

The farm level analysis model (FLAM) went through several stages of evolution during the five-year research period. In addition to modeling the impact of technology and policy options at the farm level, an overarching objective of the DSS development was to provide the ability to scale up or scale down the results of these options and to link their economic and biophysical-environmental consequences. To accommodate the spatial aspect and the linkages to ARCVIEW, a new version of FLAM was developed to accept input directly from ARCVIEW. This was achieved through the use of spatially explicit analysis which, in turn, drove several innovations to the economic models. This creates consistency between FLAM and the spatial framework, as it allows FLAM to tap into the biophysical and spatial databases created during analysis and housed in GIS. To estimate environmental impacts of alternative farming techniques, the structure of FLAM was generalized to include the time varying aspects of changes in soil physical and chemical properties. This required integration with the biophysical models PHYGROW (Phytomass Growth Simulator) and SWAN (Soil, Water, Air, and Nutrition System), as well as integration with the environmental model SWAT (Soil Water

Assessment Tool). In both cases, the integration was achieved through meta-functions, which create analytical representations of the complex and computationally exhaustive biophysical and environmental simulations. Since scaling has been a central theme in the DSS methodology, a version of FLAM was developed that allows it be directly embedded into the ASM. This provides the utmost consistency between farm level decision making and national level market outcomes since ASM prices are directly incorporated in the embedded FLAM model.

2g. National/Regional Level Economic Analysis:

* The Agriculture Sector Model

The Agriculture Sector Model (ASM) is an economic model that simulates the behavior of consumers, producers, and traders involved in, respectively, consumption, production, and trading of agricultural commodities. The model has regional and national level spatial characterization of the agriculture sector. At regional level, it considers production and consumption of the major agricultural crop and livestock commodities, while at national level it considers imports and exports of these commodities. The model is used to assess the impact of various policy or technology alternatives on prices, production, consumption, inter-regional transportation, and trade of agricultural products. The impacts are also assessed in terms of relative economic benefits to producers and consumers. The impact results are computed at the regional level with a reflection on the overall national level impact. *Inter alia*, the model has been used for the climate change impact, the impact of carbon sequestration program, and food security analysis. The utility of the model was substantially extended in these studies by the addition of stochastic elements that can be related to risk assessment and aversion. Recently a new feature was added to ASM to further augment its capabilities for food security analysis focusing the African countries. The model was extended to include the FAO methodology for quantifying food security in terms of an index called 'Prevalence of Hunger' or 'Risk of Hunger.'

* Linking food security analysis with economic sector analysis

A prime objective of agricultural polices in the developing countries is to achieve food security, yet the concept has different connotations in the community

of development researchers. Hunger, malnutrition, caloric deficit, insufficient access to food, low body mass index (BMI), stunting, and wasting are some of the terms used in describing the state of food insecurity. Use of these terms in the food policy literature is replete, however, without much substantive policy relevance. An extensive review was made on approaches for quantitatively measuring food security with a focus on their relevance to policy. The extensive review showed that the FAO approach of computing risk of hunger not only quantifies food insecurity, but also had strong policy relevance.

Accordingly, an extension of the sector level economic models was done to include the FAO methodology in the Mali Agriculture Sector Model (MASM). The model was used in a study on the impact of population, resource degradation, and new technologies on food security in Mali by year 2015. The results show that even with the wider adoption of existing improved technologies in Mali, the risk of hunger in Mali may not decrease by year 2015 from its current level of 32 percent. Hence, achieving the World Food Summit objective of reducing the world hunger by half by year 2015 would require substantially more efforts. These efforts may include a more concentrated effort on developing new cultivars, improved natural resource management, and an extension of cropland area.

The incorporation of the FAO methodology in the DSS has added a new dimension to DSS's capability for food security analysis. Also, in the process of integrating the FAO methodology with the DSS, the utility of the methodology was also enhanced by transforming it from a merely accounting procedure to the one tied to a behavioral and decision making framework.

* Methods for scaling economic and biophysical products from farm to national levels

The key to scaling outputs of models, either economic or biophysical, is to establish a spatial sampling frame that provides a mechanism to capture the diversity of production environments across a region and then scale those responses proportionally within recognized geographical areas. Several methods were devised that allowed area weighting of biophysical responses and have been described in the section on spatial analysis. Scaling up or scaling down biophysical and environmental variables has been done in a geographic framework. Levels range from farm to simulation zone to watersheds to national levels. At the current level of

our research, scaling these parts of the DSS has been more achievable than scaling economic dimensions.

It has been important, as noted elsewhere, to provide linkages between farm and sector level economic models since the outputs of each of these models is influenced by inputs from the other. However, the variability in economic preferences among farmers and consumers is quite immense and many of the complexities that dictate market (and non-market) outcomes are not completely contained within current DSS modeling parameters. As this research continues, these important factors will be captured through entropy techniques allowing aggregation to varying scales of interest to better reflect economic consequences of technology and policy.

2h. Environmental Impact Analysis:

* Coupling crop mix projections and population driven spatial models to assess water yield and soil erosion in the Sondu River basin

The Sondu River, a major drainage area of Lake Victoria, was chosen to explore the environmental impact of land use change and associated evolution of small holder dairy technology from 1978 to 1997. The basin possesses a diversity of environmental types constituting four of the seven agro-ecological zones identified for dairy production in Kenya. These characteristics were identified when the watershed Capacity Building and Institutionalization in Collaborating Institutions

* Application of modern communications technology and innovations for distance education

In year 5 of the DSS project, the ability to employ modern distance education methods for use capacity building in Mali and Kenya are being actively explored. Texas A&M is a recognized leader in the application of technology for real-time internet linked two-way video and related capacity in managing other teaching and data materials. Feasibility of its use in the target countries is paced by regulations, licensing, and availability of what is expected to be relatively low cost equipment. If this capability is not achieved under SANREM II, it may be developed in follow-on capacity building projects with CILSS (Comite Permanent Interstats de Lutte Contre la Secheresse Dabs le Saheland) and LEWS.

* User-friendly access to the DSS through the use of spreadsheet interfaces or meta models

DSS has aimed at building models that are not only simple to use but also have a greater relevance to real world issues. However, the sheer nature of the spatial and economic diversity that underlies the types of processes that the DSS was tasked to replicate resulted in the construction of some fairly complex models. For instance, the Agriculture Sector Model (ASM) was tasked to simulate how a host of agricultural commodities are produced, consumed, and traded in various regions of a country. The model's use requires such programming skills that are not often readily available in the developing countries. To overcome this limitation, the DSS was focused on developing a user friendly approach for easing access to DSS tools. As a first attempt, a spreadsheet based interface was developed for ASM.

This ASM spreadsheet interface does not require specialized programming skills beyond navigating through an EXCEL spreadsheet, resulting in minimal training costs for host country institutions. The user can provide input through spreadsheet on items such as crop yields, available cropland, and adoption rates for improved cultivars. The output items include regional and national level production and prices, and producer/consumer surplus. The interface works in four simple steps. The user enters input in spreadsheet, the interface sends this information to ASM code, runs the model, and brings results back into spreadsheet without having the user to ever see or change GAMS (Global Agricultural Sector Model) code. The first application of ASM interface is made for Mali ASM. Similar spreadsheet approaches will be developed for other models in the DSS during year 5.

2i. Application of Methodology Assessing Policy and Technology Options:

- * Impact of small holder dairy technology - example of USAID research by an IARC (International Agriculture Research Centers)
- * Economic and Environmental Impacts of Sorghum-Millet and Peanut technology - example of AID research by U.S. universities (CRSP) - Impact of risk aversion on economic well being and food security of consumers and producers
- * The impact of future population projections on food demand and technology requirements to maintain or enhance food availability

- * Alternative crop production strategies for averting the effects of and managing drought among smallholders in West Africa
- * Economic and environmental consequences of intensification and extensification of agricultural production to meet future food demands
- * Economic and environmental consequences crop and livestock interactions in mixed farming systems
- * Influence of climate change and alternative production systems on future risk of hunger
- * Assessment of factors affecting adoption of technology in the Sikasso Region of Mali
- * Global Decision Support System ñ incorporation of national and subregional data and models into the FAO-WAICENT (Food and Agriculture Organizations - World Agriculture Information Center) system
- * Application of the Decision System for assessment of the impact of the FAO Special Programme on Food Security in Mali
- * Cross cutting assessment of the application of the DSS in East and West Africa ñ geographic, socio-cultural, and economic comparisons and contrasts

3. Impacts

In summary, a highly innovative integrated set of models and related databases has been developed and its utility and usability demonstrated for application in Mali and Kenya. With additional support, the ability to use these methods will be extended to other countries in SSA. Specific applications of the method have been made for highest priority policy issues identified by senior decision makers in these countries. Results of these analyses have direct and meaningful relevance to the decision making process in these countries. The results obtained make direct contributions to the decision processes related to development of an improved standard of living, enhanced food security, improved health, natural resource conservation, institutional and human capacity building, and improved policy environment. Cadres of analysts and scientists in both Mali and Kenya are being trained to use and apply the DSS in government and national research institutes. All models and databases either have been or will be delivered in usable form by the end of the fifth year.

This project involved 12 specific applications of the DSS to quantitatively evaluate the impact of policy and technology options identified by decision makers. These studies were done to provide operational scenarios in which to develop the models. They also provided credible demonstration of utility to decision makers. They have direct implications on contemporary strategic issues for Mali and Kenya with direct application to decisions about food security, poverty reduction, and sustainable use of natural resources. The DSS methodology has been used to specifically evaluate both ex ante and ex poste impacts of technology and policy options and shown the quantitative impact of these alternatives on food security, poverty, and NRM. In addition, further studies have been conducted by collaborators outside the SANREM project (see Training and Institutional Strengthening).

Absent support to continue these studies as proposed in SANREM III, Texas A&M is actively seeking alternative funding to continue the process of capacity building and mentoring for the use of the methods in both East and West Africa. For a more complete report on impact, please see the full report at our web site for more detail. - <http://cnrit.tamu.edu>.

4. Dissemination

The process of dissemination or technology transfer was a fundamental part of the strategy and planning of this project. The priority of the commitment of the host countries to the World Food Summit and Convention to Combat Desertification and the linkages of these commitments to the activities in FAO provided an entre to key national decision makers to discuss methods to assess progress toward meeting their obligations as signatories to these and related international agreements. The Comité Permanent Interstats de Lutte Contre la Sécheresse Dans le Sahel (CILSS) through the Institut du Sahel (INSAH) sought the development of the DSS for regional applications before SANREM II was initiated. Senior officials of the governments of Mali and Kenya were engaged to define their needs for this kind of analytic tool. They were involved in developing the strategy, participating in the ongoing workshops where methods and results were presented, in defining and evaluating the priority case studies done to demonstrate the utility of the model, the commitment of national resources to the collaboration and the subsequent actions toward capacity building and institutionalization of the methodology.

The dissemination of results to "wider user communities" is intrinsic to this project and is described in detail in other parts of the report. Methods for scaling both economic and biophysical results are covered in detail. Methods for applying technology or policy options outside the immediate environs where they are developed are also described in detail elsewhere in the report. We believe the effective linkage from farm to national and multinational levels of scale is a major contribution to the goals of SANREM II that were stated by the sponsor. As a result of these efforts, we will have in place by the end of year 5 the capacity and know how to use the DSS at these multiple levels of scale by a variety of different operators. Please see the full report at our website for additional detail. For a more complete report on dissemination, please see the full report at our web site for more detail. - <http://cnrit.tamu.edu>.

5. Training and Institutional Strengthening

There have been three major workshops in Mali and three in Kenya that have provided opportunity for exposure to the DSS for both national and regional participants. Approximately 30-45 participants have been involved in each of the workshops. Regional participants have included scientists and analysts from adjacent countries as well as active participation by the INSAH and AGRHYMET (West Africa Regional Center for Training and Application in Agriculture, Meteorology and Hydrology (a CILSS Organization) as part of the CILSS organization. The CILSS NRM pole has been provided briefings on the DSS as part of the awareness program that has led to the decision to apply the DSS more broadly in West Africa. These workshops have also involved several NGO's that have been involved both as collaborators and as workshop participants. Consideration has been given to gender balance in the workshop participants with an average of 5-7 females actively participating in 30 person meetings.

One Kenyan scientist and two Malian scientists have received intensive short term training at Texas A&M in the use of the models. These are among our most involved collaborators. They are now actively engaged in planning and conducting capacity building programs in both Kenya and Mali that will last over a period of about six months during year five of the project. These national level programs will provide training for interdisciplinary teams comprised of economists, biologists, and GIS-natural resource scientists who will

train together and later work together in the application of the DSS in both government and research institutions. We will train four teams of three persons in Mali during the period July 2002 to February 2003 with primarily in-country programs and active use of internet-based instructional materials. We will train a team of 4 Kenyan scientists and analysts with an intensive one-month program conducted at Texas A&M in the fall of 2002.

The DSS project has been engaged at the regional level in West Africa for more than five years through the Comite Permanent Interstats de Lutte Contre la Secheresse Dans le Sahel (CILSS), and its Institute du Sahel (INSAH) and, to a lesser degree thus far, the Regional Centre de Agrometeorologie, et Hydrologie (AGRHYMET). Following a series of meetings with the CILSS Secretariat over the last year, the methods were presented to representatives of the CILSS nations that are involved in planning the implementation of the CILSS strategy at regional and national levels. This meeting, held in Dakar, Senegal in June 2002, led participants to enthusiastically support use of the DSS in planning and evaluating the options involved in addressing the key food security, poverty, and NRM use issues at national and regional levels that are embodied in this strategy. They recognized the need for substantial capacity building at both national and regional levels to enable the use of the DSS. A proposal has been prepared for CILSS to request support to initiate a comprehensive training program on the use of the DSS. This program will build on the experience in developing and using the DSS in Mali, which has served as a pilot study for the broader regional application. Scientists from IER and their regional collaborators will be trainers in the program, along with a continuing active involvement of Texas A&M scientists that have been previously involved in SANREM II.

Ph.D. degrees have been awarded to 5 international scientists who did their thesis work on the development of the decision support system. Three Master's level persons did their research on the DSS. A number of other students are working on the DSS as they work on advanced degrees. Three of the Ph.D. students have returned to their home country, one is now in a postdoctoral program and the third is a faculty member at Iowa State University where he has recently published an article in *Science* on Carbon Sequestration.

6. Collaborative Relationships

6a. Scientists and Collaborators:

The Texas A&M Center for Natural Resource Information Technology (CNRIT) is the institutional home for the Impact Assessment Group. This is the nexus of faculty, staff, and students that are involved in the DSS from the U.S. side. Over the duration of the project, an average of 7 senior faculty have been involved in the project. Most of these have been engaged in the ongoing work of the project, others have supervised graduate students and research associates that have been more directly involved. An average of about 6 graduate student research associates have been involved part time in the project over the five years. There has been a substantial turnover in both faculty and students during the project. CNRIT provides connections to the broader resources of the TAMUS, many of whom have contributed to the project. The number of host country scientists involved in the project has varied with time. A core group of 2 to 4 scientists were involved part time in Mali and the same number in Kenya on a more or less continuous. These colleagues were augmented with other collaborators from both the government and national research institutes as field studies and related analysis were performed. These amount to between 6 and 8 colleagues. The IAG (Impact Assessment Group) and the core host country collaborators were involved in all aspects of the project. The colleagues who participated in specific parts of the project were involved in planning, conducting, and analyzing results from these studies. All have been involved in the relevant workshops. Overall resource allocation has been mainly done by the IAG members. Host country collaborators were actively involved in planning and using the resources allocated for in-country research. There has been active collaboration with the Malian based participants in the INTSORMIL and Peanut CRSP's in conducting the case studies of the impact of their research in the early part of this project.

6b. National Governments:

National governments from the Offices of the President, through the Permanent Secretaries of the relevant Ministries, to the directors and staff involved in analysis and line functions in the Ministries have been actively involved in planning and evaluation of the project

methods and applications. Analysts and line officers within the action agencies have participated in experimental design, conduct of research, evaluation of results and communication with senior officials on outcomes.

6c. Non-Governmental Organizations:

NGO's in Mali, such as the World Food Programme and the Sasakawa Global 2000 project were actively involved in the ongoing workshops and offered useful advice on approaches for methods and scope of application studies. The Kenya Institute for Public Policy Research and Analysis (KIPPRA) is a para-governmental organization that is related to the Ministry of Finance and Planning. Engagement with this group is providing a mechanism for institutionalizing the DSS in a stable environment for the future.

6d. International Agricultural Research Centers:

The International Livestock Research Institute was an active collaborator in an early application of the DSS to evaluate the impact of smallholder dairy technology in Kenya. An informal collaboration continues with ILRI (International Livestock Research Institute) and they provide substantial logistical support for the activities of this group. ICRISAT has an active involvement with the Mali IER in the area of spatial analysis and GIS research. This project has collaborated with ICRISAT at the Sotuba location on the development of the models and acquisition of several important databases for the DSS.

6e. U.S. Based Public and Private Sector Partners:

The general area of research embodied in the DSS project is supported substantially by federal and state funds in the U.S. These are noted under the section of this report on leveraging. There has not been direct involvement with private sector partners from the U.S.

6f. Host Country Private and Public Sector Partners:

The Malian CMDT, a para-governmental organization that functions as a cooperative for cotton farmers in the Sikasso region has been an active collaborator in the Sikasso study, providing village and farm level data on production yields, costs and prices and expert opinion of factors affecting adoption. They anticipate using the DSS methods in their business.

7. Leveraged Funding External to USAID*

Texas Agricultural Experiment Station	\$200,000
WSSD	\$48,000
Rockefeller Foundation	\$67,000
USDA NRCS	<u>\$200,000</u>
Total (2 years)	\$515,000

***Years 4 and 5 only**

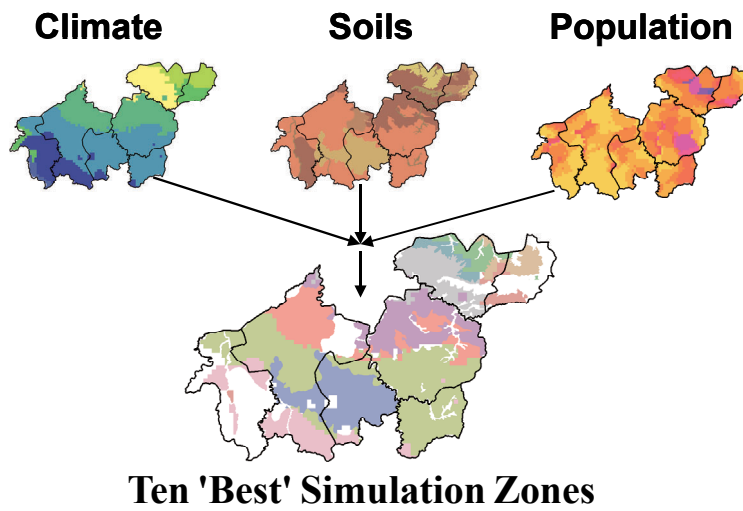


Figure 1. Creation a of simulation zones for the spatial sampling frame in the Sikasso Region of Mali.

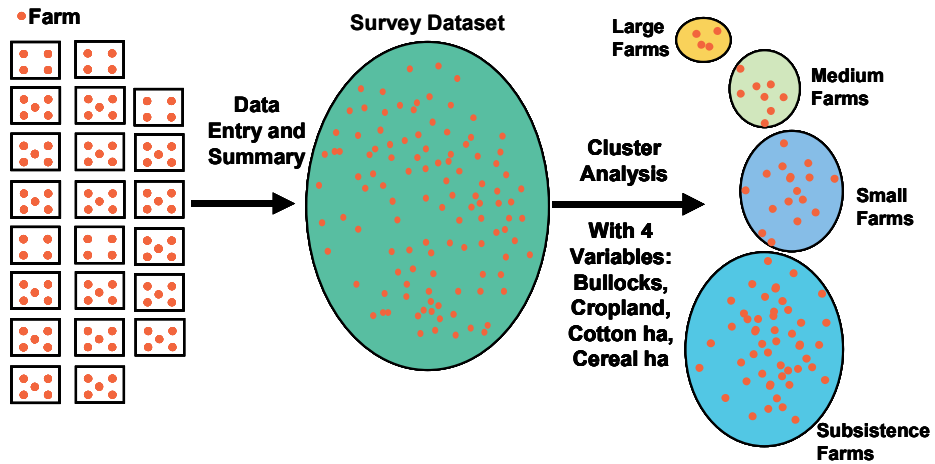


Figure 2. General framework for determining farm typology using a cluster analysis of the farm survey data collected during the rapid appraisal survey in the Sikasso region of Mali.

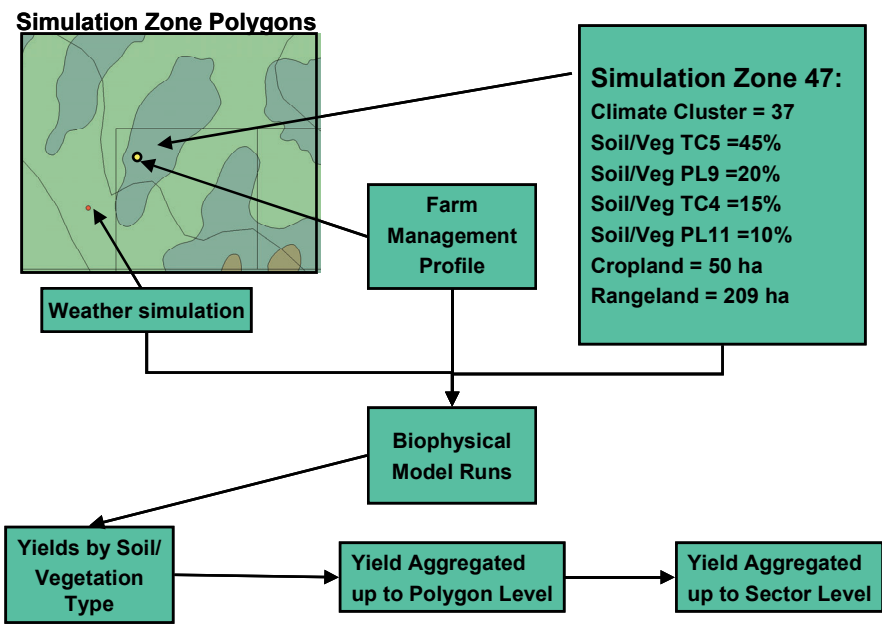


Figure 3. A representation of how the simulation zones are used for aggregating biophysical model yields for the sector model.

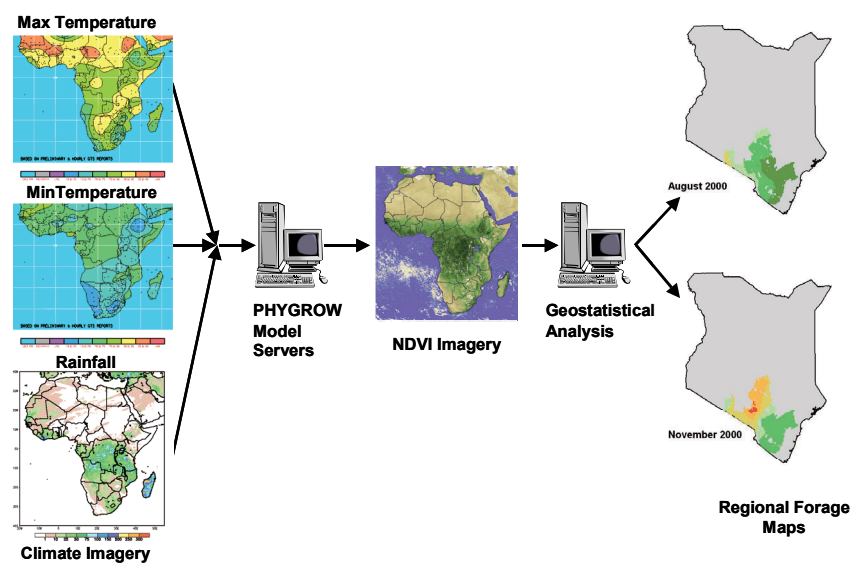


Figure 4. Conceptual framework for using satellite climate data to drive biophysical models whose output is then used to produce regional maps of forage production.

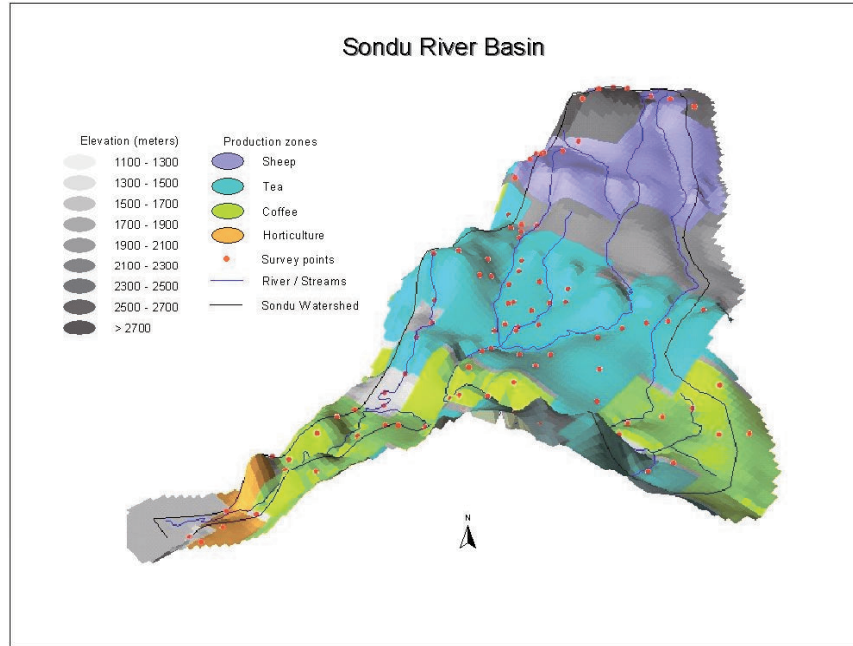


Figure 5. Distribution of site characterization points used to classify land cover types by agro-ecological zone within the Sondu River Basin to support SWAT model analysis of water yield and erosion loading.

SANREM CRSP

Sustainable Agriculture and Natural Resource Management
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Project Management

Principal
Investigator
Neville Clarke

OBJECTIVE 1

Provide a central focal point for scientific and administrative functions of the project.

Annual Achievements

Since this project was not selected for continuation in SANREM III, even greater efforts than originally planned are being made to ensure that usable products are delivered. We are committed to delivering these products, but we will not have the opportunity to continue the engagement with national partners that would be needed to more fully ensure the long term incorporation of the DSS methodology into local, national and regional level decision-making. We are continuing to seek other funds to help bridge this gap. There are no known management problems requiring attention of the Management Entity.

The CILSS has agreed to employ the DSS in the development and evaluation of implementation plans for their new five-year strategy at regional and national levels. Representatives of member nations of CILSS participated in a workshop in June 2002 to gain consensus and commitment on the use of the DSS and begin capacity building in the use of the system. CILSS has agreed to take the lead on submitting a joint proposal for funding of a three year capacity building effort for member nations.

Applications of the integrated suite of models to user-driven case studies have been completed in Mali and are underway in Kenya. Details of these achievements are provided in the following activity reports. Significant progress has been made in linking economic, environmental, and biophysical models; these

results are also given in more detail in the following activity reports.

Plans for incorporating the DSS databases and models in the FAO-WAICENT (World Agriculture Information Center) website were finalized. Although our specific obligations will be met by the end of year 5, the longer term goal of extending the work of our group in East and West Africa to a global system will not be fully achieved. Other Major Outputs in this Period

Advances

in Research - The models comprising the DSS have been linked together and metamodels have been used to facilitate and simplify these linkages. Relevant legacy databases for these studies are being organized for access through the SANREM and CNRIT websites. Progress has been good on developing spreadsheet portals for less experienced users to access and use the DSS. The cross cutting lessons learned synthesis awaits the completion of the Rift Valley studies in December 2002. It is expected that the contrast between East and West Africa will reveal show the interplay between ecological, social, and economic factors affecting the adoption and use of technology and policy in meeting future needs for sustainable methods to meet food security goals. The comparison of development and application of methods that can be seen from preliminary analysis points toward a final DSS product that will have broad geographic and political applications at multiple levels of scale.

Other Major Outputs in this Period

Conference Presentations

Clarke, N. P. 2001. *Relationships Between the Global Decision Support System and Regional Projects: SANREM II - A Conceptual Framework*. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Workshops

Clarke, N. and J. Stuth. 2002. *Introduction, Overview and Experimental Design*. Decision Support Systems for West Africa: An Examination of Issues, Policies, and Alternatives for Food Security and Natural Resource Management.

Stuth, J. 2002. *Introduction to the Decision Support System*. Decision Support Systems for West Africa: Methodology for Issues, Policies and Alternatives for Food Security and Natural Resource Management.

Training Degree

Name, Level, Start Date-Completion Date

Kristen Zander, Ph.D. 2000-

SANREM CRSP

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

June 2002
Annual Report
DSS-21

Global Level Analysis

Principal Investigator
Bruce McCarl

OBJECTIVE 1

Expand and apply Global Agricultural Sector Model (GASM) to development of national and regional impact assessment methods linking economic and natural resource management goals.

Annual Achievements

Major forces such as trade, population, climate change and greenhouse gas mitigation are likely to affect both domestic and global markets. This activity integrates the trends in global and domestic food markets. GASM, covering world markets for 8 different food crops, feeds price information to national ASM's and allows analysis of the implications of environmental based policies both domestically and internationally. Recently, GASM has been used for impact assessment studies conducted in US. Global Climate Change, El Nino Southern Oscillation events, and cost and food security implications of net greenhouse gas emission mitigation among other areas of impact assessment. The overall GASM project is partially funded by SANREM but is leveraged with USDA, EPA, and DOE funds. In the year 2001-2002, a number of studies were completed that have direct or indirect relevance to the SANREM objective. Highlights of the studies completed this year are:

1. A study on economic and food security implications of climate change in Mali was completed this year. The economic losses may be in the range of 1 to 3 percent of Mali's national income (GDP), while the risk of hunger may fall in the range of 42 to 49 percent of the Malian population as compared to 32 percent presently (for details see Objective 1 of DSS-21). In this study, GASM was used to

provide cost of food imports for Mali in the event of climate change.

2. Work was concluded on the effect of climate change on pesticide expenditures where future climate projections were found to cause significant increases in expenditures.

3. Work was carried out on the portfolio of agricultural greenhouse gas mitigation alternatives with soils, biofuels and afforestation being the most important strategies. An article in Science is forthcoming.

OBJECTIVE 2

Use DSS methods to expand the ability to interpret satellite imagery for decision-making at national, regional and global levels.

Annual Achievements

Predicting Forage Availability Using Satellite Imagery:

The Normalized Difference Vegetation Index (NDVI), which is derived from satellite imagery, and rainfall estimates was used to determine the extent to which satellite derived information could be used to project PHYGROW simulated forage production during specific intervals of varying rainfall. A statistical method called co-kriging was used for this analysis. It involves using the weighted linear average of the sampled or simulated points along with spatially rich satellite data to estimate forage production in unsampled areas. For this to work efficiently, the satellite data sample points. (NDVI or gridded rainfall data) has to be correlated with the forage production at the sample points.

Co-Principal Investigator
Jerry Stuth

The PHYGROW simulation model was used to derive the total forage available for cattle at each of 30 simulation points in Kenya. Rainfall data used in the simulations was extracted from the NOAA daily rainfall estimate archive ftp://ftp.ncep.noaa.gov/pub/cpc/fews/archive_daily_est/ for each simulation point. The NOAA rainfall estimates are derived daily for a large portion of Africa using an algorithm that combines METEOSAT 7 cold cloud duration data, weather station data, relative humidity and wind data (Herman et al. 1998). The total forage available output was then co-kriged with NDVI data to generate an interpolated surface map of forage production. The resulting interpolated surface did a good job of predicting total forage available for the simulation points. The cross-validation regression showed a very reasonable correspondence between estimated total forage available and the simulated total forage available for the household points ($r^2=0.87$, SE prediction=249 kg/ha). Co-kriging using NDVI shows promise in creating mapped surfaces of available forage for regions where limited numbers of points can be simulated due to economic and computing constraints. A time series of these maps clearly shows areas that may be susceptible to low forage conditions due to drought and spatially defines states of nature relative to grazing land capacity. For the study area in Kenya, the drought of 2000 entered the zone in May 2000 and progressed from the northwest, pushing southward and eastward through the zone. There was little evidence of pockets of drought other than in the extreme western portion of the zone. These maps tracked what was observed in the region.

Linkages with EROS Data Center:

Communications have continued with EROS on using land use and land cover data to help develop virtual landscape modeling environments based on NDVI and LANDSAT (satellite used to acquire images of the Earth) 7 data. To date, our principle efforts have been on linking point-based models of forage production and diet quality from fecal samples to extrapolate responses across regions. We have also made linkages with key personnel at the NOAA Climate Prediction Center to create our FEWS NET weather data server.

Ghana NDVI and NIRS Fecal Profiling:

For the past 11 months, a Ph.D. student has been collecting geo-referenced fecal samples from a stratified set of pastoral and agro-pastoral households throughout the rangeland regions of the northern two-thirds of

Ghana in a zone similar to the Sikasso region in Mali. A completed East and West Africa calibration set has been developed. Testing of co-kriging NDVI and geo-referenced fecal samples is currently underway to determine if regional level diet quality values can be derived spatially to better serve the sector analysis conducted in West Africa.

Acquisition of Global Database on Climate Surfaces:

The ACT team, in collaboration with CIMMYT (International Maize and Wheat Improvement Center), recently acquired a global database of monthly climate surfaces. These surfaces, produced by the Climate Research Unit of Norwich University (UK) under contract from IWMI (International Water Management Institute), offer a low-resolution look at the entire globe. The climate surface models can be exercised over the whole of these global databases providing the IAG a first look at global extrapolation zones. Two global soils databases have also been recently acquired. These databases will provide a representative soil pedon for all terrestrial areas on the planet. These foundation databases will be available and useful for all subsequent model development efforts.

OBJECTIVE 3

Expand and apply impact assessment methods for improving the capability of international organizations to monitor the status and progress toward achieving the goals of conventions and treaties dealing with food, agriculture, and natural resources.

Annual Achievements

In the early planning of this project, FAO projected the establishment of explicit national level efforts to assess the status of food insecurity and vulnerability and to develop strategies of intervention needed to achieve the WFS goal of reducing hunger by 50% in the year 2015. A food insecurity and vulnerability information mapping system (FIVIMS) was envisioned, beginning at national levels and being aggregated to the global level. One of the targets of application of the DSS is to support the FIVIMS efforts in Mali and Kenya. While the details of the FAO initiative have not fully emerged in Mali and Kenya, the general goals of nations that are signatories to the WFS are in place. The DSS is achieving its goal of providing methods to national and regional decision makers for assessing the impact of alternative policies and technology applications for achieving the goals of the WFS, inter alia. In addition, this project has provided a number of user-driven case studies which ap-

ply the DSS methodology to high priority contemporary issues in Mali and Kenya. The DSS and its illustrative case studies are being provided to FAO-FIVIMS for future use.

UNCCD:

The climate change investigations reported on under the first objective above are relevant to efforts under the United Nations Framework Convention on Climate Change. GASM has been used in this and associated projects to project the impact of climate change, EL Nino Southern Oscillation events and climate change mitigation on food availability and cost in the U.S. and other parts of the world. Other efforts were also pursued in the climate change arena examining sustainability issues with respect to climate change and pests, variability and environmental protection and in analyzing economic consequences of climate change mitigation strategies

Because potential users have different levels of experience with models in the DSS, it is necessary to pre-package the more complex models and provide different access mechanisms for various stakeholders. Research was completed on development of the concept of a common modeling environment that allows integration of pre-parameterized models in a web-based environment without modifying the models. This is based on "middleware" concept that links those stabilized models to a "console" that allows access to them. The concept has been successfully tested using the PHYGROW model. Graphics tools have been improved and new functionality has been added to the middleware language. Tests of several public source middleware tool created with PHYTHON has allowed us to demonstrate that this powerful web-based language can be used to deliver active models and access databases directly over the internet with relative ease. Working with the NGO's RANET and Arid Lands Information Network, we were able to establish the ability to transfer information via the African Learning Channel using Worldspace Satellite Radios linked with inexpensive personal computers and a serial adaptor. These systems can move up to 20 mb files in less than 15 minutes at pre-scheduled times. The same information as contained at the web site can be delivered via these "containers". Research continues on developing simple tools such as embedded metamodels and spreadsheet linkages between user input and the complex models using the metamodeling approach. The metamodels can take complex model output and create empirical formulas of

the relationship of crop type, germplasm, following period, soil type, plant available N, soil carbon level and management practices. This allows users to select combinations and predict crop yield. These simple models will be delivered on the web and over the WorldSpace Satellite Radios.

Publications

Journal Articles

Chen, C. and B. McCarl. 2001. *Pesticide Usage as Influenced by Climate: A Statistical Investigation* Climatic Change, 50: 475-487

Irland, L., D. Adams, R. Alig, C. Betz, C. Chen, M. Hutchins, B. McCarl, K. Skog and B. Sohngen. 2001. *Assessing socioeconomic impacts of climate change on U.S. forests, wood-product markets and forest recreation.* BioScience.

Marland, G., B. McCarl and U. Schneider. 2001. *Soil Carbon: Policy and Economics.* Climatic Change. 51(1): 101-117.

McCarl B. and U. Schneider 2001. *The Cost of Greenhouse Gas Mitigation in U.S. Agriculture and Forestry.* Science.

Other Major Outputs in this Period

Conference Presentations

Angerer, J., J. Stuth, F. Wandera, and R. Kaitho. 2001. *Use of Satellite-Derived Data to Improve Biophysical Model Output: An Example from Southern Kenya.* Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Training Degree

Name, Level, Start Date-Completion Date

Tanveer Butt, Ph.D. 2000-

Jay Angerer, Ph.D. 2000-

SANREM CRSP

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

June 2002
Annual Report
DSS-22

Development of Economic Models

Principal Investigator
Bobby Eddleman

Co-Principal Investigator
Bruce McCarl

OBJECTIVE 1

Adapt, extend, or create economic models to be linked with biophysical and environmental models in the DSS to provide quantitative estimates of the impact of alternative policy options or technology introductions in the agriculture of developing countries

Annual Achievements

Year four research in this project has responded to EEP recommendations through providing increased connectivity between the economic and biophysical models. At the farm level, an environmental component was added to the FLAM farm model. This captures the consequences of farmers' land use decisions when "non-green friendly" practices are adopted in lieu of new technology in terms of long-term changes in both crop and forage production. Yield estimates for the host of farming practices utilized in the analysis were derived from biophysical models EPIC and PHYGROW through the use of meta-functions. Model results were used as part of two Sikasso case studies, and were presented at the SANREM Research Conference and at a DSS workshop in Bamako. The analysis confirmed the observed propensity for land clearing that exists in the Sikasso region, and provides our research with a more complete treatment of the factors that affect the adoption of new technology. The climate change impact study was completed for Mali. The impact of climate change was serious both in terms of lost economic welfare and increases in the risk of hunger. The economic losses may be in the range of 1 to 3 percent of Mali's national income (GDP), while the risk of hunger may fall in the range of 42 to 49 percent of the Malian population as compared to 32

percent presently. The study also considered a set of economic and technological adaptations to climate change. The results showed that changes in regional cropping pattern, changes in trade, and developing heat resistant varieties were among the effective adaptations to climate change. Farm level adaptation would be less effective in mitigating the adverse impact of climate change. The study integrated the IAG biophysical and economic models (local and global). The models used in this research were Mali Agriculture Sector Model (MASM), Global ASM, PHYGROW, NUTBAL (Nutritional Balance Analyzer Program), and SWAN (Soil, Water, Air, and Nutrition System). In terms of methodological development, MASM was extended to include the FAO methodology for estimating risk of hunger (ROH) in a country. In this process, the utility of the FAO approach was also enhanced as ROH methodology was integrated in a policy analysis framework enabling an ex-ante analysis of food security, contrast to its ex-post use by the FAO. Also, the ROH estimates are available at sub-national levels compared to national level estimates provided by the FAO. The Malian and Kenyan ASM models have been updated to provide a more recent baseline data, shifting the reference year forward in time from 1996 to 1999.

OBJECTIVE 2

Develop linkages between economic models at varying levels of scale to improve the ability to forecast impact of technology introductions in the agriculture of developing countries.

Annual Achievements

The project has de-emphasized the use of farm simulation models (FLIPSIM) in favor of behavior oriented, farm programming models (FLAM). The FLAM approach was found, by TAMU (Texas A&M University) and its' Malian counterparts, more appropriate for the developing country context (see Objective 4 below) since it increased the kinds of questions that were addressed in the case studies, and gave model users a clearer view of happenings within a typical farming unit. A co-benefit of this shift in emphasis has been the increased connectivity between the farm level (FLAM) and national level analyses (ASM). The software versions of FLAM and ASM share the same computer language (GAMS), and analytically both FLAM and ASM contain common equations and variables. For this project, the most relevant intersection between the models is market prices. In year four, ASM has provided FLAM with information on future food and commodity prices that include the response to population change, new technology introduction, and land extensification. Additional data from ASM were also used as FLAM input, including labor costs, organic fertilizer prices, and natural resource availability. The ASM price estimates were then used in the farm models to estimate the impacts of the policy and technology scenarios on farm households. The impacts included changes in farm income, household food security, caloric intake, implicit resource costs, and labor usage (see the Sikasso Case studies). Another area in which improved linkages are being forged between farm and national level analyses is in factors that affect technology adoption. Field surveys were conducted to collect data on factors considered to be associated with farmer's adoption of new technology. Logit and Tobit models have been constructed to test hypotheses on which factors are significant determinants of new technology adoption. ASM has been modified to accept the results of the adoption survey, improving upon earlier studies that relied upon expert opinion regarding adoption rates.

OBJECTIVE 3

Continue to add the risk dimension to economic models at varying levels of scale to assist decision-makers in the evaluation of policy and technology options.

Annual Achievements

The rapid and intensive field studies of farm households in Sikasso were used to characterize the types of risk confronting farmers of various types within the study

zone, to determine the different levels of risk exposure among different farm types, and to assess the range of options that farmers have at their disposal to mitigate risk. The farm budgets collected in the surveys quantified the production, or yield, type of risk that farmers face. The studies confirmed a second source of risk related to food security. Both forms of risk have been introduced to the models at various levels of scale. At the farm level, the yield and food security risk components have been added to FLAM. A major revision of risk was made to the component in the Mali Agriculture Sector Model (MASM) in order to lend a greater policy relevance to the climate change impact study (see Objective 1) and the year 2015 study (see Objective 5). The earlier risk component of MASM was based on a complex mix of mean and variance of rainfall over the period 1922-1993, and was based on research work done at Purdue University (Coulibaly). The evidence from historical weather data shows that rainfall variability has considerably changed in Mali since the early sixties, hence the pre-1960 period loses its reference to the current rainfall variability in Mali. Under the new risk component, the last 12 years of weather, in the form of past 12 years yield history, were included. The incorporation of yearly yield rather than state of nature dependent yields to model weather related risk has at least two other advantages. First, it can be argued that farmers' perception of an array of expected weather events may be influenced more by what they observed in recent past rather than by a complex mix of mean and variance of rainfall observed over an extended period of time (1922-93) as previously modeled. Hence, farmers' area allocation decisions may be better simulated by modeling weather history in the recent past. Second, communicating the model results to the decision-makers requires a substantial context building when risk outcomes are formed on the basis of a complex mix of mean and variance of rainfall. Such context building often leads to decision-makers' disregard to model results. In contrast, the yearly yield history agrees with the decision-maker's own perception of weather related risk. For example, under the new structure, the model can address decision-makers questions like "what if 1987 weather is repeated"? This component of risk modeling will guide the future IAG risk modeling pursuits.

OBJECTIVE 4

Evaluate trade-offs between sophistication and quality of output versus simplicity and ease of use of economic models in the developing world.

Annual Achievements

Experiences with the FLAM model over the past year have served an important role in the model evaluation process. Since both TAMU and its Malian counterparts found FLAM to be simpler to use, more realistic in terms of its output, and less computationally demanding, there resulted a move away from the previous simulation oriented model (FLIPSIM) and to the behavior oriented model FLAM. TAMU's Malian counterparts have spent time evaluating a spreadsheet version of ASM. Although not as flexible as the source code version of ASM, the Malian counterparts found an acceptable degree of trade-off between increased accessibility and reduced flexibility. The spreadsheet version was also well received at the February 2002 Bamako workshop where numerous workshop participants expressed interest in obtaining copies of the ASM spreadsheet

OBJECTIVE 5

Use economic models as part of the GDSS (Global Decision Support System) suite in implementing the Mali and Kenya Pilot FIVIMS - GTOS (Food Insecurity and Vulnerability Mapping Information System - Global Terrestrial Observing System) Studies by evaluating scenarios deemed relevant by national decision-makers.

Annual Achievements

This section deals with the economic component of the overall assessments or case studies reported in DSS-25. These were conducted under joint sponsorship by the Africa Bureau and SANREM. In Mali, the three Sikasso case studies were completed: 1) Impact of Intensification of Cropping Systems; 2) Development of a Decision Matrix for Managing Drought; and 3) Economic and Environmental Consequences of Options for Land and Livestock Management Strategies. The case studies were presented at the February 2002 Bamako Workshop. In Kenya, the databases for the case studies have been completed, and model updates have been completed. Current evaluations are being made on how the DSS can be employed to address the marketing issues of concern in both East and West Africa. The Food Insecurity and Vulnerability Mapping Information System (FIVIMS), a product of the World Food Summit (WFS), is intended to monitor progress towards reducing hunger by 50 percent in the year 2015. Both the Mali ASM and Kenya ASM were used to examine generic technology and policy interventions to attain food affordability and availability in 2015 under the FIVIMS pilot study in each country. An extensive review was made of the available approaches towards quantifying

the extent of food insecurity in a country. The review suggested that the FAO methodology of estimate risk of hunger (ROH), the percentage of population that is undernourished, as an approach that not only can be quantitatively estimated with secondary data, but also has a strong policy relevance as it is based on the availability of food supplies in a country. The methodology of estimating was incorporated in to the economic model. The first application of DSS use for measuring the progress towards the 2015 objective was made in the Malian context by taking a holistic view of the issue of food insecurity using an integrated assessment approach. The IAG economic and biophysical models were used. The biophysical models were used to project the biophysical environment in the crop and livestock sectors by 2015. The economic models were used to determine economic and food security implications of changes in the biophysical environment, the adoption of new technologies, and population growth. The results show that without the improved technologies the risk of hunger in Mali may increase from its present level of 32 percent to 36 percent by 2015 with a considerably higher dependence on food imports. With new technologies, not only the risk of hunger stays close to the current level but also the dependence on imports is lower. The results show that achieving the 2015 objective for Mali may not be realized unless technologies in addition to those considered in this study are developed and made available to farmers. The models used in this research were Mali Agriculture Sector Model (MASM), PHY-GROW, NUTBAL, and SWAN.

Other Major Outputs in this Period

Conference Presentations

Angerer, J. and J. Vitale. 2002. *Farm Level Economic Model (FLAM)*. Decision Support Systems for West Africa: Methodology for Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Angerer, J. and J. Vitale. 2002. *Farm Surveys in the Sikasso Region*. Decision Support Systems for West Africa: An Examination of Issues, Policies and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Butt, T., C. Chen, B. Eddleman, A. Kergna, B. McCarl, and J. Vitale. 2001. *Risk Consideration in Sectoral Analysis of the Adoption of Improved Technology: A case study involving Sorghum and*

Pearl Millet in Mali. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Eddleman, B., A. Kergna, J. Vitale, B. McCarl, C. Chen, and P. Dyke. 2001. *Economic and Environmental Impact of Improved Sorghum and Millet Technology in Mali*. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Kaitho, R., B. Eddleman, C. Chen, B. McCarl, J. Angerer, and J. Stuth 2001. *Policy And Technology Options For Dairy Systems In East Africa: Economic And Environmental Assessment*. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Vitale, J. and R. Woodward. 2001. *Promoting More Sustainable Land Use in the Semi-Arid Tropics Through Improved Market Infrastructure: A Malian Case Study*. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Vitale, J., J. Stuth, P. Dyke, and J. Angerer. 2002. *Integration of Farm Level Crop and Livestock Models*. Decision Support Systems for West Africa: Methodology for Issues, Policies, and Alternatives for Food Security and Natural Resource Management.

Workshops

Butt, T. 2002. *Mali Agricultural Sector Model*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Vitale, J. 2002. *Impact of Risk at the Farm Level - Alternative Drought Management Strategies in the Semi-Arid Areas (Segou)*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

SANREM CRSP

Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program
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Development of Biophysical and Environmental Models

Principal Investigator
Jerry Stuth

Co-Principal Investigator
Jay Angerer

OBJECTIVE 1

Develop and demonstrate the utility of biophysical models to estimate performance of crop and livestock species under developing country conditions.

Annual Achievements

The research on intensification and extensification of agricultural technologies was completed in the Sikasso Region of Mali and is in progress for the Rift Valley region of Kenya. Methods to improve the utility and usability of the forage and crop models were developed including the creation of production and environmental metamodels that can be directly embedded in the economic models using the GAMS scripting language. The response variables used in the metamodels allowed the characterization of soils and vegetation conditions associated with the degradation of cropland and grazing land. The ability to allow feedback on environmental response from economic analysis greatly enhanced the responsiveness of the models to both economic and natural resource processes.

We have started the process of organizing tabular and spatial databases used in the array of simulation models in a manner that can be accessed externally via the internet by such organizations as the FAO-WAICENT Network and our many in-country partners and regional organizations, such as AGRHYMET in West Africa. A method for using the WxGEN weather generator driven by coefficients that were statistically derived from long-term WMO weather station data was developed. This allowed us to create a geo-corrected weather data set to

build a robust array of simulations, thus providing the basis for creating metamodels for estimating production and environmental responses across agroecological zones in West and East Africa. These spatially coherent weather data sets were used to develop crop and rangeland yield responses for a wide variety of crops, management inputs, and land types in both Mali and Kenya.

A suite of technologies identified in stakeholder workshops held in Bamako was parameterized in the SWAN model with an array of planting dates, germplasm, fertilizer levels, fallowing periods and management inputs by major slope position (soil type) for the entire Sikasso region. A matrix of yield estimates derived from 50-year generated weather profiles were integrated into the GAMS modeling environment for both the farm level analysis model (FLAM) and the agricultural sector model (ASM) used in the DSS-22 section.

Animal production systems in each of the provinces of Mali were profiled in NUTBAL PRO and resulting protein and energy requirements, milk production, and dry matter intake were inserted into the FLAM and ASM models. An updated LANDEMAND program was adapted to Malian conditions allowing calibration of ASM's livestock populations and projections of supporting grazing lands in each province. Three levels of rangeland degradation were defined for each of the major soils found throughout the Sikasso region and 20-year historical weather profiles were run for each complex plant community. These communities represent the varying levels of loss in major trees to fuel wood harvesting and perennial bunchgrass

loss due to overgrazing. Mid- and max-degradation representation of the communities were expressed in terms of increasing unpalatable shrubs and annual grasses.

Mid-degradation resulted in approximately a 1200 kg/ha reduction (12%) in forage for cattle, sheep and goats while maximum degradation resulted in approximately 4200 kg/ha reduction (40%) in capacity. Crop yield analysis indicates that nitrogen management issues are masking the yield potential of crops in years where there is more than 900 mm per year of rainfall. When rainfall exceeds 1100 mm per year, yields are suppressed without added fertilizer levels. Carbon loss was substantial. The SWAN modeling is providing a new perspective on carbon: nitrogen dynamics of the Sikasso region.

OBJECTIVE 2

Further develop and apply watershed models to assessment of environmental and economic impact of alternative policies and technologies.

Annual Achievements

Impending dam construction on the Sondu river makes this a questionable site for further study at this time. In year 4 the intent was to investigate alternative basins in a pilot study that would possibly carry over into SANREM III. Given that TAMU will not be involved in SANREM III, we elected not to pursue this further in the present effort. We are directing our efforts to other directly related activities in the Rift Valley and did not pursue the analysis of another watershed in year 4.

OBJECTIVE 3

Develop and use improved indicators of land and water degradation as a function of agricultural practices involving intensification and extensification of production

Annual Achievements

The case studies selected for detailed analysis in the Sikasso region of Mali and the Rift Valley in Kenya include assessment of the consequences of both intensification of production practices on existing highly productive land and the breaking out of new (often marginal) lands for crops in these areas. In Mali, communal lands offer substantial diversity in choice of practices. The case studies to model these approaches were carefully defined with stakeholder workshops. With a combination of the 1:250,000 PIRT soils of Sikasso, a climatic cluster analysis of weather patterns of the region and the EROS NDVI (Earth Resources Observation System - Normalized Difference Vegetation Index) based crop use intensity analysis, we were able to

stratify the entire Sikasso region into virtual landscapes within simulation zones (climate-soil combinations) to investigate area weighted responses of crop and forage production and environmental processes such as erosion, carbon loss, runoff and deep drainage of the region.

Publications

Book Chapters

Roberts, C, J. Stuth, P. Flinn. 2002. (*in press*). *Analysis of forage and feedstuff*. NIRS Applications in Agriculture, AAAS Press.

Stuth, J, J. Angerer, R. Kaitho, A. Jama, R. Marambii. 2002. *Strategies for monitoring forage production as an indicator of agricultural drought*. In: Agricultural Drought Monitoring Strategies in the World. Kluwer Academic Press.

Journal Articles

Lee, A. J. Conner, J. Mjelde, J. Stuth. 2002. (*in press*). *Use of Seasonal Climate Forecasts in Rangeland-Based Livestock Operations in West Texas*. Journal of Applied Meteorology.

Lee, A., J. Conner, J. Stuth, and J. Mjelde. 2002. *Economic impacts of brush control cost share on range-based ranches*. Journal of Agriculture & Resource Economics.

Lemberg, B., J. Mjelde, J. Conner, R. Griffin, W. Rosenthal and J. Stuth. 2001. (*in press*). *Integrating Ecological, Hydrologic, and Economic Models for Water Valuation in South Texas*. Journal of American Water Resources Association.

Schumann, K., J. Conner, J. Richardson, J. Stuth, W. Hamilton, and D. Drawe. 2002. (*in press*). *The use of biophysical and expected payoff probability simulation in the economic assessment of brush management alternatives*. Journal of Agriculture & Applied Economics. 33.

Souza N., Jose de, J. Conner and J. Stuth. 2001. *Biophysical and economic models for assessing impacts of change on grazingland ecosystems*. Revista Brasileira de Engenharia Agricola e Ambiental, No. 1. 5:135-137.

Stuth, J., Hamilton, W. and Conner, R. 2002. *Insights in Development and Deployment of the GLA and*

NUTBAL Decision Support Systems for Grazinglands. Journal of Agriculture Systems.

Tolleson, D., T. Wilson, R. Randel, D. Neuendorff, A. Lewis, and J. Stuth. 2001. *Near infrared reflectance spectroscopy of feces did not reliably predict serum progesterone (P4) in cows*. Journal of Animal Science. 79:21 (Suppl. I).

Other Major Outputs in this Period

Conference Presentations

Butt, T., J. Stuth, J. Vitale, P. Dyke, and J. Angerer. 2002. *Implications of Extensification and Intensification for Food Security in 2015: Agriculture Sector Level Analysis*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Stuth, J., D. Schmitt, K. Zander, C. Heath, J. Angerer, J. D. Vitale 2001. *Common Modeling Environment (CME): A Framework for Integrated Decision Support Systems*. Research Synthesis Conference, SANREM, Athens, GA. November 28-30.

Vitale, J., J. Stuth, P. Dyke, and J. Angerer. 2002. *Integration of Farm Level Crop and Livestock Models*. Decision Support Systems for West Africa: Methodology for Issues Policies, and Alternatives for Food Security and Natural Resource Management.

Vitale, J., J. Stuth, T. Butt, P. Dyke, and J. Angerer. 2002. *Implications of Extensification and Intensification for Food Security in 2015: Farm Level Analysis*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Research Reports

Stuth, J., W. Rosenthal, B. Lemberg, A. Lee, and R. Conner. 2002. *Comparison of Brush Control Induced Water Yield Estimates for Three Watersheds Using an Integrated PHYGROW-SWAT and SWAT only Simulation Models*. Texas State Soil and Water Conservation Board. 21 pp.

Workshops

Stuth, J., P. Dyke, and J. Angerer. 2002. *Biophysical Models (EPIC and PHYGROW)*. Decision Support Systems for West Africa: Methodology for Issues Policies, and Alternatives for Food Security and Natural Resource Management.

Vitale, J. 2002. *Impact of Risk at the Farm Level - Alternative Drought Management Strategies in the Semi-Arid Areas (Segou)* Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

SANREM CRSP

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

June 2002
Annual Report
DSS-24

Spatially Explicit Analysis

Principal Investigator
Jerry Stuth

OBJECTIVE 1

Develop and demonstrate the utility of a geo-referenced framework for models, information systems, and analytic procedures. These tools will be expanded to a multi-regional and (ultimately) global scale to make projections of the utility of research products to other geographically similar areas

Annual Achievements

The 3.0 version of the Almanac Characterization Tool was completed and delivered to partners at the Malian Institute of Rural Economy. This version has improved graphics and database handling capabilities. Comprehensive spatial characterizations of the Sikasso study area in Mali have been completed. The spatial analysis of the Rift Valley study has been completed with the complete restructuring of Agro-Ecological Simulation Zones for the country in close coordination with the Kenya Agricultural Research Institute. Simulation zones were defined across the study areas as sampling frames for the definition of rapid farm surveys, (see DSS-21), selection of the intensive survey farms, and ultimately restructuring of the Kenya ASM to allow aggregation of biophysical responses across the country for crop, grazing land and livestock responses. All surveys have been completed and biophysical data derived from the analysis of the vegetation, crops, soils and weather data in the Rift Valley. These serve as inputs to the SWAN and PHYGROW models (DSS-22). Each of the simulation zones were defined based on precipitation and temperature, soils type, and rural population density. Delineation of sub-area boundaries was determined by similarity in production systems, farm type composition and climatic conditions using the characteristics of the rapid

farm survey and the biophysical spatial characterization of the region overlaying the district boundaries. All farm data and biophysical attribute data are available in ACCESS databases and are being linked to the ACT 3.0 viewing tool for the Mali and Kenya Almanac. All SAS analysis of all the weather stations in Sikasso and the Rift Valley has been completed to provide the coefficients for the WxGEN weather generator. Currently, kriging of each WxGEN coefficient is being conducted with the planned product of a map that can be clicked (5x5 km grid), and the necessary coefficients are "drilled" and ready to generate weather data for the selected area. This will be the first time that weather generator coefficients have been presented this way to analysts. As stated earlier in DSS-21, a comprehensive analysis of food security vulnerability mapping is underway using LANDSAT 5 imagery to identify areas with long term moisture availability (bas-fon) and a series of data layers reflecting crop yield potential, rangeland yields, primary/secondary roads, villages/towns/cities, and markets. Using a series of buffering and classification rules, a preliminary map has been developed that provides a view of areas in Sikasso with low to high food security vulnerability. The rules will be refined based on the farm level analysis (FLAM) that is currently under way. Partnering with CIMMYT and the USAID Office of Foreign Disaster Assistance Almanac Characterization Tool (ACT) produced Country Almanacs for 13 countries in Africa. They include: Mali, Kenya, Botswana, Mozambique, Uganda, Zimbabwe, Ethio-

Co-Principal
Investigator
Raghaven Srinivasan

pia, Malawi, Tanzania, Zambia, Angola, Liberia, and Sierra Leone. In addition country ACT's and continental wide data for Africa is maintained and available on the Characterization Assessment and Application Group (CAAG) web site at www.brc.tamus.edu/char/. This web site is accessed through secured passwords before data can be downloaded. To date we have issued 230 passwords to scientist and GIS specialists from 45 countries.

Other Major Outputs in this Period

Workshops

Angerer, J. and J. Vitale. 2002. *Spatial and Sampling Framework Methods*. Decision Support Systems for West Africa: Methodology for Issues Policies, and Alternatives for Food Security and Natural Resource Management.

Angerer, J. and J. Vitale. 2002. *Setting the Spatial Framework, Scaling, Integration and Aggregation*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management.

Stuth, J. 2002. *Integration of Models, Synthesis, Common Modeling Environment*. Decision Support Systems for West Africa: Methodology for Issues Policies, and Alternatives for Food Security and Natural Resource Management.

SANREM CRSP

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

June 2002
Annual Report
DSS-25

National and Regional Applications of Decision Support Systems

Principal Investigator
Neville Clarke

Co-Principal Investigator
Jerry Stuth

OBJECTIVE 1

Extend and expand the integrated package of decision support tools through cooperation with partners by using specific case studies at varying levels of government as platforms or real-world scenarios for development of methods

Annual Achievements

Applications of the DSS to specific case studies in the Sikasso region of Mali were completed. These studies were defined by government decision-makers and research colleagues. In February 2002, the results were presented and discussed with collaborators and subsequently presented to decision-makers from the Office of the President and the several ministries of the Government of Mali that are users of the DSS products. Letters of intent were provided by senior government officials regarding the future use of the DSS. There were also presentations of the DSS methodology, which is described in other activity reports. The case studies which were conducted from the Sikasso region were presented at this workshop. The presentations included the following: 1) methods used to set the spatial framework for the studies; 2) methods used for integration and aggregation of the output of models at varying levels of scale; 3) results and implications of farm surveys conducted in the Sikasso region; 4) results of the assessment of the impact of new technologies to meet food security demands in 2015 and their impact on natural resource management; 5) comparison of the use of intensification and extensification of farming practices to achieve sustainable food security goals for 2015; 6) interactions of crop

and livestock components in mixed farming systems relative to the use of natural resources; and 7) the impact of alternative drought management strategies on food security and poverty reduction. In these studies, the suite of models was used to link economic, biophysical, and environmental consequences of the options considered. The results were based on models at the farm, sub-national, and national levels. Abstracts and slides in French and English used in these presentations may be found at <http://CNRIT.tamu.edu>. Drafts of the full papers and an accompanying compendium of the description of the methodologies developed and employed in the DSS are in final editing. Linkages with the CMDT in Sikasso are more developed than with other NGO's. A similar set of studies is underway for the Rift Valley area of Kenya, with field data collection completed and analysis well underway. These studies involve active participation by analysts from the Office of the President and several relevant ministries in the Government of Kenya. A workshop to present and discuss these results is planned for September 2002 in Nairobi. A cross-cutting analysis of the studies in East and West Africa will compare and contrast the development and use of the DSS methods in these substantially different settings with the objective of defining the broader utility of the methods for global applications. The Comité Permanent Interstats du Lutte Contre la Secheresse dans la Sahel (CILSS) committed to the use of the DSS to plan and evaluate the results of national and regional implementation as part of their new regional strategy in SSA (August 2001). Background documents used in formulating the CILSS strategy have been jointly developed. The first in a series of

regional workshops for West Africa was held in February 2002 in Bamako to accelerate this process. In a meeting of representatives of the CILSS nations in Dakar in June 2002, the DSS models were presented in the context of the major goals of the new CILSS strategy. As a result, there was strong consensus among national representatives for using the system as planned. This means they plan to engage in capacity building at both regional and national levels among their member nations to learn about and apply the DSS to strategic planning and the future evaluation of related results. The CILSS Secretariat, AGRHYMET, and INSAH are all involved in the collaboration at the regional level. They have committed to the preparation of joint proposals for external funding to enable this process. Texas A&M will collaborate with CILSS as the lead institution in this effort. These proposals will be submitted to potential sponsors in the summer of 2002. In East Africa, a second stakeholder workshop was held at Nakuru in Kenya in August 2001 to further define user needs for the DSS among the various ministries of government. This led to refinement of the subsequent study in the Rift Valley and its regional application. Specific case studies, defined by relevant stakeholders, are underway with most of the field data collected and active ongoing analysis. Progress has continued on the WAICENT collaboration, with further development of the Common Modeling Environment software and beginning applications of this to FAO projects under the Special Project on Food Security (Mali) and the Production Systems Development Activity under the FAO Agriculture Department (Kenya). Plans are underway to provide the database and models from these studies to the FAO-WAICENT website for future global applications.

OBJECTIVE 2

Participate with SANREM and other partners in developing deliverables, conducting or participating in workshops and providing training in using the SANREM GDSS methodologies.

We will continue to implement the plan for collaboration with the West Africa Project. This involves linking commune level activities of the WAF project with the model outputs and databases of the DSS. The elements of the plan, which were reviewed in February 2001 by the EEP, are shown below in the 2001-02 plan.

In addition, we will continue to participate with SANREM and other partners in developing deliverables,

conducting or participating in workshops and providing training in using the SANREM DSS methodologies.

Annual Achievements

The plan of action for the collaboration with the West Africa Project was developed in detail at the SANREM Research Conference in November 2001. Relatively little progress has been made on this collaboration in the remainder of year 4, despite considerable effort on our part. The Texas A&M group will make the national and regional databases and models developed in Mali available to the WAP and continue to pursue the collaboration in year 5. Plans for initiating engagement with the SEA project in year five, as a prelude to SANREM III, were terminated when this work was not selected for continuation.

Other Major Outputs in this Period

Conference Presentations

Angerer, J. and J. Vitale. 2002. *Farm Surveys in the Sikasso Region*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Butt, T., J. Stuth, J. Vitale, P. Dyke, and J. Angerer. 2002. *Implications of Extensification and Intensification for Food Security in 2015: Agriculture Sector Level Analysis*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Vitale, J., J. Stuth, T. Butt, P. Dyke, and J. Angerer. 2002. *Implications of Extensification and Intensification for Food Security in 2015: Farm Level Analysis*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Workshops

Clarke, N. and J. Stuth. 2002. *Synthesis of Case Studies*. Decision Support Systems for West Africa:

An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Vitale, J. 2002. *Impact of Risk at the Farm Level - Alternative Drought Management Strategies in the Semi-Arid Areas (Segou)*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Vitale, J., J. Stuth, J. Angerer, and P. Dyke 2002. *Mixed Crop-Livestock Systems: How Much Can These Systems Enhance Agricultural Sustainability?*. Decision Support Systems for West Africa: An Examination Of Issues, Policies, and Alternatives for Food Security and Natural Resource Management in the Sikasso Region of Mali.

Training Degree

Name, Level, Start Date-Completion Date

Harvey Hill, Ph.D. 1999-

SANREM CRSP

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

June 2002
Annual Report
DSS-26

Delivery Systems and Capacity Building

Principal Investigator
Neville Clarke

Co-Principal Investigator
Jeffrey Vitale

OBJECTIVE 1

Prepare and deliver products from the DSS that are in usable form and format for national and regional partners

Annual Achievements

Further development of the common modeling environment software continued in collaboration with FAO as noted under DSS-23. This is part of the total system of packaging models developed so that users with varying skill levels in modeling can apply them. Work continues on developing a very simple Excel interface to the Agricultural Sector Models for East and West Africa. Meta models have been developed to provide much simplified inputs from biophysical models to the farm and sector level economic models. The NUTBAL PRO animal production model was redesigned to accommodate multiple languages and the French language has been added to the system. IER collaborators assisted with screen and help file translations to French and are in possession of the software. The Almanac Characterization Tool for Mali, Kenya and several other East African countries has been completed. The Mali ACT is available in both French and English. Follow on developments are underway that include, but move past, development of this kind of spatial database and into use of such databases for analysis in several of the DSS models. Practical experience in regional applications of the DSS models (DSS 01-25) is providing very useful capacity building through experience by our national and regional partners. Thus far, new funding to expand the FAO relationship has not been found, but efforts to do so continue. The outlook for funding of the CILSS capacity building effort is much brighter. We hope to have

at least the start up phase of this underway within the current calendar year. If successful, this will continue on past the completion of SANREM II in a separate, but related, effort to apply the DSS in West Africa.

OBJECTIVE 2

Participate with national and regional partners in information, training and evaluation workshops on the products of the DSS

Annual Achievements

A second workshop with stakeholders in Kenya was held in August 2001 to review plans for case studies in the Rift Valley region and to build capacity with users in the Government of Kenya. Meetings were also held in June 2002 with key collaborators in the Government of Kenya and in KARI to plan for a major capacity building workshop in September 2002 and follow up on intensive training of four Kenyan analysts and scientists for a month at Texas A&M in year five. A regional workshop in Bamako was held in February 2002 to further expose Malian scientists and decision-makers to the DSS. Forty-two persons were in attendance during this four-day workshop. Representatives from CILSS were also in attendance, and agreements were made to write a joint proposal to expand the capacity building program that is currently limited to Mali, to include other CILSS nations. The February workshop was followed up by a more intensive, training workshop in June 2002. This workshop involved the fourteen scientists that were selected, by TAMU and its' Malian counterparts, for the capacity building program that will last until February

2003. The Malian colleagues given long-term training at Texas A&M were active in the February and June workshops and have begun to train others in the use of the DSS. This effort will provide a cadre of individuals that are able to use the DSS with the simplified interface to the full suite of models.

OBJECTIVE 3

Provide long-term training of national analysts in both research and operational parts of the government

Annual Achievements

Two Malian scientists from IER spent three months on the campus of Texas A&M - completing their training on the use of DSS models in mid-July 2001. Dr. Robert Kaitho from the Kenyan Agricultural Research Institute and International Livestock Research Institute participated in the SANREM Research Conference and subsequently in continued planning for future research and capacity building while visiting the campus of Texas A&M. In meetings held with Kenyan colleagues in June 2002, it was agreed that intensive training for one month at TAMU will be provided for four Kenyan scientists and analysts in year 5.

OBJECTIVE 4

Engage with national and regional partners in ongoing training and mentoring on the use of the DSS and its component parts in impact assessment

Annual Achievements

The workshop held in Bamako in February 2002 helped identify the participants in the capacity building effort to be conducted in year five. Another three day workshop was held in June 2002 to initiate the training process. Fourteen participants are involved in an ongoing set of seminars and workshops that involve active participation by Texas A&M players both through in-country training sessions and internet or web-based interactive instruction. Initiated in June, these sessions will be completed in February 2003. In Kenya, our national partner has applied the DSS suite to several in-country studies and serves as a mentor to five Kenyan graduate students who are being trained in the use of the DSS. As noted in DSS-25, a workshop was held in Dakar in June 2002 with CILSS country representatives to develop consensus based plans for the use of the DSS in planning and implementing the new CILSS strategy. This resulted in the commitment to seek funds for regional capacity building with a cadre of national specialists based in the Malian IER.

Other Major Outputs in this Period

Training Non Degree

Workshop

Exposing Malian scientists and decision-makers to DSS was attended by 42 person(s) and lasted 4 day(s).

Capacity building program was attended by 14 person(s) and lasted 3 day(s).



SANREM Global Impacts and Information Exchange Project Overview

1. Introduction

Global Impact and Information Exchange (GIIE) consists of two separate initiatives which blend to mutually support the SANREM program and regional project themes. Coordinated and administrated by the Management Entity (ME) of SANREM, the major priorities of the GIIE project are research, information exchange, and assessment of decision support priorities and opportunities.

The GIIE Project has two key activities; these are categorized under the headings of:

1. Assessing Decision Maker Priorities
2. Information Exchange

The initiative on **Assessing Decision Maker Priorities** (GLO-31) aims to ensure that SANREM's global decision support activities are responsive to real demands of decision-makers. This activity emphasizes the understanding of the process of decision making at various levels and the identification of the specific needs of different groups of decision-makers. Identification of appropriate types of decision support (e.g., data and information, tools and methods, and capacity building) for various decision makers is also an important component. The exploration of appropriate technologies and decision support mechanisms has expanded beyond SANREM

research to include the larger arena of natural resource management and sustainable agriculture activities by other organizations.

The **Information Exchange** (GLO-11) initiative facilitates exchange among and between researchers and decision-makers through various media and fora. Exchange among researchers emphasizes collaborative development of methodologies for identifying appropriate technologies, practices, and policies with wide applicability. Exchange among decision-makers emphasizes collaborative development and sharing of decision-support tools and methods. Exchange between researchers and decision-makers emphasizes the comparison between the needs of decision-makers (demands) and the characteristics of the decision-support products provided by the researchers (supply) as well as lessons learned along the way. The project supports traditional face-to-face meetings (workshops, symposia, etc.), electronic conferences, and publications. The project also provides ever-changing, innovative ways to encourage collaboration and communication for decision makers.

The two projects under the Global Impacts and Information Exchange complement each other well because they integrate the desire to better understand and improve decision-making by natural resource managers and development practitioners (GLO-31) with the wide scale dissemination of the knowledge gained to both SANREM and non-SANREM audiences (GLO-11) via the internet and printed materials.

The major objectives of the two projects housed under the GLOBAL Impacts and Information Exchange heading are:

- * Facilitation of communications and information exchange among regional and global projects, decision makers, and agencies and institutions involved in similar work.
- * The identification of critical and recurring agriculture and natural resource management decisions and issues through an assessment of decision-making processes.

These two together contribute to the third objective, which is to:

- * Improve the capability to make informed decisions and to assess the impact of decisions related to consequences of adopting specific agricultural and natural resources management technology, practices, and policy at landscape, provincial, national, regional and global levels

2. Highlights of Accomplishments

2a. Information Exchange (GLO-11):

One of the greatest functions of the Information Exchange project is to ensure that information generated by the SANREM projects is documented, and shared for use by a number of groups, including: civil society groups, development practitioners, local government units, policy makers and researchers. The ultimate goal of the information dissemination is to support improved sustainable agriculture and natural resource management. Additionally, this activity serves to support institutionalization efforts in the program.

This activity involves communications and information exchange within SANREM, but it is also designed for information exchange among a broader network of institutions that may use the program outputs. Much effort is made to utilize the variety of means for information communication and exchange. Currently, the vehicles used for communication and information exchange include research reports, policy briefs, case studies, newsletters, videos, electronic conferences, workshops, and tools. All of these methods are available via SANREM's Web site.

Website - When Phase II started, the ME was tasked to set up a Website for SANREM as a whole. At the same time, the regional program (Andes, South East Asia and West Africa) set their own websites to highlight the regional activities. In the last two years, the overall SANREM website has been improved to provide up-to-date and enlightening information on SANREM activities. An open architecture was adopted which is linked to a database with documents and images provided by SANREM researchers. The website currently includes information on SANREM but also makes timely reference to documents, conferences, funding opportunities and other types of information related to sustainable agriculture and natural resource management. The website is also being used to highlight the partnerships that SANREM has established over the years, and especially joint activities. Among the latter, we include collaborative activities with FAO in support of the World Summit for Sustainable Development (2002) and the on-going project entitled "Carbon from Communities", funded by NASA and implemented jointly in Mali by SANREM and the Soils CRSP. The SANREM website has more than 1200 hits a month.

By improving and expanding the SANREM web site, SANREM research and activities were made more visible to others that are similarly addressing sustainable agriculture and natural resources management issues. A concerted effort was made to synthesize research results and disseminate the information to the public in an accessible format. These took the form of research briefs, book releases, field news reports, and research impact statements, all of which are featured on the web site.

News from the Field: Another new feature is called "News from the Field". These are short, descriptive articles contributed by SANREM researchers to highlight what their field work is like and provide additional information about the location of their research by including country information, web links for country specific web sites, and photographs.

Research Briefs: Twelve separate manuscripts were synthesized into research briefs. The briefs capture the basic themes and concepts of the larger documents. The briefs are accessible to a larger audience because of their condensed length, and fewer technical details in exchange for summaries of major research conclusions and observations. The briefs are available

online for downloading and distribution.s are available online for downloading and distribution.

Book releases: Three promotional flyers announced new items published and edited by SANREM scientists. These flyers place the work in the context of SANREM research and themes. The releases will also increase the visibility of SANREM scientists and publications worldwide.

Research impact statement: The first of several research impact articles was produced. The first of which looks at the policy implications of the water monitoring in Lantapan, Philippines.

The SANREM Web site has been integral in the exchange and dissemination of information. It was further developed to provide an integrated communications environment for internal and external communications, in accordance with recommendations at the SANREM annual meeting in 2001. Many modifications were made to the Web site to increase the number of repeat visitors by making it more inviting to explore. In addition, steps have been taken towards generating a greater awareness of national and international NRM events of interest to web site visitors. Two recent examples were the inclusion of information regarding the International Year of the Mountain and links to the World Summit on Sustainable Development. Other goals for the web site were to increase the likelihood of public interaction and feedback, while providing researchers and others with access to knowledge and tools developed by the SANREM program.

Access to publications and resources has been consolidated and organized under the heading of resources with a detailed list of options, both SANREM and non-SANREM have been made available on line. Much has been done towards the completion of an online bibliography of SANREM documents. SANREM documents including reprints, research abstracts, manuals, white papers, case studies, models, technical reports, and proceedings were added to the online collection as part of the ongoing effort to make all of our information available online. So far, all items stored in the SANREM library have been entered into the bibliography database. This database indicates the type of document, its availability (online or in house), and includes abstracts and keywords. Several documents



Example of one of twelve research briefs

are linked to online texts that are available for downloading. With the exception of copyrighted materials, all documents will soon be available online.

The addition of an online reporting system proved to be a very effective means of collecting relevant documents from regional project groups. The database has increased ease of online submission of reports from the SANREM. Online reporting was also used for compilation of information collected for the Research Conference (November 28-30, 2001) including bio-data of and papers presented by the conference participants.

Electronic submission has been well received by SANREM researchers who have found it an easy transition. In addition, electronic submission has, in many cases, decreased the amount of time required to make documents and information available online to both SANREM and external audiences.

Recently, emphasis has been placed on making SANREM research accessible to lay audiences. Regularly updated news stories are posted on the home page, keeping visitors apprised of SANREM happenings. Electronic announcements were sent at various times to alert researchers and others to website updates, especially in the way of news announcements. News features covered a range of items that were

selected as being of interest to both SANREM viewers and the general public viewing audience.

The web site has been updated and modified to be more user-friendly and inviting to explore. A feedback option has been provided for web audiences to comment on the SANREM web site. All comments received have been considered and changes made where appropriate.

Presentations on SANREM have been given in a number of venues, most recently at Florida Agricultural and Mechanical University.

2b. Assessing Decision Maker Priorities (GLO-31):

The assessment of decision maker priorities has been an ongoing, multi-step process. This research activity aims at better understanding how natural resource management decisions are actually made; the needs, priorities and values involved in natural resource decision-making; the methods, data and information sources that decision-makers use; and the processes whereby decisions are made, reinforced and/or changed over time. The research encompasses natural resource management decision-makers at multiple scales and in various sectors (local and national government, private sector, NGO's).

Over the course of the project, it has approximated its goal of providing information to enhance the relevance of sustainable agriculture and natural resource decision support methods and approaches developed by SANREM researchers. The assessment results will inform the design of specific methods and approaches to respond to the decision-makers' most pressing needs, priorities, constraints and opportunities. The research results have provided insights into the methods and/or approaches that currently are not fully or completely developed by SANREM or that need retooling in order to meet the specifications of the final users. The research will therefore contribute to shortening the time for decision-making methods' R&D, as well as to sharpening the potential for massive user adoption of the methods and approaches developed.

The focus of efforts this year were on understanding the current issues and divergent views associated with civil society organizations, governments private sector, the assessment methodology, and a decision support tools inventory and database.

2c. Assessment of Decision Maker Priorities:

SANREM has been involved in the design and moderation of FAO E-Conferences on Multifunctional Character of Agriculture; Integrating Food Security in the NARS Agenda (with resulting SANREM, FAO and GFAR (Global Forum on Agriculture Research) book); Multi-stakeholder Dialogues (includes Farmers, Indigenous Peoples, Business and Industry, Agricultural and Trade Workers, Women, Youth, Local Authorities, and NGO's) for Chapters 10, 12, and 14 of Agenda 21 for Rio+10, and design assistance on E-Conferences on Upstream Downstream Relationships (Resulting Book Featuring SANREM Case Study) and Good Agricultural Practices.

Through the involvement with multi-stakeholder dialogues associated with the Commission on Sustainable Development (since CSD-8), preparatory committee meetings for the World Summit on Sustainable Development, the Committee on Agriculture's 16th Session at the Food and Agriculture Organization and Electronic Fora managed and moderated by SANREM, stakeholder perspectives from representatives of nine Major Group (Farmers, Indigenous People, Trade and Agriculture Workers, Women, Youth, Non-governmental Organizations, Local Authorities, Business and Industry, and Science and Technology) were analyzed to assess the priority issues related to Sustainable Agriculture and Rural Development. The results of the assessment are reported in the paper entitled, "Priorities of Stakeholder Decision Makers" Constance Neely, presented at the SANREM CRSP Research Scientific Synthesis Conference, November 28-30, 2001, Athens, GA.

2d. Decision support tools inventory and database:

The culmination of many steps towards understanding decision-making tools and needs was the creation of an inventory and subsequent database of decision support tools. The creation of the database structure is completed, however the inventory is ever expanding and will be continuously updated. The survey highlights SANREM's tools in addition to decision-making tools from a variety of other groups and organizations. The inventory is currently available to decision makers in developing countries via the web and other media.

Prior to this, a methodological protocol had been developed to assess the priorities and needs of local-to-provincial level agricultural and natural resource decision

makers and its testing and application were documented in from field tests in Mali, the Philippines, Ecuador, and the SE United States.

This year, further steps toward improving the identification and understanding of decision-making priorities and constraints were made. These included the development of a matrix for understanding the categories of tools and issues of different stakeholder groups with particular emphasis on tools that are currently in use and a library and web search (literature review) to inventory the practical decision support tools available in both developed and developing countries. Through these efforts key tools were identified serving as examples of tools most readily available to large sectors of users. For each tool added to the database, information was gathered regarding how it was used, if it is currently used, and who, specifically, is using it. For presentation on the web, the tools have been organized into major categories. This categorization has allowed for perception of realms of decision-making that have a great number of tools available to NGO's and Natural Resource Management practitioners. In addition, it highlighted the areas which are lacking tools or that have tools that have not been widely disseminated or advertised. This tool database will be made available online and will be enhanced by the addition of new tools and the discovery of existing tools. This tool database also includes tools specifically designed and used by SANREM researchers.

In addition, in an effort to more clearly represent the demand for tools, we have created an online survey directed towards NGO's and others working in Natural Resource Management and Sustainable Agriculture. The information gained from the online survey will illuminate the types of tools people working at the local levels are using or have knowledge of. The questions ask for information regarding the tools their organization is currently using and the reasons behind their decision to use or not use the particular tool. A letter announcing the survey was sent to several organizations and individuals involved in local decision-making issues. The results of the survey are being compiled and will be placed online shortly.

2e. Additional support:

Both database and web site support have been provided to projects. The Andes website was completely refurbished, and assistance was provided to the

development of a database for water quality/quantity monitoring for SANREM activities in the Philippines (SEA-25) and Ecuador (AND-24) but also in other parts of the world, including the US.

An E-discussion among SANREM PI's and colleagues outside SANREM was facilitated allowing for the identification of various strategic issues, thrusts as well as lessons learned that have been essential to planning SANREM's Phase III.

3. Impacts

By clearly stating SANREM's work in the realm of NRM and sustainable agriculture, we have provided information on line that will aid others working in the same areas. Positive response from web site visitors on the utility of a number of our products (i.e. briefs, the tools database, the links/bookmarks section) indicate the impact of both the information exchange as well as the assessment of decision maker priorities because of the response they have generated.

4. Dissemination

SANREM research findings have been made widely available on the web site through a new series of publications such as Research Briefs, "News from the Field" articles, and descriptive book announcements. In addition, the creation of the "Bookmarks" section of our website has also generated greater access to a wealth of online resources and information for environmental and natural resource management.

5. Collaborative Relationships

The Assessment of Decision Maker Priorities protocol paper is being finalized to be used by a wider range of audiences. The previous version of the protocol was requested by and shared with researchers from ILRI and IFPRI who found it very relevant for their work. SANREM assisted FAO in developing a participatory planning process on Good Farming Practices to engage multiple stakeholder groups in identifying principles or codes of good farming practice.

The SANREM CRSP continues to lend support to the FAO's Task Manager for Chapter 14 of Agenda 21 on Sustainable Agriculture and Rural Development including identifying emerging issues, success stories and capacity building needs for SARD within the

context of Access to Resources (Land and Genetic), Good Practices for SARD, and Fair Employment for Agricultural Workers. SANREM is supporting the organization of the World Summit for Sustainable Development (August-September 2002) through the facilitation of face-to-face and electronic dialogues among multiple stakeholders on these themes, consultation on a SARD initiative, and promoting sustainable agriculture for both the WSSD implementation document and political declaration. Constance Neely has been seconded to FAO from May to September to support this process.

Additionally Constance Neely has served US Delegation as Sustainable Agriculture Scientific Advisor for the Commission on Sustainable Development's Eighth Session (2000) on Land and Agriculture and the Preparatory Committee II for the World Summit on Sustainable Development (2002). She served on the official FAO delegation at Preparatory Committee III in May 2002.

Finally, Constance Neely and Cornelia Flora have been supporting efforts for the International Farming Systems Association and its upcoming 17th Symposium in terms of awareness raising, resource mobilization and journal publication.

SANREM CRSP

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

June 2002
Annual Report
GLO-11

Communications and Information Exchange

Principal Investigator
Constance Neely

Co-Principal Investigator
Robert Phares
Julie March

OBJECTIVE 1

Collect and facilitate access to knowledge generated by SANREM regional and global projects.

Annual Achievements

The focus of Year 4 activities was on the further development of an information system and communication of research results to a variety of audiences. During this time, the SANREM Web site was further developed to provide an integrated communications environment for internal and external communications, in accordance with recommendations at the SANREM annual meeting in 2001. Many modifications were made to the Web site to increase the number of repeat visitors by making it more inviting to explore. Other goals for the web site were to increase the likelihood of public interaction and feedback, while providing researchers and others with access to knowledge and tools developed by the SANREM program. SANREM documents including reprints, research abstracts, manuals, white papers, case studies, models, technical reports, and proceedings were added to the online collection as part of the ongoing effort to make all of our information available online. We found that during Year 3, the online reporting system was very effective as a means of collecting relevant documents twice annually from PM's and PI's, i.e. the semiannual and annual reports. Due to the system's positive response and the fact that it did not put an undo burden on researchers, we continued to use this reporting method during Year 4 to obtain information from the projects. The database has increased ease of online submission of reports

from the SANREM. Online reporting was also used for compilation of information collected for the Research Conference (November 28-30, 2001) including bio-data of and papers presented by the conference participants. Electronic submission has been well received by SANREM researchers who have found it an easy transition. In year 4, more emphasis was placed on making SANREM research accessible to lay audiences. News stories were regularly posted on the Web site with a concomitant electronic newsletter to inform subscribers about changes on the SANREM Web site. The web site has been updated and modified to be more user-friendly and inviting to explore. A feedback option has been provided for web audiences to comment on the SANREM web site. All comments received have been considered and changes made where appropriate. Ease of access to SANREM documents has increased greatly through our new online availability of various documents. Access to publications and resources has been consolidated and organized under the heading of resources with a detailed list of options, both SANREM and non-SANREM. Much has been done towards the completion of an online bibliography of SANREM documents. So far, all items stored in the SANREM library have been entered into the bibliography database. This database indicates the type of document, its availability (both online or in house), and includes abstracts and keywords. Several documents are linked to online texts that are available for downloading. All documents will be available online soon unless they are

copyrighted. Electronic announcements were sent four times to alert researchers and others to website updates, especially in the way of news announcements. News features covered a range of items that were selected as being of interest to both SANREM viewers and the general public viewing audience.

OBJECTIVE 2

Generate awareness of SANREM research and activities and promote understanding of sustainable agriculture and natural resources management issues, in particular as undertaken by SANREM.

Annual Achievements

An effort was made to synthesize research results and disseminate the information to the public in an accessible format. These took the form of research briefs, book releases and research impact statements, all of which are featured on the web site.

Research briefs:

Twelve separate documents were synthesized into research briefs. The briefs capture the basic themes and concepts of the larger documents. The briefs are accessible to a larger audience because of their condensed length, and fewer technical details in exchange for summaries of major research conclusions and observations. The briefs are available online for downloading and distribution.

Book releases:

Three promotional flyers announced new items published and edited by SANREM scientists. These flyers place the work in the context of SANREM research and themes. The releases will also increase the visibility of SANREM scientists and publications worldwide.

Research impact statement:

We produced the first of several research impact articles. This document looks at the policy implications of the water monitoring in Lantapan, Philippines. The SANREM CRSP continues to lend support to the FAO's Task Manager for Chapter 14 of Agenda 21 on Sustainable Agriculture and Rural Development including identifying emerging themes of consensus among major groups as well as development of an approach on Good Farming Practice for proceeding to the WSSD. Constance Neely and Cornelia Flora have been supporting efforts for the Farming Systems meeting in terms of awareness raising, resource mobilization and journal

publication. We have taken a step towards generating a greater awareness of national and international events of interest to web site viewers. For example, the inclusion of information regarding the International Year of the Mountain and the World Summit on Sustainable Development. In the future, we hope to use those types of venues to generate awareness about our ongoing research. We have made much progress in disseminating SANREM information and making SANREM a recognizable name. Several features were added to our web site to encourage repeat visitors. One of these was the announcement and publicity for both SANREM and Non-SANREM conferences and meetings. Some of these included the Year of the Mountain CONDESAN E-conference, and the upcoming International Farming Systems Conference. Another new feature was a creation of a section called "News from the Field". These are short, descriptive articles contributed by SANREM researchers to highlight what their field work is like and give some additional information about the location of their research by including country information, web links for country specific web sites, and photographs.

OBJECTIVE 3

Facilitate exchange of information and data generated by SANREM research among and between SANREM partners and others interested in sustainable agriculture and natural resource management.

Annual Achievements

Both database and web site support were provided during this period. The Andes website was completely refurbished, and assistance was provided to the development of a database for water quality/quantity monitoring for SANREM activities in the Philippines (SEA-25) and Ecuador (AND-24) but also in other parts of the world, including the US.

An E-discussion was facilitated which allowed for the compilation of various issues and items which are important to planning the next phase. The E-discussion allowed for a multi-site dialogue between researchers on common SANREM themes.

Finally, the exchange of data and information was greatly enhanced through posting of research papers from the Research conference, on line. The papers are available in pdf and word formats and are accessible to all who have web access. In addition, power point presentations from the Research meeting are posted. It was suggested during the conference that these would be useful tools for dissemination of information from the

conference to students, researchers and community members alike.

The web news section also focused on SANREM activities including announcements for international conferences, and calls for papers etc.

Advances

in Research - The greater availability of research findings on the web site and through publications such as research briefs, "News from the Field" articles, and descriptive book announcements has made the efforts by the various SANREM sites clearer to both SANREM researchers and the general public.

in Improved Environment and Natural Resource Management - By clearly stating SANREM's work in the realm of NRM and sustainable agriculture, we have provided information on line that will aid others working in the same areas. In addition, the creation of the "Bookmarks" section of our website has also generated greater access to a wealth of online resources and information for environmental and natural resource management.

SANREM CRSP

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Development of Decision-Maker Priorities and Decision Support Opportunities

Principal Investigator
Constance Neely

Co-Principal Investigator
Carlos Perez
Julie March

OBJECTIVE 1

To fine tune the methodology for ID and understanding of natural resource decision-making priorities and constraints.

Annual Achievements

Many steps were taken to improve the identification and understanding of decision-making priorities and constraints. To begin the process, a matrix was developed to enable us to better understand the categories of tools and issues of different stakeholder groups with particular emphasis on tools that are currently in use. A library and web search was undertaken to begin to inventory the tools available in both developed and developing countries. Key tools were identified through a review of available decision-making tools. Initially, this search has been primarily a web based "literature" review, as the examples that surfaced appeared to be the tools most readily available to large sectors of users. In addition, a more intensive, traditional literature review will follow to complement the information already gathered from the decision making tools literature. For each tool added to the database, information was gathered regarding how it was used, if it is currently used, and who, specifically, is using it. For presentation on the web, the tools have been organized into major categories. This categorization has allowed for perception of realms of decision-making that have a great number of tools available to NGO's and Natural Resource Management practitioners. In addition, it highlighted the areas which are lacking tools or that have tools that have not been widely disseminated or advertised. This tool database will be made available online and

will continuously be enhanced by the addition of new tools and the discovery of existing tools which were not represented. This tool database also includes tools specifically designed and used by SANREM researchers.

OBJECTIVE 2

To synthesize and prioritize decision-maker concerns to help focus decision support research activities of SANREM, its collaborating partners, and other interested parties.

Annual Achievements

A paper was written and presented to analyze key issues of major groups (scientists, NGO's, Trade and Agricultural Workers, Business and Industry, and Indigenous Peoples) related to sustainable agriculture. The paper was presented at SANREM's research conference on November 28, 2001.

The Assessment of Decision Maker Priorities protocol paper is being drafted to be used by a wider range of audiences. The draft was requested by and shared with researchers from ILRI and IFPRI who found it very relevant for their work.

SANREM assisted FAO in developing a participatory planning process on Good Farming Practices to engage multiple stakeholder groups in identifying principles or codes of good farming practice.

OBJECTIVE 3

To compare and validate the demand for tools, information, and capacity building support to improve natural resource management decisions in the regions and globally.

Annual Achievements

One of our goals is to better understand the characteristics that make NRM decision support tools most helpful to users. To begin to do so, we compiled an inventory of decision support tools. We began with a survey of available tools through a literature review. Ultimately, this inventory will allow us to provide a compilation of the tools and their uses online for Natural Resource Management practitioners and groups worldwide. Our tool compilation thus far is largely comprised of web based resources and SANREM examples. We are aware of the existence of vast numbers of additional tools in the decision-making literature but opted to begin with easily accessible examples. In addition, in an effort to more clearly represent the demand for tools, we have created an online survey directed towards NGO's and others working in Natural Resource Management and Sustainable Agriculture. The information gained from the online survey will illuminate the types of tools people working at the local levels are using or have knowledge of. The questions ask for information regarding the tools their organization is currently using and the reasons behind their decision to use or not use the particular tool. There was also a letter announcing the survey sent to several organizations and individuals involved in local decision making issues. The results of the survey are being compiled and will be placed online shortly.

OBJECTIVE 4

To integrate findings into a participatory monitoring and evaluation framework to assess how research activities are progressing towards addressing decision-maker priorities

Annual Achievements

All of the multi-stakeholder dialogues were analyzed to begin to better address the priority issues of NGO's, Farmers, Business and Industry, Trade and Agricultural Workers, Indigenous Peoples and Science and Technology. These assessments also dealt with youth, local authorities (LGU), and women. This assessment has given us greater contact with stakeholder and decision maker priorities. A result of the assessment was the submission of the paper, "Priorities of Stakeholder Decision Makers" Constance Neely, presented at the SANREM CRSP Research Scientific Synthesis Conference, November 28-30, 2001, Athens, GA.

Other Major Outputs in this Period

Conference Presentations

Neely, C. 2001. *Priorities of Stakeholder Decision Makers*. In Proc. Research Synthesis Conference, SANREM CRSP, Athens, Georgia. <http://www.sanrem.uga.edu/sanrem/conferences/nov2801/Neely.htm>